

# What's on the menu? Options for strengthening the policy and regulatory framework for the exchange, use and conservation of animal genetic resources<sup>1</sup>

S.J. Hiemstra<sup>1</sup>, A.G. Drucker<sup>2</sup>, M.W. Tvedt<sup>3</sup>, N. Louwaars<sup>1</sup>, J.K. Oldenbroek<sup>1</sup>, K. Awgichew<sup>4</sup>, S. Abegaz Kebede<sup>5</sup>, P.N. Bhat<sup>6</sup> & A. da Silva Mariante<sup>7</sup>

<sup>1</sup>Centre for Genetic Resources, the Netherlands (CGN) of Wageningen University and Research Centre, the Netherlands. P.O. Box 65, 8200 AB Lelystad, the Netherlands

<sup>2</sup>School for Environmental Research, Charles Darwin University, Darwin, Australia

<sup>3</sup>The Fridtjof Nansen Institute, P.O. Box 326, 1326 Lysaker, Norway

<sup>4</sup>Institute of Biodiversity Conservation, P.O.Box 30726, Ethiopia

<sup>5</sup>Ambo College, P.O. Box. 19, Ambo, Ethiopia

<sup>6</sup>World Buffalo Trust (WBT), 201 303 Noida (UP), India

<sup>7</sup>EMBRAPA Cenargen, Brasilia DF, Brazil

## Summary

This paper addresses major issues and challenges for Animal Genetic Resources (AnGR) and the livestock sector, as well as options for further development of policies or regulatory approaches. Three main areas were identified, i) how we can halt the further erosion of genetic diversity and promote sustainable breeding and use, ii) whether there is a need to regulate the exchange of genetic material and iii) how to balance different systems of rights (e.g. sovereign rights of nations, intellectual property rights, communal rights or rights of livestock keepers).

To halt further erosion, complementary *ex-situ* and *in-situ* conservation approaches are needed and breeding and marketing of local breeds should be strengthened. Secondly, recognizing the importance of the exchange of AnGR, broad access and responsible and equitable exchange mechanisms should be further promoted. Thirdly, regarding intellectual property rights, there is a need to adapt the application of the patent system to the special circumstances inherent in animal breeding. Moreover, possible *sui generis* systems should be

further explored in order to better balance different rights systems.

Rather than developing a new or adapted internationally legally binding framework, the intergovernmental process under FAO may instead wish to focus, in the first instance, on the development of voluntary instruments to strengthen national policies and the implementation of action at national levels.

Debates and developments related to international agreements in the crop sector have also tended to frame the debate for AnGR. However, before launching into a discussion on whether or not an 'FAO Animal Treaty' would be needed, one should first of all clarify the problems to be dealt with and regulated via an international regime.

## Résumé

Cet article rassemble les thèmes principaux et défis des Ressources Génétiques Animales (AnGR) et du secteur élevage, ainsi que les options disponibles pour le développement de politiques ou règlements.

<sup>1</sup>This paper summarizes the main findings of a study entitled 'Exchange, Use and Conservation of Animal Genetic Resources: Policy and Regulatory Options'. Report 2006/06. Centre for Genetic Resources, the Netherlands (CGN), Wageningen University and Research Centre. The study was commissioned by FAO and funded by the Government of the United Kingdom of Great Britain and Northern Ireland, through DFID. The views expressed in the report and in this paper are the sole responsibility of the authors. The full report is downloadable from:

<http://www.cgn.wur.nl/UK/CGN+Animal+Genetic+Resources/Policy+advice/>

<http://www.cgn.wur.nl/UK/CGN+General+Information/Publications/2006/>

[http://www.fao.org/ag/againfo/subjects/en/genetics/documents/ITWG-AnGR4/AnGR\\_policy\\_and\\_regul.pdf](http://www.fao.org/ag/againfo/subjects/en/genetics/documents/ITWG-AnGR4/AnGR_policy_and_regul.pdf)

On a identifié trois domaines principaux:

1. Comment empêcher l'érosion de la diversité génétique et promouvoir l'utilisation et l'élevage durable.
2. Quand est-il nécessaire de réglementer les échanges de matériel génétique.
3. Comment adapter les différents systèmes législatifs (p.e. les droits souverains au niveau national, les droits sur la propriété intellectuelle, les droits communs ou droits des éleveurs).

