Analysis of applicability of Access and Benefit-Sharing (ABS) principles on Animal Genetic Resources (AnGR)

M. Ivanković

MSc Studies Report: June 2008

Centre for Genetic Resources, the Netherlands (CGN)

Analysis of applicability of Access and Benefit-Sharing (ABS) principles on Animal Genetic Resources (AnGR)

based on policy developments in ABS negotiations under the Convention on Biological Diversity (CBD)

MSc Student Report

Milan Ivanković

CGN Supervisor	WU Supervisor
Sipke-Joost Hiemstra Centre for Genetic Resources, the Netherlands Head Animal Genetic Resources Wageningen University and Research Centre P.O. Box 65 8200 AB Lelystad The Netherlands Email: sipkejoost.hiemstra@wur.nl	**Aarti Gupta** Environmental Policy Group **Assistant Professor** Wageningen University and Research Centre Hollandseweg 1 6706 KN Wageningen The Netherlands Email: Aarti.Gupta@wur.nl

Centre for Genetic Resources, the Netherlands (CGN)
Wageningen University and Research Centre
June 2008

CGN, Centre for Genetic Resources, the Netherlands

Address : Bornsesteeg 65, 6708 PD Wageningen, The Netherlands
: P.O. Box 16, 6700 AA Wageningen, The Netherlands
Email : sipkejoost.hiemstra@wur.nl
Internet : www.cgn.wur.nl

TABLE OF CONTENTS

Acknowledgements

While approaching the end of my Master of Environmental Studies in the Netherlands, I wish to thank all those who contributed towards the successful completion of the concluding phase of my studies – an Internship at the Centre for Genetic Resources, The Netherlands. The final product of this internship is this report. I express my sincerest gratitude to the following people:

Centre for Genetic Resources, the Netherlands (CGN):
Mr. Sipke-Joost Hiemstra, Head Animal Genetic Resources, for supervising my internship activities and guiding me through the process of research and making contacts with numerous stakeholders related to AnGR conservation and management;
Mr. Bert Visser, director of the CGN, for providing me the opportunity to have an internship within this organization in the first place and for the regular consultations and reviewing the products of my research in CGN;
All the employees of the CGN for their warm attitude and pleasurable friendly working atmosphere, thus making the hours spent there enjoyable and more productive.

Wageningen University:
Assist. Prof. Aarti Gupta for overseeing my internship as a second supervisor and evaluator of the activities conducted during this period.

My sincere thanks also to all the interviewees for dedicating their time and sharing their knowledge so as to aid me in making this research richer and more substantial: A. G. Drucker, B. de Jonge, C. Stannard, D. Kompan, E. Broxham, I. Hoffmann, K. U. Sprenger, J. K. Oldenbroek, M. Vonk, N. Louwaars, O. Hanotte, W. Vroom and V. Henson-Apollonio.

Finally, my gratitude to all those not mentioned here, who contributed to this research in any other way.

Milan Ivanković
Wageningen, June 2008

List of abbreviations

ABS	Access to genetic resources and fair and equitable Sharing of the Benefits derived from utilization of genetic resources
ABS-WG	Ad Hoc Open-Ended Working Group on ABS
AI	Artificial Insemination
AnGR	Animal Genetic Resources
Article 8(j) WG	Article 8(j) Working Group
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CGIAR	Consultative Group on International Agricultural Research
COP	Conference of the Parties
CGRFA	Commission on Genetic Resources for Food and Agriculture
FAO	Food and Agriculture Organisation of the United Nations
GR	Genetic resources
IPRs	Intellectual Property Rights
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUPGR	International Undertaking on Plant Genetic Resources
LMMC	Group of Like-minded Megadiverse Countries
MAT	Mutually Agreed Terms
MTA	Material Transfer Agreement
OIE	Office International des Epizooties in Paris
PBR	Plant Breeders' Rights
PGR	Plant Genetic Resources
PIC	Prior Informed Consent
SMTA	Standard Material Transfer Agreement
SNP	Single Nucleotide Polymorphism
SPS	Sanitary and Phytosanitary measures
TK	Traditional Knowledge
TRIPS	World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPOV	International Union for the Protection of New varieties of Plants (French: Union pour la Protection des Obtentions Vegétales)
WIPO	World Intellectual Property Organisation
WTO	World Trade Organisation

Summary

The main objective for carrying out this research was to analyse and explore the applicability of Access and Benefit-Sharing (ABS) principles on Animal Genetic Resources (AnGR), based on current developments in ABS negotiations under the Convention on Biological Diversity (CBD). Since the negotiations have not finished yet, but it is expected that a certain regime will be created within a period of two years from now, there are many speculations about the form that ABS will take with respect to AnGR. Therefore, this research is an attempt to capture the current moment of the complex debate on ABS issues, focusing on one particular group of GR: AnGR. Compiling the information gathered from various interviewees and combining it with the data found in literature, this report will give an overview of the challenges emerging around the application of ABS on AnGR, potential solutions and ideas how to regulate access without compromising fair and equitable sharing of benefits with respect to AnGR.

The outline of the report is as follows:

It begins with an Introduction (Chapter 1) which puts the ABS issue into the context of historical policy developments and introduces the problem of ABS of AnGR. Chapter 2 explains the specific nature of AnGR in comparison with other types of GR which are agreed to be covered by the scope of the negotiated international ABS regime. Chapter 3 elaborates ABS principles derived from various international policies such as environmental, agricultural, trading and intellectual property rights policies, paying attention to their applicability to AnGR. Chapter 4 explains several issues important for the current and future framing of the ABS rules in relation to AnGR. These issues are aspects addressing the need for specific measures and instruments that acknowlege the specific nature of AnGR. The following aspects will be discussed: multiple stakeholders from the livestock sector; final outcome of the ABS negotiation process; ownership of AnGR; economic value of an individual germplasm carrier; concept of a breed; veterinary and zoo-sanitary measures; and evolution of ABS concepts. Chapter 5 explains into more detail how ABS principles could be translated into specific operational measures for AnGR, based on what already exists in the PGR sector and the aquaculture sector. This chapter also describes what lies behind the skepticism about the need to establish an ABS regime which addresses AnGR. Conclusions and recommendations in Chapter 6 give an overview of the most important findings which have been drawn from the literature and the interviews' analysis. A list of suggestions of potentially appropriate options for translation of ABS principles into operational measures for AnGR are included in the recommendations.

Methodological tools used for carrying out this research have included literature reviews (reports, policy briefs, bulletins, journals), reviews of informal sources of information (internet, media, pamphlets, brochures) and interviews with experts at the national and international level which are directly or indirectly involved in developments in the livestock sector.

This report could be useful both for decision makers and the wider public interested in ABS of AnGR as it brings together divergent perspectives about applicability of the concepts of ABS to AnGR, based on identification of the main opportunities and obstacles for translation of the ABS principles into practice.

1 Introduction

As is reflected in the first assessment of the State of the World's AnGR[1] for FAO (FAO, 2007b, p.37), countries and regions of the world are interdependent in the utilization of AnGR. This was not only the case in the past, but even more gene flow might prove to be essential for development of the livestock sector in the future, because certain breeds or genes could be vital for livestock keepers and breeders elsewhere. The objective of sustainable use of GR as one of the main goals of the CBD (CBD online, 2008c), as well as sustainable development, could be achieved only through ensuring "wide access to animal genetic resources, for farmers, herders, breeders and researchers". To this end "equitable frameworks for access, and for sharing the benefits derived from genetic resources, need to be put in place at both national and international levels". Development of such frameworks should be undertaken with due respect to the distinct characteristics of agricultural biodiversity (FAO, 2007b, p.37).

The first internationally agreed framework for conservation and sustainable use of AnGR, and the fair and equitable sharing of the benefits from their use is the Global Plan of Action for Animal Genetic Resources adopted at the International Technical Conference in Interlaken, Switzerland (2007). Although both the Global Action Plan and the Interlaken Declaration have been set up to enhance mainly the sustainable use, development and conservation of AnGR used or potentially useful for food and agriculture, they also entail the commitment to facilitating access to these resources and the fair and equitable sharing of benefits arising from their use (Ibid).

Bearing in mind the fact that there will be constant need for genetic flow of AnGR, so as to sustainably use, conserve and share the benefits out of their utilization, certain policy frameworks are needed both at national and global levels in order to ensure facilitated exchange, access to GR and equitable sharing of the derived benefits between various stakeholders. Some countries rich in biodiversity have already developed and passed their own national legislation on ABS (Boisvert and Vivien, 2005, p.468) based on their own national goals but in congruence with existing international regimes. However this legislation, is not designed just for AnGR, but it includes general provisions for all types of GR. Close to 50 developing countries and regions around the world are in the process of enacting various types of ABS legislation (Rosendal, 2006, p.274). However there is still no international ABS regime which regulates utilization of all types of GR among which AnGR. One of the main policy issues under the Convention on Biological Diversity is further regulation of access to genetic resources and the equitable sharing of the benefits out of utilization of these genetic resources (ABS) on a global scale.

[1] The following terminology based on the Interlaken Declaration and Global Plan of Action for Animal Genetic Resources is used throughout the report (2007a, p.5):
Animal Genetic Resources (AnGR) refers specifically to animal genetic resources used in or potentially useful for food and agriculture. The term *Livestock* encompasses all domesticated animals used for food and agriculture.

Before the Interlaken Declaration has been established in 2007, some authors were using the term: *Farm AnGR* - those AnGR that are or have been maintained to contribute to food and agricultural production and productivity (Gibson et al., 2006).

The work of the CBD on ABS was initiated at COP-4 (May 1998, Bratislava, Slovakia) when parties decided to establish a regionally balanced expert panel on ABS (ABS-WG5 Summary, 2007). One of the most significant developments under the auspices of CBD with respect to the ABS negotiations was the creation of the Ad Hoc Open-ended Working Group on Access and Benefit-sharing by the COP-5, in May 2000, in Nairobi. This Group was set up as a subsidiary body of the Conference of the Parties of CBD. It was authorized to ensure developing guidelines for assisting the Parties with the implementation of the Access and Benefit-sharing provisions of the Convention (CBD online, 2008a). Just a few years later this group was mandated to elaborate and negotiate an International Regime on access to genetic resources and benefit-sharing, at COP-7, which was held in February 2004 in Kuala Lumpur, Malaysia.

Access and Benefit-Sharing (ABS) negotiations involve a huge debate about how to create an international regime as soon as possible and no later than 2010, so as to meet the Millennium Development Goal of significantly reducing the rates of biodiversity loss by that time. Meetings of the Working Group have been organized six times and the last one was held in January 2008 in Geneva, Switzerland. Given the current status of negotiations it is not clear yet how the negotiators are going to solve tensions stemming from several other regimes seeking to regulate ABS. Until now, policy developments related to ABS negotiations have mostly focused on Plant Genetic Resources (PGR). There are various explanations for this such as the power of stakeholders from the plant breeding sector, and the existence of a lot of policies already regulating ABS of PGR for food and agriculture. However, the international community is expected to develop a comprehensive ABS policy framework which encompasses AnGR as well, because of the internationally agreed scope of the future ABS regime which includes all types of GR. Assuming that the outcome of the ABS negotiations might be one of the following two scenarios: 1) a single legally binding regime; or 2) a "hybrid" regime comprised of both legally binding and non-legally binding instruments, it is useful to see how these scenarios might affect sustainable management, flow and utilization of AnGR.

Current exchange of AnGR is in a way already indirectly "regulated" as certain ABS principles have been already set up even long before the ABS negotiations started. They are for example embodied in the CBD, and in FAO, WIPO and WTO policies (IPRs). As one of the respondents indicated, until now there seems to be a lack of coherence in the institutional structures regarding ABS. The objectives set in various policies are seemingly conflicting. Environmental regimes are often strong at the international level but often not strong at the national level. National regulatory ABS frameworks based on the CBD have blocked movement of genetic material in a number of cases. When ABS principles are not similarly agreed in various policies, this could act as a barrier in the exchange of GR. Therefore an international ABS regime should contribute to harmonized ABS policies. If this is not the case, then the positive impact of the regime is questionable (personal communication).

One of the challenges with respect to implementing ABS principles is the constant evolution and changes in the understanding of ABS issue. The perception of the ABS issue has been changing over time within the last two decades. Initial interpretation of the ABS issue (open access and common heritage) went later through a phase of framing of state sovereignty over giving access and in conjunction to the framing of private property rights over genetic resources. Evolution of the perception of ABS is explained here from a more general perspective by considering all types of GR.

One might claim that the perception of ABS with respect to AnGR has not been changing over time in the same way, but the other way round. AnGR have always been in private ownership of livestock keepers or breeders. Then, the CBD agreed on the principle of state sovereignty over genetic resources (AnGR as well). The next step in framing of ABS of AnGR might be imposing of intellectual property rights over animal breeds. As an alternative development, there is the possibility to develop a Multilateral System for AnGR and to consider AnGR as the common heritage of mankind in the first place.

