منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Alimentación y la Agricultura

Country report

supporting the preparation of *The Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture*, including sector-specific data contributing to *The State of the World's Biodiversity for Food and Agriculture* - 2013 -

Country: United States of America

I. EXECUTIVE SUMMARY

Please provide an executive summary (not more than two pages) that will allow national and international stakeholders to gain a quick overview of the content of the country report.
The executive summary should contain information on:

- key trends and driving forces affecting animal genetic resources management in your country;
- strengths, weaknesses and gaps in capacity to manage animal genetic resources in your country;
- key constraints and challenges with respect to animal genetic resources management in your country;
- priorities and strategic directions for future action (focusing particularly on the next ten years).

Animal genetic resources in the United States are broad and diverse. Due to the vitality of breeding programs the U. S. has developed a large number of breeds or significantly changed breeds from varying origins. As a result it may be viewed as a new center of livestock genetic diversity. As the 2007 SOW report illustrates many of the internationally important breeds (Duroc, Leghorn, Holstein, Brahman, Hereford, etc) are prominently used as a result of U. S. breeding programs. The current levels of genetic diversity is a function of a wide range of production systems, dramatically different environments which livestock are produced, and a geographically broad sampling of breeds brought to the U. S. The key element driving production increases of various breeds are the diverse group breeders/producers who own the livestock genetics and manipulate the genetic resources as they deem appropriate. Because breeders/producers are diverse it has facilitated genetic improvement across species. Historically and across species there have been fads which breeders follow to extremes which in turn result in negative impacts on breeds and species. However, due to the diversity of breeders and their selection goals they have been able to self-correct the negative impacts of extreme selection programs.

Conservation programs are maturing. The government's primary approach to genetic resource management is gene banking gametes and tissues across livestock species. To date large and substantial levels of genetic diversity have been captured in the repository. In addition the gene bank is being called upon to supply germplasm and tissue samples to industry and the research community to: regenerate genotypes/populations of interest, add genetic diversity to minor breeds, and provide researchers with varying genotypes for genomic or physiological experiments. In-situ conservation efforts are the responsibility of the private sector and their various breeder based associations. No government subsidy for maintaining at-risk populations is provided, nor does government maintain at-risk populations for conservation purposes. However, the USDA/ARS National Animal Germplasm Program supports breeders and their associations by providing analysis concerning inbreeding trends, effective population size, and identification of major clusters of genetic diversity within a breed.

Important driving forces during the next decade will be increasing focus on genetic environmental interactions (heat

stress, grazing behavior, reproductive efficiency), increasing production efficiency, and further growth in niche markets for locally grown and other specialty livestock products. Increased use of genomic tools will facilitate selection and breeding in various breeds to address the previously identified issues. As a result, expanding the use of genomic information across all species and breeds will be an important initiative during the next decade. To facilitate genomic research the gene bank will need to insure breeds are widely sampled in order to provide samples to researchers wishing to perform genomic analysis.

An emerging conservation issue exists for breeds of medium or small (but not at-risk) population sizes. This group of breeds has been slower to adopt and implement genomic evaluation on a scale sufficient to remain competitive with leading breeds within a species. As a result these breeds may fall further behind in productive advantage and therefore experience a contraction in population size and industry importance. Another emerging issue is how to classify corporate populations used to produce animals destined for slaughter - in essence should these populations be considered the new breeds of the 21st century. Over the next decade gene banking efforts will continue to acquire genetic resources in the form of gametes and various tissues for an expanding user base. Particularly efforts will focus on identifying and filling gaps in the collection. In addition to physical sample acquisition, increasing efforts will be made to database genomic information into the Animal-GRIN database so that potential gene bank users can have access to genomic, phenotypic, geographic, production system, and environmental information. From a policy perspective efforts will continue to encourage private sector exchange of genetic resources with minimal governmental oversight, regulation and monitoring.

II. DATA FOR UPDATING THE PARTS AND SECTIONS OF *THE STATE OF THE WORLD'S ANIMAL GENETIC RESOURCES FOR FOOD AND AGRICULTURE*

FLOWS OF ANIMAL GENETIC RESOURCES

1. Studies of gene flow in animal genetic resources have generally concluded that most gene flow occurs either between developed countries or from developed countries to developing countries. Does this correspond to the pattern of gene flow into and out of your country?

For developed countries, exceptions to the usual pattern would include significant imports of genetic resources from developing countries. For developing countries, exceptions would include significant exports of genetic resources to developed countries, and/or significant imports and/or exports of genetic resources to/from other developing countries.

- (●) yes
- ( ) no
- ( ) yes but with some significant exceptions

1.1. If you answer “no” or “yes but with some significant exceptions”, please provide further details. Please include information on: which species are exceptions and which regions of the world are the sources and/or destinations of the respective genetic material.

n/a

2. Have there been any significant changes in patterns of geneflow in and out of your country in the last ten years?

- ( ) yes
- (●) no

2.1. If yes, please indicate whether this view is based on quantified data (e.g. import and export statistics collected by the government).

- ( ) yes
- (●) no

2.2. If yes, please provide references (preferably including web links) (if relevant, indicate which types of animal genetic resources are covered).

N/A

2.3. Please also describe the changes, indicating the species involved, the direction of the changes, and the regions of the world to and from which the patterns of imports and exports have changed.

3. Please describe how the patterns of geneflow described under Questions 1 and 2 affect animal genetic resources and their management in your country.

Note: Please answer this question even if the pattern of geneflow into and out of your country corresponds to the "usual" pattern described in the first sentence of Question 1 and/or has not changed significantly in the last ten years.

The pattern of gene flow does not impact the management of animal genetic resources. However, some breeders develop specific populations for non-US markets.

LIVESTOCK SECTOR TRENDS

4. Please indicate the extent to which the following trends or drivers of change have affected or are predicted to affect animal genetic resources and their management in your country and describe these effects.

Note: Relevant impacts on animal genetic resources and their management might include, for example, changes in the type of animal genetic resources kept (e.g. different breeds or species), changes in the uses to which animal genetic resources are put, changes in the geographical distribution of different types of animal genetic resources, increases or decreases in the number of breeds at risk of extinction, changes in the objectives of breeding programmes, changes in the number or type of conservation programmes being implemented, etc. In the text sections, please briefly describe the changes. If possible, provide some concrete examples of the challenges or opportunities presented by the respective drivers and the actions taken to address these challenges or opportunities. If relevant, you may also indicate why a given driver is not affecting animal genetic resources and their management in your country. For a general discussion of drivers of change, please see The State of the World's Animal Genetic Resources for Food and Agriculture (Part 2, Section A) (http://www.fao.org/docrep/010/a1250e/a1250e00.htm).

Drivers of change	Impact on animal genetic resources and their management over last ten years	Future impact on animal genetic resources and their management (predicted for the next ten years)	Describe the effects on animal genetic resources and their management
Changing demand for livestock products (quantity)	medium	medium	To keep pace with future demand increased efficiency will be sought.
Changing demand for livestock products (quality)	medium	medium	Uniformity of quality has played a big role to enhancing the position of some breeds, however medium and at-risk breeds tend to be at a disadvantage under these types of market conditions. New local &/or regionally based markets will permit product branding and this momentum supports at-risk breed use. All breeds.
Changes in marketing infrastructure and access	low	low	Market infrastructure has not caused a benefit to one breed vs another.
Changes in retailing	low	low	A segment of consumers support product differentiation based upon geographical location. All breeds.
Changes in international trade in animal products (imports)	low	low	Importation of breeding stock is limited and of low impact. Importation of meat is principally based upon meeting short falls in domestic production.
Changes in international trade in animal products (exports)	medium	medium	US will continue exporting germplasm. Animal products will continue to be exported. Primarily commercial breeds.

Drivers of change	Impact on animal genetic resources and their management over last ten years	Future impact on animal genetic resources and their management (predicted for the next ten years)	Describe the effects on animal genetic resources and their management
Climatic changes	low	medium	Climate change has not caused any shift in demand for specific genetic resources or alteration in species used (as is predicted for some tropical production systems). It is anticipated that all species can and will respond to this challenge through within breed selection.
Degradation or improvement of grazing land	none	none	Degradation of public and private grazing land is non existent. Improvements have been made but these are not associated with animal genetic resources.
Loss of, or loss of access to, grazing land and other natural resources	medium	medium	Environmentalist/livestock producer conflicts will continue and impact will be at the species level not the breed level. Urbanization and resulting increase land prices will continue to impact livestock production.
Economic, livelihood or lifestyle factors affecting the popularity of livestock keeping	medium	medium	Some increases in popularity of raising livestock in peri-urban setting. In rural areas economic viability has been and will continue to be a driving force and tend to favor rare breeds.
Replacement of livestock functions	none	none	None
Changing cultural roles of livestock	low	low	None
Changes in technology	high	high	Technological changes are key to fostering a productive and economical livestock sector. All breeds.
Policy factors	medium	medium	Increased environmental regulations may impact livestock production.
Disease epidemics	none	medium	The risk of negative impacts for at-risk breeds due to epidemics is higher than for larger breeds due to limited numbers of animals and management differences.

OVERVIEW OF ANIMAL GENETIC RESOURCES

5. Please provide the number of locally adapted and exotic breeds kept in your country.

Data on the number of breeds is needed in order to calculate the percentage of breeds subject to the various management activities that are covered in this questionnaire. In line with the request of the Commission on Genetic Resources for Food and Agriculture at its Fourteenth Regular Session (CGRFA-14/13/Report, paragraph 31), FAO will implement the "locally adapted" vs. "exotic breed" classification system in the Domestic Animal Diversity Information System (DAD-IS). Once countries have fully updated their breed lists and classified all breeds in DAD-IS, it will be possible to use these data to obtain the numbers of breeds in each category.

Species	Locally adapted breeds	Exotic breeds
Cattle (specialized dairy)	11	4
Cattle (specialized beef)	55	4
Cattle (multipurpose)	4	0

Species	Locally adapted breeds	Exotic breeds
Sheep	57	0
Goats	16	0
Pigs	25	1
Chickens	54	10
Turkeys	20	0
Buffaloes	1	0
Yaks	1	0
Alpacas	1	0
Llamas	1	0
Horses	39	0
Ducks	5	0
Quails	1	0

CHARACTERIZATION

To provide further details of your country's activities in the field of characterization, surveying and monitoring, please go to Strategic Priority Area 1 of the "Progress report on the implementation of the Global Plan of Action for Animal Genetic Resources 2007–2013" (below).

6. Please provide an overview of the current state of characterization in your country by indicating the extent to which the activities shown in the following table have been carried out.

Note: Please focus on characterization studies that have been conducted within the last ten years (baseline surveys of population size may have been conducted in the more distant past). Recall that some types of characterization study on your country's breeds may have been conducted outside your country. For the first two columns, please insert the number of breeds; for columns 3 to 8 please choose one of the following categories: none; low (approximately <33%); medium (approximately 33–67%); high (approximately >67%).

Species	Baseline survey of population size	Regular monitoring of population size	Phenotypic characterization	Molecular genetic diversity studies – within breed	Genetic diversity studies based on pedigree	Molecular genetic diversity studies – between breed	Genetic variance component estimation	Molecular genetic evaluation
Cattle (specialized dairy)	11	11	high	medium	medium	medium	medium	medium
Cattle (specialized beef)	55	55	medium	low	medium	medium	medium	low
Cattle (multipurpose)	4	4	medium	low	medium	medium	none	none
Sheep	57	57	medium	medium	low	medium	low	medium

Species	Baseline survey of population size	Regular monitoring of population size	Phenotypic characterization	Molecular genetic diversity studies – within breed	Genetic diversity studies based on pedigree	Molecular genetic diversity studies – between breed	Genetic variance component estimation	Molecular genetic evaluation
Goats	16	16	medium	medium	low	medium	medium	none
Pigs	25	25	medium	low	low	low	low	low
Chickens	54	54	high	low	low	low	low	low

INSTITUTIONS AND STAKEHOLDERS

To provide further details of your country's activities in the field of institutions and stakeholders, please go to Strategic Priority Area 4 of the "Progress report on the implementation of the Global Plan of Action for Animal Genetic Resources 2007–2013" (below).

7. Please indicate the state of your country's capacities and provisions in the following areas of animal genetic resources management.

