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1 Introduction

As genetic diversity of crops and domestic animals used in agriculture is part of the wider genetic diversity and referred to in the CBD, this issue is to be addressed within WP5 of the MEACAP project as Task 5.2., which involves ‘an examination of the measures required for the maintenance and sustainable use of livestock and plant genetic resources’. The conservation of genetic resources might be less connected directly with land use, a meeting point for the different workpackages of the project, still, maintenance of marginal grassland can be dependent on being grazed by breeds, adapted to this kind of management and to specific conditions of the respective area. Organic farming relies on breeds and crops that can cope with less intensive methods of production. In general, a concentration on only few breeds or crop varieties can increase the vulnerability of agriculture. As especially in marginal areas with traditional land management old breeds and crop varieties have survived and giving up of these practices or abandonment of land will further diminish genetic diversity. Member States have obligations to conserve genetic diversity, and there are different measures that can be taken to fulfil these commitments.

Aim of the case study is to analyse national strategies regarding the conservation of genetic resources in food and agriculture. At the beginning, a short overview will be given on international guidelines concerning genetic resources, on legislative obstacles and on the situation and measures taken by the EU-15 and EU-10 to protect crop and livestock genetic diversity (information about the EU-10 is derived from the questionnaires, which have been answered by subcontractors in the course of the MEACAP project). In the second and central part England, Germany and Poland will be considered as examples, and their programmes and measures for maintaining genetic diversity will be presented. For Italy only some examples for support of genetic resources could be found. These will be included as well, because of the importance of an approach to combine marketing of food with conservation of biodiversity. The most important common problems and measures of the case study areas will be highlighted in the summary, and resulting recommendations for the conservation of crop and livestock genetic resources will be given.

For this case study, not the overall biodiversity connected to the agricultural area, but only livestock and crop genetic resources are taken into account. As well the report does not deal with genetic modification of plants and animals.

Importance of genetic diversity

There seems to be broad consensus, that global losses of genetic resources for food and agriculture have been substantial over the last 100 years (OECD, 2001). With over 2,500 breeds registered in the FAO breeds’ database, Europe harbours almost half of the world’s recorded domestic livestock diversity. Lack of economic competitiveness and abandonment of pastures lead to almost 50% of all European livestock breeds being

extinct or having endangered or critical status (EEA, 2006a). The loss of plant genetic resources is poorly documented (Virchow, 1999), but it is obvious that a concentration on fewer crops and cultivars can be observed. Plant genetic resources for food and agriculture comprise the diversity of genetic material contained in traditional varieties and modern cultivars, as well as crop wild relatives and other wild plant species that can be used now or in the future for food and agriculture. Major forces for the loss of plant genetic resources can be seen in the standardisation of the production process, the consumer preferences, technological change (e.g. breeding, Genetically Modified Organisms) as well as international competition. Modern breeding methods and recent advances in genetic improvement have helped to increase agricultural productivity, but concerns have been raised about risks posed through pests and diseases because of the short term strategy of relying on relatively few breeds or varieties (OECD, 2001). Only in few, predominantly marginal areas, old livestock breeds or crops are still being used within traditional management. On the other hand, hobby breeders are more and more becoming the main actors for the conservation of rare breeds.

Plant and animal genetic resources for food and agriculture are the biological basis of world food security. Apart from their potential economic importance (contributing with specific qualities to breeding programmes or producing quality meat for niche markets), local or regional breeds and varieties can be of ecologic importance, as they might be adapted to specific ecologic conditions (e.g. transhumance, landscape management in marginal areas that depend on grazing; breeds that cope better with conditions in organic agriculture or in extensive cultivation than high-performance breeds). New developments, e.g. increased cultivation of crops for the production of biomass as energy, or demands resulting from climate change (e.g. drought resistant crops and breeds) might rely on species, that are of little economic value today. Besides, rare breeds and crops constitute a cultural and heritage and are an important part of regional identity. Apart from contributing to production they can play a part in conservation, tourism and leisure activities.

