

Genetic impact assessments – summary of a debate

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Summary

Some countries have introduced a requirement for genetic impact assessments prior to granting permission for the import of new exotic livestock breeds. However, the merits of such a system are not universally accepted. During February 2007 a discussion on the subject took place on FAO's Domestic Animal Diversity Network (DAD-Net) electronic forum. This paper presents a description of how the discussion developed, and a summary of the issues raised. Arguments both for and against requiring impact assessments were put forward. Those opposing such measures focused on the risks of limiting access to animal genetic resources (AnGR), and questioned the benefits of government interference. Practical constraints to implementation and enforcement were also noted. Counter arguments pointed to the potential for avoiding the loss of valuable AnGR, and stressed governments' responsibilities to intervene where necessary to promote sustainable development, to defend the interests of the poor, or to protect national heritage. The debate ranged more widely – encompassing the respective roles of local and exotic AnGR in different regions of the world and in different production systems.

Résumé

Certains pays ont introduit le besoin d'évaluation de l'impact génétique comme condition pour l'obtention du permis d'exportation de nouvelles races exotique. Cependant, l'importance de ce système n'est pas mondialement reconnu. En février 2007 a eu lieu une discussion à ce sujet au sein du forum électronique du Réseau pour la Diversité des Animaux Domestiques de la FAO. Cet article présente une description du déroulement de la discussion et un résumé des objectifs atteints. On décrit les arguments à faveur ou contre l'évaluation de l'impact. Les opposateurs à ces mesures ont

présenté les risques que comporte limiter l'accès des ressources génétiques animales (AnGR) et ont remis en question les bénéfices de l'interférence gouvernementale. Les argument exposés dans ce sens soulignent la potentialité d'éviter la perte d'une partie importante de AnGR et insistent sur les responsabilités des gouvernements dans leur intervention sur la promotion du développement durable, la défense des intérêts des plus pauvres ou la protection de l'héritage national. Le débat s'est étendu ultérieurement pour inclure les rôles des AnGR au niveau local et exotiques dans les différentes régions du monde et différents systèmes de production.

Resumen

Algunos países han introducido la necesidad de la evaluación del impacto genético como condición para la obtención del permiso de exportación de nuevas razas exóticas. Sin embargo la importancia de este sistema no está reconocida a nivel mundial. En febrero 2007 se mantuvo una discusión a este respecto en el foro electrónico de la Red sobre la Diversidad de los Animales Domésticos de la FAO. Este artículo presenta una descripción sobre el desarrollo de la discusión y un resumen de los objetivos alcanzados. Se describen los argumentos a favor o en contra de la evaluación de impacto. Los opositores a estas medidas se centraron en los riesgos que supone limitar el acceso de los recursos zoogenéticos (AnGR) y cuestionaron los beneficios de la interferencia estatal. También se plantearon las limitaciones prácticas para reenforzar y llevar a cabo este proceso. Los argumentos expuestos en este sentido subrayaban la potencialidad de evitar la pérdida de una parte importante de AnGR, insistiendo sobre las responsabilidades de los gobiernos en su intervención en la promoción del desarrollo sostenible, la defensa de los intereses de los pobres o en la protección de la herencia nacional. El debate se extendió ulteriormente para incluir los respectivos roles de los AnGR locales y

exóticos en las distintas regiones del mundo y en diversos sistemas de producción.

Keywords: *Animal genetic resources, Genetic impact assessment, Regulations.*

Introduction

This paper presents an overview of an exchange that took place on FAO's Domestic Animal Diversity Network (DAD-Net¹) during February 2007. Central to the debate was the question of genetic impact assessments - whether there should be a requirement for such a study prior to the import of new exotic animal genetic resources (AnGR) into a country. However, the discussion ranged more widely, encompassing the roles and relative merits of exotic and local breeds in livestock development in different regions of the world and different production systems, and the roles of various stakeholders (farmers, governments, commercial interests) in decision-making.

The widespread interest in the topic was clear; a single request for information sparked a spontaneous exchange which ran to almost 60 messages posted over a 15-day period. Participants from at least 25 countries and all regions of the world² contributed their views. A number of new subscribers joined DAD-Net in order to participate or to follow the discussion. The objective here is to bring the debate to a wider audience.

DAD-Net is managed by the Animal Production and Health Division of FAO. The purpose of this electronic service is to provide an informal forum for the discussion of issues relevant to the management of AnGR at national, regional and international levels. After free registration users receive all messages posted. Users are encouraged to post messages on topics of interest related to the management of AnGR, and are also invited to contribute articles or other information in English, French or Spanish dealing with the following subjects: characterization, conservation, utilization, breeding, data and information management, training and education, emergency planning and response, research and technology transfer, and any other subject they consider relevant to AnGR. FAO

periodically contributes information and acts as moderator. DAD-Net has around 1 000 subscribers; at the time of writing, 520 messages had been posted since its launch in February 2005.

Development of the Discussion

The message that initiated the discussion was a simple question: is South Africa the only country in the world that demands impact assessments prior to the import of a new exotic breed? The message explained that the question was prompted by the surprised reaction of an agent from a European country when he learnt of this requirement. Further messages supplied DAD-Net subscribers with the wording of the South African guidelines (Department of Agriculture, 2003), and an FAO document that had been used in their preparation (FAO, 1994). The guidelines indicate that any party wishing to import new exotic breeds has to arrange for an impact study to be conducted by reputable animal scientists. The completed study has to be evaluated before the breed will be considered for recognition and importation under the terms of the Animal Improvement Act, 1998 (Act No. 62 of 1977). There may be a requirement for a further on-site evaluation. For further details of the guidelines, see Appendix 1.

Initial responses were generally supportive of the South African measures. Participants from two European countries (Iceland and Spain) indicated that their countries also required impact assessments. It was a message posted by a participant from Brazil that stimulated much of the subsequent discussion. Two related points were raised:

- Exotic genetic resources (Zebus) have been vital to the Brazilian cattle industry (including small-scale producers) although there was strong opposition to their introduction during the early twentieth century.
- This example illustrates that decisions are better left to the farmer, and that government interference should be avoided.

The implication seemed to be that genetic impact studies are unnecessary and, indeed, are likely to do more harm than good. The following sections

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²Africa, Asia, Europe, Latin America and the Caribbean, the Near East, North America and the Southwest Pacific.

present a summary of the main arguments put forward during the subsequent discussion.