	Score
Education	low
Research	medium
Knowledge	high
Awareness	medium
Infrastructure	high
Stakeholder participation	medium
Policies	high
Policy implementation	high
Laws	high
Implementation of laws	high

8. Please provide further information regarding your country's capacities in each of the above-mentioned areas of management. If relevant, please indicate what obstacles or constraints your country faces in each of these areas and what needs to be done to address these constraints. You may also provide information on any particular successes achieved in your country in any of these areas and on the reasons for these successes.

	Description
Education	In general there is a lack of formal training on how to manage animal genetic resources at the university level.
Research	Significant research has been performed on major economically important breeds. In addition, breed comparisons (molecular and pedigree) have been made on a national and international levels. For some species these results have shown that US genetic diversity is as great as or greater than in the countries near the center of domestication. However, significant numbers of breeds with small to medium population sizes have not been adequately researched in the areas of genetic diversity, management of genetically constrained populations, phenotypic expression, and roles in new marketing structures.
Knowledge	Access to pre-existing knowledge by stakeholders is high through internet, breeder associations.
Awareness	Awareness has increased nationally among stakeholders, the research community, and public at large (through non-agricultural popular press articles).
Infrastructure	Infrastructure is in place and consists of government activities, state universities, and non-governmental organizations (such as breed associations).
Stakeholder participation	Across species and breeds (major and minor) stakeholder participation is significant and important in the execution of activities for the management of animal genetic resources.
Policies	National policy is concerned with the conservation and sustainable use of animal genetic resources.
Policy implementation	National policy is operational and has successfully worked toward the conservation and sustainable use of animal genetic resources.
Laws	The legal framework is well established.
Implementation of laws	All laws regarding the livestock owners rights are operational.

9. What steps have been taken in your country to engage or empower the various stakeholders in animal genetic resources management (e.g. establishment of livestock keepers' organizations, development of biocultural community protocols)?

Note: Biocultural community protocol: a document that is developed after a community undertakes a consultative process to outline their core cultural and spiritual values and customary laws relating to their traditional knowledge and resources. For a discussion of the potential role of biocultural community protocols in the conservation of animal genetic resources, please see the guidelines In vivo conservation of animal genetic resources (http://www.fao.org/docrep/018/i3327e/i3327e.pdf).

Because livestock (and therefore animal genetic resources) are private property livestock producers/breeders have always been empowered to manage genetic resources as they deem appropriate. Breed associations have been formed and play an important role in expressing the interests of the membership.

BREEDING PROGRAMMES

Note: Breeding programmes: systematic and structured programmes for changing the genetic composition of a population towards a defined breeding goal (objective) to realize genetic gain (response to selection), based on objective performance criteria. Breeding programmes typically contain the following elements: definition of breeding goal; identification of animals; performance testing; estimation of breeding values; selection; mating; genetic gain and transfer of genetic gain. Breeding programmes are usually operated either by a group of livestock breeders organized in a breeders' association, community-based entity or other collective body; by a large commercial breeding company; or by the government.

To provide further details of your country's activities in the field of breeding programmes, please go to Strategic Priority Area 2 of the "Progress report on the implementation of the Global Plan of Action for Animal Genetic Resources 2007–2013" (below).

10. Who operates breeding programmes in your country?

Note: the objective of this question is to identify which stakeholders lead or organize the breeding programmes that exist in your country. Stakeholder participation in the implementation of the various elements of breeding programmes is covered under Question 15. If you wish to provide further information on the activities of the various stakeholder groups (including collaborative activities on an international scale), please provide it in the text section of Question 15.

Species	Government	Livestock keepers organized at community level	Breeders' associations or cooperatives	National commercial companies	External commercial companies	Non-governmental organizations	Others
Cattle (specialized dairy)	no	yes	yes	yes	yes	no	yes
Cattle (specialized beef)	no	yes	yes	yes	yes	no	yes
Cattle (multipurpose)	no	yes	yes	no	no	no	yes
Sheep	no	yes	yes	yes	no	no	yes
Goats	no	yes	yes	yes	no	no	yes
Pigs	no	no	yes	yes	yes	no	yes
Chickens	no	no	yes	yes	yes	no	yes
Turkeys	no	no	yes	yes	yes	no	yes

10.1. If you choose the option "others", please indicate what kind of operator(s) this refers to.

Other = Livestock owners/breeders are the primary stakeholder and are responsible for developing and implementing breeding programs. These individuals may act in concert through community based organizations or breed associations however, the breeding program always devolves to the individual livestock owner.

11. For how many breeds in your country are the following activities undertaken?

Note: Please do not include activities that are only undertaken for experimental purposes, i.e. include only activities that directly serve or involve livestock keepers. However, please include activities even if they do not at present form part of a breeding programme. The intention is to obtain an indication of whether the "building blocks" of a breeding programme are available or being developed in your country. Loc = Locally adapted breeds; Ex = Exotic breeds.

Species	Tools															
	Animal identification		Breeding goal defined		Performance recording		Pedigree recording		Genetic evaluation (classic approach)		Genetic evaluation including genomic information		Management of genetic variation (by maximizing effective population size or minimizing rate of inbreeding)		Artificial insemination	
	Loc	Ex	Loc	Ex	Loc	Ex	Loc	Ex	Loc	Ex	Loc	Ex	Loc	Ex	Loc	Ex
Cattle (specialized dairy)	11	4	11	4	11	4	11	4	11	4	11	4	11	4	11	4
Cattle (specialized beef)	55	0	53	0	33	0	55	0	29	0	16	0	19	0	59	0
Sheep	52	0	52	0	35	0	41	0	13	0	0	0	18	0	28	0
Goats	16	0	14	0	12	0	11	0	5	0	0	0	8	0	23	0
Pigs	22	2	20	2	20	2	15	2	10	1	6	2	16	2	14	2
Chickens	23	0	56	0	8	0	6	0	6	0	6	0	27	0	4	0
Turkeys	2	0	20	0	2	0	2	0	2	0	2	0	20	0	2	0

12. Please indicate how many of the breeds in your country are subject to breeding programmes applying the following breeding methods.

Note: Loc = Locally adapted breeds; Ex = Exotic breeds.

Species	Breeding method			
	Straight/pure-breeding only		Straight/pure-breeding and cross-breeding	
	Loc	Ex	Loc	Ex
Cattle (specialized dairy)	0	0	11	4
Cattle (specialized beef)	0	0	55	4
Sheep	0	0	57	0
Goats	0	0	16	0
Pigs	0	0	28	1
Chickens	0	0	54	0
Turkeys	0	0	20	0
Cattle (multipurpose)	0	0	4	0

13. Please indicate the state of research and training in the field of animal breeding in your country.

Species	Training	Research
Cattle (specialized dairy)	medium	high
Cattle (specialized beef)	high	high

Species	Training	Research
Cattle (multipurpose)	low	low
Sheep	medium	medium
Goats	medium	medium
Pigs	high	high
Chickens	high	high
Turkeys	low	high

14. Please indicate the extent to which livestock keepers in your country are organized for the purposes of animal breeding.

Species	Organization of livestock keepers
Cattle (specialized dairy)	high
Cattle (specialized beef)	high
Cattle (multipurpose)	medium
Sheep	medium
Goats	medium
Pigs	high
Chickens	medium
Turkeys	medium

15. Please indicate the level of stakeholder involvement in the various elements of breeding programmes in your country.

Note: If your country has different types of breeding programme, the level of involvement of the various stakeholders may vary from one type of programme to another. In answering this question please try to indicate the overall degree of involvement of the various stakeholder groups.

Cattle (specialized dairy)	Government	Research organizations	Breeders' associations or cooperatives	Individual breeders/livestock keepers	National commercial companies	External commercial companies	Non-governmental organizations	Others
Setting breeding goals	medium	medium	high	high	high	high	low	none
Animal identification	none	none	high	high	high	high	low	none
Recording	none	none	high	high	high	high	low	none
Provision of artificial insemination services	none	none	none	high	high	high	none	none
Genetic evaluation	low	low	high	high	high	high	none	none

Cattle (specialized beef)	Government	Research organizations	Breeders' associations or cooperatives	Individual breeders/livestock keepers	National commercial companies	External commercial companies	Non-governmental organizations	Others
Setting breeding goals	medium	medium	high	high	high	high	low	none
Animal identification	none	none	high	high	high	high	low	none
Recording	none	none	high	high	high	high	low	none
Provision of artificial insemination services	none	none	none	high	high	high	none	none
Genetic evaluation	low	low	high	high	high	high	none	none

Sheep	Government	Research organizations	Breeders' associations or cooperatives	Individual breeders/livestock keepers	National commercial companies	External commercial companies	Non-governmental organizations	Others
Setting breeding goals	low	low	high	high	high	none	low	none
Animal identification	low	none	high	high	high	none	low	none
Recording	none	none	high	high	high	none	low	none
Provision of artificial insemination services	none	none	none	medium	medium	none	none	none
Genetic evaluation	low	low	high	high	high	none	none	none

Goats	Government	Research organizations	Breeders' associations or cooperatives	Individual breeders/livestock keepers	National commercial companies	External commercial companies	Non-governmental organizations	Others
Setting breeding goals	low	low	high	high	none	none	low	none
Animal identification	none	none	high	high	none	none	low	none
Recording	none	none	high	high	none	none	low	none
Provision of artificial insemination services	none	none	none	medium	medium	none	none	none
Genetic evaluation	low	low	high	high	none	none	none	none

Pigs	Government	Research organizations	Breeders' associations or cooperatives	Individual breeders/livestock keepers	National commercial companies	External commercial companies	Non-governmental organizations	Others
Setting breeding goals	low	low	high	high	high	high	low	none
Animal identification	none	none	high	high	high	high	low	none
Recording	none	none	high	high	high	high	low	none
Provision of artificial insemination services	none	none	low	high	high	high	none	none
Genetic evaluation	low	low	high	high	high	high	none	none

Chickens	Government	Research organizations	Breeders' associations or cooperatives	Individual breeders/livestock keepers	National commercial companies	External commercial companies	Non-governmental organizations	Others
Setting breeding goals	low	low	high	medium	high	high	low	none
Animal identification	none	none	high	medium	high	high	low	none
Recording	none	none	high	medium	high	high	low	none
Provision of artificial insemination services	none	none	none	medium	high	high	none	none
Genetic evaluation	low	low	high	medium	high	high	none	none

Turkeys	Government	Research organizations	Breeders' associations or cooperatives	Individual breeders/livestock keepers	National commercial companies	External commercial companies	Non-governmental organizations	Others
Setting breeding goals	low	low	high	medium	high	high	low	none
Animal identification	none	none	high	medium	high	high	low	none
Recording	none	none	high	medium	high	high	low	none
Provision of artificial insemination services	none	none	high	low	high	high	none	none
Genetic evaluation	low	low	medium	medium	high	high	none	none

15.1. If you choose the option "others", please indicate what kind of operator(s) this refers to.

N/A

15.2. Please provide further information on the roles that the stakeholders identified in the table play in the implementation of the various activities. If relevant, please also provide further information on the organizational roles played by the stakeholders identified in Question 10.

N/A

16. Does your country implement any policies or programmes aimed at supporting breeding programmes or influencing their objectives?

Species	Policies or programmes
Cattle (specialized dairy)	yes
Cattle (specialized beef)	yes
Cattle (multipurpose)	yes
Sheep	yes
Goats	yes
Pigs	yes
Chickens	yes
Turkeys	yes

16.1. Please describe these policies or programmes, indicating whether or not they include any measures specifically aimed at supporting breeding programmes for locally adapted breeds or any measures specifically aimed at supporting breeding programmes for exotic breeds (including breed-replacement programmes). Please indicate whether different types of programme are promoted in different production systems (and describe the differences).

Species	Description of policies or programmes
Cattle (specialized dairy)	The programs that support breeding programs are technology based and available for all livestock breeds. As with all breeding programs they are adjustable across production systems.
Cattle (specialized beef)	The programs that support breeding programs are technology based and available for all livestock breeds. As with all breeding programs they are adjustable across production systems.
Cattle (multipurpose)	The programs that support breeding programs are technology based and available for all livestock breeds. As with all breeding programs they are adjustable across production systems.
Sheep	The programs that support breeding programs are technology based and available for all livestock breeds. As with all breeding programs they are adjustable across production systems.
Goats	The programs that support breeding programs are technology based and available for all livestock breeds. As with all breeding programs they are adjustable across production systems.
Pigs	The programs that support breeding programs are technology based and available for all livestock breeds. As with all breeding programs they are adjustable across production systems.
Chickens	The programs that support breeding programs are technology based and available for all livestock breeds. As with all breeding programs they are adjustable across production systems.
Turkeys	The programs that support breeding programs are technology based and available for all livestock breeds. As with all breeding programs they are adjustable across production systems.