2 Specific nature of AnGR

Before defining AnGR, it is important to mention that according to Article 2 of the Convention of Biological Diversity (CBD online, 2008c), *genetic resources* are considered to be "genetic material of actual or potential value". Genetic material is defined as "any material of plant, microbial or other origin containing functional units of heredity i.e. genes[2]". The CBD implies that genetic resources include not only the tangible (physical) genetic material, but also to the genetic information and knowledge (Hiemstra *et al*., 2006).

AnGR from the perspective of FAO (2000) encompass genetic resources of those animal species which are used, or may be used, for the production of food and for agriculture, as well as the populations within them (feral populations, landraces[3] and primary populations, standardized breeds, selected lines and any conserved material).

Several features make AnGR specific compared to non-domesticated genetic resources:

- All animal genetic resources for food and agriculture are the result of human intervention (FAO, 2007a). For more than 10,000 years, more than 7,000 domestic animal breed populations have been developed by farmers and pastoralists, while scientific animal breeders have further improved their genetic basis within the last two hundred years;
- AnGR biodiversity can only be maintained under continuous active human management, as the animals have coevolved in close connection with particular human economies, cultures and knowledge systems (FAO, 2007a);
- AnGR are unevenly spread around the world based on specific features of agricultural (livestock keeping) diffusion (Stannard *et al*., 2004). Their genetic background is a composite, as many persons, communities, and countries took part in their creation.

Although at first glance it appears that animal and plant breeding are based on the same principles, it is also obvious that there are several distinct features in terms of biological, technical and institutional differences, which have to be taken into account when developing certain policy frameworks such as ABS (Hiemstra *et al*., 2006). The specific nature of AnGR is apparent both when considering animals versus plants in general, and when focusing on

[2] Gene: the functional unit of heredity consisting of a sequence of DNA (deoxyribonucleic acid) that codes for a specific biochemical function in a living organism (IDRC, 2008, p.254).

[3] Landraces, folk varieties or farmers' varieties: 'a crop cultivar or animal breed that evolved with and has been genetically improved by traditional agriculturalists, but has not been influenced by modern breeding practices' (IDRC, 2008, p.254).

differences between agricultural crops and AnGR.

Summarized differences are included in Table 1.

Table 1 Biological, technical and institutional differences between plant and farm animal genetic resources. Adapted from Hiemstra *et al.* (2006)

Factor	Plant genetic resources	Farm animal genetic resources
Mendelian segregation	Yes	Yes
Self pollination	Yes, frequent	No
Asexual reproduction / clonal propagation	Yes, substantial	No, only artificial
Cross-breeding	Yes, between inbred lines or different varieties	Yes, between selected lines or different breeds
Inbreeding	Yes, in breeding programmes to acquire genetic stocks	Not desirable
Genetic modifications	Possible and efficient	Possible but hardly accepted
Generation interval	Low often < 1 year	High 1 up to 8 years
Number of offspring	High	Small number up to higher number
Economic value of an individual or germplasm	Generally low	Moderate to high
Phenotyping costs for production traits (individual/family)	Very low to moderate	High to very high
Phenotyping costs for adaptation resistance traits (individual/family)	Low to moderate	Very high
Cost of breed/variety testing	Inexpensive	Expensive
Status of *in situ* genetic conservation	Promoted but not well established	Promoted, but not well established
Status of in vivo *ex situ* conservation	Relatively minor role	Major component of *ex situ* conservation
Status of gene banks	Extensive collections (important role of CGIAR)	Semen collections in developed countries and in a small number of developing countries (no involvement of CGIAR)
Technical feasibility of *ex situ* (*in vitro*) conservation	For a majority of species	In the form of semen for a majority of species and embryos for several species
Conditions for storage	In cold conditions	Liquid nitrogen only
Ease and costs of extracting/testing accessions from gene banks	Generally easy and relatively low cost	Difficult, costly and/or time consuming (often several generations backcrossing when recreating)
Ongoing collection of indigenous/wild germplasm	Still significant	Very little activity

Costs of collection	Low to moderate	High to very high
State of global databases	Relatively advanced databases	Country controlled data in FAO database

Additional differences not included in this Table 1 are supplemented in Table 2, based on the interviews findings..

Table 2 Additional elements of the distinct nature of AnGR compared to crops (PGR).

Factor	**Plant genetic resources**	**Animal genetic resources**
Exchange/gene flow	South-North transfer is important (introgression of wild genes)	North-North (small need for introgression of new genes in commercial breeding)[4]; and North-South (distribution of improved breeds).
Property issues/ownership	Existence of public gene banks with free access to PGR	Private ownership; generally not in the public domain
Patentability	Crop varieties are considered to be patentable (Article 27.3 of the TRIPS)	Animal breeds, lines and hybrids are not considered as patentable (Article 27.3 (b) of TRIPS)
Breeding systems	Highly industrialized seed production; major public breedng programmes (CGIAR)	Just few public breeding programmes; no international gene banks; pig, poultry (and dairy) breeding is lately concentrated in a small number of dominant global players
Centres of origin (diversity)	Pretty well defined (usually semi-tropical)	Not clearly defined, or multiple domestication centres
Stakeholders perception of GR value	Germplasm from South valuable on a global scale	Germplasm from South only potentially valuable on a global scale for some specific traits
Selection approach	Usually looking for individual important traits; Adapting plants to environment	Performance and general fitness is more important; adapting environment to animals
Trading/exchange of genetic material	Farmers' and breeders rights (UPOV); use of MTAs	No livestock keepers' and breeders' rights; bilateral agreements between seller and buyer
Transmissible diseases to humans	None	Epizootic relationships

[4] Examples where Southern germplasm has been used in Northern countries and resold are fairly few and exceptional. E.g. Tuli and Boran cattle exported from Africa to Australia. There is not a real interest in germplasm flow from South to North, and therefore an issue of biopiracy which is relevant in PGR is not really important with AnGR. Not only that the North is not interested in germplasm from the South, but there is a lot of export in the opposite direction as in the case of Holstein Friesian cattle breed (personal communication with one of the respondents).

Policies (institutionalization) with certain ABS provisions	Already a lot of policies both at the national (national access laws) and international (UPOV, IUPGR, ITPGRFA) level	Initial phase of establishing policies both at national and international (Global Action Plan, Interlaken Declaration) level

There are also in addition technical, socio-economical and cultural differences between AnGR themselves when it comes to livestock management and exchange between different regions of the word, which consequently may affect ABS policies. One of the respondents distinguishes between three basic breeding systems: 1) *pastoralism* – which is predominantly spread in Africa, a system in which basically just people and animals feature, without any written and regulated rules. Pastoralism is one modus of keeping the animals in which groups of people are the collective owners of herds of cattle or flocks of sheep and goats. There are certain rules for the management of animals but no written regulations; 2) a second category is formed by *small-scale subsistence-based farmers,* in which individuals are the owners of the animals; and 3) a *centralized breeding system,* which is typical for developed countries such as many European countries, and in which breeding organizations (private companies or cooperatives owned by farmers) are owners of the breeding animals. Strict regulations and written contracts[5] are used for transaction of the breeding material. Most of the other countries have systems which are combination of the two (personal communication).

When observing AnGR from the broader perspective, we should also include wild relatives of domestic animals and we could even include aquaculture species (Hiemstra *et al*, 2006). However, aquaculture species have several characteristics which make them unique in comparison with PGR and AnGR. Table 3 below summarizes the distinct nature of aquaculture GR in comparison to PGR and AnGR, based on the work of Rosendal *et al*. (2006).

Table 3 Distinct nature of farm Aquaculture GR compared to AnGR and PGR (crops). Based on Rosendaal et al. (2006).

Factor	**Aquaculture genetic resources**	**AnGR**	**PGR**
Fecundity and reproductive capacity	Fish species such as cods and salmonids have extremely high fecundity and reproductive capacity	Lower fecundity and reproductive capacity (variation between species)	High reproductive capacity (easy propagation on farm in large quantities)
Generation interval	Short	Long (1-8 years)	Short < 1 year
Inbreeding depression	Severe effects on viability and performance	Severe effects on viability and performance	In most cases not impairing viability and performance
Selection approach	Based on selection of the best performing individuals within the	Selection within strains or populations	Improvements through selection processes like: inbreeding,

[5] However, a lot of breeding animals are also sold without a 'written' contract.

	population (stocks) as parents to the next generation		vegetative propagation but also crossbreeding, both pedigree selection and mass selection
Genetic variation within the population	High; Variable populations and evolving from generation to generation	Rather high; Genetic variation within the population is insurance for better adaptive capacities.	Uniform plant varieties both phenotypically and genetically (UPOV criteria – new, distinct, uniform and stable)

3 The roots of ABS principles

Depending on the level of abstraction and generalization, most of the internationally envisioned ABS principles could be seen to be more or less applicable to AnGR. As it has been already explained in the introduction, these principles are coming from various international policies which often have conflicting goals.

Three basic groups of policies are shaping the ABS issue: Environmental (CBD), agricultural (FAO) and IPR (WIPO, WTO) policies. They have different goals, each influencing exchange, flows and management of GR in a different way. While environmental policies (CBD) emphasize the objectives of conservation, sustainable use and equitable sharing of benefits out of utilization of GR, agricultural policies additionally promote free access to, for example, important staple crops and forages and they assure plant breeders' and farmers rights. IPR policies are focusing on how to secure intellectual property rights related to technological inventions and innovations.

From the wider scope, several other regimes such as: CITES, the Framework Convention on Climate Change and TRIPS plus agreements (Boisvert and Vivien, 2005, p.470) could be indirectly influencing perceptions of ABS issues. Thus, these authors explain that 'easing of restrictions on endangered species trade and development of markets for emission quotas to fight against climate change all contribute towards the definition of a doctrine about resource management that affects the CBD'. Even the international multi- or bi-lateral treaties in the domain of TRIPS indirectly affect the creation of future conservation and intellectual property rights policies. UNESCO is also relevan in this context because it develops model provisions on the protection of folklore, in which context traditional uses of biological resources are seen as a specific form of cultural heritage. Benefit sharing is quite elaborated in other international policy arenas among which UNESCO and UNCTAD (Rosendal, 2006, p.274). UNCTAD's Biotrade initiative assists developing countries to 'develop an institutional environment to facilitate trade and investment, in products and services of biological diversity, as a means to attain the objectives of the CBD' (UNCTAD online, 2008).

3.1 ABS principles originating from CBD

The agreed ABS principles stemming from the CBD are believed to be universally applicable to all types of genetic resources, including AnGR. They are related to all three objectives of the CBD: conservation of genetic resources, sustainable use and equitable sharing of benefits derived out of their utilization. In general, at this high level of abstraction

the objectives do not present a problem for AnGR. But as soon as implementation of the ABS principles is at hand, the situation gets more complex. . For example, if access becomes restricted too much, then there are no benefits to be shares, a development that may affect all types of GR.

The Convention on Biological Diversity (CBD online, 2008c) recognizes *national sovereign rights* to genetic resources (Art 15.1) while access to genetic resources should be guided by the principles of *prior informed consent* (Art. 15.4.) and *mutually agreed terms* (Art. 15.5). This means that countries have the sovereign right of providing access to their GR only under mutually agreed terms between provider and recipient.

Other provisions specifically relate to access to GR, such as Article 16.3 (access to and transfer of technology that makes use of GR), Article 19.1 (participation in biotechnological research on genetic resources) and 19.2 (access to results and benefits from biotechnologies) according to the Summary Report of the ABS-WG2 (2003).

One of the Articles which plays an important role in ABS with respect to the role of traditional knowledge is Article 8(j) of the CBD. It states that "parties will, subject to national legislation, respect and preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biodiversity; promote their wider application with the approval and involvement of knowledge-holders; and encourage equitable sharing of benefits arising from the utilization of such knowledge" (ABS-WG5 Summary, 2007, p.2).

Related provisions address the customary use of biological resources in accordance with traditional cultural practices [Article 10(c)], information exchange [Article 17.2] and cooperation in the development and use of technologies [Article 18.4] (ABS-WB5 Summary, 2007, p.2).

Ten years after the CBD has been adopted, the ABS issue is still debated. The first serious result of the negotiations has been establishing the voluntary Bonn Guidelines in 2002. The Bonn Guidelines on ABS have been drafted at the first meeting of the ABS-WG1 in October 2001 in Bonn, Germany, and they have been adopted at COP-6 in April 2002 in The Hague, Netherlands (ABS-WG5 Summary, 2007). The Bonn Guidelines were set up as a voluntary framework prescribing various monetary and non-monetary benefit sharing measures so as to facilitate access to GR.

3.2 ABS principles originating from FAO policies

ABS principles embodied in the FAO policies almost exclusively regard PGR. They are tackling issues of farmers' and breeders' rights (The International Union for the Protection of New varieties of Plants - UPOV), secured open access to raw and improved Plant Genetic Resources – PGR (International Undertaking on Plant Genetic Resources - IUPGR) and secure access to staple crops (International Treaty on Plant Genetic resources - ITPGRFA).