Arguments Against Genetic Impact Studies

A key argument put forward by those opposing impact studies related to the need to avoid restricting the options available to breeders and livestock keepers. Put more forcefully, the suggestion was that too much emphasis on keeping local genetic resources in use compromises food security and prevents farmers from improving their livelihoods. According to this view, it is the livestock keepers who are the best judges as to what AnGR are appropriate for the circumstances in which they make their living; it is they rather than the government officials who bear the risks associated with such decisions.

It was also argued that it is impossible to use legal means to prevent breeders from obtaining the genetic resources they want. Moreover, it was pointed out that if governments are at present unable or unmotivated to protect their local AnGR, it is questionable if they should be trusted to organize effective impact studies and abide by the findings. The cynical view was that the desired outcome could always be arranged.

Other practical concerns were raised including the question of how national-level restrictions of imports could account for the diversity of the production systems that exist within many countries. Either some potential users will be denied appropriate resources, or once imported there is a risk that AnGR will 'leak' into systems to which they are not adapted. Another question related to how an impact assessment could account for the many different potential cross-breeding combinations for which an introduced breed might be used.

It should be noted that the participants who cast doubt on the role of genetic impact assessments stressed that they were not questioning the importance of maintaining local breeds or the need for governments to support conservation measures. Neither should it be concluded that all those who oppose restrictions on imports do not recognize the importance of a policy framework to manage the utilization of exotic AnGR. One participant suggested that rather than keeping exotic breeds out, the real requirement was structures to be put in place to allow the development and testing of

breeds within the country to ensure optimal utilization. There was another suggestion that while there should be no restrictions on imports, those seeking to profit from importing germplasm should be obliged to contribute to data collection and monitoring activities within the country, and hence to the development of local AnGR.

Arguments in Favour of Genetic Impact Studies

The objections described in the preceding section gave rise to a number of counter arguments. One set of arguments was based on comparing genetic impact assessments to the provisions put in place to regulate other aspects of livestock trade or of development projects in general. For example, governments impose import restrictions in order to protect veterinary and public health – a parallel was drawn between the need for such provisions and the need to defend the public goods embodied in local AnGR. Indeed, it was further argued that exotic imports could in themselves present a threat to a country's animal health status, as their susceptibility makes them effective carriers of diseases and parasites. Parallels were also drawn with the environmental (and social) impact assessments which have become widely required for the approval of development projects. Such studies, it was noted, need not be expensive unless a particular threat that requires deeper investigation is identified. The argument ran that the costs of these studies are generally regarded as worthwhile as they reduce the risk of a far more expensive environmental disaster in the future.

Another theme related to the availability of information. It was argued that breeders and livestock keepers do not always have the relevant information on which to make informed judgements regarding breed choices. The role of commercial interests that wish to promote the use of their products without regard for their suitability to the production environment was raised as a concern, including both lobbying of decision-makers and the supply of inadequate information to the farmer. Genetic impact assessments are seen as a means of countering such biases.

It was also argued that free trade in AnGR should not be seen as a goal in itself. According to this perspective, governments have a responsibility to intervene where necessary to promote sustainable development, to defend the interests of the poor or to protect the country's heritage.

Roles of Local and Exotic Breeds

The demand for genetic impact assessments arises primarily because of concerns about the potential loss of genetic diversity through breed replacement or ill-considered crossing/upgrading. However, imports may influence not only the future availability of local AnGR, but also influence (for better or worse) current utilization – the economy, development objectives and the livelihoods of livestock keepers may be affected. It was, therefore, not surprising that the scope of the discussion broadened to encompass the respective roles (strengths, weaknesses, potentials) of local and exotic breeds within a country's livestock sector.

Where tropical countries are concerned, much of the discussion focused on the suitability, or otherwise, of temperate AnGR within local production systems. The problems associated with raising pure-bred temperate livestock in the tropics were widely acknowledged. Susceptibility to disease, poor tolerance of high temperatures, and poor adaptation to local feed resources greatly constrain the utilization of such animals. Animal welfare issues associated with the introduction of animals to environments to which they are not suited were noted. It was also recognized that consideration has to be given not only climatic and ecological conditions, but also the multiple roles that livestock are required to fulfil within smallholder production systems, and to which local animals tend to be well adapted. One situation in which it was noted that there is a need for careful assessment of the potential impact of the introduction of exotic AnGR was in the case of restocking projects carried out in post-disaster conditions.

There was, however, recognition of the contribution that temperate AnGR have made in the development of composite breeds utilized in the tropics/subtropics. Examples mentioned in the context of South Africa included Dorper and Afrino sheep, and Bonsmara and Drakensberger cattle. Attention was also drawn to the contribution of temperate × Zebu cross-bred dairy animals (Brazil being the main example cited). A paper outlining the role of exotic AnGR in Latin America was circulated to participants (Madalena, 2005). It was also pointed out that where there is a lack of capacity to organize breeding programmes for local breeds, the introduction of exotic AnGR often appears to be the only practical option to achieve genetic improvement. The need for improved management if the utilization of exotic AnGR in the tropics is to be a success was recognized. Cases in

which this has been successfully achieved (e.g. provision of improved forage and veterinary care for dairy cattle in Brazil) were cited. However, it was also noted that for some livestock keepers, meeting the costs of the additional inputs required by exotic or cross-bred animals can be prohibitive.

In the case of Latin America, both Zebus and European breeds are, of course, of exotic origin. A number of participants drew attention to this difference between the Old and the New worlds - the former being richly endowed with local breeds of the major international livestock species (cattle, goats, sheep, pigs, chickens etc) adapted to the local conditions, the latter lacking these species prior to European colonization. Although Zebus are exotic to Latin America, they are adapted to tropical conditions. In this context, it was interesting to note the rather different perspective emanating from Latin America as compared, for example, to that expressed by most participants from Africa who had a more favourable view of the importance of local breeds and the need for impact assessments.