17. Please describe the consequences of your country’s breeding policies and programmes, or lack of breeding policies and programmes, for your country’s animal genetic resources and their management.

Species	Description of consequences
Cattle (specialized dairy)	Breeding policy (decisions) is under the purview of the livestock owner/breeder since livestock genetic resources are private property. Federal and state research organizations may develop approaches to evaluate traits that the industry deems important it is industry's responsibility to adapt and utilize such approaches. Similarly breed associations or NGOs can make recommendations to breeders but it is incumbent upon the membership (individual breeders) to accept or reject such recommendations. As a result of this approach genetic diversity, particularly within breed, is well maintained and breeders/owners have the opportunity to develop and manage their mating strategies as they see beneficial.
Cattle (specialized beef)	Breeding policy (decisions) is under the purview of the livestock owner/breeder since livestock genetic resources are private property. Federal and state research organizations may develop approaches to evaluate traits that the industry deems important it is industry's responsibility to adapt and utilize such approaches. Similarly breed associations or NGOs can make recommendations to breeders but it is incumbent upon the membership (individual breeders) to accept or reject such recommendations. As a result of this approach genetic diversity, particularly within breed, is well maintained and breeders/owners have the opportunity to develop and manage their mating strategies as they see beneficial.

Species	Description of consequences
Cattle (multipurpose)	Breeding policy (decisions) is under the purview of the livestock owner/breeder since livestock genetic resources are private property. Federal and state research organizations may develop approaches to evaluate traits that the industry deems important it is industry's responsibility to adapt and utilize such approaches. Similarly breed associations or NGOs can make recommendations to breeders but it is incumbent upon the membership (individual breeders) to accept or reject such recommendations. As a result of this approach genetic diversity, particularly within breed, is well maintained and breeders/owners have the opportunity to develop and manage their mating strategies as they see beneficial.
Sheep	Breeding policy (decisions) is under the purview of the livestock owner/breeder since livestock genetic resources are private property. Federal and state research organizations may develop approaches to evaluate traits that the industry deems important it is industry's responsibility to adapt and utilize such approaches. Similarly breed associations or NGOs can make recommendations to breeders but it is incumbent upon the membership (individual breeders) to accept or reject such recommendations. As a result of this approach genetic diversity, particularly within breed, is well maintained and breeders/owners have the opportunity to develop and manage their mating strategies as they see beneficial.
Goats	Breeding policy (decisions) is under the purview of the livestock owner/breeder since livestock genetic resources are private property. Federal and state research organizations may develop approaches to evaluate traits that the industry deems important it is industry's responsibility to adapt and utilize such approaches. Similarly breed associations or NGOs can make recommendations to breeders but it is incumbent upon the membership (individual breeders) to accept or reject such recommendations. As a result of this approach genetic diversity, particularly within breed, is well maintained and breeders/owners have the opportunity to develop and manage their mating strategies as they see beneficial.
Pigs	Breeding policy (decisions) is under the purview of the livestock owner/breeder since livestock genetic resources are private property. Federal and state research organizations may develop approaches to evaluate traits that the industry deems important it is industry's responsibility to adapt and utilize such approaches. Similarly breed associations or NGOs can make recommendations to breeders but it is incumbent upon the membership (individual breeders) to accept or reject such recommendations. As a result of this approach genetic diversity, particularly within breed, is well maintained and breeders/owners have the opportunity to develop and manage their mating strategies as they see beneficial.
Chickens	Commercial poultry breeding decisions are under the purview of large multinational breeding companies, and the genetics are owned by them. Their breeding decisions are influenced by market forces, sponsored research, and independent research by federal and state research organizations. Globalization of primary breeding companies has led to some expansion of biodiversity, as there is more global sharing of genetics selected under different production environments. At the other end of the spectrum, the majority of breeds are raised by individual producers, often with little training. Breeding decisions are influenced by breed clubs and NGO's. The most endangered breeds are raised only by fanciers and hobbyists. These latter may have a good understanding of breeding and avoidance of inbreeding, but outcrossing to other breeds is believed to have had a larger than expected impact on breed purity. There is very little influence of government policy, multinational breeding companies, or independent research on individual poultry breeders.
Turkeys	Same as chickens, however for the niche market breeds there are fewer individual breeders of turkeys than chickens and consequently the average level of training is adequate.

18. Please describe the main constraints to the implementation of breeding programmes in your country and what needs to be done to address these constraints. You may also provide information on any particular successes achieved in your country with respect to the establishment and operation of breeding programmes and on the factors that have contributed to these successes.

While the above issues are present breeder longevity and herd size plays an important role in the effective implementation of breeding programs. Breeders have expressed a willingness and interest in utilizing the gene bank collection to assist them in the implementation of their breeding programs.

19. Please describe future objectives, priorities and plans for the establishment or further development of breeding programmes in your country.

Species	Description of future objectives, priorities and plans
Cattle (specialized dairy)	Selection goals will continue to be driven by economic considerations related to dairy production, including higher milk, fat and protein yields, fertility, health, and survival. Efforts to develop genomic evaluations for economically important traits not currently recorded in the commercial population, such as feed efficiency, are ongoing. There is currently no commercial dairy production from transgenically modified cattle, but some development of transgenic cattle has occurred and could become commercially applicable. Development of nucleus populations that are owned by artificial insemination organizations may reduce the influence of individual cattle owners in genetic improvement programs.
Cattle (specialized beef)	Increases in production efficiency will continue to be a priority for cattle breeds. Development and implementation of multibreed genetic evaluation and genome-enhanced estimated breeding values is a priority. For full functionality procedures for sampling DNA is needed by all breeders. Due to the large number of traits that estimated breeding values are computed there is a need for robust selection index development. This may potentially lead to greater utilization and a rebirth of system analysis approaches to better match genotypes to environmental and production systems.
Cattle (multipurpose)	Individual breeders and breed associations will continue to guide breeding decisions, with emphasis on beef production and some selection for small scale dairy production. Avoidance of inbreeding, population expansion through recruitment of additional breeders, and maintenance of adaptive traits remain priorities for these breeds.
Sheep	Breeding programs and objectives will remain associated with individual breeders and their association. Efforts will be focused on disease resistance; especially parasite resistance/resilience. The role of genetic evaluation programs for performance characteristics will play a greater role. Efforts will continue to improving production efficiency for growth, reproductive and carcass characteristics.
Goats	Breeding programs and objectives will remain associated with individual breeders and their association. Efforts will be focused on disease resistance; especially parasite resistance/resilience. The role of genetic evaluation programs for performance characteristics will play a greater role. Efforts will continue to improving production efficiency for growth, reproductive and carcass characteristics.
Pigs	Little change is predicted in the structure of pig breeding programs. Selection programs will continue to emphasis economically important traits of litter size, maternal ability, longevity, pig growth, feed efficiency, carcass lean, and meat quality. Interest is expanding to include disease resistance. Inclusion of molecular markers in breeding value estimation is expected to expand with emphasis on the lowly heritable and phenotypically difficult to measure traits.

Species	Description of future objectives, priorities and plans
Chickens	Breeding programs for commercial layers and broilers will continue to emphasize economically important traits of feed efficiency, yield and growth, lay, fertility, structural soundness and disease resistance. Regulations requiring removal of antibiotics from the feed will drive additional emphasis on disease resistance, and emphasis on multi-environment selection strategies. Genomic selection will continue to play a role, both for inclusion/exclusion of specific markers and to maintain genetic diversity. There is renewed emphasis on combining ability of male and female lines. Consumer demand for "naturally grown" meat has impacted development of new lines, enhancing biodiversity at the commercial level. Breeding for layers will continue to emphasize persistency of lay rather than peak production, and animal welfare regulations (in some states) may lead to new genetic lines for cage-free production. Among non-industrial producers there are breeding programs for the majority of poultry breeds, including at-risk breeds, that have focused primarily on conformation and appearance, this is expected to change rapidly. Yet there are training opportunities to encourage selection for production traits, and growing market opportunities to restore productivity to dual purpose breeds (meat, and eggs). This along with growing interest in "backyard" poultry could expand minor breed populations during in the next 10 years. However, rare breeds once raised for primarily for egg production, gaming, or as ornamental fowl will continue to be threatened.
Turkeys	Breeding trends and priorities for turkeys are similar as for chickens above. The impacts of globalization are less for turkeys than chickens, but there is great potential for increased global demand for turkey meat that could impact selection for light meat vs. dark meat and adaptive traits. Niche marketing for turkey meat has been even greater than for chickens, and both primary breeding companies and small startup companies have developed new lines. Breeding programs for purebred turkeys and at-risk breeds is similar to those for chickens. The popularity of heritage turkeys for holiday celebrations is likely to drive greater selection for production traits in these breeds, and training breeders in selection and prevention of inbreeding will be a priority.

CONSERVATION

To provide further details of your country's activities in the field of conservation, please go to Strategic Priority Area 3 of the "Progress report on the implementation of the Global Plan of Action for Animal Genetic Resources 2007–2013" (below).

20. Please provide an indication of the extent to which your country's breeds are covered by conservation programmes.

Please focus on at-risk breeds and breeds for which there are serious grounds for concern about their potential to fall into the at-risk category in the near future. Countries should not reduce their scores because of a lack of conservation programmes for breeds that are clearly not at risk. The main purpose of this question is to obtain an indication of the extent to which your country's conservation programmes meet the objective of protecting breeds from extinction. If your country has no official national criteria for classifying breed risk status or lacks the relevant data for identifying which breeds are at risk, please base your answers on estimations. Please also note that Question 8 of the "Progress report on the implementation of the Global Plan of Action for Animal Genetic Resources – 2007 to 2013" (below) requests countries to provide information on the criteria they use to assess the risk status of animal genetic resources.

Note: n/a = no programmes implemented because all breeds of this species present in the country are secure.

Species	In situ conservation	Ex situ in vivo conservation	Ex situ in vitro conservation
Cattle (specialized dairy)	high	none	high
Cattle (specialized beef)	high	low	high
Cattle (multipurpose)	high	low	high
Sheep	high	low	high
Goats	high	low	high
Pigs	high	low	high
Chickens	high	low	high
Turkeys	high	low	low

21. Does your country use formal approaches to prioritize breeds for conservation?

- (•) yes
- ( ) no

21.1. If so, which of the following factors are considered?

Note: See Sections 2 and 3 of the FAO guidelines In vivo conservation of animal genetic resources (http://www.fao.org/docrep/018/i3327e/i3327e.pdf).

	Considered in formal prioritization approaches
Risk of extinction	yes
Genetic uniqueness	yes
Genetic variation within the breed	yes
Production traits	yes
Non-production traits	yes
Cultural or historical importance	yes
Probability of success	yes

22. Please indicate which of the following methods are used as elements of in situ conservation programmes in your country and which operators are managing them.

Note: Operators: the sector(s) that initiate(s) and manage(s) the respective activities. If both sectors undertake the respective activity, please answer "yes" in both rows. Please answer "yes" if the respective sector only works with some of the species targeted. If necessary, details of which sector addresses which species can be provided in the textual response. Information on what kinds of public- or private-sector organizations undertake the activities can also be provided, if necessary, in the textual response. Species targeted: Please answer "yes" if there are any such activities targeting the respective species, whether they are undertaken by the public sector, private sector or both.