International guidelines

Conservation of genetic resources in agriculture is addressed through several international guidelines. Though the **Convention on Biodiversity (CBD)** is rather undefined in the area of conservation of genetic resources in food and agriculture, it aims to ‘maintain genetic resources’ by means of *in situ* conservation, complemented by *ex situ* conservation. The Member States having signed the CBD have commitments concerning the regulation of access to genetic resources and access to and transfer of technology. Technical and financial support for *ex situ* conservation, including research, has to be granted.

The **Agenda 21** from 1992 is not a legal instrument but has a high political importance and includes conservation and sustainable use of animal and plant genetic resources. The **FAO** took on the important functions for implementation of Agenda 21. Its Commission

on Genetic Resources for Food and Agriculture (CGRFA), where the EU and Member States are members, now includes plant and animal genetic resources. Concerning animal genetic resources, the first **Report on the State of the World's Animal Genetic Resources** is about to be produced, based on national reports. A framework for plant genetic resources was set on an international conference convened by the FAO: **The Global Plan of Action for the Conservation and Sustainable Utilisation of Plant Genetic Resources for Food and Agriculture (Leipzig 1996)** is a voluntary agreement, still, the EU and its Member States committed themselves to build strong **national programmes** on *ex situ* conservation, *in situ* conservation and development and utilisation of plant genetic resources. This development was complemented by the adoption of the **International Treaty on Plant Genetic Resources for Food and Agriculture** by the FAO conference in 2001, which aims at the conservation and sustainable use of plant genetic resources, an integration of respective measures into agriculture and rural development policies and equitable sharing of benefits. For animal genetic resources there is no separate treaty.

Plant breeding regulations have important implications on genetic diversity. Plant varieties are controlled at both national and European level, and plant breeding relies heavily on intellectual property rights. Plant Breeders' Rights give the breeder an exclusive right on the variety he has developed as a marketable product, thus restricting free access to genetic resources. This provides incentives for commercial plant breeding focussed on varieties with a large market potential. According to the International Union for the Protection of New Varieties of Plants (UPOV), which has been ratified by nearly all EU Member States, new plant varieties have to fulfil the criteria of distinctness, uniformity and stability (DUS-criteria) leading to limited genetic diversity within a plant variety and exclusion of old landraces with often high genetic diversity. In the future patents, being even more restrictive than Plant Breeders' Rights, will as well be of high importance. According to the Council Directive 98/95/EC, the DUS criteria are not applied to old and farm bred varieties. Further changes to EU legislation in relation to variety performance testing are being planned in order to facilitate the use of old varieties.

The EU addresses genetic resources for agriculture and plans measures to support 'the development of technologies assessing levels of diversity in genetic resources, to reinforce the policy of conservation *in situ* and *ex situ* and to ensure that the legislation does not obstruct the conservation of genetic resources' in its **Biodiversity Strategy from 1998**. Still, these objectives have not been translated into corresponding concrete action in the **Biodiversity Action Plan for Agriculture 2001**, although one of its main fields is the conservation of genetic variety of domesticated plants and animals.

The **European Cooperative Programme for Crop Genetic Resources Networks ECP/GR** involves 36 countries in a joint effort to ensure the long term conservation and increased use of plant genetic resources in Europe. By strengthening links between plant

genetic resources stakeholders including national institutions, NGOs and private breeders, ECP/GR promotes the sharing of conservation responsibilities in Europe. IPGRI currently provides the Secretariat to ECP/GR. A project, developed by ECP/GR for the establishment of a European Plant Genetic Resources Information Infra-Structure is being funded by the European Commission and will contribute to the further development of national plant genetic resources information systems throughout Europe and development of crop-specific databases. An international association with the aim to link botanic gardens and their activities to conserve plant genetic resources is Botanic Gardens Conservation International. It launched the **Action Plan for Botanic Gardens in the European Union** with the objective to provide a EU-wide framework.

Community environmental policy is developed in the framework of multi-annual **Environmental Action Programmes (EAP)**: the 5th EAP contains as a general objective the conservation of genetic resources and calls for action to protect all endangered domestic animal races. The 6th EAP (2002-2012) aims to ‘halt the loss of biodiversity in the EU and globally’.