Although most participants would probably share the view that both local and exotic AnGR have a contribution to make in the tropics, and that AnGR should be matched to the given production conditions, there certainly seemed to be differences of opinion as to where the balance should lie. Several participants cautioned against assuming too readily that exotic or cross-bred animals are the most appropriate for local production conditions, and cited some examples to support this case. Mention was made, for example, of the study by King *et al.* (2006), which revealed how heat stress and energy deficit constrain milk yield and cow replacement rates among Friesians kept on Kenyan smallholdings. Several messages emphasized the need for a more comprehensive understanding of the concept of productivity, particularly in smallholder production systems, including the use of a definition based on the efficient use of scarce resources and inclusion of the non-marketed benefits provided by the animals. The case study conducted by Ayalew *et al.* (2003) which found indigenous goats to be more productive than cross-breeds under smallholder conditions in the Highlands of Ethiopia was cited in this respect.

Concerns regarding the use of exotic AnGR to upgrade local breeds were summed up by one participant with the following quote taken from Hall (1992): "*There is ... a major risk that the best females of local breeds will be the first to be used for upgrading, which would erode the local breeds. Upgrading will foster a climate of contempt for local breeds and devalue traditional husbandry skills. It is*

unlikely to benefit the smallholder farmer and hence may have limited contribution to the alleviation of rural poverty. However, such developments are very attractive to governments and aid agencies and are likely to continue."

There was widespread recognition that the utilization of local breeds in developing countries is constrained by a lack of adequate characterization. The absence of long-term breed comparisons was noted as a problem. Similarly, there is a lack of capacity to implement genetic improvement programmes in local breeds.

Some participants emphasized the contributions made by exotic AnGR in both developing-country and developed-country (e.g. North American Holstein genetics in Europe) contexts. Others, however, warned against ignoring the valuable characteristics of local breeds – including their potential contribution to profitable commercial production. A participant from Canada argued against the view that the producer is always in a position to make the optimal choice of breeds. A lack of knowledge, and limited availability of alternatives in a market dominated by industrial-scale production, may mean that small-scale producers overlook potentially superior options – the example cited was that of the Bronze turkey in Canada. A participant from South Africa noted the great commercial potential of local pig breeds and of cattle breeds such as the Nguni – the latter having been almost wiped out by indiscriminate cross-breeding in the name of 'improvement'.

The risks to the livestock sector of policies promoting uniformity in pursuit of increased output were noted by some participants. In developed countries (Spain was cited as an example) high levels of milk production have been achieved, yet many producers struggle to make a profit. There is an urgent need for diversification. Local breeds that enable the farmer to exploit niche markets can be a valuable resource in this context.

Concluding Remarks

The discussion summarized in this article arose spontaneously; it was essentially an informal and unstructured exchange of views. No attempt was made to arrive at a set of conclusions or recommendations. It would be inappropriate to attempt to do so here.

By their willingness to share their opinions the participants showed that they recognize the importance of debating policy and management

options for the sustainable use and development of AnGR. If one item of consensus can safely be identified, it is that there is a need for all stakeholders to be better informed about AnGR and strategies for their management. The DAD-Net discussion on genetic impact assessment was a contribution to this process.

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Appendix 1. South Africa's guidelines for impact assessment studies

The following requirements are outlined in the guideline document (Department of Agriculture, 2003):

1. The study should be undertaken by a reputable animal scientist, group of animal scientists or animal science institution (university, research institute).
2. Animal scientists or organizations in South Africa can be contracted to do the work.
3. The report must include color photographs of the breed.
4. Special attention should also be given to the possible use of the breed in developing areas in South Africa.
5. Where the importation of a limited amount of genetic material has been authorized for evaluation purposes, all animals and progeny must be recorded on the National database.

Further details of the framework for such studies are set out in table 1.

On receipt of the study, a decision will be taken with regard to the need for further evaluation on site.

Genetic material may be imported for further evaluation under the following conditions:

- “1. The import will be strictly for evaluation purposes and all animals and progeny must be recorded on the INTERGIS [Integrated Registration and Genetic Information System] as a breed under evaluation.
2. Participation in a relevant animal evaluation scheme (e.g. beef cattle or dairy cattle recording and evaluation scheme).
3. All animals and progeny must be identified by way of DNA.
4. No animals or genetic material may be disposed of in any way without the permission of the registrar.
5. No publication of results or any other information without the permission of the registrar.”

Table 1. Basic framework an impact assessment in South Africa

Subject	Details	Additional Comments
Breed description	Basic description	Type
	Color	Color
	Size (male, female, calf)	Weight, linear measurements
	Hair coat	Smooth, woolly, etc
	Origin	If a composite supply details of the development of the breed
	Grazing pattern	Is the breed a bulk grazer, browser, selective grazer etc. What impact can it have on the environment?
	Specific details	Details of fertility and growth under different conditions.
Normal production environment	Performance (reproduction and growth)	
	Feed conversion rate under field and stall conditions	
Known genetic defects	Milk production (dairy breeds)	Dairy breeds must include details of production and contents analysis
	Describe the environment where the breed occurs naturally	Where will the breed adapt best?
Production systems	Selected for e.g. double muscling	e.g. Belgian Blue and Piedmontese are selected for double muscling – mainly with a veal market in mind
	Selected against	List all known genetic defects that have occurred in the breed and the measures taken to control these
Level of management	Extensive beef production	Describe the production systems where the breed has been used. Supply statistics to verify production figures.
	Veal production	
	Industrial crossing	
	Production of feedlotters	Similar.
	Milk production	
Breeds in South Africa	Wool	
	Mutton etc.	
Impact on production systems in South Africa	Level of management required e.g. what management inputs are needed for optimal production	Evaluation the suitability of the breed for the small farm/ developing sector
	Any similar breeds already in South Africa E.g. the Australian Belmont Red is similar to the Bonsmara	What impact will the breed in question have on any similar breeds?
Impact on the indigenous livestock resources of South Africa	Asses the impact of the breed on production systems in South Africa	Specify areas where it could compete with similar breeds Specify areas where it could compete with indigenous and locally developed breeds
	Investigate the possibility of the breeds converging on indigenous breeds	A projected potential impact is particularly important where the breed in question is similar to local breeds and where it could lead to the erosion of local genotypes.
Impact	Could it lead to a projected loss in diversity?	Marketing
	Assess the quality of the genetic material	Is it better than any locally available breed?
Impact in other countries	Is it quality or surplus?	Certify that this is not surplus and that genetic material will not be made available at prices below the local semen market prices
	Supply case studies of where the breed has been introduced and its impact in the country in question.	This could be in the form of a literature study. But: List referees for each reference enabling verification and possible cross-referencing
	A developing country	
	A developed country	

Source: Department of Agriculture (2003).

