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The Management of Farm Animal Genetic Resources and FAO's Global Strategy

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The genetic resources used form a crucial component in sustainable livestock production, in meeting both current and future global food requirements. Globally, animal production contributes 40 percent of the total value of food and agriculture, with 1.96 billion people obtaining at least part of their livelihood from livestock.

In 1989-90 the governing bodies of FAO raised concern about the situation of world livestock production and particularly about the loss of farm animal diversity. The Organization was asked to examine the feasibility of developing for countries a programme for the global management of animal genetic resources. In signing the Rome Declaration on World Food Security and developing the World Food Summit Plan of Action in 1996 (FAO 1996a), Governments reaffirmed the right of all human beings to have access to safe and nutritious food and to be free from hunger and, *inter alia*, resolved to "promote the conservation and sustainable utilization of animal genetic resources"(Objective 3.2(e)).

FUTURE DEMAND FOR ANIMAL PRODUCTS

The future changes in the livestock sector will be influenced primarily by the demand for food products of animal origin. This demand will have to be met from sustainable production systems which carefully exploit all natural resources while avoiding further deterioration of the environment. Future demand will depend very much on the following main factors:

1. **Human population size**, which from 1970 to 1995 grew at a rate per year of 2.1 percent in developing countries and 0.7 percent in developed countries, and to the year 2020 is expected to grow by 1.7 percent and 0.4 percent per annum in developing and developed countries, respectively, when the total word population is expected to reach 8 Billion people.
2. **Progressive urbanization**, projected to grow in the period to 2020 by 3.8 and 1.1 percent per annum, respectively, in the developing and developed world.
3. **Purchasing power** of people, where GNP is expected to increase by 2.1 percent per annum in the developing world and by 1.7 per cent in the developed world. (UNDP, 1998).

These changes will not only lead to an increased overall demand for livestock products such as milk, meat and eggs but also to more diversified and higher quality (where quality relates to community needs) food stuffs. People in developing countries currently consume 21 kg of meat and 40 kg of milk, which form one-third and one-fifth of the consumption levels by people in developed countries (FAO and Rosengrant *et al* 1998 and Delgado 1999). IFPRI's1 International Model for Policy Analysis of Agriculture Commodities and Trade (IMPACT) projects aggregate consumption growth rates for meat and milk at 2.8 and 3.3 percent per year in developing countries compared to 0.6 and 0.2 percent, respectively, in developed countries. This would result in the demand for meat in the developing world increasing from 65 million tons in 1990 to 170–220 million tons by 2020 and, for milk, an additional 224 million metric tons would be required. These dramatic demand increases for livestock products are projected to outpace those for plant products, creating a Livestock Revolution. This Livestock Revolution differs to the Green Revolution in that it will be driven by demand, whilst the latter was driven by supply (Delgado *et al* 1999).

Higher consumption and the demand for diversified products are leading to a rapid global transformation of the livestock sector. It will shift from livestock that mobilize surplus and waste resources (backyard scraps, remote pastures, and grasses, all of which are indigestible to humans) to a livestock sector which actively seeks new feed resources for the production of human food products (Steinfeld, de Haan, and Blackburn 1997). As a consequence, most of the future demand for livestock products will have to be met through the intensification of the resource rich mixed crop/livestock production environments, by increasing the productivity of land and livestock. In addition peri-urban industrial type livestock production is mushrooming around the large cities to meet the demand of urban people.

LIVESTOCK PRODUCTION IN DEVELOPED COUNTRIES

Post-war livestock production in the developed world has reached market saturation where the management of surplus production for certain commodities and products has become a problem. Per capita meat and milk production in 1993 was 78 kg and 272 kg, while it was only 21 kg and 39 kg, respectively, for developing countries. Capital and technology intensive industrialized systems are based on the development and improvement of a very small number of high producing breeds per species. Advanced biotechnologies such as artificial insemination and embryo-transfer are being used in highly sophisticated breeding and selection programmes to further speed breeding progress. Animal husbandry has been used to maximise production with particular attention simultaneously to feeding, genetic improvement, and animal health care of chickens, dairy cattle and pigs. Increasingly, the overall concept is maximising productivity, output per unit of input, in a controlled environment. Note that these production environments are modified to accommodate the physiological requirements of the animal rather than the animal having to match an environment formed from the local climatic and community living conditions, as in developing countries. In the highly industrialized production systems of the developed world, many local breeds and strains which where highly adapted to prior particular environments or specific uses have either completely disappeared or have become endangered. As a consequence the rate of loss of these farm animal genetic resources (AnGR) is highest in the industrialized world. Only very recently have changes in consumer preferences to healthier food, as we have understood some of our very specific nutritive requirements, and with our increased understanding of the impact of feed production method on livestock productivity have we begun to re-discover previous production systems and breeds.