Operators / Species targeted	Promotion of niche marketing or other market differentiation	Community-based conservation programmes	Incentive or subsidy payment schemes for keeping at-risk breeds	Development of biocultural community protocols	Recognition/award programmes for breeders	Conservation breeding programmes	Selection programmes for increased production or productivity in at-risk breeds	Promotion of at-risk breeds as tourist attractions	Use of at-risk breeds in the management of wildlife habitats and landscapes	Promotion of breed-related cultural activities	Extension programmes to improve the management of at-risk breeds	Awareness-raising activities providing information on the potential of specific at-risk breeds
Public sector	no	no	no	no	no	no	no	no	no	no	yes	no
Private sector	yes	yes	no	no	yes	yes	yes	yes	no	yes	no	yes
Cattle (specialized dairy)	yes	no	no	no	yes	no	yes	no	no	no	no	yes
Cattle (specialized beef)	yes	no	no	no	yes	no	yes	yes	no	no	no	yes
Cattle (multipurpose)	yes	no	no	no	yes	yes	yes	yes	no	no	no	yes
Sheep	yes	yes	no	no	yes	yes	yes	yes	no	yes	yes	yes

Operators / Species targeted	Promotion of niche marketing or other market differentiation	Community-based conservation programmes	Incentive or subsidy payment schemes for keeping at-risk breeds	Development of biocultural community protocols	Recognition/award programmes for breeders	Conservation breeding programmes	Selection programmes for increased production or productivity in at-risk breeds	Promotion of at-risk breeds as tourist attractions	Use of at-risk breeds in the management of wildlife habitats and landscapes	Promotion of breed-related cultural activities	Extension programmes to improve the management of at-risk breeds	Awareness-raising activities providing information on the potential of specific at-risk breeds
Goats	yes	no	no	no	yes	no	yes	no	no	no	yes	yes
Pigs	yes	yes	no	no	yes	no	yes	no	no	no	yes	yes
Chickens	yes	no	no	no	yes	yes	yes	no	no	no	no	yes
Turkeys	yes	no	no	no	yes	no	yes	no	no	no	no	yes

22.1. Please provide further details of the activities recorded in the table and any other in situ conservation activities or programmes being implemented in your country.

N/A

23. Does your country have an operational in vitro gene bank for animal genetic resources?

In vitro gene bank: a collection of documented cryoconserved genetic material, primarily stored for the purpose of medium- to long-term conservation, with agreed protocols and procedures for acquisition and use of the genetic material.

- (•) yes
- ( ) no

23.1. If your country has no in vitro gene bank for animal genetic resources, does it have plans to develop one?

- ( ) yes
- ( ) no

23.2. If yes, please describe the plans.

N/A

24. If your country has an in vitro gene bank for animal genetic resources, please indicate what kind of material is stored there.

	Stored in national genebank
Semen	yes
Embryos	yes
Oocytes	yes

	Stored in national genebank
Somatic cells (tissue or cultured cells)	yes
Isolated DNA	yes

25. If your country has an in vitro gene bank for animal genetic resources, please complete the following table.

Species	Number of breeds for which material is stored	Number of breeds for which sufficient material is stored	Does the collection include material from not-at-risk breeds?	Have any extinct populations been reconstituted using material from the gene bank?	Have the gene bank collections been used to introduce genetic variability into an in situ population?	Have the gene bank collections been used to introduce genetic variability into an ex situ population?	Do livestock keepers or breeders' associations participate in the planning of the gene banking activities?
Cattle (specialized dairy)	12	7	yes	no	yes	yes	yes
Cattle (specialized beef)	45	18	yes	no	yes	yes	yes
Cattle (multipurpose)	1	1	yes	no	no	no	yes
Sheep	38	7	yes	no	yes	yes	yes
Goats	14	2	yes	no	no	yes	yes
Pigs	24	11	yes	yes	yes	yes	yes
Chickens	16	2	yes	no	no	no	yes
Turkeys	1	1	yes	no	no	no	yes

25.1. Please provide further details of the activities recorded in the table (including any examples of the use of gene bank material to reconstitute populations or introduce genetic variability) and any other in vitro conservation activities or programmes being implemented in your country.

The gene bank has captured and placed substantial genetic variation in the repository from US livestock populations. Since inception the collection has grown at exponential rates. The primary role of the program has been to serve as a backup of in-situ livestock populations in the event that a national or industry based need arises (e.g., disease outbreak or genetic bottleneck). However, since inception it has become evident that the collection can serve more immediate needs that the public and private sectors may have. Specifically, the collection has been used to provide samples for a variety of DNA experiments, reconstituting research populations, adding genetic variability into industry populations, and evaluating germplasm in a range of different physiology experiments. Since 2006 a total of 16,108 samples from 6,043 animals have been distributed from the repository.

26. Does your country have plans to enter into collaboration with other countries to set up a regional or subregional in vitro gene bank for animal genetic resources?

- ○ yes
- ◉ no

26.1. If yes, please describe the plans, including a list of the countries involved.

No plans for an in-vitro gene bank, however, we are jointly developing a comprehensive database on animal genetic resources and gene bank acquisitions with Canada and Brazil. In addition we do backup samples for Jersey Island.

27. If there have been any cases in your country in which breeds that were formerly classified as at risk of extinction have recovered to a position in which they are no longer at risk, please list the breeds and describe how the recovery was achieved.

Yes. We totally recovered a population of pigs in which there was no in-situ population. In-situ populations of 17 at-risk breeds were expanded between 2003-2013. Notable successes include Katahdin sheep, Myotonic goats, Belted Galloway and Dexter cattle, and Nigerian Dwarf goats. Most at-risk breed populations have been stable during this period.

REPRODUCTIVE AND MOLECULAR BIOTECHNOLOGIES

28. Please indicate the level of availability of reproductive and molecular biotechnologies for use in livestock production in your country.

Note: low = at experimental level only; medium = available to livestock keepers in some locations or production systems; high = widely available to livestock keepers.

	Biotechnologies								
Species	Artificial insemination	Embryo transfer	Multiple ovulation and embryo transfer	Semen sexing	In vitro fertilization	Cloning	Genetic modification	Molecular genetic or genomic information	Transplantation of gonadal tissue
Cattle (specialized dairy)	high	high	high	high	high	medium	low	high	none
Cattle (specialized beef)	high	high	high	medium	high	medium	low	high	none
Cattle (multipurpose)	medium	medium	medium	low	none	none	none	medium	none
Sheep	medium	medium	low	none	none	none	none	medium	none
Goats	high	medium	low	none	none	none	none	medium	none
Pigs	high	low	low	none	none	none	low	high	none
Chickens	high	none	none	none	none	none	low	high	medium
Turkeys	high	none	none	none	none	none	low	medium	low

28.1. Please provide additional information on the use of these biotechnologies in your country.

N/A

29. If the reproductive and/or molecular technologies are available for use by livestock keepers in your country, please indicate which stakeholders are involved in providing the respective services to the livestock keepers.

	Stakeholders					
	Public sector	Breeders' associations or cooperatives	National non-governmental organizations	Donors and development agencies	National commercial companies	External commercial companies
Artificial insemination	no	no	no	no	yes	yes
Embryo transfer	no	no	no	no	yes	yes
Molecular Information	yes	yes	no	no	yes	yes

29.1. Please provide additional information on the roles that the providers identified in the table play in the provision of biotechnology services in your country.

The technologies are implemented primarily by the private sector. As technologies are developed they are quickly transfered from public institutions to the private sector, which not only includes large companies but also private and independent breeders.

30. Please indicate which biotechnologies your country is undertaking research on.

Biotechnologies	Public or private research at national level	Research undertaken as part of international collaboration
Artificial insemination	yes	no
Embryo transfer or MOET	yes	no
Semen sexing	yes	no
In vitro fertilization	yes	no
Cloning	yes	no
Genetic modification	yes	no
Use of molecular genetic or genomic information for estimation of genetic diversity	yes	yes
Use of molecular genetic or genomic information for prediction of breeding values	yes	yes
Research on adaptedness based on molecular genetic or genomic information	yes	yes

30.1. Please briefly describe the research.

N/A

31. Please estimate the extent to which artificial insemination (using semen from exotic and/or locally adapted breeds) and/or natural mating is used in your country's various production systems.

Note: low = approximately <33% of matings; medium = approximately 33–67% of matings; high = approximately >67% of mating; n/a = production system not present in this country.

Cattle (specialized dairy)	Ranching or similar grassland -based production systems	Pastoralist systems	Mixed farming systems (rural areas)	Industrial systems	Small-scale urban or peri-urban systems
Artificial insemination using semen from locally adapted breeds	n/a	n/a	high	high	n/a
Artificial insemination using nationally produced semen from exotic breeds	n/a	n/a	medium	medium	n/a
Artificial insemination using imported semen from exotic breeds	n/a	n/a	medium	medium	n/a
Natural mating	n/a	n/a	medium	medium	n/a

Cattle (specialized beef)	Ranching or similar grassland -based production systems	Pastoralist systems	Mixed farming systems (rural areas)	Industrial systems	Small-scale urban or peri-urban systems
Artificial insemination using semen from locally adapted breeds	medium	low	high	n/a	n/a
Artificial insemination using nationally produced semen from exotic breeds	none	none	none	n/a	n/a
Artificial insemination using imported semen from exotic breeds	none	none	none	none	none
Natural mating	high	high	high	n/a	n/a

Sheep	Ranching or similar grassland -based production systems	Pastoralist systems	Mixed farming systems (rural areas)	Industrial systems	Small-scale urban or peri-urban systems
Artificial insemination using semen from locally adapted breeds	low	none	low	low	n/a
Artificial insemination using nationally produced semen from exotic breeds	none	none	none	low	n/a
Artificial insemination using imported semen from exotic breeds	low	none	medium	none	n/a
Natural mating	high	high	high	high	n/a

Goats	Ranching or similar grassland -based production systems	Pastoralist systems	Mixed farming systems (rural areas)	Industrial systems	Small-scale urban or peri-urban systems
Artificial insemination using semen from locally adapted breeds	none	none	medium	high	n/a
Artificial insemination using nationally produced semen from exotic breeds	low	none	low	low	n/a
Artificial insemination using imported semen from exotic breeds	low	none	low	low	n/a
Natural mating	high	high	high	medium	n/a

Pigs	Ranching or similar grassland -based production systems	Pastoralist systems	Mixed farming systems (rural areas)	Industrial systems	Small-scale urban or peri-urban systems
Artificial insemination using semen from locally adapted breeds	n/a	n/a	low	high	n/a
Artificial insemination using nationally produced semen from exotic breeds	n/a	n/a	none	none	n/a
Artificial insemination using imported semen from exotic breeds	n/a	n/a	none	none	n/a
Natural mating	n/a	high	high	low	n/a

Chickens	Ranching or similar grassland -based production systems	Pastoralist systems	Mixed farming systems (rural areas)	Industrial systems	Small-scale urban or peri-urban systems
Artificial insemination using semen from locally adapted breeds	n/a	n/a	none	high	none
Artificial insemination using nationally produced semen from exotic breeds	n/a	n/a	none	none	none
Artificial insemination using imported semen from exotic breeds	n/a	n/a	none	none	none
Natural mating	n/a	n/a	high	high	high

Turkeys	Ranching or similar grassland -based production systems	Pastoralist systems	Mixed farming systems (rural areas)	Industrial systems	Small-scale urban or peri-urban systems
Artificial insemination using semen from locally adapted breeds	n/a	n/a	none	high	none
Artificial insemination using nationally produced semen from exotic breeds	n/a	n/a	none	none	none
Artificial insemination using imported semen from exotic breeds	n/a	n/a	none	none	none
Natural mating	n/a	n/a	high	low	high

32. Please provide further details on the use of reproductive and molecular biotechnologies in animal genetic resources management in your country. Please note any particular constraints to implementing these activities and any problems associated with their use. Please indicate what needs to be done to address these constraints and/or problems. You may also provide information on any particular successes achieved in your country in the use of biotechnologies in animal genetic resources management and on the factors that have contributed to these successes.

Dairy Cattle: Sexed semen (female) is available from all large breeding companies and has been widely adopted by dairy producers. Embryo transfer and in-vitro fertilization are routinely used by breeders that provide bulls for artificial insemination. A genomic evaluation system has been developed and nearly all males have a genomic evaluation conducted before entering an artificial insemination program. **Beef Cattle:** Across the industry and breeds AI rate is low. Embryo transfer is used mainly by elite breeders to shorten generation intervals and increase the number of progeny from highly desirable bulls and cows. **Pigs:** The use of AI utilizing chilled extended semen is highly integrated into current production systems. Utilization of embryo transfer is very low because embryo freezing in pigs has a very low efficiency. Marker assisted selection methodologies are starting to be used and usage will expand as the accuracy of the marker panels is enhanced. Use of molecular modification methods is not currently utilized by the industry and development will depend on clear market signals of acceptance of GMO by the consumer. **Sheep:** The sheep industry makes only limited use of artificial insemination, due to limited success of transcervical AI using frozen semen. Embryo transfer is used mainly for importing new genetic resources. There is marker assisted selection, mostly related to selection for disease resistance. **Goats:** Goat production is practiced mostly in small scale industries. Artificial insemination using frozen semen is widely adopted in the dairy goat industry, and less so in the meat and fiber goat industries. There is some embryo transfer, mostly associated with the propagation of imported genetics. **Chickens.** Artificial insemination with fresh extended semen is used by chicken breeders. Advent of ovary transplantation represents a significant step in conserving poultry genetics. Marker assisted selection is implemented by large breeding companies.