At the moment there are two main support mechanisms for the conservation of crop/animal biodiversity within the EU

- The Member States and/or their regions can set up **agri-environment measures (AEMs)** according to Reg. (EC) No.1257/99 to support genetic diversity. Article 14 of the implementation regulation Reg. (EC) No.445/2002 states, that payments can be made to farmers, which ‘rear farm animals of local breeds indigenous to the area and in danger of being lost to farming’ or ‘preserve plant genetic resources naturally adapted to the local and regional conditions and under threat of genetic erosion’. 8.25 million € have been spent in 2001 in the EU for such measures. Reg. (EC) No.445/2002 gives eligible farm animal species (cattle, sheep, goats, equidae, pigs, avian) and thresholds for numbers of breeding female animals, under which a local breed is considered as being at risk.
- **Reg. (EC) No. 870/2004** (with an annex containing target actions) provides for a community programme from 2004-2006 with a budget of ECU 20 million for the promotion of genetic diversity, exchange of information, co-ordination and the establishment of a web-based inventory. There is a clear reference to multinational arrangements such as the CBD and FAO measures. Member States have to provide matching funding and develop national programmes in order to receive funding under this Regulation.

Measures for the conservation of livestock and crops genetic diversity

Bearing in mind the precautionary principle, as many genetic resources as possible should be preserved. Different approaches for the conservation of crop and livestock genetic resources are distinguished and can complement each other:

- **Ex situ conservation:** conservation of components of genetic diversity outside their national habitats (e.g. seed banks, cryconservation). Whereas ex situ

conservation of plants is relatively simple compared to procedures for animals. Generally, there has been a rapid increase in the numbers of **gene banks** worldwide since the 1970s, many of them in private hands (OECD, 2001).

- **In situ conservation** (monitoring and protection of natural ecosystems) in order to complement ex situ measures and to ensure the development of genetic resources influenced by environmental factors, and.
- Conservation and **management on-farm** (part of in situ conservation - monitoring and protection of agro-ecosystems).

Besides measures that support directly the conservation of plant and animal genetic resources, **indirect measures** play a role as well in protecting habitats where wild relatives of crops occur, or farming systems and land management that favour a higher biodiversity or profit from the use of old breeds and landraces, but the protection of nature with a view to conserving genetic resources is a relatively new field of research. Examples can be:

- AEMs, such as support of organic farming, nature conservation and extensive grassland schemes or support of traditional orchards
- Designation of protected areas (e.g. NATURA 2000) with certain management requirements
- Minimum maintenance requirements under cross-compliance in cases where grazing of extensive grassland is favoured, and requirements for the conservation of permanent pasture.
- The economic value of genetic resources can be increased through developing markets for products derived from rare breeds and plant varieties, through identifying and promoting their contribution to environmental services (e.g. landscape conservation, agro-ecosystems management) and to a multifunctional character of agriculture (e.g. maintenance of rural cultural diversity, tourism, etc.).
- Success of all measures as well depends on awareness of farmers and consumers and the availability of appropriate information.

Besides, effective conservation depends on **systematic registration and recording** of genetic resources.

Agri-environmental indicators concerning genetic diversity

Within its set of agri-environmental indicators relating to biodiversity the OECD proposed indicators for genetic diversity of livestock and crops (OECD, 2001):

- For the main crop/livestock categories the total number of crop varieties/livestock breeds that have been registered and certified for marketing.
- The share of key crop varieties in total marketed production for individual crops
- The share of the key livestock breeds in respective categories of livestock numbers
- The number of national crop varieties/livestock breeds that are endangered

These indicators have been adapted and summarised as subindicators under the IRENA indicator 25 (Genetic diversity). But data are rare and difficult to interpret (EEA, 2006b).