Country Contributions

Contributions from countries highlighting country actions in AnGR management based on and following the preparation of Country Reports on the State of AnGR

Bangladesh	111
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Bangladesh

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Livestock in Bangladesh consists of 22.3 million large ruminants (cattle and buffalo), 14.6 million small ruminants (goats and sheep) and 126.7 million chickens and ducks. The highest number of households (13.6 million) raises fowls followed by households who raise cattle (8.2 million), ducks (7.0 million), goats (5.6 million) and sheep (0.5 million). The least number of households were found to raise buffalo (0.3 million). The gross value of livestock in Bangladesh according to BBS (2000) is equivalent to about US\$ 426.3 million most of which is held by smallholders. The domestic animal genetic resources in the country are rich sources of valuable products like meat, milk, skin and genes of economic importance (disease resistance, capacity for production on poor quality management and product of special flavor or other quality) but few efforts are being made towards their conservation or sustainable development in food and agriculture.

The major imports of livestock products are powdered milk and live poultry while the major exports are leather, skin and animal casings. The average annual growth rate of meat and milk products is 3.7% and 4.2% respectively, and that of eggs about 7.7%. Animal agriculture receives priority attention from the public sector for the purposes of increasing the production of meat, milk and eggs to meet the growing demands of the country. Most of the livestock species are still reared under traditional production systems except for the considerable development of commercial poultry based on imported germplasm, feed and medicines. The available genetic resources of cattle may be classified as:

1. Native cattle (Pabna Red Chittagong, Munshigonj and North Bengal Grey cattle).
2. Crossbred cattle and exotic breeds (Holstein - Friesian, Shahiwal, Sindhi and Jersey).
3. Native buffalo and the Nili-Ravi exotic breed.

It is estimated that more than 90 % of total goat population in Bangladesh is comprised of Black Bengal goats, the remainder being Jamnapari and their crosses. Sheep in Bangladesh are mostly indigenous non-descript type. Native chicken

(Naked Neck, Hilly, Aseel, native dwarf type and Yasmine), five purebred and ten commercial strain chicken germplasm are available in the country. Non-descript indigenous type and Deshi White Pekin duck are limited to some duck farms in the public sector. The types of special fowls found in Bangladesh are geese, quail, pigeon and guinea fowl. The country also has genetic resources of pigs, horse, deer and dogs.

The national cross-boundary priorities for conservation and development of farm AnGR are:

1. Establishment of a coordination system for livestock development programs.
2. Breed surveys, population size estimation, risk assessment and characterization.
3. Formulation of national breeding policies for different AnGR.
4. Economic evaluation of AnGR and resource uses.
5. Breed diversity assessment and improvement.
6. Developing systems for regular recording and evaluation of production performance data of AnGR.
7. Strengthening livestock research and development (R&D) and technology transfer systems.
8. Strengthening of livestock production extension services.
9. Training and development of human resources.
10. *Ex-situ* conservation of germplasm.
11. Development of livestock marketing and quality control systems.
12. Acquisition of funding.
13. Promoting public awareness .
14. Encouraging formation of breed associations.

Global and regional cooperation and initiatives will assist identification of resource potentials and their utilization for economic and social development through application of biotechnology and other technological advances.

Bangladesh is an active partner in the on-going efforts to promote sustainable development of livestock; believes in capacity building to achieve better management of AnGR to help food security, poverty alleviation and employment generation, especially, for rural people; and responds to changing global demands and market preferences.

Croatia

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The preparation of the Country Report on AnGR management has included a large number of experts who engage in the preservation of genetic resources. The guidelines for the preparation of the national AnGR report initiated a wider public debate on the harmonisation of the strategic lines of direction in the preservation of the entire genetic resource base. The meetings that followed gave answers to some of the questions raised, and tried to take into consideration the national and regional characteristics of Croatia. The preparation of the Country Report on AnGR management stimulated a revision of the scope of animal genetic resources in Croatia. A need to supplement the list of breeds that are included in the active care of the wider community has been noted, following the undertaking of a further revision and analysis of the state of genetic resources.

On the basis of a revision, the Busha, Murisland horse, Croatian Coldblood and the Tsigai breeds have been included in the list of protected breeds. With the aim of determining priorities relating to the more reliable protection of original breeds, a systematic molecular genetic determination is being

performed. In this way, the phylogenetic interrelation and the genetic originality of original breeds can be more clearly discerned, a basis for the subsequent tracking of gene flows is set and a priority list of breeds in the protection programme can be determined. Following the preparation of the national AnGR report, a program to reaffirm the economic potential of original breeds through the production of recognisable, refined and high-value foods has been initiated. There are several programs focussed on the organisation and standardisation of products currently in use, whose goal is to increase the economic benefits of production based on original breeds of domestic animals (Kulen, Pag sheep cheese, Istrian beef, etc.).

The preparation of the national report on AnGR management provided stimulation for a revision of the state of original breeds and the efficiency of the protection system. The First Report on the State of the World's Animal Genetic Resources will certainly be a new incentive in the completion and harmonisation of the existing system of protection of original breeds in Croatia, as well as in the exchange of experiences with other states, especially those that host related breeds.

Ghana

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National Co-ordinator for the management of AnGR

Ghana accepted the FAO Director General's invitation to join the Sow-AnGR process in the late 1990s. Consequently, the Animal Production Directorate (APD) of the Ministry of Food and Agriculture (MOFA) was identified as the host institution. A broad-based and multi-disciplinary stakeholder National Consultative Committee (NCC) was formed and a National Co-ordinator appointed. The NCC identified the need to infuse the goals of the Sow-AnGR especially sustainable AnGR management for present and future generations, into Ghana's Livestock Policy which aim, among others, to establish breed improvement schemes to help improve the performance of indigenous/local livestock species (APD/MOFA, 2005).