UPOV introduced property rights just for improved PGR, while undomesticated PGR were still treated as common heritage (Raustiala and Victor, 2004). UPOV presumes that genetic information (from raw PGR) was developed without using scientific knowledge and therefore it cannot be owned, i.e. raw genetic material is supposed to be a common good. The need for establishing the UPOV Agreement came from the idea that plant breeders should be guaranteed exclusive rights for commercial marketing of the crop varieties they have developed (Andersen, 2004). Furthermore, UPOV disregards the property status of landraces and farmers' rights.

For some parties, the IUPGR was adopted by FAO in 1983 as an attempt to counter the emergence of property rights in improved PGR. The idea was to define all genetic resources, no matter if they were wild/raw or improved, as 'common heritage' (Raustiala and Victor, 2004).

The International Treaty (ITPGRFA) includes a multilateral system ensuring facilitated access to a list of specified food and forage crops in the public domain of the countries which are parties to the Treaty. The list includes 35 staple food crops for food and agriculture, and 29 forage crops, considered to be essential for halting genetic erosion and providing food security and human survival. Whereas AnGR are predominantly in private possession of farmers and breeders, some PGR are held in the public domain.

Whether an international multilateral system for free access to certain AnGR will be established remains to be seen in the future. However, many stakeholders claim that access to AnGR is already free because it is based only on the bilateral agreement between the seller and the buyer of the animal. Others believe that access is not free because if the seller does not agree to trade, then access is obstructed. One respondent to the interviews series explained that the international community needs a special international treaty that will facilitate movement of AnGR, so that research, development and sharing of benefits is not prevented in a world which is becoming more and more globalized. However, he also pointed out that we should be aware of one major difference compared to PGR, i.e. that access to AnGR can never be totally free because animals themselves have certain economic value regardless their genetic value. Therefore, he concluded, it would be better to say that there should be a free market for exchange of AnGR, not a system with totally free access (personal communication).

3.3 ABS principles originating from WIPO and WTO policies

Some of the ABS principles originate from policies regulating IPRs with respect to technological and biotechnological innovations and come from WTO and WIPO. After living organisms have been considered to be patentable[6], the TRIPS Agreement has been established as a framework for granting intellectual patent rights for plant varieties and pharmaceuticals as they are mostly being subject of patenting compared to other biological (genetic) resources. Article 27.3 of the TRIPS Agreement specifies that plant varieties are to be protected either by *patents* (a minimum standard) or by an effective *sui generis* system (system of its own kind – but it is not elaborated what this system could imply). As Andersen (2004) explains, a patent is the strongest form of intellectual property rights protection since it limits the rights of farmers to sell or reuse what they have grown, but it also prevents breeders to use the seeds for further research and breeding purposes. Although plant varieties may be considered as patentable and national patent law may also cover plant varieties, in most legislation they do not fulfill the general patent criteria such as reproducibility, although they do fulfil the UPOV criteria of being stable, uniform and distinct (Rosendal, 2003).

[6] The breaking point in the history of patent law regarding living organisms occurred in USA in 1980, when the 'Supreme Court ruled in the landmark case of *Diamond v. Chakrabarty* (447 U.S.303) granting intellectual property protection for a live, human made organism' (Juma, 2005). Chakrabarty case changed the perception of living organisms and products derived from their utilization, so that the concept of 'anything under the sun which is made by man is patentable subject matter in the United States' became widely accepted nowadays.

The situation is similar for animals and animal breeds. Animal breeds are not considered within any legal framework as patentable (Simianer, 2005), although animal breeds are to a certain extent comparable to plant varieties. The main reason for this is not the incompatibility of AnGR with patenting systems per se, but the impossibility to determine *prior art*[7] with respect to AnGR. On the other hand, it is allowed to patent DNA sequences or genes of livestock breeds as Simianer explains based on the Rothschield's work (2002).

Another aspect of patenting is related to traditional knowledge (TK)[8]. TK is not seen as patentable since it does not fulfill the patenting criteria on prior art[9], so that mechanisms for sharing benefits with indigenous communities which employed their knowledge in creation of certain genetic varieties are yet to be further developed, since they normally would not fulfil the patentability criteria.

4 Main issues framing current and future ABS rules for AnGR

Several challenges must be faced in establishing ABS principles that are specifically suited to AnGR. Future policy developments, multiple stakeholders with different views and attitudes, the ownership status of AnGR, the economic value of AnGR, the concept of a breed, veterinary and zoo-sanitary measures, and the evolution of ABS concepts all render the process of designing specific ABS measures for AnGR highly complex. Each of the mentioned issues will be discussed into more detail below.

4.1 Final outcome of the ABS negotiation process – policy scenarios

One of the essential factors affecting the future of AnGR management is the direction into which the ABS negotiation process is heading to, in particular with respect to the nature and scope of such a regime. Policy and regulatory frameworks which will include provisions for ABS of AnGR should be able to anticipate future developments in AnGR use with respect to the emerging challenges of globalization, biotechnological advancements, climate change and emerging diseases (Hiemstra *et al*., 2006). It is quite a challenge to elaborate likely scenarios of future use and how these might affect exchange and management of all types of GR. Ongoing developments in the ABS negotiations seem to reflect only the current situation of GR exchange, rather than the expected future trends. This may render the agreed regime

[7] Prior art: "publications and other public disclosures made before the filing (or priority) date of a patent application and against which novelty and inventiveness of the invention in the patent application is judged. In some jurisdictions only prior art within that jurisdiction is recognized, or only prior art in certain forms – e.g. written, but not oral" (IDRC, 2008, p.255).

[8] Definition of Traditional knowledge (TK): 'TK is socially developed knowledge, and should be distinguished from knowledge that is developed in a specialized scientific and industrial context. Particularly indigenous TK is valuable' (Koopman, 2005, p.524).
"Whilst there is no generally acceptable definition, TK includes, for example, tradition based creations, innovations, literary, artistic or scientific works, performances, and designs. Such knowledge is often transmitted from generation to generaton and is often associated with a particular people or territory" (IDRC, 2008, p.256).

[9] In particular in relation to prior knowledge, because it cannot be considered as new.

not to be a long lasting one, as it may not be functional for long in a continuously changing future.

There are several options for the outcome of the negotiation process on the International Regime. The two most likely policy scenarios are (based on the outcome of the fifth meeting of the ABS-WG held in Montreal - Canada, 2007):

1. a single legally binding regime; or
2. a 'hybrid' regime comprised of both legally binding and non-legally binding instruments.

4.1.1 Scenario 1: A single legally binding ABS regime

The scenario of having a single international legally binding regime as a basis for dealing with ABS issues globally is one of the possible outcomes of the ongong negotiations. Having a strict international regime with provisions to be implemented and enforced globally, might appear to be a necessity, as the world is becoming more and more globalized[10] and interdependent. Setting up internationally applicable rules might be very useful for unhampered flow of genetic resources under agreed terms. Breeding corporations would be very happy with a situation with reduced uncertainty for accessing the genetic material for selection improvements and research, provided the conditions of access would be suiable for AnGR exchange. However, a single ABS regime which addresses genetic resources in general would be hardly able to adequately regulate all aspects of ABS of AnGR, because of the specific nature of AnGR. Therefore, a single legally binding international ABS regime should ideally only form a basis[11] for developing specific legal frameworks designed for AnGR. Having a single ABS regime might not be considered just as one ABS international treaty, but it may be seen as a "regime complex" comprised of ABS provisions set up within several policy forums (FAO, CBD, WIPO, WTO). Some examples of how legally binding agreements developed which addresses the specific nature of AnGR follow below.

The Global Action Plan and the Interlaken Declaration for Animal Genetic Resources which have been agreed in 2007, are indicators for the commitment to the conservation and utization of AnGR, and these documents already reflect the commitment of 109 countries (from 169 participating countries) to facilitate access to these resources and ensure fair and equitable sharing of benefits from their use (FAO, 2007a).

Comparable to Plant genetic resources where the UPOV agreement protects breeders' rights[12] and also provides for a farmers' privilege, analogous (parallel) international agreements could be set up with respect to AnGR i.e. livestock breeders' rights and livestock keepers' rights.

Furthermore, globalization brings fast population growth and the demand for

[10] Nevertheless one could still argue that sectoral approaches are as likely as the overall globalization.

[11] This is applicable just in case if the first regime is formulated in such a way.

[12] The Plant Breeders' Right (PBR) is based on the criteria of: novelty, distinctiveness, uniformity and stability. There are two major distinctions that set PBR apart from patents: the breeders' exemption and the farmers' privilege.
The breeders' exemption allows for the free use of protected varieties for the purpose of breeding other varieties. Farmers' privilege allows farmers to use, for propagation purposes on their own holdings, the protected variety (BRG, 2002).

insurance against food crises. Therefore, setting up an agreement equivalent to the ITPGRFA (including a Multilateral System for free access to 35 staple crops and 29 forages), which would guarantee free access to certain animal genetic material, would be a step towards ensuring enough animal protein components for the staple diet of the emerging population. In order to have a Multilateral System for AnGR, it would be necessary to establish international and national animal gene bank(s). Just as the Standard Material Transfer Agreement has been designed for exchange of plant genetic material under the ITPGRFA, a similar Agreement could be used when it comes to trade and transfer of AnGR. It is believed that a Multilateral System for AnGR could facilitate research based on common animal genetic material in the public domain. It would also lead to facilitated access to those AnGR considered to be crucial for fighting hunger worldwide and ensuring security against future changes.

Although there could be many benefits from establishing a Multilateral System for AnGR, there are also many doubts about realization of this goal. The first complication for setting up the Multilateral System for AnGR is that AnGR have never been considered to be in the public domain, as animals are almost always owned privately. Another reservation comes from the fact that setting up of the Multilateral System for PGR was rather a lengthy process as it took seven years to create it, so it is expected to be similarly demanding to develop such mechanism for AnGR..

Legislation in the IPR forums may also affect the feasibility of a multilateral system on acess and benefit-sharing.Another forum where establishing of strict legislation might affect ABS of AnGR is IPR sector. Patenting of animal genes, animals or even breeds or breeding stocks (in fish breeding) might become everyday practice based on biotech-oriented legislation specifically designed for these purposes.

Although the title of this subchapter was indicating that final outcome of ABS negotiations might be a strict legally regime in the form of a Protocol under CBD, this is not the only way how we could look at things. Thus, all of the above mentioned policies (FAO policies, IPR policies) together with the future ABS Protocol might be seen together as elements of an ABS regime in a broader sense. ABS regime might not be necessarily defined just as a single Treaty or a Protocol under CBD but it might be seen as a combination of several regimes from the mentioned policy forums. Strict ABS regime complex would enable certainty in accessing animal genetic material and transferring of both monetary and non-monetary benefits to providers and owners of traditional knowledge and indigenous and local animal genetic resources. It is very delicate to foresee the likelihood of such policy outcome, but it seems that majority of stakeholders would like to know the rules of the game of exchanging AnGR.

4.1.2 Scenario 2: A 'hybrid' regime

The scenario of negotiating a 'hybrid' regime comprised of blocks of both legally binding and non-legally binding instruments would form an alternative development and possibly more feasible, for the reason that it is easier to agree just on a core of legally binding measures and for the remainder of aspects leave options that might be implemented with more flexibility. Since ABS issues are highly contested, most of the stakeholders are not willing to give in and quit their interests.

As it is almost impossible to reach consensus on a single all-encompassing legally binding regime, it is more plausible that the ABS regime might have certain legally binding

provisions (probably some broad rules could be agreed), whereas certain non legally binding provisions would be included too, depending on the specific biological, technical or institutional attributes of specific genetic resources. This means that certain provisions pertaining to ABS of general interest might be universally obliging, while some others might be left open to countries (regions/communities) or sectors to decide how to implement. Even more, indigenous and local communities might be given an active role in deciding how access and benefit sharing should be regulated with respect to genetic resources and traditional knowledge in their possession. For example, facilitated access to AnGR for research and development might be guaranteed and considered as an obliging provision of ABS regime, but some providers might interpret a regime differently insisting more on the sovereign right of states to determine access through national legislation and thus blocking access to certain genetic material. Countries have the sovereign right to only provide access to genetic material based on their prior informed consent and under mutually agreed terms of the contracting parties according to the internationally adopted concepts from CBD.

Therefore, if certain countries believe that they would not be fairly compensated for giving access to their animal genetic material, they could just impede the access procedure. Developing countries usually tend to regulate access to their genetic resources because of the intention to prevent biopiracy[13] and consequently inequitable benefit sharing. The Group of Like-minded Megadiverse Countries (LMMC),i.e. Mexico, Brazil, China, Colombia, Costa Rica, Ecuador, India, Indonesia, Kenya, Peru, South Africa and Venezuela, take such position. They believe that restrictive approaches towards their genetic resources is something that might be helpful in preventing biopiracy of the genetic material by stakeholders, which might later on profit on products derived from the resources which have been taken from their territories. This could prevent breeding companies from improving their breeding stocks, and also scientific research could be more complicated.