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LIVESTOCK PRODUCTION IN DEVELOPING COUNTRIES

Livestock production in developing countries still relies mainly on traditional operations. A quarter of the world's land is used for grazing, with the larger part of this in the developing world which sustains about 10 % of the world meat production (Sere and Steinfeld 1996). Much of the developing world's past increase in production is the result of an increase in numbers rather than from increased productivity. Increased numbers on limited grazing area has lead to land degradation, increased clearing of forest, and to the shift to more intensive or mixed farming production systems. Production systems in developing countries rely almost exclusively on the use of locally adapted breeds of livestock, which in addition to producing milk, meat and eggs, also provide a wide range of other goods and services, such as:

- animal power for transport, cultivation, irrigation and harvesting;
- fibre for clothing and a number of other daily community needs;
- hides and leather to meet a variety of material needs;
- supplying manure for fuel and fertilizer;
- supplying various medicinal and food additive needs;
- providing a store of capital, and particularly for small farmers in developing countries enabling the longer term management of risk;
- levelling out employment throughout the year; and
- supplying a range of cultural needs, at least some of which are considered by communities as very important.(Sansoucy *et al* 1996)

These additional goods and services further underline the importance of livestock for the rural populations in developing countries. Of course they also should be costed as outputs or products if the real benefits of livestock are being evaluated.

THE IMPORTANCE OF INDIGENOUS BREEDS

The locally adapted indigenous breeds in developing countries commonly show low absolute production figures with, for example, lactations often below 1 000 kg and daily gains of less than 500 g in cattle and buffalo, 100 g in sheep, goats and pigs, or less than 50 eggs per year in chickens; but they do make efficient use of the very poor local resources in unfriendly production environments. They are considered an important asset since they have developed over time valuable adaptive traits such as:

- tolerance and resistance to diseases and to internal- and ecto-parasites;
- tolerance to large fluctuations in availability and quality of feed resources and water;
- tolerance to extremes of temperature, humidity and other climatic factors;

which allow them to survive, produce and reproduce under harsh environmental conditions. Hence, farmers do not need to maintain a large portion of their herd or flock as young to provide replacements breeding stock, consuming scarce inputs whilst not producing. These characteristics make these breeds also interesting for genetic exploitation of these traits, and indeed for use in research aimed at better understanding biological mechanisms.

REASONS FOR LOSS OF DOMESTIC ANIMAL DIVERSITY

The rapidly increasing demand for animal protein and related economic and market forces pressures the world's livestock sector into major transformation. Since traditional feed resources are limited and animal numbers cannot be further expanded to meet the expansion in product demand, livestock production is intensifying at a rapid pace. In the process of intensification, the environmental constraints to animal production are alleviated or removed, as more and better resources, housing and veterinary care are provided. This process is inevitably associated with marked changes in the genetic resources required since some species and breeds can make better use of these high potential and much less variable production environments; whereas the many widely differing, lower input production environments each require highly adapted and different animal genetic resources to realize outputs and sustainable systems. The very meaning of "genetic superiority" in each of the matrix of low to medium input, high stress production environments differs and contrasts with the standards required in the high input, high output production environments.

Important policy and economic issues for developing countries are: Which agricultural land will be used to develop high input production systems? How to plan and enable this development whilst not contributing to the deterioration of the common and important medium and even low input production environments in the country? How to overcome market externalities and ensure that the most appropriate animal genetic resources are developed for <u>each</u> of the country's primary production environments?

Developing countries host most of today's animal genetic resources. In these, mostly tropical countries, the costs of adjusting the production environment to the conditions required by high performance breeds of developed country origin are significantly higher than programmes aimed at improving locally adapted breeds. Future reliance on genotypes adapted to medium input and perhaps even to low input, higher stress areas in these countries will be essential.