The Sow-AnGR process has brought to the public attention the livestock sector of Ghana's Agriculture which hitherto had been overshadowed by activities in the crop sector. The first National Workshop on AnGR management was held in 2003 to educate the general public on sustainable management of AnGR. The NCC with support of the FAO and MOFA managed to produce and submit Ghana's Country Report (CR) in good time. The CR raised critical issues which informed policy makers the need to give attention to local AnGR. This period coincided with the launch in 2004 of a 6-year Livestock Development Project (LDP) by the Government of Ghana with funding from the African Development Bank (ADB). This project had a major component of developing of local/indigenous livestock breeds including

formation of breed associations. In all districts where the LDP is being implemented, livestock breed associations have been formed to encourage raising of local livestock species: Ashanti Black Pig, Ghana Shorthorn Cattle, White Fulani Cattle, Sanga Cattle, West African Dwarf Goats and Djallonke sheep. A priority area identified in Ghana's CR was the need to develop human resource in the area of AnGR management. The curricula of animal breeding in the country's universities are being revised to include topics on conservation and sustainable utilization of AnGR as well as biotechnology. This should help improve both the quality and quantity of people involved in AnGR management in the present and in the future. Ghana has actively participated in regional and sub-regional meetings on AnGR with the view to strengthening networks with other developing countries. Ghana is currently a member of the Intergovernmental Technical Working Group on AnGR.

Ghana has taken a bold step to be part of the global Sow-AnGR process. We call on our development partners to help by collaborating with us on various projects in AnGR, providing assistance to help Ghana train students and Post Docs in new areas of AnGR management such as the application of various molecular techniques to characterize AnGR. Finally support for the establishment of a permanent office for the management of AnGR in Ghana will be highly appreciated.

Islamic Republic of Iran

Mohammad Ali Kamali

National Co-ordinator for the management of AnGR

The Iranian plateau with its geographical situation, extensive plains, climatic diversity and position as a junction point for west and east highways, provides the location for the gathering and movement of various livestock and poultry species. As a result, certain species of sheep, goats, poultry and cattle have developed a relatively desirable range of genetic diversities and enhanced the country's reputation as the home of authentic genetic stock. Iran is globally assumed to be one of the richest centers of diversified genetic resources, amounting to up to 12 000 plant species, of which 59 156 domestic and wild samples have been already recorded, as well as 26 breeds of sheep, 9 breeds of goat, 7 breeds of cattle, 7 breeds of horse.

The Islamic Republic of Iran also has experienced some genetic encroachment on native species by exogenous breeds which resulted in large scale genetic mixing and population decline, intensified by the non-economic production of native species. Rearing of some native species is no more economic mainly due to changes in market patterns or life styles which have led to decreased consumption of these species, and decreasing trends in their populations particularly in the case of cattle. This decreasing trend can also be seen in other species. In response to this situation several actions have initiated with the intention of harmonizing and organizing the inventories of AnGR in Iran as follows:

- Pursuant to relative perceptions voiced by national stakeholders on animal genetic conservation, tangible support in the form of technical, research and extension services were recently forwarded which may continue and increase in the future. In this respect, "The Law

of Livestock Breeding Systems" was prepared by the Ministry of Jihad-e-Agriculture and presented to the Government for ratification. The law has resulted in the creation of the Ministry for the Conservation of Aquatic, Livestock and Poultry Genetic Resources.

- To date, the Act of National Veterinary Systems, which was laid down in 1971 and encompassed overall regulations on hygienic aspects of animal husbandry, still governs quarantine codes and the trans-boundary movement of native or exotic animal genetic resources. The act also covers the following measures under its domain:
 - Preventing and controlling animal diseases or common human and animal diseases.
 - Issuance of hygiene certificates for animals and related raw products for export.
 - Hygienic supervision of pastures, watering places, stables, and other breeding establishments.
 - Monitoring of feeding plants, slaughter houses and processing units.
 - Controlling the production, import, export and marketing process of various biologic materials e.g. drugs, vaccines, serums, etc.
- Development of AnGR databanks in *ex-situ* and *in-situ* forms for native cattle, camels, goats, horses, buffalo, sheep and poultry at a national level.
- Expanding biotechnology activities aimed at recognizing, conserving and preserving AnGR especially in poultry, sheep, horses, camels and cattle.
- Breeding and extension projects in poultry, cattle and sheep in order to improve the products of relevant species.

Ireland

Helen O'Toole

National Co-ordinator for the management of AnGR

The management of animal genetic resources for food and agriculture in Ireland is co-ordinated by the Department of Agriculture and Food with the assistance of a National Advisory Committee. The Committee meets on an annual basis and provides funding to a range of projects that cover one or more of the primary policy objectives including; identification, evaluation and conservation of unique Irish Genetic Resources whose survival is being threatened or endangered, development and utilisation of genetic resources to increase national food security and the promotion of public awareness and support for genetic resources.

Arising from the recommendations from Ireland's Country Report the Advisory Committee has prioritised funding for the following actions:

- A National Conservation Strategy Plan was established to develop a long-term conservation plan for a number of endangered traditional livestock breeds. The plans include the national cross-cutting priorities as outlined in Ireland's Country Report. For example the development of an emergency reaction plan which can be invoked in the event of a disease outbreak, and
- the use of National Parks and State lands as a resource for the maintenance of indigenous breeds as a living gene-bank.
- Phenotypic, genetic and molecular characterisation of breeds was carried out on a number of endangered rare breeds and the results have been used in devising conservation plans.
- Ireland is participating in the EFABIS Net project (www.eaap.org/content/efabis_net.htm) to assist with the development of a national database for all breeds of farm animals. Further work is required in this area to develop the capacities of breed societies to ensure the effective flow of the required information.
- *Ex-situ* conservation work has been carried out for a number of endangered breeds, however, a national gene-bank for these breeds has yet to be established.
- Ireland Rural Environmental Protection Scheme was modified in light of recommendations in Ireland's Country Report to encourage the greater uptake of measures for rare native breeds. Improvements to the measure have resulted in a greater level of participation and an increase in the number of animals that are eligible for support under the measure.

Madagascar

R. Rakotonravao

National Co-ordinator for the management of AnGR

Objectif:

Développement et sauvegarde des ressources génétiques animales pour la sécurité alimentaire.

Les actions prioritaires:

1. La première action à entreprendre repose sur le développement de l'élevage de zébu malgache, cheptel le plus important. Il s'agit de mettre en place une bonne gestion de ces ressources par une bonne politique d'utilisation et par l'amélioration de sa performance par un programme de sélection.
2. En deuxième priorité, on doit faire un effort de conservation de la race «renitelo» par un croisement de retrempe.
3. La troisième action prioritaire porte sur la caractérisation de la race « Baria » et la mise en place d'un programme d'utilisation et de

conservation de cette race. Favoriser la domestication et la constitution de ferme d'élevage.