It might turn out that there is no special interest in having rules which strictly regulate ABS of AnGR because, at the moment, livestock breeding is not so much dependent on introgression of new genes from local breeds, populations or wild relatives into breeding stock unlike plant breeding, so that access to AnGR is not really an issue. Exchange of animal genetic material might just continue to be predominantly based on private and customary bilateral trade agreements and market supply and demand. However, certain ABS conditions would have to be fulfilled even if the exchange of AnGR continues to be based on the same mechanisms as before. They would be have to be defined within a 'hybrid' ABS regime but they would be far more flexible compared to the scenario of having a strict legally binding regime.

4.2 Multiple stakeholders with conflicting interests and unequal power

[13] "Biopirates are those individuals and companies accused of one or both of the following acts: (1) the misappropriation of genetic resources and/or TK through a patent system and (2) the unauthorized collection for commercial ends of genetic resources and/or TK" (IDRC, 2008, p.147).

Concept of biopiracy was explained by Rosendal (2003) as stealing of the biodiversity or traditional knowledge without sharing the benefits with the owner countries or communities from where the benefits have been derived. The first one to use term biopiracy has been former assistant general director of the Food and Agricultural Organization, Mr. Obaidullah Khana (Koopman, 2005, p.527). What he defined as biopiracy was: 'commercial development of naturally occurring biological materials, such as plants substances or genetic cell lines, by a technologically advanced country or organization without fair compensation to the peoples or nations in whose territory the materials were originally discovered'.

First and foremost, it is important to point out that there is widespread unawareness amongst the stakeholders[14] in the livestock sector on the current ABS negotiations in general.

Moreover, different stakeholder groups take diverging positions about conservation and sustainable use of AnGR and the sharing of benefits coming out of its utilization. Finally, stakeholders are still adapting their positions. "At times they need free and easy access to new genetic resources; later they need exclusive rights to exploit the economic benefits from their work; and when working to improve breeds/stocks they may again want free and open access to new genetic material" (Rosendal *et al*., 2006, p.394 from Tvedt, 2005b). As a result it is a true challenge how to reconcile[15] all those interests and how to ensure rational incorporation of the agreed ABS concepts into the overall ABS regime which deals with all types of GR.

Some stakeholders are more dominant in the ABS debate, especially government representatives, non-governmental and civil society organizations and scientists, while livestock keepers, consumers, traders, processors and retailers are less conspicious (Hiemstra et al., 2006). Often major differences occur between the perceptions of policy makers and farmers, pastoralists and breeding organizations.

One of the interviewees explains that in essence the debate about ABS of AnGR is a clash between the formal sector and the informal sector. Whereas the formal sector, represented by business companies and associations is mainly interested in profits and free access to all types of genetic resources, the informal sector (livestock keepers, local and indigenous communities, smallholders and civil society groups) is more concerned about loosing incomes and rights to their culture and traditions (personal communication).

Other respondents point out that the breeding industry is among the strongest stakeholders and therefore development of any ABS legal framework should fit into the current business of trading semen and embryos. They hold that modern breeding companies made far more progress in livestock breeding than in traditional breeding, which makes it difficult to say that traditional breeds could really contribute to the needs for high production, which by consequence puts traditional livestock breeds and their keepers into inferior position (personal communication).

4.3 Ownership of AnGR

A huge challenge for implementing ABS principles on AnGR arises from the fact that

[14] Stakeholders from the livestock sector involve (Hiemstra et al., 2006):

- livestock keepers and their communities (pastoralists, small holder farmers, hobby farmers and local and indigenous communities;
- end users of breeding material;
- specialized breeders and multipliers (private breeders, public breeders);
- consumers, traders, processors, retailers;
- scientists;
- policy makers (national governments, international organizations such as FAO); and
- groups influencing relevant to AnGR with backgrounds in environment, development, commerce and culture.

[15] However, this may not be the way how the process of ABS negotiations will unfold, as it is not only a bottom-up process. It does not mean that all the interests have to be reconciled so as to set up a regime, because establishing of a regime before 2010 is an obligation according to the mandate of the ABS-WG.

AnGR are primarily owned privately (sometimes communally) and are not considered to be in the public domain, which consequently affects their exchange and management. The concept that the owner of individual animals has the right of using the genetic resources in further breeding based on the bilateral contract or customary law is widely accepted. However, it is a strange concept for AnGR to be considered as private ownership, because genes are not private[16] according to the perception of one of the interviewees (personal communication). AnGR are actually under the state sovereignty, just as all the other genetic resources, and therefore exchange and trading of AnGR germplasm should not be based on private contracts and communal rules only.

Private ownership of AnGR is considered a challenge for fair and equitable ABS of AnGR, because according to current practice it is only the owner of the animal who may decide to sell the animal and with it the AnGR involved, and under which conditions. This means that access to AnGR is only governed by and might be hampered by the private ownership of animals. As a consequence, free/facilitated access to certain AnGR would require the animals concerned to be publicly owned. This would require establishing an (inter)national gene bank for AnGR, but it would be a great challenge how to fund and maintain such an international institution. The issue of benefit sharing is also directly related to the ownership of AnGR. If an international gene bank for AnGR were established, it would then be an issue how to ensure sharing of benefits with the initial owners of these AnGR if access was considered to be entirely free.

Ownership of AnGR is also interfered with by the IPRs over improved AnGR The development of new options and ABS concepts is thus needed, in particular because biotechnological developments might very soon make it attractive to patent animal breeds or improve genetic material. This would introduce additional forms of rewarding that go beyond the absolute rights of the owner of the animal. Compensation for "exclusive rights to knowledge and breeding technology" (Hiemstra *et al*. 2006, Pp.7-8) that have been employed in the process of genetic improvement programmes carried out by breeding companies, have to be envisioned. Patenting is usually the option considered to be suitable in this case. But whereas animal breeds may become patentable and thus generate benefits for the patent owners, there might be several other options for benefit sharing which take into account the need to reward all those who contributed to the unique (or improved) features of certain breeds. Here are examples of some of these mechanisms: a *sui generis* system for AnGR based on breed associations (associated with trademarks), geographical indications, the protection of TK and livestock keepers' and breeders' rights (Ibid.).

4.4 Economic value of AnGR

One of the critical differences between PGR and AnGR is that the economic value of an individual is very low[17] for plants as compared to animals. Even a single seed[18] contains the

[16] As one of the respondents observed, the animals carrying the genes are private. One can decide differently on the genes themselves, so the challenge is how to find access to carriers of the genes (personal communication, May 5, 2008)

[17] It is not a rule that PGR always have lower economic value. Thus: coffee, rubber, spices, etc. are very valuable, but most of PGR are not highly expensive.

[18] But some animals are also not that highly expensive. E.g. A single chicken is carrying the whole genetic

complete genetic information that might be further used for propagation, research and genetic improvements. The economic value of individual breeding animals is incomparably higher. In other words, access to PGR is far less expensive than accessing AnGR, if it is considered just from the point of the economic value of an individual germplasm carrier. But it is not only the relatively high economic value of AnGR that may be an obstacle when accessing AnGR, but it is also in the future added breeding value protected by intellectual property rights over improved breeding material.

It is generally believed that the purchasing value of an animal (the attainable price) already reflects all the inputs possible outputs, and enables equitable sharing of benefits between the seller and purchaser. However, the breeding value could exceed the purchase value of the exported animal or breeding germplasm (Hiemstra *et al.* 2006, Pp.7-8). This means that the purchase value of an animal does not reflect only the physical inputs, but it should also include intellectual property rights related to the breeding programmes.

But this is another challenge by itself, not only because animal breeds are still not seen as patentable, but also because there is still no universally accepted definition for an animal breed.

4.5 Concept of a breed

One of the interviewees recognizes in personal communication that the basic precondition for ABS of AnGR is to have an internationally agreed definition of what the basic livestock taxonomic unit is. The notion of a livestock breed is pretty artificial and not universally accepted. Definitions are not the same in developing and developed countries. As long as a single concept of a breed is lacking, it is a challenge how to consider ABS of AnGR on a global scale. Furthermore, the same respondent explains that only if we are certain about who is really responsible for the development of unique features of certain breeds, could it be possible to organize ABS in a fair and equitable way, a problem also encountered in ABS for the products of plant breeding.

Another interviewee noticed that even if the concept of defining the breed[19] shifts from phenotypic characterization based on the physical characteristics to DNA fingerprinting, there are still no mechanisms to define whether an individual animal is belonging to a breed or not. Until 25 years ago the exterior of an animal was the only modus for describing the breed (e.g. colour of the skin, the length of the animal, the height, size and shape of the ears, etc.– it was very subjective). Nowadays we have the possibility to make a DNA fingerprint of an animal which can be more accurate but it cannot tell a lot about the breed or breed history. Even if we had two animals which phenotypically clearly belong to different breeds, it may be difficult to determine which of their DNA fingerprints matches particular animal. It is a real challenge to develop such DNA fingerprinting system that could unequivocally confirm that an animal is belonging to a particular breed. Even with the state of the art SNP[20] technology it is difficult

material which might be interesting for research and further selection, but the price of that same carrier is fairly low.

[19] Breed is defined by Gibson and Paulin as a population of animals that share certain defined physical characteristics and which are not routinely bred with other populations (Hiemstra et al. 2006, p.13).

[20] Single Nucleotide Polymorphism (SNP, pronounced *snip*), is a DNA sequence variations that occur when a single nucleotide (A, T, C, or G) in the genome sequence is altered. Each individual has many single nucleotide polymorphisms that together create a unique DNA pattern for that individual. SNPs promise to significantly

to ensure that DNA fingerprinting could effectively distinguish between different populations of a species (personal communication). In other words, even in developed countries with state-of–the-art technology, it is difficult to organize ABS of AnGR based on DNA fingerprints, as it is not always possible to be absolutely certain that a particular DNA fingerprint is really indicating that an animal belongs to a particular breed.

There is another complication with respect to ABS when thinking about breeds, because apart from "local" breeds which are occurring just in one country, "transboundary" breeds have been identified as well. According to the new classification system for breed populations developed for The State of the World's Animal Genetic Resources for Food and Agriculture, 1,080 (14 percent) of the total 7,616 recorded breeds are considered to be trans-boundary breeds. Within the trans-boundary breed category, a further distinction is made between "regional" trans-boundary breeds – those that occur in more than one country within a single region, and "international" trans-boundary breeds – those that occur in more than one region. (FAO, 2007b, p.13).

It remains to be seen how access and benefit sharing could be organized if certain AnGR would come into the public domain, because trans-boundary breeds imply that the benefits should be shared between regions and countries responsible for the development and further maintenance of those breeds. Those breeds are not only trans-boundary in terms of the regions where they are located presently, but also in terms of their composite origins based on contributions made by several communities and countries that have dedicated their knowledge and efforts to develop these breeds. Although all AnGR originate from a limited number of centres of origin/domestication, further breeding contributions have been made by many individuals/communities, in the process of development of new breeds. As one respondent indicated, the formation of livestock genetic make-up is a dynamic process. Breeds are the result of a combination of old and recent events regarding the management of genetic material (personal communication).

4.6 Veterinary and zoo-sanitary measures

Another important aspect of resulting in restricted access to AnGR is that a significant amount of transmissible diseases is prevalent among domestic animals (enzootic) and between domestic animals and people (epizootic). Some respondents express the opinion that infectious diseases lead to additional precaution when dealing with AnGR compared to PGR (personal communication). Therefore, access to AnGR appears to be more complicated by itself, as it does not deal exclusively with reducing economic risks such as with transmissible diseases in plants, but also with human health risks. In other words, prevention of zoonoses is also related to ethical, sociological and political concerns, imposing additional obstacles in exchange of AnGR in that way.

Veterinary and zoo-sanitary measures are set up at the national level in all countries, but they are also coordinated through the international standards from the Office International des Epizooties (OIE) in Paris, France. Furthermore, international standards of the WTO with respect to Sanitary and Phytosanitary measures (SPS) aim to harmonize national legislation of individual countries. The SPS Agreement[21] has the aim to reduce unjustified sanitary and

advance our ability to understand and treat human disease (BMBCB, 2008).

[21] The WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) – see more at http://www.wto.org/english/tratop_e/sps_e/spsagr_e.htm (visited at 28-05-2008).

phytosanitary measures for the purpose of promoting trade. These rules are not designed to regulate the exchange of AnGR, but they indirectly impact on international exchange of genetic resources (Hiemstra *et al*, 2006).