While some loss of animal genetic resources is inevitable, and should be planned, the process of intensification at all input levels is not always driven by rational principles, nor is it always accompanied by appropriate technologies. First, there is a systematic and almost ubiquitous policy bias favouring exotic breeds against indigenous breeds. In other words, different breeds are not competing on a level playing field. Governments often favour the introduction and spread of particular breeds, farmers may preferentially feed and otherwise care for the exotic animals, sometimes for years before they realize that they are no longer as well off - sometimes a serious natural disaster such as a drought must occur to initiate awakening for the exotic animals are the first to die. Often, the full costs are not paid for exotic genetic material. Superior livestock semen is provided to developing countries free of charge, without progeny testing and disregarding the specific production environment in which the semen is to be used. Genetic material is donated or given at low cost to speed up genetic progress in developing countries; but progress for what objective and will this be sustainable? Furthermore, artificial insemination (AI) services to developing countries are often provided initially free of charge or real costs are not fully recovered. This provides access to exotic genotypes at a lower cost than would be applied for AI of indigenous breeds if the mechanisms were in place.

Producing food and agriculture from high input, short lifecycle exotic breeds implies a different cost structure to that using indigenous breeds. In many countries, there are subsidies on feed and other inputs which tend to favour exotic breeds as they make more extensive use of it. At a lower level, there may be subsidies on production inputs, such as fuel and fertilizer to produce concentrate feed. Preferred credit schemes are likely to have a similar effect. Other factors that may affect breed choice include economy wide policies and determinants such as exchange rates, producer prices, inflation and interest rates.

These trends favour loss of the indigenous animal genetic diversity beyond the rate that would occur without distorting the food and agriculture production intensification process. Further factors contributing to loss of genetic resources include natural disasters, wars and other forms of socio-political instability. A number of the war torn and drought stricken countries in the world have lost great parts of their livestock resources. The re-establishment of national herds to meet the demand of the people has been repeatedly demonstrated to be extremely difficult. Very often the adapted genetic material for the required production environment has been decimated and cannot be found in the neighbouring countries, and if it is found it is generally only in very small numbers.

REASONS FOR CONSERVING LIVESTOCK BIODIVERSITY

There is little doubt that the 160 or so developing countries harbour the majority of the world's farm animal genetic resources and associated animal diversity, and that country interdependency in animal genetic resources is now increasing. Preliminary survey data shows that most of the 180 countries involved possess a number of the world's 5000 or so remaining breeds of farm livestock, with the majority of these breeds occurring only in one or another developing country. Most of these animal genetic resources are owned by small farmers, emphasizing the importance of private good to the sound management of these resources. However, some 1500 of the breeds are now categorised by FAO as endangered, and very preliminary data shows that less than 10% of these are being maintained in any managed population or cryo-conservation bank. Preliminary data is now indicating that over 800 breeds of farm livestock have become extinct this century, most within the last few decades.

The rationale for conserving animal genetic resources has been discussed at length elsewhere (Hodges 1987; Henson 1992; Hammond and Leitch 1996; Oldenbroek 1999; Blench 1999):In summary, the key arguments for conserving are:

- **Economic:**
  - Enabling quick response to changes in market conditions, consumer preference and environmental change.
  - Hedging against an uncertain future. Concentration upon a small number of breeds is likely to result in a loss of genes and particularly to loss of gene combinations which may not be relevant at present but which could be important in the future.
  - Defence against pathogens; the more genetically uniform a country's livestock production is the more vulnerable it is to the range of epizootics.
- **Ecological:**
  - Domestic animal diversity (DAD) is part of most agro-ecosystems. The loss of this diversity may contribute to higher risk in these production systems, to lowered food security and to the degradation and loss of the systems.
  - For the longer term, and viewing humankind as an integral component of Earth's ecological system, the retention of domestic animal diversity is required to help meet the food and agriculture needs of future generations of the human species, part of the so-called intergenerational reason for conserving agro-biodiversity.
- **Aesthetic:**
  - Communities argue that diversity has intrinsic value in its aesthetic desirability.
- **Socio-cultural:**
  - Animal diversity makes important cultural contributions as an integral part of community life, in celebrations and day-to-day customs.
  - Sustaining communities and their lifestyles over time also contributes to the above mentioned intergenerational argument for maintaining agro-diversity.

- **Research and training:**

Diversity contributes to basic biological research in immunology, nutrition, reproduction, genetics and adaptation to climatic and other environmental changes, being used to better understand the processes involved and to develop new approaches.