Problems connected with these indicators are for example, that only the main crops are covered by statistics and endangered crop varieties are not defined or registered in many states and some of them may be very closely related to each other (Wetterich, 2003). Besides, the number of registered varieties does not correspond with the real diversity on the fields, where few cultivars might dominate. On the other hand, the available gene pool is probably much wider, as not all old landraces are registered everywhere. Concerning livestock, additional information, if breeds are native or non-native would provide clearer information, as for native breeds there is a generally higher national responsibility for conservation and the number of introduced individuals of non-native breeds can sometimes be very small and no significant contribution to the conservation of global genetic resources (Wetterich, 2003). The indicators as well presume, that population size is more or less correlated with the diversity within the breed and do not take into account modern breeding methods, especially common for cattle, pigs and poultry, resulting in uniformisation and reproducing few top performing individuals.

It is also important to assess ecosystem diversity, as many crop varieties and livestock breeds have been developed together with specific agro-ecosystems, and their adaptation to certain ecosystems can make their conservation and use desirable.

2 Overview on measures for on-farm conservation of genetic resources in the EU

2.1 Assessment of agri-environment measures for the conservation of genetic resources in EU-15

Although often quite modest in size, agri-environment measures (AEMs) can play a significant part in protecting rare breeds and plant varieties in the European Union (European Commission, 2005a). Named as examples, where AEMs showed impacts, were Portugal, where measures for cattle cover a significant proportion of national breeds, Germany, Austria, where a considerable increase of support of livestock as well as of plant varieties has taken place in the recent years, and Piemonte in Italy with a high number of supported animals.

Data about the supported number of livestock or hectares and the height of premium covering the whole of the EU could not be found and sometimes were not consistent. A recent evaluation of AEM in the EU by Oreade-Breche (2005) did not provide data for the national situation all over the EU-15 (e.g. in Germany and Italy only few regions were taken as examples). EU Monitoring Data for Rural Development Programmes from 2003 (see Annex 1) were acquired for the project, but numbers concerning AEMs for genetic resources were not available for many regions (e.g. data for many Spanish and Italian regions, for Ireland as well as for Baden-Württemberg in Germany were missing). Thus, the data used in this report are rather of exemplary character.

AEM supporting endangered domestic livestock breeds

Europe is the region with the highest proportion of livestock breeds being covered by conservation programmes. AEMs are a main tool for **the support of livestock biodiversity**. Signorello and Pappalardo (2003) compared domestic animal biodiversity conservation within the Rural Development Plans (RDP) of the EU-15. According to this study, the highest number of local breeds at risk within these Member States exist in Germany (164), France (123) and Italy (115), but ‘the number of breeds included in the RDPs are consistently lower than the number of breeds listed by the FAO’, the highest percentage being reached in Austria (87.9%) and in Spain (80.4%). In Denmark, The Netherlands¹ and the United Kingdom no farm animal protection measures can be found in the RDPs. Looking at absolute numbers of breeds included in RDP, Italy is leading, followed by France, Germany and Spain (Fadlaoui et al. 2005). According to the synthesis of the Rural Development Mid-Term Evaluations (European Commission, 2005b) these measures have been successful in some Regions/Member States in stabilising endangered

¹ In The Netherland, The Rare Domestic Breed Scheme has only been nationally financed since 2002. It will not be continued as such any more.

livestock breeds to some extent. Oreade-Breche (2005) name Austria, Greece, Germany and some Italian regions (e.g. Piemonte and Emilia-Romagna) as examples, where AEMs contributed to stabilising or increasing the number of animal breeds. Still, low uptake of measures seems to be a problem in several countries (European Commission, 2005a and Oreade-Breche, 2005).

Signorello and Pappalardo (2003) found that RDPs only rarely disclosed how the level of the payments was determined. Payments often do not take into account the risk status of the supported breeds and don't offer sufficient incentives for farmers to maintain the current population of at risk breeds or even to switch from higher yielding to local breeds (Oreade-Breche, 2005; Signorello and Pappalardo, 2003).

AEM for endangered cultivated plant species

Compared to livestock genetic resources, a much higher number of species is involved concerning **crop genetic resources**. Collection, characterisation, conservation and use have been part of plant breeding for a long time, as breeding and research has often been funded publicly. Structured in situ **conservation and development of plant genetic resources** have only occurred to a little extent, mostly in botanic gardens, but is a high priority within the Global Plan of Action (FAO, 1996).