When relating ABS of AnGR to veterinary and zoo-sanitary measures, one can conclude that these measures significantly affect movement and exchange of animal genetic material. For example, access to AnGR might be blocked in case of outbreaks of transmissible animal diseases. Sometimes, veterinary and zoo-sanitary measures require destroying of complete populations of animals in case of serious diseases, and consequently, access to the genetic pool of culled populations might be impossible for good.. This might be the case especially with the zoonoses, where priority is always given to saving human lives. As a bottom line, it can be concluded that even if ABS of AnGR was perfectly functioning, in case of diseases it would be dramatically affected by veterinary and zoo-sanitary measures.

4.7 Evolution of ABS concepts

Last but not least, a challenge in how to frame ABS of AnGR lies in the fact that even seemingly universal ABS concepts and principles are evolving and changing over time. Thus, the initial framing of the ABS issue (open access and common heritage) went later through a subsequent framing of state sovereignty over access, and finally to the framing of intellectual property rights over genetic resources. This general trend in evolving ABS concepts might seem not to fit the case of AnGR, as perceptions on ABS with respect to AnGR have not been changing in the same way.

AnGR have always been the private ownership of livestock keepers or breeders. So we could say that the initial framing of ABS of AnGR was private ownership and exchange based on either bilateral agreements between seller and purchaser or other private and communal rules. Later on, the CBD changed this perception with the view that all genetic resources (AnGR for food and agriculture as well) were considered to fall under state sovereignty. The notion of sovereign rights over genetic resources risks creating an anti-commons or a new enclosure system for raw genetic materials. An anti-commons can occur when too many individuals or entities have rights of exclusion to a given resource (IDRC, 2008, p.161 from Safrin 2004). An anti-commons or new enclosure system poses many problems in GR for conservation, breeding and improvement of genetic resources crucial for food security.

When it comes to intellectual property rights, livestock breeds still do not fulfill the patentability requirements, whereas no sui generis system has been developed either. Furthermore, AnGR for food and agriculture are not yet considered to be in the public domain, so they are not regarded as a common heritage of mankind. But in the near future, this might change if a Multilateral System for AnGR though an international gene bank system for AnGR were to be developed.

The main emphasis in interpreting the ABS issue is lately placed on equitable sharing of benefits, especially with traditional and indigenous communities. Mechanisms for ensuring fair benefit sharing have been indicated in the Bonn Guidelines, but they are formulated just as a list of benefits that may be included, without being exhaustive (CBD online, 2008b). Those measures are defined as instruments which could be operational with all types of GR, but they are not designed to specifically address the needs of stakeholders from the livestock keeping and breeding sector.

Developing nations (and their indigenous communities) are becoming aware of the

profits foregone if they do not act, and their prompt reaction to the concept of state sovereignty over genetic resources has been enacting strict national access legislation. Thus the Andean Community[22] (formerly known as the Andean Pact/Group), which is multi-ethnic, pluri-cultural and rich in important biological and genetic resources, has established a strict legislation to provide access to genetic resources. However, one of the respondents warns that, even when there have been stringent laws put in place (Andean region), genetic material can still be smuggled out (such as llamas and alpacas from the Andes to the USA).
It is very difficult to design a system that allows enough freedom for commercial trade, while at the same time making sure that some of the commercial benefits go back to the place where animals have been developed or domesticated (personal communication). Limited access to animal genetic resources directly affects the commercial benefits that could be gained. The contradiction exists even within the two objectives of giving access and sharing the benefits, and it is a real challenge how to bring them together.
.

5 Translation of ABS principles into operational measures

Since according to the mandate of the ABS-WG the ABS Protocol under the CBD is expected to be completed in 2010, it is high time to start thinking about specific operational measures which could be agreed as elements of the international ABS regime. However, many stakeholders of the negotiation process believe that it is still early to develop specific instruments, since even the basic elements (nature of the regime) of the overall ABS regime have not yet been agreed upon between the negotiating parties.

Just as the outcome of the negotiation process regarding the nature of the future ABS regime is not clear, discussions about potential ABS instruments and operational measures will often be speculative based on the two policy scenarios introduced in Chapter 4.2. Proposed measures for ABS of AnGR are derived from the discussions in international policy forums dealing directly or indirectly with exchange of animal genetic material (CBD, FAO, WIPO, WTO), and also from the anticipated national access legislation of Norway which is still pending (Rosendal *et al*., 2005). Likewise, some of the ABS instruments listed below could be seen as legally binding, while others might be more voluntary and could be seen just as a suggestion of how to organize fair and equitable ABS for transactions with AnGR.

5.1 The need for an ABS regime

Before going into detail about specific operational measures which might be used for ABS of AnGR, it is necessary to mention a remark made by a number of survey respondents. They believe that it is too early to envisage certain ABS measures for AnGR, because there are still more relevant actions to be undertaken. They indicated that several issues might be more relevant for conservation and sustainable use of AnGR. Problems such as pests,

[22] The Andean Community (Spanish: *Comunidad Andina*, CAN) is a trade bloc comprising the South American countries of Bolivia, Colombia, Ecuador and Peru. The trade bloc was called the Andean Pact until 1996 and came into existence with the signing of the Cartagena Agreement in 1969. Its headquarters are located in Lima, Peru. The original Andean Pact was founded in 1969 by Bolivia, Chile, Colombia, Ecuador and Peru. In 1973, the pact gained its sixth member, Venezuela. In 1976, however, its membership was again reduced to five when Chile withdrew. Venezuela announced its withdrawal in 2006, reducing the Andean Community to four member states. Visit at: http://www.comunidadandina.org/.

zoonoses and climate change, which might all induce biodiversity loss and genetic erosion of livestock might be far more serious than the need for regulating access and benefit sharing among various stakeholders related to livestock keeping, breeding and using.

Genetic resources on a global scale constitute an "essential heritage of humankind" (BRG, 2002, p.4). We have inherited great wealth and diversity of AnGR created through millennia. FAO's Global Databank for AnGR for Food and Agriculture gathered data of 7,616 livestock breeds in total in 2007. However, 86% of all these breeds are local, occurring just in one country, so that there is a great threat of marginalization and loss of these breeds which are becoming underutilized or even totally excluded from the new production systems. 62 breeds have gone extinct during the last six years, which equals to one breed lost per month during the last six years (FAO, 2007a). Agro-biodiversity is under great threat, but the awareness about its importance and the need for immediate action for conservation of what remained is not really high on the internationally policy agenda.

An encouraging fact is that the international community realized that countries and regions are interdependent in utilization of AnGR. Historic and current gene flows reaffirm the idea that AnGR are our common global responsibility. Although we know that just part of the overall biological diversity is really vital for future food security, we do not exactly know which part it is, based on the anticipated future developments. Even more, the knowledge about genetic knowledge is still quite limited. Implementation of the Global Plan of Action for AnGR is expected to significantly contribute to achieving the Millennium Development Goals 1 (to eradicate extreme poverty and hunger), and 7 (to ensure environmental sustainability), and it is consequently going to affect ABS of AnGR. Eradicating extreme poverty and hunger will be feasible only if access to all types of GR (AnGR as well) is facilitated, whereas ensuring environmental sustainability through significant reduction of biodiversity loss rates will direct how to use and maintain AnGR.

As several respondents explain, 20 percent of the recorded breeds according to The State of the Word's AnGR for Food and Agriculture is classified as being "at risk" which implies that conservation and sustainable use of AnGR should be higher on the agenda than the need to arrange ABS. Therefore, reverting the rate of biodiversity loss by 2010 (one of the sub-goals of United Nations Millennium Goal 7) through identification, conservation and sustainable use of AnGR might be a first necessary step before ABS should become a real issue. If agro-biodiversity was lost, then discussion about access and sharing the benefits out of something that does not exist would be completely futile. This might be one of the reasons why just a few authors and international organizations have really focused on defining the ABS instruments that are pertinent for AnGR, thinking it might be more relevant to focus on identification, conservation and sustainable use of AnGR.

The impression that setting up an international ABS regime (that deals with AnGR as well) is not a priority at this moment, is especially present in the attitude of stakeholders from the commercial breeding sectors, because of the fears that imposing new legally binding rules would further complicate trade and management of AnGR. An interviewee sharing this opinion explains that new ABS legislation might just impose higher administrative and administrative costs when it comes to exchanging of genetic material. Setting up of such legislation would even prevent poor owners (such as owners of local and indigenous breeds) to participate in such a system as they could hardly be able to bear those costs. Therefore, the suggestion from the commercial breeding sector is to continue using the existing frameworks (such as the European legal framework for the breeding organizations) and possibly to try to supplement them with few additional ABS elements (personal communication).

At the same time, one might claim that it makes no sense to discuss the urgency of

ABS rules because it has been internationally agreed that the regime will have to be completed before 2010. So, it is not the issue whether we need an international ABS regime, but how to shape such a regime so as to adequately address the specific nature of AnGR. Bearing in mind the specific nature of AnGR, it is apparent that fair and equitable access to and benefit sharing of AnGR could be only achieved through specifically designed measures that fit their distinct nature. As there are huge biological and technical breeding differences between the different species of AnGR, proposing certain sets of instruments might not be applicable for all species of AnGR. It might be difficult to create even a single regime for AnGR that could perfectly cover all aspects and fit all the interests and needs given the differences among various types of AnGR.

Some stakeholders even believe that regarding a single species of domestic animals, certain ABS instruments might not be applicable in the same way to all breed categories based on whether genetic flows are North-South, North-North, South-North or South-South. It might seem that the creation of special ABS sub-regimes for AnGR based on the differences in genetic flows is far from practical reality, but this approach might also be helpful to address the specific nature of AnGR.

Taking into account all the specificities and unique nature of AnGR, it will be a great challenge to create one ABS regime which includes all types (plant, animal and microbial) of natural and domesticated GR for food and agriculture among which AnGR as well, and that would not at the same time neglect some of the specific features of these GR. One of the respondents emphasizes that "one size fits all approach" could just create all kinds of problems. It is necessary to recognize the differences between different types of GR and make the International Regime sufficiently flexible. One respondent adds that having an all inclusive regime would be possible just on a declarative level but when it comes to implementation, it would not be easily implementable (personal communication).

5.2 Applicability of ABS Strategies in Aquaculture to AnGR

Rosendal *et al*. (2005) proposed quite an elaborate framework of protecting strategies for regulating access to aquaculture genetic resources, based on the Norwegian access legislation which is currently being developed. Although aquaculture does not involve a mainstream type of AnGR relevant for food and agriculture, some of the instruments explained in this study could be considered as potentially useful and applicable for ABS of conventional livestock species. Table 4 and Table 5 presented below give short overviews of all these strategies/measures.

All of the measures mentioned in Table 4 and Table 5 are mostly protective and they seem to be representing just one specific aspect of ABS i.e. the control of gene flows by breeding organisations. The reason why precisely these measures have been envisaged, might be because aquaculture genetic resources are reported to be in the public domain and therefore it is not an issue how to access aquaculture genetic resources, since they are wild and considered a common resource open for everyone to use, according to the Norwegian Nature Diversity Act (Rosendal *et al*., 2005, p.7). However it is still a question how to access breeding material and how to share benefits when breeding material is being exchanged.

Biological protection measures do not represent policy measures for implementing ABS principles, but they do get used as mechanisms to prevent unauthorized use of aquaculture breeding stocks. Consequently, these measures affect the benefits that could be

derived from these genetic resources. For instance, if a "hybrid" or a cross-bred animal is sold to a purchaser, it is then impossible to regenerate the parent lines or reproduce the same features in the progeny from those commercial hybrids within a short period of timeand with simple means. Therefore, the benefits only fall on the breeders themselves, since the buyer/consumer will always come back to breeders. However, when thinking about typical livestock species, biological protection measures are not always feasible. Creation of hybrids and improved breeding stocks are already widely used practices in commercial poultry and pig breeding, but sterile animal production is not something that fits AnGR conservation, because maintaining the high reproductive capacity is very valuable for all domestic animals, and it is not constructive to lose it.

Table 4 Strategies for biological, legal and other protection of Aquaculture GR.
Based on Rosendal *et al.* (2005)

Type of measure	Measure		Characteristics
Biological protection	**Continuous upgrading of the material (staying ahead of competitors)**		Every new generation performs better, so that breeders entice producers to come back for source and pay extra for the upgraded genetic material.
	Protection of the breeding process	**1. Cross-breeding and hybrids**	Users of the material cannot maintain the heterosis effects in the progeny if hybrids are reproduced and thus they have to come back to breeders and purchase cross-bred animals; the drawback is formed by the costs for producing and maintaining the parent lines of the variety.
		2. Sterile production animals	Applicable just to some aquaculture species by applying shock on the eggs in the hatchery (temperature, pressure or chemicals), reminiscent of GURTS.
Legal protection	**Branding**		Register product names and trademarks and thus ensure this type of intellectual property rights on genetically improved populations; the drawback is that it only prevents unauthorized use of the registered name, whereas the genetic material itself can be freely propagated by outsiders.
	Material Transfer Agreements		The breeding programme supplies the user with genetically improved livestock or semen under the conditions of: financial returns to the breeding programme and limitations on the use of material; the drawback is that opportunities for tracing of sold material are limited.
	Patents		Animal varieties still cannot be patented, but animal gene constructs could be if they are based on gene sequence, transgenic animal and/or marker gene; the drawback for third parties is that patents might lead to restricted access and thus to reduced options for further innovations.
	***Sui generis* systems**		Animal breeders' rights may be based on different principles than the Plant breeders' rights: animal populations are genetically heterogenous[23] and do not

[23] But even some plant varieties such as crucifers and maize are genetically heterogeneous (personal communication).

		fulfill the criteria of being: new, distinct, uniform and stable
Other protection	**Trade secrets**	Exclusive access to use of a breeding nucleus, procedures for data recording, data processing, selection and mating of animals; the drawback is that trade secrets are vulnerable to leakage of genetic material and that they hamper access and exchange of genetic material.