Pour empêcher une érosion ultérieure des études complémentaires *in-situ* et *ex-situ* seront nécessaires, ainsi qu'un renforcement de la sélection et commercialisation des races locales. En deuxième lieu, et tenant compte de l'importance des échanges de AnGR, on devrait promouvoir un majeur accès et des mécanismes responsables et équitables. Pour finir, en ce qui concerne les droits de la propriété intellectuelle, il faudrait adapter l'application des systèmes de brevet aux circonstances spéciales inhérents au secteur de l'élevage animal.

Cependant, on pourrait rechercher d'autres systèmes possibles *sui generis* afin de mieux adapter les différents systèmes législatifs. Au lieu de développer un nouveau système ou adapter un cadre légal au niveau international, le procès intergouvernemental sous la supervision de la FAO voudrait centrer le thème en principe sur le développement d'outils volontaires qui renforceraient les politiques nationales et la mise en oeuvre d'actions au niveau national. Les débats et développements en relation avec les accords internationaux dans le domaine agricole ont contribué aussi à l'encadrer dans les AnGR. Cependant avant d'initier une discussion sur l'opportunité ou moins d'établir un "Traité FAO sur les animaux" il serait nécessaire d'identifier les problèmes auxquels il faudra faire face et comment les réglementer à travers un accord international.

## Resumen

Este artículo recoge los temas principales y desafíos de los Recursos Zoogenéticos (AnGR) y del sector ganadero, así como las opciones para el consiguiente desarrollo de políticas o reglamentos. Se identificaron tres áreas principales:

1. Cómo impedir la erosión de la diversidad genética y promover la utilización y cría sostenible.
2. Cuando es necesario reglamentar los intercambios de material genético.

3. Cómo adaptar los distintos sistemas legales (p.e. los derechos soberanos a nivel nacional, los derechos de la propiedad intelectual, los derechos comunales o derechos de los ganaderos).

Para impedir una erosión ulterior serán necesarios estudios complementarios *in-situ* y *ex-situ*, así como un reforzamiento de la cría y comercialización de las razas locales. En segundo lugar, teniendo en cuenta la importancia de los intercambios de AnGR, se debería promover un mayor acceso y mecanismos responsables y equitativos. Por fin, en lo relativo a los derechos de la propiedad intelectual, sería necesario adaptar la aplicación del sistemas de patentes a las circunstancias especiales inherentes al sector de la cría animal. Sin embargo, se podrían investigar ulteriores posibles sistemas *sui generis* con el fin de adaptar mejor los distintos sistemas legales. En vez de desarrollar un nuevo sistema o adaptar un marco legal a nivel internacional, el proceso intergubernamental bajo supervisión de la FAO desearía enfocar el tema en un principio en el desarrollo de instrumentos voluntarios que reforen las políticas nacionales y la implementación de las acciones a nivel nacional. Los debates y desarrollos relacionados con los acuerdos internacionales en el sector agrícola también han contribuido a enmarcar el debate en el campo de AnGR. Sin embargo, antes de lanzarse en una discusión sobre la oportunidad o menos de establecer un "Tratado de la FAO sobre animales", se deberían identificar los problemas que se encontraran y cómo reglamentarlos a través de un acuerdo internacional.