Some Member States offer AEMs concerned with the cultivation of threatened crops (e.g. in Germany, Brandenburg grants payments for the cultivation of certain crop varieties; such support is more widespread e.g. in Italy and Spain; in France the 'Conservation of rare livestock breeds and crop varieties for the protection of biological diversity' was one category offered under the 'farming territorial contracts' CTE; in Finland the cultivation of local crops counts as an "additional AEM") (Bonnieux et al., 2004; Oreade-Breche, 2005). In most cases it is annual crops that are subject of support, although in the Emilia-Romagna in Italy only specialised perennial crops are targeted (RD-data, 2003). Traditional orchards are supported in several Member States and Regions, but often not explicitly under a scheme for endangered plant varieties. Positive single effects of such AEMs have been monitored (e.g. on spelt cultivation or for the preservation of permanent crop species). In Austria the area with supported plant varieties increased considerably in the last years. Still, uptake of measures was often low, thus the existing AEMs alone cannot be expected to halt the loss of plant varieties (Oreade-Breche, 2005).

Further measures

Further measures for in situ conservation exist outside AEMs, sometimes as publicly financed national or regional measures, measures promoted by NGOs and further initiatives. Besides farmers eligible for CAP-support, various other actors are involved in the conservation of rare breeds. Most traditional breeds are maintained nowadays by dedicated rare breed societies and hobby breeders (EEA, 2006b). For crop genetic resources, botanical gardens play an important role. Under the heading of the case study areas in this report, some approaches will be described in more detail.

2.2 Overview on the situation in EU-10²

In many parts of central and eastern Europe local forms of crops have survived in gardens or small-scale agriculture. The abandonment of traditional farming methods, however, and the fact that much of the knowledge of growing and using these old varieties is often harboured by older farmers puts these landraces at risk. National measures of most EU-10 countries include financial support of ex situ conservation and support for rearing rare breeds and crops. Especially the Czech Republic and Poland have a long tradition of systematically collecting old varieties of crops, in other countries, programmes have been developed more recently, e.g. one of the objectives of National Programme on Biological Diversity in Latvia is to support the Latvian crop variety gene bank.

Still, in many cases problems have been experienced as a result of the huge changes of the last years, and financial resources, e.g. for funding gene banks, are often scarce. The Slovak Republic only managed to establish a national gene bank in 1996.

National programmes and measures are in place in most of the EU-10. In the Czech Republic, there is a yearly budget for support measures, among them support for rearing the Kladruby horses. In Lithuania several local breeds threatened by extinction are supported under the State Animal Breeding Programme, as is the case in Latvia, where the National Programme on Biological Diversity defines endangered animal breeds, which are subject to a national support programme. An action plan in the Slovak Republic includes strategic targets and a number of programmes and activities to support genetic resources in food and agriculture and sets out financial resources for support of livestock genetic resources.

In some states, there is no national strategy and no or very few national measures yet, as is the case in Cyprus and Malta. In Malta national inventories of ex situ and in situ collections are developed and some national measures exist for the in situ conservation of genetic resources.

Only in few of the new Member States there are **AEMs** in place for the **conservation of animal breeds**. This is the case in Hungary (for cattle, pigs, sheep, poultry and rabbits), in Estonia (for the Estonian native horse and the Estonian cattle breed) and in Slovenia, where 14 animal breeds are supported. In Poland three measures for the protection of certain breeds of endemic cattle, horses and sheep are proposed in the RDP for 2004 to 2006. Several more breeds are subject to breeding programmes according to the Polish National Programme for the Protection of Animal Genetic Resources and farmers can be supported for rearing these animals. Whereas in the Slovak Republic there is now good

² Based on questionnaires WP 5 of MEACAP Project

feedback from farmers, in Slovenia interest in participating in AEMs is reported to be rather low so far.

As in the EU-15, AEMs for the **conservation of plant genetic resources** are rare. Outstanding examples are Hungary, where hectare payments support the cultivation of special field crops, vegetables, fruits and grapes, and Slovenia, which as well supports growing of autochthonous and traditional varieties of agricultural plants. As well in the Slovak Republic state subsidies are paid for the cultivation of land races of poppies, mountain rye and fruit trees.