Legal protection measures are likely to be applied on AnGR for food and agriculture, and they are not only relevant from the perspective of breeding organizations. For example, branding could be used together with geographic indications for certain breeds to ensure fair compensation even for small holders. However, in such scenarion it is very important to have adequate enforcement strategies, so as to be able to control and trace use of aquaculture genetic material. Table 5 gives some of options for enforcement measures.

Table 5 Enforcement strategies for tracing and documenting unauthorized use of aquaculture genetic material.
Based on Rosendal *et al*. (2005)

Enforcement Strategies	**Allele frequencies**	Suitable for discrimination between populations (tracing population from one generation to another); not suitable for assigning individuals to a particular population. Ambiguities likely, so difficult to implement
	Marker sequences	Individuals carrying unique alleles of a gene may be assigned with certainty to a particular population (isolated for many generations); high frequencies of certain allele typical for a brood stock population found in farmed stock indicate unauthorized use of the breeding programme. Applied by Monsanto in policing unauthorized use of its maize seeds.
	DNA fingerprinting/profiling	Tracing ancestors of an individual based on highly variable DNA sequences like microsatellites or single nucleotide polymorphisms (SNP); the major drawback ths that this is a rather extpnsive laboratory analysis required which is rather expensive and laborious exercise.
	Certificates of origin[24]	Genetic origin of stocks (males and females used for production of seed) could be traced back to breeding programmes and breeding nucleus by documentation and possibly by techniques such as DNA fingerprinting; whereas it might be easy to establish consensus on such fingerprinting system nationally, it probably is a major challenge at the international level; moreover, the same ambiguities as for allele frequencies apply.

[24] One respondent indicated in personal communication that the concept of: country of origin is useless for AnGR because certain animal breeds are trans-boundary and not exclusively under the state/national sovereignty. At the same time AnGR have multiple domestication centres.

It is obvious that most of the instruments have been developed as protective measures for restricting access to AnGR that have been improved through breeding programmes. However, there is growing awareness in the international community that in addition to property protection in ABS of AnGR facilitating access to the resources which have to be considered as common and shared needs to be secured. In this context it should be mentioned that the majority of the interviewed stakeholders pointed out that a protective approach is not the best solution for ABS of AnGR.

As explained in the introduction, ensuring wide access to AnGR for various interested users and sharing the benefits derived from genetic resources is essential for the conservation, sustainable use and development of AnGR for food and agriculture; for world food security; improving human nutritional status; and for rural development (FAO, 2007a).

One of the interviewees explains that a liberal approach for sustainable use of GR is more constructive than a protectionist approach. He believes that there should be a focus on practical needs stemming from current and anticipated flows of genetic material and not on a hypothetical discussion about the necessity to restrict access to GR. This will prevent establishing paper tigers, he concluded (personal communication).

Although patenting is not yet seen to be a widely applicable approach, that position might change within few years. At the same time, other types of intellectual property protection such as branding (trademarks), trade-secrets, and geographical indications may appear appealing in relation to AnGR. Trademarks are "exclusive rights to use distinctive signs, such as symbols, colours, letters, shapes or names, to identify the producer of a product and protect its associated reputation" (IDRC, 2008, p.256). Although a trademark gives an added value to a product, breeds themselves will not be protected through trademarks, but the products derived from breeds could be covered by trademarks, and – together with a system of geographical indication – add value to the products of an animal (breed). Trade secrets regard "commercially valuable information about production methods, business plans, clientele, etc. They are protected as long as they remain secret by laws which prevent acquisition by commercially unfair means and unauthorized disclosure" (ibid.)

5.3 Applicability of ABS instruments developed for PGR to AnGR

The development of some internationally agreed ABS principles, such as state sovereignty over GR, and free access to important GR which are in the public domain, seem to better fit Plant Genetic Resources. Some respondents stress this by referring to already existing policies regulating exchange of PGR (UPOV Agreement, ITPGRFA). They point at the fact that the capacity of negotiating parties in the plant breeding sector is incomparably stronger. Some other explanations for neglecting AnGR in the ABS debate have also been offered. As one of the interviewees speculated, the reason might be that the ratio of people working on AnGR versus PGR within the Consultative Group on International Agricultural Research is 1:10 according to estimations (personal communication). However one might also claim that ABS issues only form a marginal topic in research so that this observation is ot very informative.

As it has been mentioned above, animals breeds have complex (composite) pedigrees, and it is still difficult to formulate mechanisms that would specifically recognize and compemsate all those who might have been responsible for their creation. However, in this

context, some of the mechanisms which have been developed for PGR might be used as a good starting point when developing ABS measures for AnGR.

5.3.1 Multilateral System for facilitated access to AnGR

Unlike measures which are foremost developed to prevent profit making on commercialized products without fair benefit sharing such as on improved genetic materials developed by breeding organizations, some measures have been developed by which purchaser and seller are not the only two parties sharing the benefits of products developed using genetic material exchanged.

ALong these lines, ideas have been proposed for facilitated access to certain germplasm of domesticated AnGR through a model which is comparable to the Multilateral System developed in the framework of the ITPGRFA. This would entail that all interested users of AnGR would obtain the possibility to access this genetic material through a facilitated procedure that would include benefit sharing arrangements.

The Standard Material Transfer Agreement in the context of the ITPGRFA has been developed as a special instrument for facilitating access to PGR listed in the Annex 1 of the ITPGRFA, and for sharing in a fair and equitable way, the benefits arising from utilization of these resources, on a complementary and mutually reinforcing basis. It is believed that a single or small number of model MTAs could be used similarly to facilitate exchange of AnGR based on the characteristics of the AnGR involved, agreed commercial transfer prices and conditions for the animal(s), use restrictions and supplementary benefit sharing provisions (Hiemstra *et al.,* 2006). While some authors believe that such model contracts may lead to reduction of inequality of negotiation parties, some stakeholders such as the breeding industry claim that such kinds of agreements are not needed because bilateral trade agreements already regulate exchange of genetic material in an adequate manner.

One respondent explained in the interview that the existing EU legal framework for animal breeding organizations would fit reasonably the current situation in the livestock sector without restricting exchange of genetic material and without creating additional costs for those parties who are already not in a position to afford the purchase (personal communication).

Another respondent warned that there are also differences in position among countries and regions regarding the need to develop MTAs for AnGR. Hence, he explained, it seems rather unrealistic to suggest creating and using separate and unique MTAs for AnGR, because such development process would only increase transaction costs and it would become more expensive to exchange genetic material (personal communication).

5.3.2 International gene banks for AnGR

A majority of the interview respondents agreed that one of the potentially very good mechanisms for ensuring fair and equitable ABS of AnGR is to create a list of certain germplasm of domesticated AnGR that is considered relevant in order to prevent future food shortages, and to which access should be free as they would be publicly owned and considered as common good of the international community. This would require establishing

an international gene bank for AnGR where genetic material could be conserved *ex-situ*[25]. However, creating a global public good is very difficult in light of the CBD principles as one of the respondents noticed (personal communication). He explained that a lot of technical and political terms need to be agreed before it would become feasible to establish publicly owned AnGR germplasm, because the issue is also related to (Intellectual) Property Rights, technology transfer and trade matters.

Some stakeholders are opposed to the vision of *ex situ* gene banks as a global storage of publicly owned AnGR, as they believe that *in situ*[26] conservation is just as relevant, and it would be al least reasonable to combine the two approaches. However, having a international genetic resources centre that combines both approaches for all the relevant species and breeds of domestic animals is very difficult to establish and maintain at one place, according to the perception of few respondents. The costs of keeping the animal populations *in-situ* are very high, as much as the costs for preparation, collecting and freezing of semen, embryos or tissues *ex situ*. Even more, as one interviewee indicated, if we maintain animals on-farm, the amount of land required is much larger proportionately than it is to maintain major genetic resources of plants. Thus, the respondent concluded, there are not many germplasm collections for AnGR (gene banks for animals) either in the public domain or under government (or private) control, because it is very costly to maintain them, and it requires substantial technical skill (personal communication).

On the other hand, one interviewee added that although having an equivalent to the Svalbard Global Seed Vault[27] for PGR should be a goal for AnGR as well, the fact that there are no international gene banks for AnGR does not mean that there is no free access, because under the current system of trade no one can stop a person from buying an individual animal from a private owner. Despite of this, access is still not guaranteed because there should be a party willing to sell (personal communication).

At the same time, there are arguments against exclusive reliance on *ex situ* collections by certain stakeholders, as these would not encompass constant further adaptations of the

---

[25] *Ex-situ* conservation is according to the Article 2 of the CBD (CBD online, 2008c): "the conservation of the components of biological diversity outside their natural habitat".
Literally it means conservation "off-site" or outside organism's natural habitat, such as in gene banks (IDRC, 2008, p.254).
According to Hiemstra et al. (2008) based on Gibson et al.:
"*Ex situ – In vitro* conservation involves maintenance of endangered AnGR outside their traditional environment (cryoconservation of gametes, embryos or somatic cells that have the potential to reconstitute live animals).
Ex situ – In vivo conservation involves the maintenance of living animals outside the area where they evolved or are normally found, e.g. research stations or zoos".

[26] *In-situ* conservation is according to the Article 2 of the CBD (CBD online, 2008c): "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".
Literally it means conservation "on-site": in the wild or on farmers' fields (IDRC, 2008, p.255).
According to Hiemstra et al. (2008) based on Gibson et al.:
"*In situ or On-farm* conservation requires continued use of a breed by livestock keepers in agroeco-system in which the breed evolved or is now normally found. This includes both farms and pastoral production systems".

[27] Visit home page at:
http://www.regjeringen.no/en/dep/lmd/campain/svalbard-global-seed-vault.html?id=462220.

Besides the idea to have a single international gene bank for AnGR comparable to the Svalbard in Norway, there are ideas about establishing a decentralized gene bank where certain percentage of genetic resources might be allocated and kept in Artificial Insemination (AI) Centres or comparable institutions.

animal germplasm to changing environmental conditions (climate change, emerging new diseases, disasters and microbial co-evolution with AnGR), so that the GR should be kept and conserved in the environment where they originated, because of the process of dynamic adaptations. The same concerns about establishing of the *ex situ* gene banks for PGR have been debated for many years, but they were finally resolved with the notion that *ex situ* and *in situ* approaches are complementary. As one respondent explained, new copies of animal genes should be conserved each year, because of the need for constant adaptation and evolution in relation to microbial mutations. For instance, he added, if we conserve a certain copy of genes, it might prove after 50 years not to be adapted to new environmental conditions and micro-organisms which would have evolved in the meanwhile. The old copy of an animal gene would not suffice because it might not have the adaptive mechanisms relevant for survival (personal communication).

Therefore some respondents suggest alternative, less expensive mechanisms for conservation of animal genetic material. One of these, highly technological, options could be to develop and maintain certain cultures of virally transformed cell lines of important AnGR germplasm. Genetic material of endangered breeds could thus be maintained in the form of transformed cell lines and propagated when needed.

But again the technical skills for preserving the cell lines although easier than for preserving the embryos, are still quite complicated and not applicable for all cases of conservation (personal communication).

5.3.3 Livestock keepers' and livestock breeders' rights

Translating of certain ABS principles already developed for PGR such as farmers' rights and plant breeder's rights into livestock keepers' rights and livestock breeder's rights proves to be quite a challenge as there are a lot of similarities but also certain differences. A summary of the similarities and differences between farmers' and livestock keepers' rights is included in Table 6. Livestock keepers' and livestock breeders' rights are currently unexplored legal and political concepts, although the "Karen Commitment" already shows the first signs of developing these concepts (LPP-KC, 2003). Discussions about the contribution of traditional and local communities to conservation and sustainable use of biodiversity have become relevant in the last two years in the light of the negotiations for a global ABS regime.

Although the role of the special[28] working group mandated to deal with the issues of traditional knowledge was expected to be more stimulative in ABS discussions, the ABS-WG5 meeting showed that protection of traditional knowledge could be a big issue in the ABS negotiations (ABS-WG5 Summary, 2007).