**Keywords:** AnGR, Policy and Regulatory Options, Exchange, Conservation, Use, Rights.

## Introduction

The FAO International Technical Conference on Animal Genetic Resources (AnGR) in Interlaken in 2007 will represent a milestone, finalizing the global assessment on the State of the World's Animal Genetic Resources and providing an opportunity to reach agreement on how best to address priorities for the sustainable use, development and conservation of animal genetic resources for food and agriculture (AnGR). One of the expected outcomes of this Conference is a Global Plan of Action on Animal Genetic Resources, therefore Interlaken will probably be for AnGR what Leipzig was for plant genetic resources for food and agriculture. The overall process, coordinated by

FAO and driven by national governments, should result in action contributing to conservation and sustainable breeding and utilization of AnGR. It is expected that three important issues need to be discussed:

1. How we can halt the further erosion of genetic diversity and promote sustainable breeding and use.
2. Whether there is a need to regulate the exchange of genetic material.
3. How to better balance different systems of rights (e.g. sovereign rights of nations, intellectual property rights, individual or communal ownership rights or access rights to AnGR and natural resources).

Debate on these issues may lead to a decision as to whether an international legally binding mechanism is needed, or if 'softer' arrangements can adequately meet the objectives in a more effective manner.

Although not designed primarily for AnGR, international agreements with a general scope (governed by the Convention on Biological Diversity (CBD), the World Trade Organisation/Trade Related Intellectual Property System (WTO/TRIPS) and the World Intellectual Property Organisation (WIPO)) also apply to AnGR. As their implementation advances further, they may have an increasingly significant impact on AnGR exchange, use and conservation. While the special nature of agricultural biodiversity is recognized, FAO could play a key role in facilitating and informing the debate on specific AnGR needs and challenges.

In 2004, the Intergovernmental Technical Working Group on Animal Genetic Resources<sup>2</sup> recommended that FAO commission a study<sup>3</sup> to assess how exchange practices regarding AnGR affect the various stakeholders in the livestock sector, and to identify policies and regulatory options that guide the global exchange, use and

conservation of AnGR. This paper presents the main findings of the recommended study: policy and regulatory options related to the exchange and the conservation and sustainable use of AnGR. The identification of options is based on literature surveys<sup>4</sup> and stakeholder consultations. A review of the current situation and the exploration of future scenarios served as input for the latter.<sup>5</sup>

## The International Treaty on Plant Genetic Resources (PGR) for Food and Agriculture as an example for AnGR?

Debates and developments related to international agreements in the crop sector have also tended to frame the debate for AnGR. Some argue that it is important to develop a legally binding international agreement for AnGR similar to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) that has been ratified by a growing number of countries. Core elements of this treaty are a multilateral system for the exchange of accessions of plant genetic resources for food and agriculture and the recognition of farmers' rights which are left to countries to implement. The treaty is in line with CBD and regulates specific aspects for plant genetic resources in agriculture. Before launching into a discussion on whether or not an 'FAO Animal Treaty' would be needed, one should clarify which problems need to be regulated or which trends needed to be positively influenced. Key biological, historical, socio-economic and institutional differences between plant and animal genetic resources need to be understood and to be brought into the policy, regulatory and legal discussions about AnGR. The substantial differences between animal and plant breeding

<sup>2</sup> CGRFA/WG-AnGR-3/04/REPORT, paragraph 24

<sup>3</sup> The study, entitled 'Exchange, use and conservation of animal genetic resources: policy and regulatory options' was commissioned by FAO and funded by the Government of the United Kingdom of Great Britain and Northern Ireland, through DFID. The views expressed in the report and in this paper are the sole responsibility of the authors. The full report is downloadable from:

<http://www.cgn.wur.nl/UK/CGN+Animal+Genetic+Resources/Policy+advice/>

<http://www.cgn.wur.nl/UK/CGN+General+Information/Publications/2006/>

[http://www.fao.org/ag/againfo/subjects/en/genetics/documents/ITWG-AnGR4/AnGR\\_policy\\_and\\_regul.pdf](http://www.fao.org/ag/againfo/subjects/en/genetics/documents/ITWG-AnGR4/AnGR_policy_and_regul.pdf)

<sup>4</sup> Due to the large number of references, they are listed in the Bibliography section at the end

<sup>5</sup> For further details about future scenario's and stakeholder analysis see also Drucker *et al.* (this volume); a detailed analysis of property rights, exclusive rights and use rights is provided by Tvedt *et al.* (this volume).

strongly suggest that to simply copy the solutions from the plant sector to the animal branch will not provide a suitable solution.