III. DATA CONTRIBUTING TO THE PREPARATION OF *THE STATE OF THE WORLD'S BIODIVERSITY FOR FOOD AND AGRICULTURE*

INTEGRATION OF THE MANAGEMENT OF ANIMAL GENETIC RESOURCES WITH THE MANAGEMENT OF PLANT, FORESTRY AND AQUATIC GENETIC RESOURCES

1. Please indicate the extent to which the management of animal genetic resources in your country is integrated with the management of plant, forestry and aquatic genetic resources. Please describe the collaboration, including, if relevant, a description of the benefits gained by pursuing a collaborative approach.

	Extent of collaboration	Description
Development of joint national strategies or action plans	none	
Collaboration in the characterization, surveying or monitoring of genetic resources, production environments or ecosystems	none	
Collaboration related to genetic improvement	none	
Collaboration related to product development and/or marketing	none	
Collaboration in conservation strategies, programmes or projects	limited	Sustainable agriculture initiatives integrate livestock, crops, and ecosystems, including silvopastoral systems.
Collaboration in awareness-raising on the roles and values of genetic resources	limited	
Training activities and/or educational curricula that address genetic resources in an integrated manner	limited	USDA provides limited training in sustainable agriculture through the National Center for Apropriate Technology
Collaboration in the mobilization of resources for the management of genetic resources	none	

2. Please describe any other types of collaboration.

Highly focused initiatives are in place for livestock, plant, forestry and aquatic genetic resources. However, cross life form collaboration is minimal as such efforts will most likely detract from the primary mission of the individual life form.

3. If relevant, please describe the benefits that could be achieved by strengthening collaboration in the management of genetic resources in the animal, plant, forest and aquatic sectors in your country. If specific plans to increase collaboration are in place, please describe them and the benefits foreseen

Given the breadth of the subject matter the benefit in strengthening or initiating collaboration is unclear. Any cross life form linkages are likely to be at such a highly aggregated level that they would afford little if any leveraging of resources or activities.

4. Please describe any factors that facilitate or constrain collaborative approaches to the management of genetic resources in your country.

Collaborations in sustainable agriculture have been developed in the private sector, and through USDA's Sustainable Agriculture Research and Education Program and USDA's conservation programs.

5. If there are constraints, please indicate what needs to be done to overcome them.

No constraints

ANIMAL GENETIC RESOURCES MANAGEMENT AND THE PROVISION OF REGULATING AND SUPPORTING ECOSYSTEM SERVICES

6. Do your country's policies, plans or strategies for animal genetic resources management include measures specifically addressing the roles of livestock in the provision of regulating ecosystem services and/or supporting ecosystem services?

Regulating ecosystem services: "Benefits obtained from the regulation of ecosystem processes" – Millennium Ecosystem Assessment. 2005. Ecosystems and human well-being: synthesis. Washington D.C., Island Press (available at http://millenniumassessment.org/documents/document.356.aspx.pdf), page 40. Supporting ecosystem services: "Services necessary for the production of all other ecosystem services" – Millennium Ecosystem Assessment. 2005. Ecosystems and human well-being: synthesis. Washington D.C., Island Press (available at http://millenniumassessment.org/documents/document.356.aspx.pdf), page 40.

- ○ yes
- ◉ no

6.1. If yes, please describe these measures and indicate which supporting and/or regulating ecosystem services are targeted, and in which production systems.

Examples of supporting and regulatory ecosystem services provided by livestock might include the following: provision or maintenance of wildlife habitats (e.g. via grazing); seed dispersal (e.g. in dung or on animals' coats); promoting plant growth (e.g. stimulating growth via grazing or browsing); soil formation (e.g. via the supply of manure); soil nutrient cycling (e.g. via supply of manure); soil quality regulation (e.g. affecting soil structure and water-holding capacity via trampling or dunging); control of weeds and invasive species (e.g. via grazing or browsing invasive plants); climate regulation (e.g. by promoting carbon sequestration through dunging); enhancing pollination levels (e.g. by creating habitats for pollinators); fire control (e.g. by removal of biomass that may fuel fires); avalanche control (e.g. grazing to keep vegetation short to reduce the probability that snow will slide); erosion regulation (e.g. indirect via fire control services); maintenance of water quality and quantity (e.g. indirect effect via erosion control); management of crop residues (e.g. consumption of unwanted crop residues by animals); pest regulation (e.g. by destruction of pests or pest habitats); disease regulation (e.g. by destruction of disease vectors or their habitats); buffering of water quantities – flood regulation (e.g. indirect effect via fire and erosion control).

The livestock sector, particularly at the species level, provides a broad range of ecosystem services such as, soil nutrient cycling, maintenance of wildlife habitat, vegetation management on public and private lands, and control of noxious weeds. In addition, through grazing plant carbon cycling is stimulated thereby increasing carbon sequestration. However, these services have note been identified as a focus for animal genetic resource management.

6.1.1 Please describe what the outcome of these measures has been in terms of the supply of the respective ecosystem services (including an indication of the scale on which these outcomes have been obtained).

The scale of these types of activities are national.

6.1.2 Please describe what the outcome of these measures has been in terms of the state of animal genetic resources and their management (including an indication of the scale on which these outcomes have been obtained).

Integrated livestock-agro-ecosystem practices have become the focus of a growing movement. Such practices include use of grazing practices (e.g. rotational grazing) and animal manure to support soil formation, fertility and quality, and plant diversity. Rotation of different livestock species on the same land is sometimes practiced to further enhance these processes and aid in parasite and pest reduction. Cattle, goats, pigs and sheep have been used to control undergrowth in wooded areas. Pigs are used to clear new areas for planting, and businesses have been created nationwide for brush control using goats, on both private and public lands. Likewise, these practices provide alternative foodstuffs for animals, reducing carbon footprints of transporting grains from the regions where they are grown to the regions where livestock are raised. However, growth in these practices has not impacted genetic resources management.

7. Do your country's policies, plans or strategies for animal genetic resources management include measures specifically addressing environmental problems associated with livestock production?

Examples might include choosing to use particular species or breeds because they are less environmentally damaging in a given ecosystem or adapting breeding goals to produce animals that have some characteristic that makes them more environmentally friendly.

- ○ yes
- ◉ no

7.1. If yes, please describe these measures and indicate the environmental problems that are targeted, and in which production systems.

N/A

7.1.1 Please describe what the outcome of these measures has been in terms of the reduction of the respective environmental problem (including an indication of the scale on which these outcomes have been obtained).

N/A

7.1.2 Please describe what the outcome of these measures has been in terms of the state of animal genetic resources and their management (including an indication of the scale on which these outcomes have been obtained).

N/A

8. Please describe any constraints or problems encountered or foreseen in the implementation of measures in your country aimed at promoting the provision of regulating and supporting ecosystem services or reducing environmental problems.

No constraints or problems identified.

9. Please provide examples of cases in which the role of livestock or specific animal genetic resources is particularly important in the provision of regulating and/or supporting ecosystem services in your country. Please also describe any examples in which diverse animal genetic resources are important in terms of reducing the adverse environmental effects of livestock production.

Livestock provide ecosystem services in a number of ways across diverse ecosystems. In the southern plains goats and to a lesser extent sheep are used to mitigate brush encroachment. Sheep and goats are also used to manage vegetation growth (e.g., trees and shrubs) along electrical power-line easements in mountainous areas thereby reduce the use of herbicides. On mountainous public lands sheep and cattle grazing contributes to vegetation health and plant diversity. Particularly in the Great Plains livestock grazing can stimulate plant vegetative processes that results in increased carbon sequestration. Also in the western half of the U.S. sheep are used as a bio-control for noxious weeds. All of these uses are species specific and are not based upon the utilization of a specific genotype. No breed types have been identified as having the ability to mitigate adverse environmental effects of livestock production. Mitigation has been achieved through management actions.

10. Please describe the potential steps that could be taken in your country to further expand or strengthen positive links between animal genetic resources management and the provision of regulating and/or supporting ecosystem services or the reduction of environmental problems. If your country has specific plans to take further action in this field, please describe them.

At this time there are no recognized steps needed to link genetic resources management and regulating or supporting ecosystem services. That said technologies are emerging which will facilitate the selection of animals within a breed capable of more active grazing patterns on rangelands.

11. Please provide any further information on the links between animal genetic resources management in your country and the provision of supporting and/or regulating ecosystem services and/or the reduction of environmental problems.

N/A

IV. PROGRESS REPORT ON THE IMPLEMENTATION OF THE *GLOBAL PLAN OF ACTION FOR ANIMAL GENETIC RESOURCES* – 2007 TO 2013

Note: Please provide further details in the text boxes below each question, including, if relevant, information on why no action has been taken.

STRATEGIC PRIORITY AREA 1: CHARACTERIZATION, INVENTORY AND MONITORING OF TRENDS AND ASSOCIATED RISKS

- The state of inventory and characterization of animal genetic resources
- The state of monitoring programmes and country-based early warning and response systems
- The state of international technical standards and protocols for characterization, inventory, and monitoring

1. Which of the following options best describes your country's progress in building an inventory of its animal genetic resources covering all livestock species of economic importance (SP 1, Action 1)?

Glossary: An inventory is a complete list of all the different breeds present in a country.

- (●) a. Completed before the adoption of the GPA
- ( ) b. Completed after the adoption of the GPA
- ( ) c. Partially completed (further progress since the adoption of the GPA)
- ( ) d. Partially completed (no further progress since the adoption of the GPA)

Please provide further details:

N/A

2. Which of the following options best describes your country's progress in implementing phenotypic characterization studies covering morphology, performance, location, production environments and specific features in all livestock species of economic importance (SP 1, Actions 1 and 2)?

- (●) a. Comprehensive studies were undertaken before the adoption of the GPA
- ( ) b. Sufficient information has been generated because of progress made since the adoption of the GPA
- ( ) c. Some information has been generated (further progress since the adoption of the GPA)
- ( ) d. Some information has been generated (no further progress since the adoption of the GPA)
- ( ) e. None, but action is planned and funding identified
- ( ) f. None, but action is planned and funding is sought
- ( ) g. None

Please provide further details:

N/A

3. Which of the following options best describes your country's progress in molecular characterization of its animal genetic resources covering all livestock species of economic importance (SP 1)?

- ( ) a. Comprehensive studies were undertaken before the adoption of the GPA
- (●) b. Sufficient information has been generated because of progress made since the adoption of the GPA
- ( ) c. Some information has been generated (further progress since the adoption of the GPA)
- ( ) d. Some information has been generated (no further progress since the adoption of the GPA)
- ( ) e. None, but action is planned and funding identified
- ( ) f. None, but action is planned and funding is sought
- ( ) g. None

Please provide further details:

N/A

4. Has your country conducted a baseline survey of the population status of its animal genetic resources for all livestock species of economic importance (SP 1, Action 1)?

Glossary: A baseline provides a reference point for monitoring population trends. Population status refers to the total size of a national breed population (ideally, also the proportion that is actively used for breeding and the number of male and female breeding animals).

- (●) a. Yes, a baseline survey was undertaken before the adoption of the GPA
- ( ) b. Yes, a baseline survey has been undertaken or has commenced after the adoption of the GPA
- ( ) c. Yes, a baseline survey has been undertaken for some species (coverage increased since the adoption of the GPA)
- ( ) d. Yes, a baseline survey has been undertaken for some species (coverage not increased since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

N/A

5. Have institutional responsibilities for monitoring the status of animal genetic resources in your country been established (SP 1, Action 3)?

Glossary: Monitoring is a systematic set of activities undertaken to document changes in the population size and structure of animal genetic resources over time.

- (●) a. Yes, responsibilities established before the adoption of the GPA
- ( ) b. Yes, responsibilities established after the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details:

N/A

6. Have protocols (details of schedules, objectives and methods) been established for a programme to monitor the status of animal genetic resources in your country (SP 2)?