Recognition of the enormous contribution of the local and indigenous communities and farmers, pastoralists and animal breeders throughout the world is emphasized even in the Interlaken Declaration on Animal Genetic Resources, which is an important outcome of the International Technical Conference on Animal Genetic Resources held in Switzerland in

[28] Call for advanced work on implementation of Article 8(j) originated from the meeting of COP 3 of the CBD and later, special open-ended working group on Article 8(j) has been established on COP4. There have been six meetings of the Article 8(j) WG. This working group considered collaboration with the ABS-WG at its fourth meeting (2006, Granada, Spain). COP 8 (2006, Curitiba , Brazil) requested the Article 8(j) WG to contribute to the mandate of ABS-WG. During the ABS-WG5 meeting (2007, Montreal, Canada), meeting of the Article 8(j) WG5 was concomitantly organized at the same venue with the aim of preparing recommendations on inputs by the Article 8(j) to the negotiation of an international ABS regime. This proved to be very difficult as there were many disagreements and recommendations have not been adopted.

September 2007 (FAO, 2007a, p.1). It recognizes "the historic and relevant contribution of all persons engaged in animal husbandry, who have molded AnGR to meet societal needs. It is their ownership and management of the genetic resources of their livestock that has enabled them to make important contributions in the past. It is this ownership and management that should be ensured for future societal benefits (…) they should participate in the fair and equitable sharing of the benefits arising from the utilization of AnGR for food and agriculture" (Ibid.) This means that their traditional knowledge should be preserved and respected, and they should be allowed and supported to participate in decision making.

In this context, as one interviewee perceived, the indigenous livestock keepers might have had a great contribution in the creation of certain locally adapted animal breeds, but it is not their responsibility to continue keeping them without an adequate compensation and supporting measures (personal communication).

Table 6 Similarities and differences between farmers' rights over PGR and livestock keepers' rights over AnGR.
Based on Visser & Hiemstra (2008).

Factor	Farmers' rights	Livestock keepers' rights
History	First mentioned in 1980s; adopted by FAO International Undertaking in 1990; elaborated in Art. 9 of the International Treaty.	developed since 2000
Scope	the local and indigenous communities and farmers	farmers, pastoralists and indigenous communities
Objectives	to recognize farmers' contributions in the past, present and future to maintaining plant genetic resources; to conserve plant genetic resources; to ensure full benefits to farmers.	to enable livestock keeping communities to continue keeping their breeds and use/develop them as the basis for sustainable rural income generation; to have access to grazing territories, water and other resources; to conserve livestock diversity; to contribute to rural poverty alleviation.
Common elements	Art. 8j of the CBD "to respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices";	
Issue: traditional knowledge	protection of traditional knowledge relevant to plant genetic resources for food and agriculture	recognition of traditional breeds associated with indigenous knowledge and cultural expression
Issue: right to benefit-sharing	the right to equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture;	the right to equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture;

	info exchange, tech transfer, capacity development.	info exchange, tech transfer, capacity development.
Issue: right to participate in decision-making	right to participate in making decisions on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture	right to participate in policy making processes on animal genetic resource issues
Issue: right to save, use, develop, exchange and sell farm-saved seeds and breeding materials	rights that farmers have to save, use, exchange and sell farm-saved seed/propagating material, subject to national law and as appropriate	right to make breeding decisions; right to breed, and right to sell animals and their products.

It has been agreed in the Global Plan of Action for Animal Genetic Resources that one of the main aims is to "promote and recognize the role of traditional knowledge relevant to conservation of AnGR… and meet the needs of pastoralists and farmers, individually and collectively… 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 AnGR, and benefits from economic development" (FAO, 2007a, p.10).

Taking into account that livestock keepers' rights could include not only the right to keep, breed and sell animals, but also grazing rights and the right to be consulted in policy making (Hiemstra *et al.*, 2006, p.32), special measures could be developed for supporting livestock keepers in maintaining and sustainably using indigenous and local breeds. These measures should take their specific ecological, socio-economic and cultural features into consideration. Some of these measures might be the following (FAO, 2007s, p.20):

- assessing the value and importance of indigenous and local production systems, identifying trends and drivers affecting the genetic base;
- supporting through the following measures: veterinary and extension services, micro-crediting for women in rural areas, ensuring appropriate access to market and natural resources, resolving land tenure issues, recognition of cultural practices and values, and adding value to their specialist products;
- integrating traditional knowledge with scientific approaches through exchange, interaction and dialogue among indigenous and local communities and scientists and government officials and other stakeholders; and
- promoting and developing niche markets for products derived from indigenous and local species and breeds, and strengthening the process of adding value to their primary products.

6 Conclusions and Recommendations

An analysis of the applicability of Access and Benefit-Sharing (ABS) principles on Animal Genetic Resources (AnGR), as under development in the ABS negotiations under the Convention on Biological Diversity (CBD), proved to be quite a demanding task. The multifaceted nature of the ABS issue required close examination of several topics and assumptions featuring in multiple debates the most important being: (1) the need for setting up an international ABS regime which amongst all types of GR would also deal with AnGR;

(2) the perceived specific nature of AnGR distinguisging it not only from undomesticated biodiversity but also from PGR; (3) current practices used in the exchange of AnGR, in which the genetic resources is traded as part of the transaction on the animal(s).

The following overall conclusions can be drawn based on the presented analysis:

1. Animal genetic resources with actual or potential value have contributed to human survival and development throughout history, and they represent nowadays a valuable heritage created through millennia of breeding and selection. The genetic diversity of livestock breeds is a great reservoir that could act as insurance against future changes including emerging diseases, climate change, and socio-economic and institutional changes. But in order to make use of this potential to its full extent, an important precondition has to be fulfilled: *AnGR should be considered a public good so that they could be made freely accessible.*
2. At this time, 20 percent of all recorded breeds are considered to be at risk, while 62 breeds have gone extinct during the last six years, which equals a loss of one breed per month. In general, agro-biodiversity is under threat, whereas the awareness about its importance and the need for immediate action for conservation of what remains does not feature really high on the national and international policy agendas.
3. The international community realized that countries and regions are interdependent in their utilization of AnGR. Historic and current gene flows reaffirm the idea that AnGR are our common global responsibility. The Global Action Plan for AnGR and the Interlaken Declaration form the first signs of a growing international concern about the necessity of conservation, sustainable use and equitable sharing of benefits from the use of AnGR.
4. Although we have inherited a great diversity of AnGR, we have also brought it under threat. Therefore, we need to develop such national and international institutional frameworks that would contribute to conservation and sustainable use of AnGR. This will be a difficult task because significant gaps and weaknesses in national and international capacities to inventory, monitor, characterize, sustainably use, develop and conserve animal genetic resources exist (FAO, 2007b). In this context, many stakeholders agree that ensuring wide access to genetic resources and equitable frameworks for benefit sharing both on the national and international levels are a prerequisite for sustainable use of livestock biodiversity, its further development and continued availability for the generations to come.
5. Negotiating an ABS framework that would guide management and exchange of all types of GR among which AnGR appears to be quite a complicated task, in the first place because the ABS issue is by itself quite complex. Overlapping goals set in environmental (CBD), agricultural (FAO) and IPR (WIPI, WTP) policies, institutional gaps, and the multitude of involved stakeholders, have held up the negotiation process for almost a decade without a clear picture yet on the final outcome.
6. Despite the opposition of some stakeholders to creating a specific ABS regime for AnGR, there is general agreement at the international (within the forums of CBD and FAO) that legal frameworks for ABS need to be put in place. It is not only a need, but even an obligation according to the mandate of the ABS-WG to complete negotiations before 2010. Whether the regime is to be a single legally binding instrument or will take the form of combining legally binding and non-legally binding elements will depend on how the negotiating parties are going to reconcile their interests on all the

relevant issues and how the lack of coherence in institutional structures regarding ABS (environmental, agricultural, trade, and IPR regimes) is going to be resolved.

7. The majority of stakeholders in the ABS debate with respect to AnGR believe that having a single all-inclusive regime is far from ideal, given the differences between PGR, AnGR (and microbial GR) and non-domsticated biodivesrity. Some stakeholders are even questioning the need for an international ABS regime encompassing AnGR, because existing national ABS legislation together with other relevant legal frameworks would already regulate ABS to a satisfying degree. Additional international ABS provisions would only impose additional transaction costs without adding anything new to current ABS practices.
8. Although the scope of the international ABS regime is to cover all types of genetic resources, as recently agreed, negotiations have focused mostly on non-domesticated biodiversity, and to some extent on PGR. One reason why ABS of AnGR is not debated as much as for PGR might be because there might not be perceived political urgency to elaborate mechanisms for AnGR, since current systems of exchange are already enabling satisfactory benefits sharing. In transactions om livestock, access to AnGR is often not understood as an element of the transaction. Another reason might be the lack of sufficient funds to support the development of measures for ABS of AnGR.

The following recommendations have been made based on the analysis:

1. Not withstanding the sceptic perception of several interviewees about the need and urgency of negotiating an international ABS regime, the real issue is not whether we need such regime, as completion of the ABS regime before 2010 is internationally agreed between all Parties to the CBD. Therefore, the questions is not whether we need an ABS regime, but on how to design ABS principles and mechanisms which are also addressing the specific nature of AnGR, so that the resulting regime will not compromise the options for facilitated access to AnGR and the fair and equitable benefit sharing linked to its use.
2. Regardless of the fact that the nature of the future ABS regime is still not agreed (a single legally binding instrument or not), envisioning specific instruments and measures addressing AnGR should be based on what can be expected as likely negotiating scenarios. As it seems hardly feasible that the Parties to the CBD will develop a single legally binding regime within the next two years, given the complexity of the issues at stake, it would be challenging to see how to combine legally binding and non-legally binding measures, or how under a framework agreement an approach may be adopted in which development of measures for specific sectors will be delegated to subsequent negotiations.
3. A majority of stakeholders believes that one all-inclusive ABS regime could not regulate ABS of AnGR in an adequate manner, and therefore – along the lines suggested above - they suggest to develop a specific sub-regime for AnGR under the auspices of an overall ABS regime, which would address the specific nature of AnGR in a more detailed and precise fashion. Although having a single all-inclusive international ABS regime is conceptually very attractive, it is almost impossible to cover all different types of biodiversity and to reconcile all different stakeholders' interests within a single regime, and this generated the idea of designing an ABS sub-regime for AnGR, with specifically designed measures and instruments that address

the specific nature of AnGR.

4. Speculations have arisen whether even a specifically designed ABS regime for AnGR could address all different species of domestic animals, and different types of international exchange (North-North, North-South, South-North or South-South). In this line of thought, it might even be necessary to design special sub-regimes for ABS of AnGR based on the flows of farm animal germplasm. At this point in time, this seems quite unrealistic, but it might become a more useful approach in future.
5. An interesting suggestion is to continue using the existing frameworks (such as the European legal framework for the breeding organizations) and to try to supplement them with additional ABS-derived elements. Some recommend that this approachsystem would be more functional than establishing an entirely new ABS agreement specifically designed for AnGR, as it might simply impose higher administrative and legal administrative costs when it comes to exchanging of genetic material.
6. ABS mechanisms and instruments already developed for PGR could be used as a reference for how to develop analogous mechanisms for AnGR, with the precaution that what is applicable for PGR might not fully fit directly to AnGR. It might be carefully considered how constructive it would be to develop parallel instruments for AnGR, based on those existing for PGR. Here it should be taken in mind that it might not be feasible to quickly establish such parallel regimes (and operational measures) for AnGR based on what is already existing for plants, referring to the fact that it took seven years to agree on the International Treaty for PGR and it took another three years to negotiate the SMTA under the ITPGRFA. In any case it would be quite difficult to create parallel regimes for AnGR based on PGR within the short time frame of the next two years preceding the agreement on an international ABS regime .
7. The ABS strategies proposed to protect aquaculture genetic resources may also form a reference from where to proceed further when designing specific instruments and measures for AnGR, although also these genetic resources differ with the specific nature of AnGR.
8. Existing national regulatory ABS frameworks based on the CBD have hampered movement of genetic material in a number of cases. The protective approach may have negatively affected investments into scientific research and development of improved breeding stocks. Therefore a more enabling approach should form the be basis of the international ABS regime, in which facilitated access to AnGR does not only promote scientific research and breeding, but also creates new options for conservation, sustainable development and equitable sharing of the benefits derived out of utilization of GR.
9. Since the ABS regime must be produced very soon, it will not be perfect, and the consequences for the exchange and management of AnGR will have to play out. Assuming that it will be useful to have even an imperfect international agreement it should also be realized that in itself it will have to function as the starting point for further improvements and amendments.
10. One of the recommendations for setting up an ABS regime that adequately deals with the complex nature of ABS measures for AnGR is to change and revert the approach. In this line of thinking, it will help to start with envisioning from scratch what a successful ABS instrument for AnGR would look like, and then try to work backwards, including also the expectations of different animal holders and breeders in different parts of the world. This might help in better articulating specific and

adequate ABS instruments and measures applicable to AnGR.