REASONS AGAINST CONSERVING

The arguments against conserving AnGR may be summarized as:

- **Economic:**
  - The argument that the 'market' will serve to maintain the diversity required to sustain humankind assumes that all current and future values have been internalized within the market process.
  - Developing country priorities, where short-term food security should be a priority.
  - The costs of conservation are too high for the potential future value.
- **Biological:**
  - Ample variation exists, and is constantly being generated, within our commercial livestock species, to meet any challenge (Franklin 1997).
  - Change the production environment to enable it to sustain the high input genetic resources which are already exposed to very successful selection programmes in the developed countries.
  - We will not revert to the earlier less industrial production environments, so there will no be a need for the type of genetics used in those circumstances.
  - Utilize non-genetic solutions in meeting the challenges.
  - The cryogenic technologies developed to date for use, *inter alia,* in conservation of animal genomes are too costly and risky for general use for conservation purposes.

HOW TO HALT THE EROSION?

Conservation strategies can be categorized as either *in-situ* conservation where the breed is maintained in the environment in which it is developing, or *ex-situ* conservation for all other cases. The latter can be further divided into *ex-situ in vivo* conservation where breeds are kept in a different environment including farm parks, and as *ex-situ in vitro,* utilizing cryogenic storage of semen, oocytes, embryos or DNA (FAO 1999).

The viability of a livestock resource is maximized through the development of programmes which focus on the traits that increase the economic value of the breed, assuming that the modelling of economic value provides for all inputs and outputs from the total herd or flock over time, or when the livestock occupy a secure niche in the commercial livestock industry of a nation. A number of approaches have been used to stop or reduce the decline of livestock breed resources.

Of course "wise use" also forms a highly desirable form of conservation (Notter 1999); and the maintenance of a breed in its environment also satisfies the requirements of Article 8 of the Convention on Biological Diversity (UNEP 1992) which gives first priority to *in-situ* conservation. For indigenous breeds already with a market for their particular type of product, selection programmes can be implemented to further develop the traits included in the breeding goals to increase economic returns, thereby helping to maintain the breed as a distinct entity.

Where, after thorough feasibility study, considering technical, operational and economic aspects, a continuous crossing of indigenous and exotic breeds proves superior, the indigenous breed still has an important economic value as one of the lines in a sustained crossbreeding programme; and of course further improvement of the systematic cross will depend on whether the parent breeds are being improved for the traits of interest.

The potential for niche markets for indigenous breeds and their products, including development of novel products, should be evaluated. There are now developing many examples where a product from the local breed is marketed at a higher price than the comparable product from the exotic breed, based on product quality differences and way of production, which becomes increasingly important criteria for consumers. For endangered breeds, unique products already have a rarity value, which often can be capitalized upon.

Cryo-conservation as a sole means of maintaining breeds at risk of loss, should be considered as a last resort. It means conservation away from the habitat and the production system in which the resource developed; hence, there can be no further genetic development in the cryo-conserved material. The cost for the establishment of cryogenic banks have been reviewed by Brem *et al* (1989), Lömker and Simon (1994), and Ollivier and Renard (1995). This depends very much on the species, the type of material being stored, the number of doses per parent (dam or sire), and on the perceived potential future uses on which the planning for the conservation programme is based. One of the most useful aspects of cryo-conservation is the supportive role it can play to *in vivo* conservation programmes. *In vivo* conserved populations may acquire more sub-lethal and lethal recessives over time which, without careful management of these generally small populations, may reach high frequencies and these will be harmful to these populations. Guidance on the conservation of AnGR is provided by the secondary guideline for the management of small populations at risk (FAO 1998) and by Oldenbroek (1999).

FAO'S ROLE

Country recognition of the importance of animal genetic resources, of the need to sustainably use, develop and conserve these essential resources, and of the poor state of their current management, led the governing bodies of FAO to request the development of the Global Strategy for the Management of Farm Animal Genetic Resources (FAO 1999) (Global Strategy). The priority action is aimed at further enhancing awareness of the many roles and values of animal genetic resources; providing a framework for local, national, regional and global efforts to better use, develop and conserve these resources; and mobilizing the necessary financial support to further development and implement the Strategy. The FAO governing bodies have decided that the initial focus should be on the 14 or so most important livestock species (see Table 1) which account for over 90 percent of agriculture and food production.