- (●) a. Yes, protocols established before the adoption of the GPA
- ( ) b. Yes, protocols established after the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details:

N/A

7. Are the population status and trends of your country's animal genetic resources being monitored regularly for all livestock species of economic importance (SP 1, Action 2)?

- (●) a. Yes, regular monitoring commenced before the adoption of the GPA
- ( ) b. Yes, regular monitoring commenced after the adoption of the GPA
- ( ) c. Yes, regular monitoring is being undertaken for some species (coverage increased since the adoption of the GPA)

- ○ d. Yes, regular monitoring is being undertaken for some species (coverage not increased since the adoption of the GPA)
- ○ e. No, but action is planned and funding identified
- ○ f. No, but action is planned and funding is sought
- ○ g. No

Please provide further details:

N/A

8. Which criteria does your country use for assessing the risk status of its animal genetic resources (SP 1, Action 7)?

Glossary: FAO has developed criteria that it uses to allocate breeds to risk-status categories based on the size and structure of their populations (http://www.fao.org/docrep/010/a1250e/a1250e00.htm).

- ○ a. FAO criteria
- ◉ b. National criteria that differ from the FAO criteria
- ○ c. Other criteria (e.g. defined by international body such as European Union)
- ○ d. None

Please provide further details. If applicable, please describe (or provide a link to a web site that describes) your national criteria or those of the respective international body:

N/A

9. Has your country established an operational emergency response system (http://www.fao.org/docrep/meeting/021/K3812e.pdf) that provides for immediate action to safeguard breeds at risk in all important livestock species (SP 1, Action 7)?

- ○ a. Yes, a comprehensive system was established before the adoption of the GPA
- ○ b. Yes, a comprehensive system has been established since the adoption of the GPA
- ◉ c. For some species and breeds (coverage expanded since the adoption of the GPA)
- ○ d. For some species and breeds (coverage not expanded since the adoption of the GPA)
- ○ e. No, but action is planned and funding identified
- ○ f. No, but action is planned and funding is sought
- ○ g. No

Please provide further details:

N/A

10. Is your country conducting research to develop methods, technical standards or protocols for phenotypic or molecular characterization, or breed evaluation, valuation or comparison? (SP 2, Action 2)

- ◉ a. Yes, research commenced before the adoption of the GPA
- ○ b. Yes, research commenced after the adoption of the GPA
- ○ c. No, but action is planned and funding identified
- ○ d. No, but action is planned and funding is sought
- ○ e. No

Please provide further details:

N/A

11. Has your country identified the major barriers and obstacles to enhancing its inventory, characterization and monitoring programmes?

- (●) a. Yes
- ( ) b. No
- ( ) c. No major barriers and obstacles exist. Comprehensive inventory, characterization and monitoring programmes are in place.

Please provide further details. If barriers and obstacles have been identified, please list them:

N/A

12. If applicable, please list and describe the measures that need to be taken to address these barriers and obstacles and to enhance your country's inventory, characterization and monitoring programmes:

Characterization of at-risk breeds is becoming dated, the lack of current information inhibits assessment of the most appropriate ways in which these breeds might be used.

13. Please provide further comments on your country's activities related to Strategic Priority Area 1: Characterization, inventory and monitoring of trends and associated risks (including regional and international cooperation)

Note: It is not necessary to duplicate information provided in previous sections. Where relevant, please provide cross-references.

As more genomic information becomes available more complete assessments of the genetic variability of at-risk breeds can be made which should in turn facilitate strategies for future use.

STRATEGIC PRIORITY AREA 2: SUSTAINABLE USE AND DEVELOPMENT

- The state of national sustainable use policies for animal genetic resources
- The state of national species and breed development strategies and programmes
- The state of efforts to promote agro-ecosystem approaches

14. Does your country have adequate national policies in place to promote the sustainable use of animal genetic resources (see also questions 46 and 54)?

- (●) a. Yes, since before the adoption of the GPA
- ( ) b. Yes, policies put in place or updated after the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details. If available, please provide the text of the policies or a web link to the text:

N/A

15. Do these policies address the integration of agro-ecosystem approaches into the management of animal genetic resources in your country (SP5) (see also questions 46 and 54)?

Glossary: The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (for further information see http://www.cbd.int/ecosystem/description.shtml).

- ( ) a. Yes
- ( ) b. No, but a policy update is planned and funding identified
- ( ) c. No, but action is planned and funding is sought

- (●) d. No

Please provide further details:

A number of policies and programs

16. Do breeding programmes exist in your country for all major species and breeds, and are these programmes regularly reviewed, and if necessary revised, with the aim of meeting foreseeable economic and social needs and market demands (SP4, Action 2)?

- (●) a. Yes, since before the adoption of the GPA
- ( ) b. Yes, put in place after the adoption of the GPA
- ( ) c. For some species and breeds (coverage has increased since the adoption of the GPA)
- ( ) d. For some species and breeds (coverage has not increased since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

A number of policies and programs promote integrated agro-livestock-ecosytem approaches, including silvopasturing. However, this has not impacted animal genetic resource management. Technologies are emerging, however, that will facilitate the selection of animals within a breed capable of more active grazing patterns on rangelands.

17. Is long-term sustainable use planning – including, if appropriate, strategic breeding programmes – in place for all major livestock species and breeds (SP4, Action 1)?

- (●) a. Yes, since before the adoption of the GPA
- ( ) b. Yes, put in place after the adoption of the GPA
- ( ) c. For some species and breeds (further progress made since the adoption of the GPA)
- ( ) d. For some species and breeds (no further progress made since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

Private sector breeders establish and execute the strategies which they deem appropriate.

18. Have the major barriers and obstacles to enhancing the sustainable use and development of animal genetic resources in your country been identified?

- (●) a. Yes
- ( ) b. No
- ( ) c. No major barriers and obstacles exist. Comprehensive sustainable use and development measures are in place.

Please provide further details. If barriers and obstacles have been identified, please list them:

N/A

19. Have the long-term impacts of the use of exotic breeds on locally adapted breeds (e.g. economic, environmental or genetic impacts) and on food security been assessed in your country (SP4, Action 1)?

Glossary:

Exotic breeds are breeds that are maintained in a different area from the one in which they were developed. Exotic breeds comprise both recently introduced breeds and continually imported breeds.

Locally adapted breeds are breeds that have been in the country for a sufficient time to be genetically adapted to one or more of traditional production systems or environments in the country. The phrase "sufficient time" refers to time present in one or more of the country's traditional production systems or environments. Taking cultural, social and genetic aspects into account, a period of 40 years and six generations of the respective species might be considered as a guiding value for "sufficient time", subject to specific national circumstances.

b. Yes, assessments were introduced before the adoption of the GPA

Please provide further details:

Breeders are free to decide about the appropriate use of locally adapted or exotic breeds. Their decisions are governed by the nexus of economic, environmental, or genetic impact.

20. Have recording systems and organizational structures for breeding programmes been established or strengthened (SP4, Action 3)?

- (●) a. Yes, sufficient recording systems and organizational structures for breeding programmes have existed since before the adoption of the GPA
- ( ) b. Yes, sufficient recording systems and organizational structures for breeding programmes exist because of progress made since the adoption of the GPA
- ( ) c. Yes, recording systems and organizational structures for breeding programmes are partially in place (and were established or strengthened after the adoption of the GPA)
- ( ) d. Yes, recording systems and organizational structures for breeding programmes are partially in place (but no progress has been made since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

N/A

21. Are mechanisms in place in your country to facilitate interactions among stakeholders, scientific disciplines and sectors as part of sustainable use development planning (SP5, Action 3)?

- (●) a. Yes, comprehensive mechanisms have existed since before the adoption of the GPA
- ( ) b. Yes, comprehensive mechanisms exist because of progress made since the adoption of the GPA
- ( ) c. Yes, mechanisms are partially in place (and were established or strengthened after the adoption of the GPA)
- ( ) d. Yes, mechanisms are partially in place (but no progress has been made since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

N/A

22. Have measures been implemented in your country to provide farmers and livestock keepers with information that facilitates their access to animal genetic resources (SP 4, Action 7)?

- (●) a. Yes, comprehensive measures have existed since before the adoption of the GPA
- ( ) b. Yes, comprehensive measures exist because of progress made since the adoption of the GPA
- ( ) c. Yes, measures partially implemented (and were established or strengthened after the adoption of the GPA)
- ( ) d. Yes, measures partially implemented (but no progress has been made since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified

- ○ f. No, but action is planned and funding is sought
- ○ g. No

Please provide further details:

N/A

23. Has your country developed a national policy or entered specific contractual agreements for access to and the equitable sharing of benefits resulting from the use and development of animal genetic resources and associated traditional knowledge (SP3, Action 2)?

- ◉ a. Yes, sufficient measures (policy and/or agreements) have been in place since before the adoption of the GPA
- ○ b. Yes, sufficient measures (policy and/or agreements) are in place because of progress made since the adoption of the GPA
- ○ c. Yes, some measures (policy and/or agreements) are in place (progress has been made since the adoption of the GPA)
- ○ d. Yes, some measures (policy and/or agreements) are in place (but no progress has been made since the adoption of the GPA)
- ○ e. No, but a policy and/or agreements are in preparation
- ○ f. No, but a policy and/or agreements are planned
- ○ g. No

Please provide further details:

Livestock and genetic resources are the property of the livestock breeder and exchange is via private treaty contracts between buyer and seller. Therefore exchange and use is protected by long standing private property and contract laws.

24. Have training and technical support programmes for the breeding activities of livestock-keepers been established or strengthened in your country (SP 4, Action 1)?

- ◉ a. Yes, sufficient programmes have existed since before the adoption of the GPA
- ○ b. Yes, sufficient programmes exist because of progress made since the adoption of the GPA
- ○ c. Yes, some programmes exist (progress has been made since the adoption of the GPA)
- ○ d. Yes, some programmes exist (but no progress has been made since the adoption of the GPA)
- ○ e. No, but action is planned and funding identified
- ○ f. No, but action is planned and funding is sought
- ○ g. No

Please provide further details:

N/A

25. Have priorities for future technical training and support programmes to enhance the use and development of animal genetic resources in your country been identified (SP 4, paragraph 42)?

- ◉ a. Yes, priorities have been identified or updated since the adoption of the GPA
- ○ b. Yes, priorities were identified before the adaption of the GPA but have not been updated
- ○ c. No, but action is planned and funding identified
- ○ d. No, but action is planned and funding is sought
- ○ e. No

Please provide further details:

N/A

26. Have efforts been made in your country to assess and support indigenous or local production systems and associated traditional knowledge and practices related to animal genetic resources (SP 6, Action 1, 2)?

- (●) a. Yes, sufficient measures have been in place since before the adoption of the GPA
- ( ) b. Yes, sufficient measures are in place because of progress made since the adoption of the GPA
- ( ) c. Yes, some measures are in place (and were established or strengthened after the adoption of the GPA)
- ( ) d. Yes, some measures are in place (but no progress has been made since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

N/A

27. Have efforts been made in your country to promote products derived from indigenous and local species and locally adapted breeds, and facilitate access to markets (SP 6, Action 2, 4)?

- (●) a. Yes, sufficient measures have been in place since before the adoption of the GPA
- ( ) b. Yes, sufficient measures are in place because of progress made since the adoption of the GPA
- ( ) c. Yes, some measures are in place (and were established or strengthened after the adoption of the GPA)
- ( ) d. Yes, some measures are in place (but no progress has been made since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

N/A

28. If applicable, please list and describe priority requirements for enhancing the sustainable use and development of animal genetic resources in your country:

To enhance sustainable use and develop animal genetic resources producers/breeders must have current assessments of their populations genetic status and the tools necessary to employ effective selection for traits deemed important for the market and production system.

29. Please provide further comments on your country's activities related to Strategic Priority Area 2: Sustainable Use and Development (including regional and international cooperation)

Note: It is not necessary to duplicate information provided in previous sections. Where relevant, please provide cross-references.