## Halt Further Genetic Erosion and Promote Sustainable Breeding and Use

There is consensus that global AnGR diversity is under pressure. The global livestock sector is increasingly focused on a small number of highly specialized breeds and local breeds are threatened. The existence of threats to farm animal breeds and farm animal genetic diversity is generally accepted,



Figure 1. Dutch Landrace goat, the Netherlands (photo by H.F. Cnossen).

even though debate remains about the severity of genetic erosion. FAO (2007) reported that, globally, 20% of recorded breeds are classified as 'at risk'. On the other hand, the loss of breeds is only one indicator of the loss of farm animal genetic diversity, as a major part of genetic diversity is found within breeds and there is also significant genetic overlap between breeds. Maintenance of *within* breed diversity is as important as *between* breed diversity as a genetic reservoir for future breeding and use. Both commercial breeds and rare breeds sometimes have very limited *within* breed diversity. Therefore, the problem may be bigger than figures of breed loss imply.

Even where diverse animal genetic resources currently have a low 'direct use' value, such resources may nonetheless be particularly valuable for future use. Such 'non-market' values provide a key justification for the public sector to play an important role in their conservation and management. However, there is limited awareness about the importance of conservation and the sustainable use of AnGR among policy makers and major stakeholders in the livestock sector.

To halt further genetic erosion, complementary *ex-situ* and *in-situ* conservation approaches are needed, to be organized at national, regional and/or global levels. The major responsibility for the conservation and sustainable use of AnGR lies at the national level (according to the CBD).

However, coordination and collaborative arrangements at regional and/or global levels are also likely to be important.

*Ex-situ* conservation could either support *in-situ* conservation and breeding in the short term or may have a long term (insurance) objective. *Ex-situ* approaches require appropriate infrastructure, organization, technical capacity, agreed priorities, sustained funding and (new) legal arrangements regarding ownership and the use of germplasm.

In many countries there is a lack of human resources and institutional capacity in animal breeding. Lack of effective, sustainable breeding programs

for local breeds may be one of the reasons that such breeds lose their competitive advantage, especially where production systems or external conditions are subject to change. Poor marketing and breed promotion is also an important limiting factor for the continued use of valuable breeds. Without interventions and the strengthening of breeding capacity for local breeds, the current threat to the survival of local AnGR is inevitably going to escalate. Within-breed diversity in both local and international breeds may also decline without proper consideration of inbreeding issues and sustainable long term breeding goals.



Figure 2. Yak, Bhutan (photo S.J. Hiemstra).

## Responsible and equitable exchange mechanisms

Exchange of genetic material between countries and regions over millennia has been a very valuable mechanism for breed and livestock development. Countries and regions are highly interdependent, and continue to need broad access to AnGR for their livestock development. However, there have also been direct or indirect negative effects on farm animal genetic diversity.

A tremendous amount of AnGR exchange currently takes place between developed countries ('North' to 'North') while globalization drives the exportation of high performing breeding stock from 'North' to 'South'. 'South' to 'South' exchange has also been extensive and important for livestock development but less well documented than 'North' to 'North' exchange. Movements of livestock germplasm from 'South to North' have been rare in the past century. The latter practice is in stark contrast to plants, where South to North flows are prominent, driven by the search for disease resistance and adaptive genes for new plant varieties. This important difference in the gene flow direction is likely to influence discussions on the regulation of exchange.

The exchange of AnGR is currently mainly regulated through the transfer of private ownership

(by private law contracts and customary law) and is also influenced by zoo-sanitary regulations. Some countries have specific access regulations or regulations to assess the potential impact of AnGR introductions in the country.

## Zoo-sanitary regulations

Zoo-sanitary regulations are considered to be the main constraints to exchange. In order to avoid frustrating the exchange of AnGR, further harmonization of

*zoo-sanitary laws* should continue at regional and global levels. Special attention should be given to the use of resources cry-conserved in the past.