Table 1. Species of livestock to receive primary initial focus by the Global Strategy

Ass	Duck	Pig
Buffalo	Goat	Rabbit
Camel	Domestic goose	Sheep
Cattle	Horse	Turkey
Chicken	Lamoids	Yak

The Global Strategy provides a framework for country action to both sustainably use and conserve DAD, one of the critical sectors of agro-biodiversity. Accordingly, it has been designed to harmonize with and the work complement that underway to implement such international agreements as the Convention on Biological Diversity.

The Global Strategy's framework consists of **four fundamental components** and **sets of elements.** The Strategy is designed to be comprehensive and to emphasize a balanced approach. These are required for countries to cost-effectively manage over time their sovereign AnGR; enabling the better understanding, use, development, maintenance and access to all unique AnGR of interest to food and agriculture.

The strategic framework is configured to be applicable at all levels, within country, national, regional and global; and its four fundamental components are:

1. A country-based global infrastructure, providing the enabling structure for country action and regional and global support**.** This infrastructure comprises 3 elements:

- *Focal Points and networks.* Responsible expertise is required to assist countries design, implement and maintain comprehensive national strategies for the management of their AnGR. The need has been clearly demonstrated to distribute the focal points to at least 3 levels, country, regional and global; although for effective policy and technical development sub-regional networks are also indicated for some regions.
- *Stakeholder involvement.* This element provides for a range of dimensions of involvement by the broad spectrum of parties associated with AnGR. Involvement can occur by geographical area, AnGR management element, production environment, species and via research and training involvement for there are critical needs for capacity building throughout the spectrum of AnGR management policy development, operations and technical areas.
- *A virtual structure, DAD-IS.* To assist countries in particular collect and use the information required for good management decision-making, to co-ordinate, report, facilitate the spectrum of management processes, and to share information within and across countries and regions, a virtual structure known as the Domestic Animal Diversity Information System (DAD-IS) is being developed as an advanced communications and information system, in the first instance for country use. DAD-IS is available on the Internet and on active CD-ROM. The different modules range from breeds databanks with more than 5 000 entries to communication tools, a specialist reference library and training modules will assist country action. DAD-IS also serves as the primary clearing-house mechanism for this domestic animal sector of biodiversity, as required under the CBD.

2. An Intergovernmental Mechanism, to ensure direct government involvement and continuity of policy advice and support. The Intergovernmental Technical Working for Animal Genetic Resources (ITWG-AnGR) under the Commission for Genetic Resources for Food and Agriculture (CGRFA) is now the forum for FAO Member Governments to consider policy issues related to the management of farm animal gentic resources. The ITWG–AnGR has identified the need for the FAO to undertake a major action assisting countries to prepare the first *Report on the State of the World's Animal Gentic Resources.*

3. A technical programme of work. A comprehensive technical programme is aimed at supporting effective management action at the country level, through the provision of guidelines and technical assistance, harmonizing also with the CBD. This programme incorporates a set of 6 elements:

- *Characterization.* Encompassing development and application of indicators and assessment methodology for use in describing both production environments and AnGRs. Of particular significance, also is the systematic breed-level characterisation of the molecular genetic composition of species, which will enable development of least-cost strategies for maintaining broad genetic variety within each species via a limited number of breeds; together with the initiation of work aimed at developing AnGR valuation procedures for country use.
- *Sustainable intensification of AnGR.* Sound genetic resource use and development is particularly important for farm animal species because of the high unit cost of animals and often long generation intervals of species. Of course, the development of competitive, sustainable production systems will not warrant the use of all existing breeds in a particular time period. Whilst wise use should be central to a successful conservation policy, utilization does not provide the universal solution for conservation of domestic animal diversity.
- *Conservation of AnGR, via animals and cryo-preserved materials.* Whilst semen and embryos of only a few of the 1500 or so endangered breeds are so far held in cryo-conservation storage; this approach forms both a useful complement to *in situ* and *ex situ in vivo* conservation. In some situations it may also offer a viable alternative to *in vivo* conservation of breeds at risk where the latter is not feasible and practical cryo-conservation is possible for the species. Now that reversible DNA quiescence in mammalian somatic cells has been demonstrated feasible (Campbell *et al* 1996) perhaps the sampling and storage of somatic cells such as hair follicles may be of higher utility but practical field protocols remain to be developed. However, the nature of cryo-conservation of animal cells renders storage high risk without sample duplication. Practical field protocols for the sample and storage of the preferred type of somatic cells remain to be researched.
- *Communication of AnGR issues.* The rapid advances in communication and information technology, the spread of AnGR and the nature of their management, and the need for heightened awareness within countries and regions highlight the importance of these technologies to cost-effective action.
- *Emergency planning and response.* To provide guidance and perhaps a mechanism for action enabling effective response to natural and other disasters, ensuring also that where heavy losses of indigenous AnGR ensue effective conservation action is taken and, where required to quickly re-establish food and agriculture production, appropriate replacement livestock are introduced.