3 England

3.1 Actors for the conservation of crop and livestock genetic resources

Despite of being committed to fulfil international agreements and programmes of the EU, there has been no overall strategic policy concerning genetic resources for food and agriculture in the UK so far. The **Department for Environment, Food and Rural Affairs (Defra)** is responsible for policy in his area for England and Wales. The need for better cooperation and to develop an overarching framework for the conservation and sustainable use of genetic resources for food and agriculture has been recognised now. In 2002, Defra has produced the **UK Country Report on Farm Animal Genetic Resources** with resulting policy recommendations for the FAO Report on the State of the World's Animal Genetic Resources. Defra carried out a review on its policy concerning genetic resources for food and agriculture, which involved discussions and a conference with stakeholders in this area, in order to **develop a strategy for a national policy on agrobiodiversity**.

Activities for the conservation and use of genetic resources have been fragmented. Within Defra, Research Policy as well as the International Division, the Sustainable Agriculture and Livestock Productions Directorate and other divisions touch the issue of agrobiodiversity. **Defra financially supports several ex situ collections**, mainly for plants, and various research projects (e.g. exploring potential uses for breeds at risk for conservation grazing) connected to genetic resources, **and keeps a national database on farm animal breeds**. Defra as well provides the secretariat to the **UK Plant Genetic Resources group (UKPGR)**, which includes research institutes, NGOs and private companies, and is the **UK National Focal Point** for plant and farm animal genetic resources, representing the UK at the FAO. Several other government agencies, research institutes, commercial breeding companies and individual breeders and NGOs are involved in activities in the area of conservation of crop and livestock genetic resources.

According to Defras' review there is need for identification and more information about all *ex situ* collections and in situ sites, and about livestock breeds at risk or rare crop varieties and landraces, and a better coordination of efforts of stakeholders in this respect. The development of a national information system about genetic resources collections and sites could be an important contribution of Defra in future.

Several quite important NGOs have been funded in the UK and play a crucial role for the conservation of breeds at risk:

- **Rare Breeds International (RBI)** identifies breeds at risk and interacts with FAO at the global level and EAAP (European Regional Focal Point) at the European level in developing international standards
- **The Rare Breeds Survival Trust (RBST)** promotes and conserves rare and threatened breeds of farm livestock within the UK. It currently lists 79 breeds

using a set of guidelines based upon conservation criteria to identify breeds, which it supports and continually monitors (RBST, 2005). As well the trust is developing a privately funded cryogenic storage facility and germplasm collection schemes.

- **The Sheep Trust** was funded by the Heritage GeneBank in 2001 in reaction on the foot-and-mouth disease outbreak, collected germplasm of sheep breeds that were in danger of extinction and set up a priority list of heritage sheep breeds for its cryopreservation programme)

3.2 Animal genetic resources

A high number of livestock breeds exist in the UK, including up to 85 sheep, 72 cattle, 15 pig and 8 goat breeds and 237 poultry breeds, many of the latter being kept for showing (Defra, nd). Besides existing on-farm, there are small feral populations of cattle and sheep. The traditional livestock industry has changed significantly within the last century, adapting to increased production and favouring few high yielding breeds, especially in the dairy, pig and poultry sector, and resulting in a reduction of traditional, native breeds (Defra, 2002). The UK livestock sector, especially of cattle and sheep breeds has suffered after BSE, Swine Fever and FMD outbreaks. Not only were some local breeds severely threatened by the FMD outbreak in 2001, the general decline of the livestock industry as well poses a general disincentive to engage in livestock production. Revitalising of the international trade in order to provide income is being seen by Defra as a key issue for funding a sustainable development of the livestock sectors in the UK.

With environmental objectives becoming more important within the last years, the utilisation of old and locally adapted breeds is expected to increase again. Already the increase in more extensive production systems, particularly in LFA, has lead to more commercial interest in native breeds (such as the Welsh Black, Sussex and Aberdeen Angus cattle). Conservation programmes for breeds at risk have been carried out by **NGOs and private breeders** or breed societies with support of animal breeding institutes and universities. These organisations support in situ and on-farm conservation of breeds at risk through breeding plans and genetic advice.