## Impact assessment

There are examples of the damaging effects of introducing exotic material from North to South to improve local breeds. The existence of genotype x environment interactions, and the avoidance of undesired effects of exchange, may trigger the need to *assess the (genetic) impact* of import/export on sustainable (livestock sector) development in the country. Such an instrument may be worth considering as a basis for putting in place strategies to support the mitigation of potential negative side-effects of particular exchange practices. Application of a (voluntary) 'code of good practice' would be useful in this context, creating stronger responsibilities for both exporters and importers. Genetic impact assessments (both positive and negative) could also be extended to include economic and livelihood impacts as well as other developmental and/or environmental impacts. A potential disadvantage that would have to be overcome is the likelihood of increased bureaucracy, thereby blocking imports and reducing livestock sector development opportunities.

## Access and benefit sharing

It is a general belief that the current exchange of AnGR has generated benefits for both seller and buyer under the present circumstances where private law agreements have been in use. However, there are some cases where stakeholders consider that benefit sharing has not been sufficiently catered for. There are cases where the value in further breeding turned out to significantly outweigh the purchase value of the exported breeding animal or germplasm. The CBD presupposes the right of a country to exercise sovereign control over its AnGR (accompanied by a number of responsibilities). An exporting country may wish to maintain property rights over the AnGR after the resources have left the country. Even if the animals and breeding material are under private ownership, states have, according to the CBD, the right to regulate export. It can be argued that private parties agree on benefit sharing when AnGR is being transferred by a private law agreement. An *export regulation* could however set rules or a minimum standard for the content of a private law agreement to be considered legal or valid.

An *export regulation* could provide a useful supplementary tool for private law agreements, in particular in situations where negotiating capacities or market positions are significantly unequal. Two countries who commonly trade AnGR could also decide to develop a *bilateral framework agreement* aimed at facilitated exchange, following a pre-negotiated set of rules.

Development of a *model Material Transfer Agreement* (model MTA) at the international level,



Figure 4. Groningen White Headed cattle, the Netherlands (photo by H.F. Cnossen).

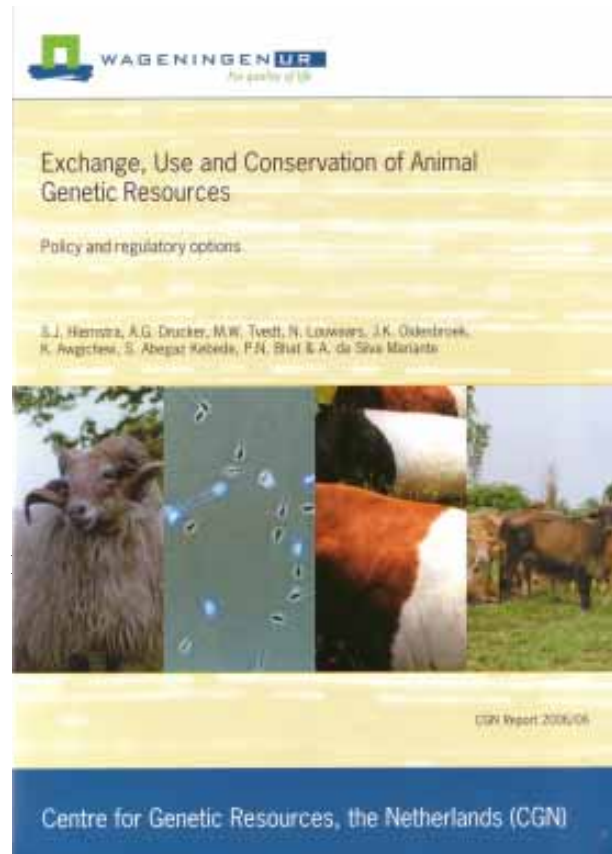


Figure 3. Cover of the Report "Exchange, use and conservation of animal genetic resources: policy and regulatory options". Report 2006/06.

largely based on current exchange practices as well as covering all important negotiation issues relevant to AnGR exchange, would also be useful, in order to support the responsible exchange of AnGR. Development of such a *model MTA* may become particularly important if patterns of gene flow were to change substantially in the future. Private law guided exchange could be supplemented by a *model MTA* which would supplement the fragmented use of contracts today.