N/A

STRATEGIC PRIORITY AREA 3: CONSERVATION

- The state of national conservation policies
- The state of *in situ* and *ex situ* conservation programmes
- The state of regional and global long-term conservation strategies and agreement on technical standards for conservation

30. Does your country regularly assess factors leading to the erosion of its animal genetic resources (SP 7, Action 2)?

- ○ a. Erosion not occurring
- ◉ b. Yes, regular assessments have been implemented since before the adoption of the GPA
- ○ c. Yes, regular assessments have commenced since the adoption of the GPA
- ○ d. No, but action is planned and funding identified
- ○ e. No, but action is planned and funding is sought
- ○ f. No

Please provide further details:

N/A

31. What factors or drivers are leading to the erosion of animal genetic resources? Please describe the factors specifying which breeds or species are affected:

Across breeds and species consumer demand drives the success or failure of livestock breeds. The vast majority of consumers demand low cost animal products. Breeds capable of producing products at the lowest cost (usually expressed on a per animal basis) have successfully captured larger shares of the market. However, as segments of society generate demand for livestock produced locally or with lower levels of production intensity, pockets of demand have been created for breeds that produce products at lower quantities per animal or bio-economic efficiencies. For Beef Cattle, there are a few large breed associations that generate enough revenue as to maintain staff and have breeders that can afford a full-scale program. However, small breed associations struggle to maintain an office, databases registered animals, germplasm preservation, etc. The loss of government price support system for wool and fiber has had a detrimental impact on some sheep and also goat breeds. In the goat industry the importation of the Boer goat has resulted in the extensive crossbreeding with landrace breeds, especially the Spanish goat that resulted in a threat to the survival of these breeds in its purebred form. A strong consumer shift to higher demand of eating quality (primarily tenderness and flavor) has resulted in a rapid decline in the census of the Hampshire pig breed which is associated with lean carcasses with low water holding capacity resulting in less palatable meat. Conversely, it has led to an expansion in population size for the Berkshire breed which has high levels of intramuscular lipid resulting in enhanced eating quality. A small countervailing force is the expansion of niche markets which can be exploited by small scale farmers delivering pork products to local consumers. At-risk breeds are frequently utilized in these niche production programs.

32. Does your country have conservation policies and programmes in place to protect locally adapted breeds at risk in all important livestock species (SP 7, SP 8 and SP 9)?

Glossary: Locally adapted breeds are breeds that have been in the country for a sufficient time to be genetically adapted to one or more of traditional production systems or environments in the country. The phrase "sufficient time" refers to time present in one or more of the country's traditional production systems or environments. Taking cultural, social and genetic aspects into account, a period of 40 years and six generations of the respective species might be considered as a guiding value for "sufficient time", subject to specific national circumstances.

- ○ a. Country requires no policies and programmes because all locally adapted breeds are secure
- ◉ b. Yes, comprehensive policies and programmes have been in place since before the adoption of the GPA
- ○ c. Yes, comprehensive policies and programmes exist because of progress made since the adoption of the GPA
- ○ d. For some species and breeds (coverage expanded since the adoption of the GPA)
- ○ e. For some species and breeds (coverage not expanded since the adoption of the GPA)
- ○ f. No, but action is planned and funding identified
- ○ g. No, but action is planned and funding is sought
- ○ h. No

Please provide further details:

N/A

33. If conservation policies and programmes are in place, are they regularly evaluated or reviewed (SP 7, Action 1; SP 8, Action 1; and SP 9, Action 1)?

- (●) a. Yes
- ( ) b. No, but action is planned and funding identified
- ( ) c. No, but action is planned and funding is sought
- ( ) d. No

Please provide further details:

N/A

34. Does your country have in situ conservation measures in place for locally adapted breeds at risk of extinction and to prevent breeds from becoming at risk (SP 8 and SP 9)?

Glossary: Locally adapted breeds are breeds that have been in the country for a sufficient time to be genetically adapted to one or more of traditional production systems or environments in the country. The phrase "sufficient time" refers to time present in one or more of the country's traditional production systems or environments. Taking cultural, social and genetic aspects into account, a period of 40 years and six generations of the respective species might be considered as a guiding value for "sufficient time", subject to specific national circumstances.

- ( ) a. Country requires no in situ conservation measures because all locally adapted breeds are secure
- (●) b. Yes for all breeds
- ( ) c. For some breeds (coverage expanded since the adoption of the GPA)
- ( ) d. For some breeds (coverage not expanded since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

N/A

35. Does your country have ex situ in vivo conservation measures in place for locally adapted breeds at risk of extinction and to prevent breeds from becoming at risk (SP 8 and SP 9)?

Glossary: Ex situ in vivo conservation - maintenance of live animal populations not kept under their normal management conditions - e.g. in zoological parks or governmental farms - and/or outside the area in which they evolved or are now normally found.

- ( ) a. Country requires no ex situ in vivo conservation measures because all locally adapted breeds are secure
- (●) b. Yes for all breeds
- ( ) c. For some breeds (coverage expanded since the adoption of the GPA)
- ( ) d. For some breeds (coverage not expanded since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

N/A

36. Does your country have ex situ in vitro conservation measures in place for locally adapted breeds at risk of extinction and to prevent breeds from becoming at risk (SP 8 and SP 9)?

Glossary: Ex situ in vitro - conservation, under cryogenic conditions including, inter alia, the cryoconservation of embryos, semen, oocytes, somatic cells or tissues having the potential to reconstitute live animals at a later date.

- ○ a. Country requires no ex situ in vitro conservation measures because all locally adapted breeds are secure
- ◉ b. Yes for all breeds
- ○ c. For some breeds (coverage expanded since the adoption of the GPA)
- ○ d. For some breeds (coverage not expanded since the adoption of the GPA)
- ○ e. No, but action is planned and funding identified
- ○ f. No, but action is planned and funding is sought
- ○ g. No

Please provide further details:

Ex-situ in-vitro conservation is the preferred method of conservation since it accomplishes the conservation initiative at a fraction of the cost associated in ex-situ in-vivo conservation methods.

37. Please describe the measures (indicating for each whether they were introduced before or after the adoption of the GPA) or provide a web link to a published document that provides further information:

Before adoption of the GPA ex-situ in-vitro and ex-situ in-vivo approaches were established. For ex-situ in-vitro see: http://nrrc.ars.usda.gov/A-GRIN/main_webpage/ars?record_source=US

38. If your country has not established any conservation programmes, is this a future priority?

- ○ a. Yes
- ○ b. No

Please provide further details:

N/A

39. Has your country identified the major barriers and obstacles to enhancing the conservation of its animal genetic resources?

- ○ a. Country requires no conservation programmes because all animal genetic resources are secure
- ◉ b. Yes
- ○ c. No
- ○ d. No major barriers and obstacles exist. Comprehensive conservation programmes are in place

Please provide further details. If barriers and obstacles have been identified, please list them:

N/A

40. If your country has existing ex situ collections of animal genetic resources, are there major gaps in these collections (SP 9, Action 5)?

- ◉ a. Yes
- ○ b. No

If yes, have priorities for filling the gaps been established?

- ◉ a. Yes
- ○ b. No, but action is planned and funding identified
- ○ c. No, but action is planned and funding is sought
- ○ d. No

Please provide further details:

N/A

41. Are arrangements in place in your country to protect breeds and populations that are at risk from natural or human-induced disasters (SPA 3)?

- (●) a. Yes, arrangements have been in place since before the adoption of the GPA
- ( ) b. Yes, arrangements put in place after the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details:

N/A

42. Are arrangements in place in your country for extraction and use of conserved genetic material following loss of animal genetic resources (e.g. through disasters), including arrangements to enable restocking (SP 9, Action 3)?

- (●) a. Yes, arrangements have been in place since before the adoption of the GPA
- ( ) b. Yes, arrangements put in place after the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details:

N/A

43. Is your country conducting research to adapt existing, or develop new, methods and technologies for in situ and ex situ conservation of animal genetic resources (SP 11, Action 1)?

- (●) a. Yes, research commenced before the adoption of the GPA
- ( ) b. Yes, research commenced since the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details. If yes, please briefly describe the research:

Research is focused upon gene banking technologies.

44. Does your country implement programmes to promote documentation and dissemination of knowledge, technologies and best practices for conservation (SP 11, Action 2)?

- (●) a. Yes, programmes commenced before the adoption of the GPA
- ( ) b. Yes, programmes commenced since the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details:

N/A

45. What are your country's priority requirements for enhancing conservation measures for animal genetic resources? Please list and describe them:

Conservation measures are based upon the equitable protection of all livestock breeds in the country. This protection consists of the ability to reconstitute populations and/or the ability of producers to access the collection to re-introduce genetic variability.

46. Please provide further comments describing your country's activities related to Strategic Priority Area 3: Conservation (including regional and international cooperation)

Note: It is not necessary to duplicate information provided in previous sections. Where relevant, please provide cross-references.

N/A

STRATEGIC PRIORITY AREA 4: POLICIES, INSTITUTIONS AND CAPACITY-BUILDING IMPLEMENTATION AND FINANCING OF THE GLOBAL PLAN OF ACTION FOR ANIMAL GENETIC RESOURCES

- The state of national institutions for planning and implementing animal genetic resources measures
- The state of information sharing
- The state of educational and research facilities capacity for characterization, inventory, and monitoring, sustainable use, development, and conservation
- The state of awareness of the roles and values of animal genetic resources
- The state of policies and legal frameworks for animal genetic resources

47. Does your country have sufficient institutional capacity to support holistic planning of the livestock sector (SP 12, Action1)?

- (●) a. Yes, sufficient capacity has been in place since before the adoption of the GPA
- ( ) b. Yes, sufficient capacity is in place because of progress made after the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details:

N/A

48. What is the current status of your country's national strategy and action plan for animal genetic resources (SP 20)?

Glossary: National strategy and action plan for animal genetic resources: a strategy and plan, agreed by stakeholders and preferably government-endorsed, that translates the internationally agreed Global Plan of Action for Animal Genetic Resources into national actions, with the aim of ensuring a strategic and comprehensive approach to the sustainable use, development and conservation of animal genetic resources for food and agriculture.

- ( ) a. Previously endorsed national strategy and action plan is being updated (or new version has been endorsed)
- (●) b. Completed and government-endorsed
- ( ) c. Completed and agreed by stakeholders
- ( ) d. In preparation
- ( ) e. Preparation is planned and funding identified
- ( ) f. Future priority activity

- ○ g. Not planned

Please provide further details. If available, please provide a copy of your country's national strategy and action plan as a separate document or as a web link:

N/A

49. Are animal genetic resources addressed in your country's National Biodiversity Strategy and Action Plan (http://www.cbd.int/nbsap/)?

- ○ a. Yes
- ○ b. No, but they will be addressed in forthcoming plan
- ◉ c. No

Please provide further details:

No National Biodiversity Strategy exists.

50. Are animal genetic resources addressed in your country's national livestock sector strategy, plan or policy (or equivalent instrument)?

- ◉ a. Yes
- ○ b. No, but they will be addressed in a forthcoming strategy, plan or policy
- ○ c. No, animal genetic resources are not addressed
- ○ d. No, the country does not have a national livestock sector strategy, plan or policy

Please provide further details. If available, please provide the text of the strategy, plan or policy or a web link to the text:

N/A

51. Has your country established or strengthened a national database for animal genetic resources (independent from DAD-IS) (SP 15, Action 4)?

- ◉ a. Yes, a national database has been in place since before the adoption of the GPA
- ○ b. Yes, a national database is in place because of progress made since the adoption of the GPA
- ○ c. Yes, a national database is in place but still requires strengthening (progress since adoption of the GPA)
- ○ d. Yes, a national database is in place but still requires strengthening (no progress since adoption of the GPA)
- ○ e. No, but action is planned and funding identified
- ○ f. No, but action is planned and funding is sought
- ○ g. No

Please provide further details:

A new version of Animal-GRIN will be released in 2014 and has been developed with the national programs in Canada and Brazil.

52. Have your country's national data on animal genetic resources been regularly updated in DAD-IS?

Note that the Commission on Genetic Resources for Food and Agriculture has requested FAO to produce global status and trends reports every two years.

- ○ a. Yes, regular updates have been occurring since before the adoption of the GPA
- ◉ b. Yes, regular updates started after the adoption of the GPA
- ○ c. No, but it is a future priority
- ○ d. No

Please provide further details:

N/A

53. Has your country established a National Advisory Committee for Animal Genetic Resources (SP 12, Action 3)?

- (●) a. Yes, established before the adoption of the GPA
- ( ) b. Yes, established after the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details. If a National Advisory Committee has been established, please list its main functions:

N/A

54. Is there strong coordination and interaction between the National Focal Point and stakeholders involved with animal genetic resources, such as the breeding industry, livestock keepers, government agencies, research institutes and civil society organizations (SP 12, Action 3)?