Most domestic pure breeds, divided into mainstream breeds and breeds at risk, locally adapted and/or rare breeds, are recorded by breed societies and listed in the UK National Database on Animal Genetic Resources, including numbers of breeding females and the breed status in the UK.

Rare breeds have to meet the criteria of the RBST, which are at the moment 18 cattle, 13 horses, 7 pig, 29 sheep, 2 goat and 10 poultry breeds (RBST, 2005). A few other breeds are included in this category because of their low number or because they are recognised by other NGOs (e.g. RBI). Significant support programmes are being provided by NGOs

for most of the native rare breeds, such as the **Traditional Breeds Incentive** by English Nature. There haven't been public incentive programmes so far in the UK. Several more breeds benefit from e.g. Breed Structure Analysis, the Heritage Gene Bank and scrapie genotyping. Payments for rare breeds through future Rural Development Plans is favoured by several stakeholders and is being discussed within Defra (Defra, nd).

Most of the breeds at risk are found in a limited geographical area mainly in low-input systems. Their utilisation depends on niche markets. There are already various examples in the UK for brand names, which are linked to breeds, and marketing schemes (e.g. Lakeland Lamb). The RBST has set up the **Traditional Meat Marketing Scheme**. As well, there are possibilities within the Rural Enterprise Scheme under the Rural Development Plan to support the utilisation and marketing of products associated with particular breeds.

Ex situ collections are held by breeders, in particular artificial insemination companies, and by NGOs, which are involved in conserving rare breeds.

National Coordinator for Animal Genetic Resources at government level represents the UK at the FAO. Defra maintains a national database of domestic breeds and submits data on animal genetic resources in the UK.

Recommendations from the UK Country Report on Farm Animal Genetic Resources 2002

At the national scale it should be aimed for joint efforts of government, private organisations and individuals. Conservation activities of NGOs and breeders organisations should be better coordinated and ideally complement each other, in order to avoid overlapping, identify gaps and prioritisation of tasks. Recommendations concerning breeds at risk include (Defra, 2002):

1. Short term projects:

- Construction and maintenance of a national rare breeds pedigree database and assistance with provision of computerised recording system to Breed Societies; a harmonisation of criteria for the recognition of breed status between government and NGOs should be considered.

2. Medium term projects:

- Development of communication networks among Government, Breed Societies, NGOs, extension services and research institutes
- Maintenance and improvement of the Breed Society infrastructure
- Characterisation of breeds for the purpose of linking local and specific adaptations and niche markets or specialist uses

3. Longer term projects:

- Creation of national rare, locally adapted and distinctive breeds gene banks
- Creation of a national rare breeds library

Defra (2002) highlights the importance of programmes for animal genetic resources being compatible with other biodiversity policy, linking conservation of native breeds to ecological projects. An example is the **Traditional Breeds Incentive** by **English Nature** in cooperation with the Traditional Livestock Foundation in certain areas, where the use of eligible traditional breeds in environmental land management projects qualifies for extra support in England and Wales (up to £60 per hectare). The **Grazing Animals Project**, currently co-ordinated by two contracts funded by English Nature and steered by representatives mainly of NGOs, provides information and encourages within several pilot projects, e.g. the use of native breeds for conservation grazing.

For an effective conservation and utilisation of animal genetic resources the **creation of a National Action Plan**, based on the outcomes of the report, and a **National Steering Committee** is strongly recommended.

3.3 Conservation of plant genetic resources

There is little in situ conservation of plant genetic resources in the UK. All major commercial crops are of non-native origin. 66 native wild species of economic value, including some wild relatives of cultivated plants are known in the UK, but these are not monitored or recorded. Only one wild relative of asparagus is a priority species under the Biodiversity Action Plan. The others might be protected by chance within nature reserves or through agri-environment schemes. Some landraces and old varieties of crops are grown in private gardens or on-farm, such as ancient orchards, barley landraces and heritage vegetable varieties. Apart from funding maintenance, restoration and creation of traditional orchards under the Environmental Stewardship scheme, Defra is currently not involved in any in situ conservation of crop genetic resources.