Following the negotiations in the CBD regarding an International Binding Regime for Access and Benefit Sharing, there is a need to survey how these changes in the international legal order for the exchange of genetic resources in general will affect

the exchange of AnGR in particular. Development of an international agreement on a *standard MTA* for AnGR could be a response to CBD developments and to unequal negotiating capacities and the market dominance of larger commercial entities in the livestock sector. A MTA for AnGR should reflect the significant differences between plant and animal genetic resources.

## Intellectual Property Rights and Use Rights

Genetic flows have changed over time, genetic diversity is under pressure, and the power between stakeholders is increasingly unbalanced. Further concentration and vertical integration in the livestock industry, combined with the protection of investments through the use of intellectual property rights are generating an increased concern about *equity* and may seriously affect the positions of livestock keepers, small farmers and (small scale) breeders.

Today, almost all farm animal genetic resources are under private control and ownership and not considered to be in the public domain. However, breeds are 'public' in the sense that governments often recognize them as distinct breeds. Commercial breeders generally 'protect' their investments by 'staying ahead' of competing breeders, through physical control of the use of their breeding animals and the use of private law contracts. The use of Intellectual Property Rights (IPR) in animal breeding has to date mainly been focused on *trademarks*. Developments in patenting in some countries have triggered discussions about the potential impact of patenting on animal breeding methods and animal genes and cells. This has also started a discussion about the need to define the *rights* of livestock keepers/farmers/breeders over the AnGR they have developed over time and about access rights to AnGR and natural resources. An increasing tension is apparent between existing *physical ownership* or *communal ownership* to AnGR and increased use of the patent system in the commercial breeding sector. Regarding developments in the patent system, concerns have been raised that a high number of patent claims and the broad scope of the claims may lead to a significant body of *exclusive rights* on knowledge and breeding technology with substantial impacts on the use of AnGR.



Figure 5. Drenthe fowl, the Netherlands (photo by F. van Welie).

### Exclusive rights

There is considerable concern that patents be granted to existing methods – although they may not sufficiently disclosed to qualify as *prior art* in the patent system. To counterbalance the effect of excessive patenting, *preventive publishing* is often put forward as a strategy to ensure that common knowledge will be considered *prior art*. However, the ability to exploit even small adaptations to what was originally published (i.e. 'patenting around the prior art') means that such an approach may be an ineffective counterbalance in practice. Other alternatives could be to oblige patent offices to take into account specific AnGR *prior art/novelty/inventiveness guidelines* and/or having countries introduce specific *exemptions* in national patent law, such as *farmers' privilege* or *breeder's exemption*. A systematic legal analysis would be advisable to assess how general patent law rules apply to AnGR and breeding. There is also a need for analyzing the effects patents might have on research and investments in the animal sector; and eventually it may be worth considering the degree to which patent protection is needed at all in the animal

sector, to promote breeding, research and development in the livestock sector.

### ***Sui generis* protection**

The present system of *plant breeders' rights* (UPOV) provides protocols for assessing and describing the unique characteristics of a new plant variety, ensuring that it is distinct, uniform and stable. Such a system is unlikely to be applicable to farm animal breeds in the same way as it is for plants. *Sui generis* protection systems could nonetheless be useful. Establishment of *breed associations or herd book registration* (governed by breeding laws) combined with *trademark* protection would be a good alternative for breed conservation and property right protection. A *sui generis* protection could also be linked to special geographical related properties and characteristics of the animals or their products (*geographical indications*).

### **Conclusions**

Based on analysis of the existing policy frameworks, and as potential solutions to the problems raised during the stakeholder consultations, a number of possible policy and regulatory options for AnGR were identified during the study. These should be considered within the context of an informed debate regarding the need for strengthening the existing policy and regulatory framework for AnGR, as well as in terms of the *form* that any such strengthening should take. With regard to the latter, rather than developing a new or adapted internationally legally binding framework, the intergovernmental process under FAO may instead wish to focus, in the first instance, on the development of voluntary instruments to strengthen national policies and the implementation of action at national levels. This could be carried out in parallel with further analysis of how other international regimes may influence AnGR. The Interlaken Conference is expected to raise the level of awareness on the many roles and values of AnGR, and to highlight the special nature of AnGR, their distinctive features, and problems needing distinctive solutions.