4. Améliorer également le système d'élevage des petits ruminants et leur utilisation.
5. L'élevage avicole villageois constitue une source de revenu et protéique au niveau du monde rural malgache. On doit renforcer les actions de promotion de ce type d'élevage et sa protection vis-à-vis des maladies. Continuer les actions de caractérisation des souches malgaches.
6. Mettre en place un système de formation spécialisée en ressources génétique animales pour renforcer la capacité de gestion des ressources.

Union of Myanmar

Nay Win

National Co-ordinator for the management of AnGR

The Livestock Breeding and Veterinary Department under the Ministry of Livestock and Fisheries is the main organization concerned with making policy and management plans for the conservation and utilization of domestic animal genetic resources (AnGR).

The main priority actions for AnGR are:

- Research into the animal production systems of existing farm animals and local breeds.
- Promotion of *in-situ* conservation and the sustainable use of rare breeds.
- Raising public awareness and providing education regarding on-farm conservation.
- Developing a regulatory framework to promote and ensure the continuity of AnGR maintenance.

According to these priority actions, the Livestock Breeding and Veterinary Department has carried out following the activities:

- In accordance with the roles and values of AnGR, the Livestock Breeding and Veterinary Department has given training to farmers on conservation of AnGR encouraging a greater focus on draught cattle and village chicken breeds than other species. For the sustainable

use and development of AnGR in future, the breeding policy for domesticated animals like draught cattle, sheep, goats, indigenous pigs and poultry must be maintained at its present level and a monitored crossbreeding programme for all species included.

- *In-situ* conservation for indigenous chicken breeds (Inbyinwa Kyet, Sittagaung Kyet, Taikket Kyet, Lin da) in special farms in lower and upper Myanmar by the Livestock Breeding and Veterinary Department. For sustainable use and conservation of Mythan, the Myanmar Livestock and Fisheries Bank is giving loans to local farmers in northern and southern Chin State.
- For an integrated approach to improving livestock production using indigenous resources and conserving the environment, useful indigenous draft cattle like the Shwe Ni and Shan Bu which are declining in numbers, have been brought under a conservation programme in Magwe Division (Middle Myanmar) and southern Shan State.
- *Ex-situ* conservation using cryogenic preservation for Mythan (frozen semen straws) has been occurring since 1997 in the Artificial Insemination Centre at Yangon.

Nigeria

Lawrence A.O. Asije

National Co-ordinator for the management of AnGR

Nigeria is richly endowed with very diverse domestic animals (cattle, sheep, goats, camels, donkeys, pigs and poultry) that are being developed and used widely for food and agriculture in the country. The predominant production system, nomadic pastoralism, is characterized by low inputs and productivity. Output in the industry has been low, a situation that led to the prioritization of enhanced management practices after the completion of *The Country Report on the State of the Animal Genetic Resources*.

Significant efforts made by the Government to ensure sustainable management of the country's animal genetic resources after completion of Country Report include:

1. Prioritization of Food Security and Poverty Alleviation Programmes in Nigeria.
2. Rehabilitation, expansion and restocking of existing animal genetic resources improvement and conservation centres in the country.
3. Provision of support for promotion of domestication and conservation of some feral relatives of the nation's AnGR (rabbits, grass-cutters, snails, etc).
4. Improvement and sustainable utilization of all national feed resources for use of farm animals.
5. Financial support to research institutes and universities of agriculture nation wide for research into various aspects of AnGR management, conservation and sustainable utilization.
6. Increased effort in the control of Trans-boundary Diseases (TADS), zoonotic and other diseases of economic importance, including Avian Influenza.
7. Accelerated development of grazing reserves, stock routes and grazing corridors and settlement and empowerment of pastoralists.
8. Putting in place policies in the areas of breeding, production, disease control, trade and animal product assurance, afforestation, prohibition of bush burning, establishment of parks, gardens, game and grazing reserves as well as stock routes that will ensure orderly and safe use of animal genetic resources in the country.

Nigerian firmly believes that prioritization of advanced production technologies and methodologies in critical areas like AI, ET, MOET, etc. will further enhance output per animal, conservation and sustainable utilization efforts. Sustainable utilization of animal genetic resources in the country will create jobs and income, and hence wealth. It will thus lead to poverty alleviation and facilitate achievement of food security. Consequently, the Government is ready to negotiate with any other government(s) and Non-governmental Organization(s) that is/are willing to assist her in these areas.

Norway

Nina Sæther

National Co-ordinator for the management of AnGR

The most important action in Norwegian AnGR management during the last years is the establishment of The Norwegian Genetic Resource Centre in July 2006. The centre was established by the Ministry of Agriculture and Food as a department of the Norwegian Forest and Landscape Institute and promotes conservation and sustainable use of national genetic resources in farm animals, crop plants and forest trees. As the national centre of expertise on genetic resources in agriculture, it acts as advisory body to the Ministry of Agriculture and Food and coordinates a wide range of activities. Furthermore it is the secretariat for The Norwegian Genetic Resource Council and for advisory committees within each of the three sectors farm animals, crop plants and forest trees. Together with these bodies the Centre develops and conducts national programmes for conservation and sustainable use of genetic resources in agriculture. The Centre initiates and administers activities within the three sectors, and cooperates with gene conservation networks for practical implementation. It contributes towards public awareness and information flow on genetic resources and is the national participant in Nordic and international programmes.

Within the AnGR conservation programme, an action of major importance is maintaining the gene

bank for egg laying hens. This gene bank includes lines from the national breeding work on egg layers which was closed in 1995, and might be the only public gene bank for egg layers in the industrialized world. Monitoring native and small populations has been highly prioritized and subsidy systems for farmers keeping these breeds have been established in the period. For the commercial native breeds of cattle and pigs, export of genetic material has been established as a permanent part of the breeding associations' activities. The increased export activity has accentuated the need for international legal frameworks regarding exchange of genetic material from farm animals. This aspect is discussed in the Nordic project "Legal framework for the rights to and exchange of animal genetic resources", a project Norway is supporting and participating in. Sustainable breeding is fundamental in Norwegian breeding work – and the three national breeding associations GENO, NORSVIN and Norsk Sau og Geit (cattle, pigs and goat and sheep breeding associations respectively) have introduced from 2006 a new chapter in their annual reports with essential parameters from their populations to document the sustainability of their breeding work, such as genetic trends and effective population size.