- (●) a. Yes, strong coordination has been in place since before the adoption of the GPA
- ( ) b. Yes, strong coordination was established after the adoption of the GPA
- ( ) c. No, but action is planned and funding identified
- ( ) d. No, but action is planned and funding is sought
- ( ) e. No

Please provide further details:

N?A

55. Does the National Focal Point (or other institutions) undertake activities to increase public awareness of the roles and values of animal genetic resources (SP 18)?

- (●) a. Yes, activities commenced before the adoption of the GPA
- ( ) b. Yes, activities commenced after the adoption of the GPA
- ( ) c. No, but activities are planned and funding identified
- ( ) d. No, but activities are planned and funding is sought
- ( ) e. No

Please provide further details:

N/A

56. Does your country have national policies and legal frameworks for animal genetic resources management (SP 20)?

- (●) a. Yes, comprehensive national policies and legal frameworks were in place before the adoption of the GPA and are kept up to date
- ( ) b. Yes, comprehensive and up-to-date national policies and legal frameworks in place because of progress made since the adoption of the GPA
- ( ) c. Yes, some national policies and legislation in place (strengthened since the adoption of the GPA)
- ( ) d. Yes, some national policies and legislation in place (not strengthened since the adoption of the GPA)
- ( ) e. No, but action is planned and funding identified
- ( ) f. No, but action is planned and funding is sought
- ( ) g. No

Please provide further details:

N/A

57. Which of the following options best describes the state of training and technology transfer programmes in your country related to inventory, characterization, monitoring, sustainable use, development and conservation of animal genetic resources (SP14, Action 1)?

- ○ a. Comprehensive programmes have been in place since before the adoption of the GPA
- ○ b. Comprehensive programmes exist because of progress made since the adoption of the GPA
- ◉ c. Some programmes exist (further progress since the adoption of the GPA)
- ○ d. Some programmes (no further progress since the adoption of the GPA)
- ○ e. None, but action is planned and funding identified
- ○ f. None, but action is planned and funding is sought
- ○ g. None

Please provide further details:

N/A

58. Have organizations (including where relevant community-based organizations), networks and initiatives for sustainable use, breeding and conservation been established or strengthened (SP 14, Action 3)?

- ◉ a. Yes, comprehensive organizations, networks and initiatives have existed since before the adoption of the GPA
- ○ b. Yes, comprehensive organizations, networks and initiatives exist because of progress made since the adoption of the GPA
- ○ c. Yes, some organizations, networks and initiatives exist (established or strengthened since adoption of the GPA)
- ○ d. Yes, some organizations, networks and initiatives exist (but no progress made since adoption of the GPA)
- ○ e. No, but action is planned and funding identified
- ○ f. No, but action is planned and funding is sought
- ○ g. No

Please provide further details:

N/A

59. Are there any national NGOs active in your country in the fields of:

Characterization?

- ◉ a. Yes
- ○ b. No

Sustainable use and development?

- ◉ c. Yes
- ○ d. No

Conservation of breeds at risk?

- ◉ e. Yes
- ○ f. No

If yes, please list the national NGOs and provide links to their web sites:

Livestock Conservancy.

60. Has your country established or strengthened research or educational institutions in the field of animal genetic resources management (SP 13, Action 3)?

- ○ a. Yes, adequate research and education institutions have existed since before the adoption of the GPA
- ○ b. Yes, adequate research and education institutions exist because of progress made since the adoption of the GPA
- ○ c. Yes, research and education institutions exist but still require strengthening (progress made since the adoption of the GPA)
- ◉ d. Yes, research and education institutions exist but still require strengthening (no progress made since the adoption of the GPA)
- ○ e. No, but action is planned and funding identified
- ○ f. No, but action is planned and funding is sought
- ○ g. No

Please provide further details:

N/A

61. Please provide further comments describing your country's activities related to Strategic Priority Area 4: Policies, Institutions and Capacity-building (including regional and international cooperation)

Note: It is not necessary to duplicate information provided in previous sections. Where relevant, please provide cross-references.

N/A

IMPLEMENTATION AND FINANCING OF THE *GLOBAL PLAN OF ACTION FOR ANIMAL GENETIC RESOURCES*

- The state of international collaboration for planning and implementing animal genetic resources measures
- The state of financial resources for the conservation, sustainable use and development of animal genetic resources

62. Has your country established or strengthened international collaboration in (SP 16):

Characterization?

- ◉ a. Yes
- ○ b. No, but action is planned and funding identified
- ○ c. No, but action is planned and funding is sought
- ○ d. No

Sustainable use and development?

- ○ e. Yes
- ○ f. No, but action is planned and funding identified
- ○ g. No, but action is planned and funding is sought
- ◉ h. No

Conservation of breeds at risk?

- ◉ i. Yes
- ○ j. No, but action is planned and funding identified
- ○ k. No, but action is planned and funding is sought

- ○ l. No

Please provide further details:

N/A

63. Are there any international NGOs active in your country in the fields of:

Characterization?

- ○ a. Yes
- ◉ b. No

Sustainable use and development?

- ○ c. Yes
- ◉ d. No

Conservation of breeds at risk?

- ○ e. Yes
- ◉ f. No

If yes, please list the international NGOs:

N/A

64. Has national funding for animal genetic resources programmes increased since the adoption of the GPA?

- ○ a. Yes
- ◉ b. No

Please provide further details:

N/A

65. Has your country received external funding for implementation of the GPA?

- ○ a. Yes
- ○ b. No
- ◉ c. No, because country generally does not receive external funding

Please provide further details:

N/A

66. Has your country supported or participated in international research and education programmes assisting developing countries and countries with economies in transition to better manage animal genetic resources (SP 15 and 16)?

- ◉ a. Yes, support or participation in place before the adoption of the GPA and strengthened since
- ○ b. Yes, support or participation in place before the adoption of the GPA but not strengthened since
- ○ c. Yes, support or participation in place since the adoption of the GPA
- ○ d. No, but action is planned and funding identified
- ○ e. No, but action is planned and funding is sought
- ○ f. No

Please provide further details:

N/A

67. Has your country supported or participated in programmes aimed at assisting developing countries and countries with economies in transition to obtain training and technologies and to build their information systems (SP 15 and 16)?

- (●) a. Yes, support or participation commenced before the adoption of the GPA and strengthened since
- ( ) b. Yes, support or participation commenced before the adoption of the GPA but not strengthened since
- ( ) c. Yes, support or participation commenced since the adoption of the GPA
- ( ) d. No, but action is planned and funding identified
- ( ) e. No, but action is planned and funding is sought
- ( ) f. No

Please provide further details:

N/A

68. Has your country provided funding to other countries for implementation of the Global Plan of Action?

- (●) a. Yes
- ( ) b. No, but action is planned and funding identified
- ( ) c. No, but action is planned and funding is sought
- ( ) d. No
- ( ) e. No, because country is generally not a donor country

Please provide further details. If relevant, specify whether funding was bilateral or multilateral; research cooperation or aid; and to whom and for what it was given:

The U.S. supported a workshop in Tunisia on the development of national gene banks. Also supporting the workshop were FAO, ICARDA, Canada, and the Netherlands.

69. Has your country contributed to international cooperative inventory, characterization and monitoring activities involving countries sharing transboundary breeds and similar production systems (SP 1, Action 5)?

- (●) a. Yes
- ( ) b. No, but action is planned and funding identified
- ( ) c. No, but action is planned and funding is sought
- ( ) d. No

Please provide further details:

Molecular characterization of sheep, goats, cattle and pigs transboundary and locally adapted. Partners include: Canada, Brazil, Tunisia, and Kazakhstan.

70. Has your country contributed to establishing or strengthening global or regional information systems or networks related to inventory, monitoring and characterization of animal genetic resources (SP 1, Action 6)?

- (●) a. Yes
- ( ) b. No, but action is planned and funding identified
- ( ) c. No, but action is planned and funding is sought
- ( ) d. No

Please provide further details:

US-Canada-Brazil Animal GRIN Version 2 database.

71. Has your country contributed to the development of international technical standards and protocols for characterization, inventory and monitoring of animal genetic resources (SP2)?

- (●) a. Yes
- ( ) b. No, but action is planned and funding identified
- ( ) c. No, but action is planned and funding is sought
- ( ) d. No

Please provide further details:

Cryoconservation of Animal Genetic Resources, In-situ Management of Animal Genetic Resources

72. Has your country contributed to the development and implementation of regional in situ conservation programmes for breeds that are at risk (SP 8, Action 2; SP 10, Action 1)?

- ( ) a. Yes
- ( ) b. No, but action is planned and funding identified
- ( ) c. No, but action is planned and funding is sought
- (●) d. No

Please provide further details:

N/A

73. Has your country contributed to the development and implementation of regional ex situ conservation programmes for breeds that are at risk (SP 9, Action 2; SP 10, Action 3; SP 10, Action 4)?

- (●) a. Yes
- ( ) b. No, but action is planned and funding identified
- ( ) c. No, but action is planned and funding is sought
- ( ) d. No

Please provide further details:

Backup of Jersey cattle from Jersey Island

74. Has your country contributed to the establishment of fair and equitable arrangements for the storage, access and use of genetic material stored in supra-national ex situ gene banks (SP9, Action 3)?

- ( ) a. Yes
- ( ) b. No, but action is planned and funding identified
- ( ) c. No, but action is planned and funding is sought
- (●) d. No

Please provide further details:

While we have no ABS arrangements we have provided backup to the Jersey Island Jersey population.

75. Has your country participated in regional or international campaigns to raise awareness of the status of animal genetic resources (SP19)?

- ○ a. Yes
- ○ b. No, but action is planned and funding identified
- ○ c. No, but action is planned and funding is sought
- ◉ d. No

Please provide further details:

N/A

76. Has your country participated in reviewing or developing international policies and regulatory frameworks relevant to animal genetic resources (SP 21)?

- ◉ a. Yes
- ○ b. No, but action is planned and funding identified
- ○ c. No, but action is planned and funding is sought
- ○ d. No

Please provide further details:

Through the CGRFA.

EMERGING ISSUES

77. In view of the possibility that at some point countries may wish to update the GPA, please list any aspects of animal genetic resources management that are not addressed in the current GPA but will be important to address in the future (approximately the next ten years). Please also describe why these issues are important and indicate what needs to be done to address them.

Issues to be addressed in future

Issues to be addressed in future (next ten years)	Reasons	Actions required
At the national level do medium to small populations lose alleles or is it that allele frequencies become reduced; and if the later do all breeds within a species essentially conserve the full complement of alleles.	Most across country comparisons have not evaluated the major breeds. Results suggest in cross country comparisons there may be small genetic differences when breeds are pooled within country. Such a finding suggests between breed genetic diversity may be significantly smaller than previously thought.	Genomic evaluation of varying species for reproductive and adaptability traits should provide clarity to the issue and inform breeders when making breeding strategies.
Increasing the adaptability of livestock to specific environmental conditions.	Commodity production for mainstream livestock production (i.e., carcass quality) dominates genetic selection programs, however there is a need to better match genotypes to the environment and increase adaptability to a range of environment conditions (e.g., altitude, arid rangelands, disease challenges) to maximize profitability.	Emphasis on identifying livestock with adaptability characteristics for environmental conditions. A more complete understanding of epistatic networks will be required to facilitate selection for adaptability traits.

Issues to be addressed in future (next ten years)	Reasons	Actions required
Deemphasizing and potentially phasing out in-situ approaches for genetic resources conservation.	Literature indicates in-situ conservation costs substantially more than ex-situ cryopreservation. Additionally, it has been shown that cryopreserved genetics has a greater longevity than previously thought, provided the breed is well sampled. The suggestion that rare breeds should be maintained in the hopes that they posses some unique allele that will propel them into greater use has not been demonstrated. For livestock sectors to make full contributions to food security and economic growth breeders should have the ability to exercise all options in selecting which genetic resources are used.	Further evaluation is needed to make a definitive conclusion. Additional genomic studies will contribute to the evaluation. Steps should be initiated to strengthen national gene bank capacities.
Ensuring gene flow continues to be exchanged in international markets without excessive regulation or trade barriers.	In the 50 least developed countries, productivity per animal has either stagnated or decreased during the past decade, suggesting livestock's full contribution to food security is not being reached.	Promote policies that continue to facilitate the private sector's exchange and choice of genetic resources; while discouraging policies that place artificial barriers (breed purity) on genetic resource exchange.

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