### **Acknowledgements**

We are grateful to FAO for commissioning this study, and to the Government of the United Kingdom of Great Britain and Northern Ireland for funding it through the Department for International Development DFID. We also thank the members of the steering committee, I. Hoffmann (FAO) and T. Brown (DFID) for their inputs and contributions.

### **List of References**

- CBD.** 1992. Convention on Biological Diversity. Available at: [www.biodiv.org](http://www.biodiv.org).
- CBD.** 2002. Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization.
- Drucker, A.G., V. Gomez & S. Anderson.** 2001. The Economic Valuation of Farm Animal Genetic Resources: A Survey of Available Methods. *Ecological Economics*. Vol. 36 (1): 1-18.
- Drucker, A.G., M. Smale & P. Zambrano.** 2005. Valuation and Sustainable Management of Crop and Livestock Biodiversity: A Review of Applied Economics Literature. SGRP/IFPRI/ILRI, [www.ilri.org](http://www.ilri.org).
- Esquinas-Alcazar, J.** 2005. Protecting crop genetic diversity for food security: political, ethical and technical challenges. *Science & Society: Nature Review Genetics* 6, 946-953.
- FAO.** 1999. The global strategy for the management of farm animal genetic resources. FAO. Rome.
- FAO.** 2005. The legal framework for the management of animal genetic resources. FAO Legislative Study 89. ISSN 1014-6679. ISBN 92-5-105433-9. Ingressia, A., Manzella, D. & Martyniuk, E. (Eds), Food and Agriculture Organization of the United Nations, Rome, 2005.
- FAO.** 2007. The State of the World's Animal Genetic Resources. B. Rischkowsky and D. Pilling (Eds).
- Gibson, J.P. & S.V. Pullin.** 2005. Conservation of Livestock and Fish Genetic Resources. Gibson, J.P. and Pullin, S.V. Science Council Secretariat, FAO.