Sultanate of Oman

Rashid Soud Al-Habsi

National Co-ordinator for the management of AnGR

The Sultanate possesses many animal genetic resources (AnGR) living under varying, difficult environmental conditions. These AnGR have adapted well to these environments. The process of the preparation of the First Report on The State of the World's AnGR has stimulated interest in these resources.

Measures taken to protect AnGR are listed below

The state has had policies and strategies in place to limit the depreciation of AnGR, which are considered a national asset. Among these strategies are:

- Establishing animal profiles like that of the endangered Arabian Oryx.
- The Sultanate has joined the CBD.
- Remodeling the policies and strategies of research establishments to cater for the monitoring and characterization of livestock species.
- Decreasing the camel stocking rate in the south of the Sultanate to maintain the pasture quality.
- Holding seminars for upper management on sustainable development, protection of AnGR, encouraging investment in the development of AnGR and national training on AnGR management

Papua New Guinea

Siva Supiramaniyam
National Co-ordinator for the management of AnGR

Following the preparation of Papua New Guinea's Country Report on the State of Farm Animal Genetic Resources in November, 2004 there has been little progress on the proposed action plan mainly due to lack of financial resources and other unforeseen delays.

The Ministry of Agriculture and Livestock has recently formulated a National Agriculture Development Plan (2007 – 2016) with technical and financial assistance from FAO. This plan has been formerly approved by the National Government of Papua New Guinea in March 2007. Implementation of this plan is expected to commence in the second half of 2007.

Conservation of farm animal genetic resources is one of the activities that have been identified for implementation under this plan and will receive budgetary support from the National Government of Papua New Guinea. As indicated in the country report National Agriculture Research Institute of

Papua New Guinea is mandated to implement the action plan proposed in the Country Report.

It must be emphasized that within the foreseeable future there is no threat to any of the AnGR in Papua New Guinea. The only exception to this is the Javanese Zebu cattle that is considered as endangered. The basic information including the number and location of different farm animals in Papua New Guinea is currently not available. Therefore, a survey has been proposed in the country report to assemble this information. This survey will now be combined with the proposed National Agricultural Census, to be conducted in 2008 under the National Agriculture Development Plan. This information is vital to refine the action plan and prioritize activities that have been highlighted in country report, especially to develop appropriate national policies to safeguard the AnGR.

Poland

Elzbieta Martyniuk

National Co-ordinator for the management of AnGR

The preparation of the Country Report supported the introduction of a new paragraph (§21a), specifically devoted to the conservation of animal genetic resources, as part of the process of amending the Law on the Organization of Breeding and Reproduction of Farm Animals in 2004.

During the last few years, several new initiatives have been undertaken to restore native breeds. The first has already proved successful with regards to Polish White-backed cattle, the others include restoration of the Carpathian goat, the Podhalanian Zackiel and the old-type Polish Merino as well as traditional cold-blooded horse breeds such as the Sokolski and Sztumski.

Changes in the livestock production system resulted in an urgent need to undertake several new conservation programs to address the continuously decreasing pre-bred populations of two native horse breeds. These programs, applied to the Malpolski and Silesian horse, led to development of relevant conservation programs in 2004. A similar situation was observed in the Wielkopolski horse breed.

The continuous increase of the Holstein genotype in the Polish dairy cattle population resulted in the introduction of Polish red and white and Polish black and white dual purpose cattle breeds into a conservation program in 2007. There are also efforts to include several coloured varieties

of nutria and two additional lines of carp in conservation programs in 2007.

The support for AnGR conservation is provided through the Agri-environmental Program (for breeds of cattle, horse, sheep and pig) and from the state budget for breeds of remaining species (poultry, fur animals, fish and honey bees). To ensure a timely and professional service for breeders participating in the conservation of native breeds, the Animal Genetic Resources Conservation Unit was established in the National Research Institute of Animal Production in Balice in January 2005. At present, nine specialists are responsible for supervising the implementation of conservation programs for each species or group of species, and for interactions with breeders.

In last several years special exhibitions of native breeds, accompanied by seminars and occasional publications have been organized during the National Animal Show POLAGRA-FARM. In 2006, an album of Polish native breeds was published and distributed during POLAGRA. To support AnGR activities and facilitate preparation for the Interlaken ITC, in May 2007, an international scientific conference entitled "Conservation of Animal Genetic Resources in Poland and in Europe - achievements and dilemmas" was held in Balice.

Serbia

Srdjan Stojanovic

National Co-ordinator for the management of AnGR

The most important issues related to the preparation of the Country Report are:

1. Serbia has signed and ratified the CBD
2. Serbia has been nominated for the NFP
3. Serbia has established NCC

Main priority actions undertaken since 2002 were the following:

1. Identification of endangered breeds of domestic animals.

2. Ongoing work on updating the National AnGR database.
3. Financial support to the stakeholders of AnGR.
4. Increasing collaboration with countries in the region.
5. Increasing collaboration with research institutes, NGO's and international organisations.
6. Provision of financial support for different projects related to AnGR.
7. Support the developing production of local products and agro-tourism in protected areas.

Slovak Republic

Ladislav Hetényi
National Co-ordinator for the management of AnGR

The following are the main actions taken in Slovak Republic in the field of AnGR management:

- Developing the national inventory on farm animal biodiversity and breed characterization and conducting regular monitoring of farm animal genetic resources.
- Involving farm animal genetic resources in agro-tourism and the non-profit sector.
- Finding the balance between market demand and the production potential of traditional breeds.
- Managing farm animal genetic resources in accordance with the principles of sustainability, environmental impact and ethological needs.
- Improving the legal framework for farm animal genetic resources and building their capacities.
- Improving public awareness and dissemination of research results in the field of farm animal genetic resources.

Spain

Isabel García Sanz

National Co-ordinator for the management of AnGR

During 2006, the Ministry of Agriculture, Fishing and Feeding (MAPA) made progress in the development of the National Strategic Plan for the Conservation, Improvement and Promotion of Zoogenetic Resources, in coordination with livestock breeders' associations and the Autonomous Communities (Spanish regions), within the framework of the New Communitarian Agrarian Policy and the FAO strategy.

Actions were undertaken to complete the current analysis of resources, and make adjustments to the administrative and technical sources utilised as part of the implementation process, in line with directives from FAO, in the following ways.