4. A Reporting and Evaluation component, to provide the critical data and information required for guidance, cost-effective planning and action. At its Eighth Regular Session over 19-23 April 1999, the Commission on Genetic Resources for Food and Agriculture agreed that FAO should coordinate the development of a country-driven *Report on the State of the World's Animal Genetic Resources* (SoW-AnGR)*;* adding a major additional element to the strategic framework's reporting and evaluation component. Five key reporting areas have been identified for inclusion in the SoW-AnGR process: i) The state of the AnGR; ii) The state of the art for managing AnGR; iii) The state of capacity for managing AnGR; and iv) Needs identification for managing AnGR.

Cross-cutting components. The Global Strategy also encompasses two cross-cutting components, Capacity Building and Technical Assistance, each with several elements. Amongst the elements of these components are the development of practical **guidelines** to assist countries in planning and executing the broad spectrum of necessary AnGR management action. The guidelines are being developed into a graphic decision-support system to aid decision-makers at all levels.

Desirable outcomes

The Strategy provides the basic mechanism and guidance for stakeholders' use in achieving the following desirable outcomes:

a) Country, regional and global co-operation and co-ordination in the development and implementation of management strategies and relevant polices, incorporating:
b) Identification, description and monitoring of all breeds of farm livestock with special attention to breeds most at risk.
c) Development of locally adapted breeds currently used by farmers, and better understanding of the country's primary production environments for food and agriculture.
d) Effective and efficient conservation of unique AnGR at risk, also ensuring ready access and integrating *in-situ* and *ex-situ* measures.
e) Programmes of research and training in the spectrum of areas associated with sound management of farm animal genetic resources.
f) Education and awareness generation to promote understanding of the roles and values of farm animal genetic resources in the immediate and longer term.
g) Maintenance of traditional knowledge and lifestyles that are necessary to utilize and conserve these resources.

CONCLUSION

Achieving and maintaining "Food for All" will require sustainable intensification of agriculture in many if not all available production environments for the foreseeable future. The genetic make-up of an animal is the key to how it will respond to different aspects of the total production environment, particularly those related to the full range of uses demanded of the animal resource, but also to climate, feed and water, exposure to disease and to type of husbandry.

International awareness of the roles and values of animal genetic resources, and concern for their rapid loss must be translated into effective action at the local, national, regional and global levels. Management decisions and activities in the next few decades will to a large degree determine the future role for animal genetic resources.

Systematic and effective planning and increased capacity building are required to ensure that these irreplaceable resources are conserved, and are used and developed to contribute to country and global food security and rural development. This is particularly important in developing countries, which account for most of the world's animal genetic resources.

Immediate national and international action is required to:

1. More sustainably and rapidly develop those adapted animal genetic resources, to respond to the food and agriculture imperatives of the twenty-first century.
2. Conserve the many breeds that are now at high risk of loss and for which we posses little documentation of their potential role and value.

Critical to both of the above areas for action is the need for characterization at all levels, to better understand these irreplaceable resources along with their production environments.

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Table 1. Constituents of the Global Strategy for the Management of Farm Animal Genetic Resources

Components:	Inter-governmental Mechanism	Country-based Planning & Implementation Infrastructure	Technical Programme of Work	Reporting & Evaluation
Elements:	The Commission on Genetic Resources for Food & Agriculture	Global Focal Point	National Management Plans for AnGR	First Report State of the World's AnGR
	Inter-Governmental Technical Working Group on Animal Genetic Resources	Regional Focal Points	Sustainable Intensification	Country Reports
	National Governments	National Focal Points	Characterization	Country & Global Monitoring
		Donor & Stakeholders Involvement Mechanism	Conservation	World Watch List - Early Warning System
		DAD-IS	Communication	
			Emergency Plans & Response	

Capacity Building:			
	Training & Education	Guidelines	Data & Information Management
	Technology Transfer	Research	Communications & Coordination

Technical Assistance:			
	FAO Experts	Informal Panel of Experts	Cadres of Experts
	Expert Meetings	Advanced Data & Information Software	
	Research		