- Gibson, J., S. Gamage, O. Hanotte, L. Iñiguez, J.C. Maillard, B. Rischkowsky, D. Semambo & J. Toll.** 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 International, Rome, Italy, pp. 53.
- Hiemstra, S.J., A.G. Drucker, M.W. Tvedt, N. Louwaars, J.K. Oldenbroek, K. Awgichew, S. Abegaz Kebede, P.N. Bhat & A. da Silva Mariante.** 2006. Exchange, use and conservation of animal genetic resources: policy and regulatory options. Report 2006/06. Centre for Genetic Resources, the Netherlands (CGN), Wageningen University and Research Centre, the Netherlands; [www.cgn.wur.nl/UK/CGN+Animal+Genetic+Resources/Policy+advice/](http://www.cgn.wur.nl/UK/CGN+Animal+Genetic+Resources/Policy+advice/); <http://www.cgn.wur.nl/UK/CGN+General+Information/Publications/2006/>; [www.fao.org/ag/againfo/subjects/en/genetics/documents/ITWG\\_AnGR4/AnGR\\_policy\\_and\\_regul.pdf](http://www.fao.org/ag/againfo/subjects/en/genetics/documents/ITWG_AnGR4/AnGR_policy_and_regul.pdf)
- Hoffmann, I. & B. Scherf.** 2005. Management of farm animal genetic diversity: opportunities and challenges. WAAP Book of the Year 2005, pp. 221-245.
- ITPGRFA.** 2004. International Treaty on Plant Genetic Resources for Food and Agriculture, FAO, Rome, 2004. Available at [www.fao.org](http://www.fao.org) (full web link).
- LID.** 1999. Livestock in poverty-focused development. Livestock in Development. Crewkerne, UK.
- LPP.** 2003. Karen Commitment. Pastoralist/Indigenous Livestock Keepers' Rights. Kenya, 27-30 October, 2003; [www.pastoralpeoples.org/docs/karen.pdf](http://www.pastoralpeoples.org/docs/karen.pdf).
- Mathias, E. & P. Mundy.** 2005. Herd movements: The exchange of livestock breeds and genes between North and South. League for Pastoral Peoples and Endogenous Livestock Development; [www.pastoralpeoples.org/docs/herdmovements.pdf](http://www.pastoralpeoples.org/docs/herdmovements.pdf)
- Notter, D.R.** 2004. Conservation strategies for animal genetic resources. Background Study Paper No. 22. Commission on Genetic Resources for Food and Agriculture, FAO, October 2004.
- Rege, J.E.O. & J. Gibson.** 2003. Animal genetic resources and economic development: issues in relation to economic valuation. *Ecological Economics* 45 (3), 319-330.
- Rosendal, G.K., I. Oleson, H.B. Bentsen, M.W. Tvedt & M. Bryde.** 2005. Strategies and Regulations Pertaining to Access to and Legal Protection of Aquaculture Genetic Resources. The Fridtjof Nansens Institute, October 2005.
- Rothschild, M.F., G. Plastow & C. Newman.** 2003. Patenting in animal breeding and genetics. WAAP Book of the Year 2003, pp. 269-278.
- Sainath, P.** 1996. Everybody Loves a Good Drought. Stories from India's Poorest Districts. Penguin Books, 1996.
- Sere, C., H. Steinfeld & J. Groenewold.** 1996. World Livestock Production Systems. Current status, issues and trends. FAO Animal Production and Health Papers 127. FAO. Rome, Italy.
- Stannard, C., N. van der Graaf, A. Randall, P. Lallas & P. Kenmore.** 2004. Agricultural biological diversity for food and agriculture: shaping international initiatives to help agriculture and the environment. *Howard Law Journal*, vol. 48, no. 1. Ed. Howard University School of Law.
- Steinfeld, H., P. Gerber, T. Wassenaar, V. Castel, M. Rosales & C. Haan.** 2006. Livestock's long shadows. Environmental issues and options. FAO; [www.virtualcentre.org/en/library/key\\_pub/longshad/A0701E00.pdf](http://www.virtualcentre.org/en/library/key_pub/longshad/A0701E00.pdf)
- Tisdell, C.** 2003. Socioeconomic causes of loss of animal diversity genetic: analysis and assessment. *Ecological Economics* 45 (3), 365 -376.
- TRIPS.** Agreement on Trade-Related Aspects of Intellectual Property Rights; available at: [www.wto.org](http://www.wto.org).
- Tvedt, M.W.** 2005. How will a substantive patent law treaty affect the public domain for genetic resources and biological material? *The Journal of World Intellectual Property*, vol. 8 no. 3, 311-344.
- Tvedt, M.W.** 2006. Element for Legislation in User Country to Meet the Fair and Equitable Benefit-Sharing Commitment. *The Journal of World Intellectual Property*, vol. 9, no. 2., 189-212.

.....

**Tvedt, M.W. & T.R. Young.** 2006 (Forthcoming). Beyond Access – A Legal Analysis of the Fair and Equitable Benefit Sharing Commitment in the CBD. IUCN.

**UPOV.** 1991. International Union for the Protection of New Varieties of Plants; available at [www.upov.int](http://www.upov.int).

**Valle Zárate, A., K. Musavaya & C. Schäfer.** 2006. Gene flow in animal genetic resources. A study on status, impact and trends. Institute of Animal Production in the Tropics and Subtropics, University of Hohenheim, Germany.

**Verrier, E., M. Tixier-Boichard, R. Bernigaud & M. Naves.** 2005. Conservation and value of local livestock breeds: usefulness of niche products and/or adaptation to specific environments. Animal Genetic Resources Information, no. 36, 2005.

**Woolliams, J. & M. Toro.** 2007. What is genetic diversity? In: Utilisation and Conservation of Farm Animal Genetic Resources. K. Oldenbroek (Ed.). Wageningen Academic Publishers.