Inventory, characterization and classification of breeds

1. Development of the Official Catalogue of Spanish's breeds. In the Official Catalogue all the livestock breeds that are zootechnically regulated and supported have been inventoried. Currently there are 169 catalogued breeds.
2. Definition of prototypes and characterization: The prototypes of most of the breeds have been approved and published, with the regulation of the genealogical book.
3. Recognition of associations of breeders of bovine, ovine, goat, pig, canine, poultry and equine species, for the purposes of the management of genealogical books, and the development of breeding programs with 159 associations.
4. Appointment of breeds inspectors to supervise the associations' functions.
5. Individual identification and inscription of the animals in the genealogical book and the registry of collaborating farms, with 2.8 million registered reproducing females.

Programs of breeding (conservation or improvement) and sustainable use

1. Approval of national programs, general and specific for each breed.
2. Reproducers valuation and animal qualification.
3. Yields control and genetic evaluation, including criteria for ovines against TSE, with 1 555 000 genotyped ovines (National Genotyping Program).
4. Authorization of Testing Centers.
5. Sustainable use of and alternatives for the employment of the breeds and their products using quality identifiers, country tourism, etc

Animal reproduction and genetics

1. Authorization of collection, storage and reproduction centers and germplasm banks. At the moment, there are 19 centers for bovine species, 15 for ovine and goat species, 46 for pigs and 17 for equines, and 25 processes for the collection of bovine embryos, 3 for equines and 1 for ovine and goat embryos.
2. Designation of the Reproducing Reference Center or National Bank (in Madrid).
3. *Ex-situ* conservation of breeds in danger.
4. Artificial insemination, and diffusion of the improvement created with high genetic value semen.
5. Authorization of genetic laboratories, DNA banks and filiation control; providing the Central Veterinary Laboratory (Algete) with proper sources.

Programs for the institutional development, coordination and creation of capacity

1. Organization of meetings, in committees, with all the partners implied in the management of breeds, both public and private.
2. Creation of communications networks and opportunities for the exchange of information, with national (Universities, INIA) and international (EAAP, FAO, EU) organisations.
3. Connection of policies and programs on animal genetics resources with other national and international initiatives in the fields of agriculture and biodiversity.
4. Educative programs for vets, livestock breeders and the general public.
5. Establishment of a legal framework including norms and policies. There are already legal norms and two Royal Decree projects exist to develop these programs.

Information

1. Dissemination of information through the Internet (Web pages, such as PEGASO for equine breeds) and awareness campaigns of and promotions, particularly the congress FUTUREQUI, in the first half of 2007.
2. Plan for export, commercialization and international cooperation (Creation of the web CEXGAN).

Creation of the national computer science system

Coordinating references to pure breed animals registered in genealogical books between different data bases.

Financing

Financing the program with national and European funds. It has been subsidized, and properly structured in the regulating legislation that is now being enacted.

Sweden

Eva-Marie Stalhammar

National Co-ordinator for the management of AnGR

- Setting up a national committee on AnGR which is advisory to the competent authority in matters concerning conservation, sustainable utilizing and developing of Swedish AnGR. The committee has worked since 2005.
- Amending the National Act and Ordinance for Livestock, etc management June 2006. A new aim was included: Promoting a sustainable management of AnGR. This addition gives the competent authority, the Swedish Board of Agriculture, the possibility to further regulate the management of AnGR towards the responsible actors such as breeding organisations.
- An Action plan for AnGR is under way. This plan will prioritize between the actions needed for conservation, use and development. The plan will give an idea of costs and also have a time plan.
- Starting a conservation project to get hold of the former dairy breed Swedish Friesian (SLB) before the Holstein breed was introduced into the Swedish population. This project has started from a farmer's appeal to save /"rescue" what is left of the this breed which used to be one of the numerous dairy breeds in Sweden. The older breed was more multi purpose than today's Holstein breed.

Viet Nam

Nguyen Vang Dang
National Co-ordinator for the management of AnGR

In terms of policy and management:

- The National Assembly has issued a national management decree for livestock breeds, consisting of national management documents regarding:
 - Strategies, management and usage of AnGR.
 - Research into selecting, creating, experimenting with and approving new animal breeds.
 - Production of and business dealings related to, animal breeds.
 - Management of livestock breed quality, directly managed and operated by the MARD.
- The Ministry of Natural Resources and Environment, in coordination with other ministries has establish the Law of Biological Diversity to be presented to the Government at the end of 2007, in which the importance of FAnGR are highlighted.
- The Government has increased the budget for the animal genetic conservation program from US\$35 000 to US\$100 000 per year.
- The biotechnical program has been improved, within which the most important project of the Ministry of Agriculture and Rural Development is concerned with using molecular techniques to analyse the animal genetic resources of local chicken breeds such as the Ri, Mia, Ho breeds.

In terms of national activities

- Publishing the completed data system including:
 - Three monographs of genetic resource conservation, one atlas of domestic animals and many publications involving the management, conservation and usage of FAnGR.
 - The establishment of a website and database system concerned with the preservation of the biological diversity of domestic and wild animals in Vietnam in the information centre at the Ministry of Science and Technology

- Enhancing the analysis of animal genetic resources including:
 - The molecular genetics laboratory in Vietnam using microsatellite techniques to determine Vietnam cattle, chicken, pig and goat genetic resources.
 - The biological research program coded KC 04-03 in which molecular genetic techniques were used to improve the productivity of Vietnamese pigs and cattle. Thirty gene sequences involving traits such as productivity and quality of pork and milk in Vietnam have been approved and proclaimed at the International Genbank. (EMBL/Genbank/DDBJ: www.ebi.ac.uk, www.ncbi.nlm.nih.gov)
- Approaching the market and exploiting several local livestock breeds which have economic benefits such as the H'mong chicken, sheep, goats and Ban pigs. Some breeds are conserved and exploited via culture and tourism through women's, elders' and gardeners' associations; worship ceremonies; Ho chicken and buffalo competitions; elephant and horse riding festivals; etc.
- Strengthening capacity and information exchange by:
 - The Vietnamese Government improving the equipment available to animal cell laboratories for analyzing AnGR in Vietnam.
 - Improving technological training for researchers through coordinated biological diversity research projects such as Biodiva and IAEA.
 - Regularly and efficiently updating helpful information networks for the management and usage of genetic resources from DAD-IS at FAO.