11. Adequate supporting measures for farmers who use local and indigenous breeds should form a necessary component of an ABS instrument for AnGR. Creative thinking is needed, for example about alternative ways to subsidize and valorize traditional breeds through products with geographical distinction such as branding and trademarks. This would allow further maintenance of AnGR on-farm. However, some measures such as blanket subsidies applied in Europe woul not be advisable considering the different needs of various local communities. When discussing how to support the keepers of traditional and local breeds, we may first need to estimate the real value of local breeds by determining which addes values the breeds concerned may really possess, for which knowledge of the local people about local circumstances, local needs and what makes their local breeds valuable compared to other breeds or commercial populations would be vital.

7 List of interviewees

1. Mr. Adam G. Drucker (PhD), Senior Research Fellow (Environmental/Ecological Economics), School for Environmental Research (http://www.cdu.edu.au/ser/AdamDruckerProfile.htm), Building 31.2.33, Charles Darwin University, Darwin NT 0909, Australia, (tel. + 61 (0)8 8946 7707; email: adam.drucker@cdu.edu.au); telephone interview: 08-05-2008.

2. Mr. Bert Visser, Director Centre for Genetic Resources (CGN), The Netherlands (www.cgn.wur.nl); Building No. 122, Bornsesteeg 65, 6708 PD Wageningen, The Netherlands (tel. +31-317/47 71 84); consultations March – June 2008.

3. Mr. Bram de Jonge (MA; PhD Candidate), Social Sciences Group, Wageningen University, Centre for Society & Genomics (http://www.society-genomics.nl/?page=190), WUR Bode 90, Hollandseweg 1, 6706 KN Wageningen, The Netherlands (tel. : +31 (0)317 484118; email: bram.dejonge@wur.nl); interview: 14-05-2008.

4. Mr. Clive Stannard, (retired: Senior Liaison Officer Commission on Genetic Resources for Food and Agriculture (http://www.fao.org/ag/cgrfa/), Viale delle Terme di Caracalla, P.O. Box 00153 Rome, Italy (tel. +390657055480; email: Clive.Stannard@fao.org); telephone interview: 07-05-2008.

5. Mr. Drago Kompan (PhD), University of Ljubljana Biotechnical Faculty Zootechnical Department (www.bfro.uni-lj.si), Groblje 3, SI – 1230 Domzale, Slovenia (tel. : +386 1 721 78 65; email: drago.kompan@bfro.uni-lj.si); telephone interview: 13-05-2008.

6. Ms. Elli Broxham, SAVE Foundation - Head Office (http://www.save-foundation.net), Josef-Belli-Weg 5, D-78467 Konstanz, Germany, (tel. +49 7531 802 73 74; +41 71 222 74 10; email: info@monitoring.eu.com); telephone interview: 07-05-2008.

7. Ms. Irene Hoffmann, FAO - Animal Production Service Animal Production and Health Division – Chief (http://www.fao.org/ag/againfo/home/en/opportunities.htm), Viale delle Terme di Caracalla, 00100 Roma, Italy, (tel. +39 06 570 52796; e-mail: Irene.hoffmann@fao.org); telephone interview: 04-06-2008.

8. Mr. Jan Merks (PhD) Director Institute for Pig Genetics (IPG) and member of board of Directors of TOPIGS International (http://www.topigs.com/), Postbox 86, NL 5268 ZH Helvoirt, The Netherlands (tel.: +31.24.6779999; Fax: +31.24.6779800; e-mail: Jan.Merks@ipg.nl); telephone interview: 23-05-2008.

9. Mr. Kai-Uwe Sprenger, DG SANCO D.1, Directorate General for Health and Consumer Protection, EUROPEAN COMMISSION (http://ec.europa.eu/comm/food/animal/index_en.htm), B232 03/43, B-1040 Brussels, Belgium (tel. +32-2-2960935; email: Kai-Uwe.SPRENGER@ec.europa.eu); telephone interview: 07-05-2008.

10. Mr. Kor Oldenbroek (PhD), Senior Policy Officer Animal Genetic Resources - Centre for Genetic Resources (CGN), The Netherlands (www.cgn.wur.nl); Building No. 122, Bornsesteeg 65, 6708 PD Wageningen, The Netherlands (tel. +31-317/480538; email: kor.oldenbroek@wur.nl); interview: 14-04-2008.

11. Ms. Margo Vonk, Productschappen Vee, Vlees en Eieren – PVE (Product Boards for Livestock, Meat and Eggs), The Netherlands (www.pve.n/); Louis Braillelaan 80, 2719 AL Zoetermeer, the Netherlands (tel. +31 344 57 1728; email: m.vonk@pve.agro.nl); telephone interview: 29-05-2008.

12. Mr. Niels Louwaars (PhD), Senior Policy Officer - Centre for Genetic Resources (CGN), The Netherlands (www.cgn.wur.nl); Building No. 122, Bornsesteeg 65, 6708 PD Wageningen, The Netherlands (tel. +31-317/480854, email: niels.louwaars@wur.nl); interview: 03-04-2008.

13. Mr. Olivier Hanotte (PhD) , Project Leader Animal Genetic Resources Characterization – ILRI: International Livestock Research Institute (http://www.ilri.org) , Naivasha Road, P.O. Boox 30709, Nairobi 00100, Kenya (tel. +254 20 422 3466; email: o.hanotte@cgiar.org); telephone interview: 02-05-2008.

14. Mr. Wietse Vroom (MSc; PhD Candidate), Critical Technology Construction, Wageningen University/Athena Institute/Vrije Universiteit Amsterdam (www.ctc.wur.nl/UK/Staff/PhD+Researchers/Wietse+Vroom/), CTC-WUR, Bode 164, Hollandsweg 1, 6706 KN Wageningen, The Netherlands (tel. +31 317/485052; mobile +31 64 7784116; email: Wietse.Vroom@wur.nl; Skype: wietsevroom); skype video interview: 01-05-2008.

15. Ms Victoria Henson-Apollonio (PhD), Senior Scientist & Programme Manager for CGIAR CAS-IP, Consultative Group on International Agriculture – Central Advisory Service on Intellectual Property (http://www.cgiar.org/who/structure/system/casip/who.html), CAS-IP**;** c/o Bioversity International Via dei Tre Denari 472/a 00057 Maccarese (Fiumicino) Rome , Italy (email: v.henson-apollonio@cgiar.org); telephone interview: 14-05-2008.

8 References

Andersen R. (2004) FAO and the Management of Plant Genetic Resources, *Yearbook of International Co-operation on Environment and Development 2003/04*. Pp. 43-54.

Boisvert V. and F. D. Vivien (2005) The convention on biological diversity: A conventionalist approach, *Ecological Economics* 53. Pp. 461-472.

Bureau des Ressources Génétiques – BRG (2002) *Keys for the Management of Genetic Resources*, Ed. André Sontot – BRG, Paris, France.

BMBCB – Department of Biochenistry, Molecular Biology & Cell Biology, Norhwestern University at: http://www.biochem.northwestern.edu/holmgren/Glossary/Definitions/Def-S/SNP.html (visted 27-05-2008).

CBD online (2008a) ABS WG - The Convention on Biological Diversity: Working Group on Access & Benefit Sharing at http://www.cbd.int/convention/wgabs.shtml. visited 15-04-2008.

CBD online (2008b) Bonn Guidelines on ABS (COP-6 Decision VI/24) at http://www.cbd.int/decisions/?dec=VI/24. visited 27-05-2008.

CBD online (2008c) The Convention on Biological Diversity at http://www.biodiv.org/convention/default.shtml. visited 15-04-2008.

FAO (2000) *World Watch List for Domestic Animal Diversity*, 3rd Ed., FAO, Rome.

FAO (2007a) *Global Plan of action for Animal Genetic Resources and the Interlaken Declaration*, Rome.

FAO (2007b) *The State of the World's Animal Genetic Resources for Food and Agriculture – in brief*, Dafydd Pilling & Barbara Rischkowsky, Rome.

Gibson J., S. Gamage, O. Hanotte, L. Iñiguez, J.C. Maillard, B. Rischowsky, D. Semambo & J. Toll J. (2006) *Options and Strategies for the Conservation of Farm Animal Genetic Resources: Report of an International Workshop (7-10 November 2005, Montpellier, France).* CGIAR System-wide Genetic Resources Programme (SGRP)/Bioversity, Rome, Italy, 53 pp.

Hiemstra S.J, A.G. Drucker, M.W. Tvedt, N. Louwaars, J.K. Oldenbroek, K. Awgichew, S. Abegaz Kebede, P.N. Bhat and A. da Silva Mariante (2006) *Exchange, Use and Conservation of Animal Genetic Resources, Policy and regulatory options.* CGN, Wageningen/the Netherlands.

IDRC: International Develpment Reearch Centre (2008) *The Future Control of Food; A guide to International Negotiations and Rules on Intellectual Propert, Biodiversity and Food Security*, Ed. Geoff Tansey & Jasmin Rajotte, Antony Rowe, Chippenham, UK.

International Institute for Sustainable Development (2003) Summary of the Second Meeting of the *ad hoc O*pen-Ended Working Group on Access and Benefit-Sharing: 1-5 December 2003, *Earth Negotiations Bulletin* 9, (268). Pp. 1-11.

International Institute for Sustainable Development (2007) Summary of the Fifth Meeting of the Working Group on Access and Benefit-Sharing and the Fifth Meeting of the Working Group on Article 8(j) and Related Provisions of the Convention on Biological Diversity: 8 – 19 October 2007, *Earth Negotiations Bulletin* 9, (398). Pp. 1-16.

Juma C. (2005) Biotechnology in a Globalizing World: The Coevolution of Technology and Social Institutions, *BioScience* 55, (3). Pp. 265–272.

Kaal-Lansbergen L. & S.J. Hiemstra (2003-5) *North-South Policy Brief*. Programme International Cooperation c/o North-South Centre, WUR, Wageningen.

Koopman J. (2005) Reconciliation of proprietary interests in genetic and knowledge resources: Hurry cautiously!, *Ecological Economics* 53. Pp. 523-541.

League of Pastoral Peoples: Karen Commitment – LPP-KC (2003) Proceedings of a Conference of Indigenous Livestock Breeding Communities on Animal Genetic Resources: 27–30 October 2003, Karen, Kenya at http://www.pastoralpeoples.org/docs/karen.pdf (visited 29-05-2008).

Raustiala K. and D. Victor (2004) The Regime Complex for Plant Genetic Resources, *International Organization* 58, Spring, The IO Foundation. Pp. 277-309.

Rosendal G.K. (2003) Interacting International Institutions: The Convention on Biological Diversity and TRIPs – Regulating Access to Genetic Resources (revised version). The Fridtjof Nansen Institute, Lysaker, Norway at: http://www.ecologic.de/english/interaction/. visited 17- 05-2008.

Rosendal G.K., I. Olesen, B. H. Bentsen, W. M. Tvedt and B. Martin (2005) *Strategies and Regulations Pertaining to Access and Legal Protection of Aquaculture Genetic resources*, Fridtjof Nasen Institute, Lysaker, Norway.

Rosendal G.K. (2006) Regulating the Use of Genetic Resources – Between International Authorities, *European Environment* 16. Pp. 265–277.

Rosendal G. K, I. Olesen, B.H. Bentsen, W.M. Tvedt and B. Martin (2006) Access to and Legal Protection of Aquaculture Genetic Resources—Norwegian Perspectives, *The Journal of World Intellectual Property* 9, (4), Pp. 392–412.

Rotschild, M.F. (2002) Patenting of genetic innovations in animal breeding. Proc. 7th World Congress on Genetics Applied to Livestock Production, CD-Rom Communication No. PS-03.

Simianer H. (2005) Decision making in livestock conservation, *Ecological Economics* 53. Pp. 559-572.

Stannard C., N. van der Graaf, A. Randal, P. Lallas & P. Kenmore (2004) Agricultural biological diversity for food and agriculture: shaping international initiatives to hel agriculture and the environment, *Howard Law Journal* 1 (48), Ed. Howard University School of Law.

UNCTAD online, United nations Conference on Trade and Development at http://www.unctad.org/. visited 24-05-2008.

Visser B. & S.J. Hiemstra (2008) Farmers' rights and livestock keepers' rights: similarities and differences, Power Point Presentation, Centre for Genetic Resources, the Netherlands.

8.1 Photo References

Photo 1 source: CGN, the NL (http://www.cgn.wur.nl/UK/CGN+Animal+Genetic+Resources/Gene+bank+collections/)

Photo 2 source: http://www.greenfacts.org/en/biodiversity/images/log-cbd.gif/

Photo 3 source: http://www.enp.wur.nl/UK/