Ex situ collections of internationally important crops (e.g. potatoes, vegetables, fruits, cereals, peas, oats, hops, soft fruit, grasses and forage crops) are kept in the UK, the majority of them for research purposes by research organisations, represented by the UK National Culture Collections for public service collections and the UK Federation of Culture Collections for a wider group. Many of them are funded by the Ministry.

There is need to develop a national inventory for genetic resources with information about any collections and sites. As well, where appropriate, plant genetic resources for food and agriculture should be incorporated into policies of nature conservation (Defra, nd).

4 Conservation of crop and livestock genetic resources in Germany

4.1 Institutional settings

Although concepts and national programmes have been drawn up and committees and expert panels established, the discussion about conservation of agrobiodiversity shows yet low public awareness and involves mainly the administrative level, in the context of implementing international commitments (Position paper, 2004). A national concept for **Genetic resources for food, agriculture and forestry** has been compiled in 2000 and provides for the development of specific programmes for plants, animals, forestry, fish and microorganisms respectively. Of these, as the most important recent developments, the **National Programme for Conservation and Sustainable Utilization of Plant Genetic Resources in Agriculture and Horticulture** has been approved in 2002, and the **National Management Plan for the Conservation and Sustainable Use of Animal Genetic Resources** exists since 2003. A programme for forestry has been reissued in 2000.

As conservation and sustainable use of genetic resources are primarily a public responsibility, a great deal of the work on genetic resources in Germany is done by public research institutions and universities. National bodies dealing with the conservation of genetic diversity are the Ministry of Agriculture (**BMELV**) and the *Informationszentrum für Biologische Vielfalt (IBV*, Information Centre for Biodiversity) of the *Zentralstelle für Agrardokumentation/Informationszentrum für Biologische Vielfalt (ZADI*, German Centre for Documentation and Information in Agriculture), an organisation subordinated to the Ministry. It has an important part in coordinating the implementation of the programmes and is the central point for documentation and information and central office for genetic resources.

For each area, **expert panels** have been founded as advisory and coordinating committees, e.g.

- the *Beratungs- und Koordinierungsausschuss für genetische Ressourcen landwirtschaftlicher und gartenbaulicher Kulturpflanzen (BeKo*; Advisory and coordinating committee for plant genetic resources for food and agriculture) and
- the *Fachbeirat Tiergenetische Ressourcen* (expert panel for animal genetic resources).

A **central committee** (*Beirat für Biodiversität und Genetische Ressourcen*; Advisory board for biodiversity and genetic resources) at the BMELV, established in 2003, has the task to consult the Ministry in overall issues about conservation and utilisation of genetic resources for food, agriculture and forestry and measures on national, EU- and international level.

The **Department of Animal Breeding and Animal Management** within the Ministry is designated National Focal Point in the framework of the Global Strategy for the Management of Farm Animal Genetic Resources; the technical functions are covered by the IBV. Research on animal genetic resources is conducted by the *Institut für Tierzucht* at the *Bundesforschungsanstalt für Landwirtschaft* (Institute for Animal Breeding at the Agricultural Federal Research Centre; FAL). It provides scientific support of decisions and consultation.

In case of **plant genetic resources** the *Bundesanstalt für Züchtungsforschung an Kulturpflanzen* (BAZ; Federal Centre for Breeding Research on Cultivated Plants) supports the implementation of the national programme. As a research institution of the BMELV it carries out long term research in the area of plant genetic resources, manages collections of plant genetic resources and develops and services databases. As well, the BAZ makes available genetic material for breeding purposes. The central gene bank, evolved from a former Easter German institute and gene bank, is - different to the BAZ - under the responsibility of the Federal Ministry of Education and Research and situated in Gatersleben within the **Institute of Plant Genetics and Crop Plant Research**. The gene bank is one of the biggest in the EU and comprises the collection, conservation, and distribution of plant genetic resources. Research focuses on further improvements in the management of the collection and on the development of strategies and methods for the improved utilisation of plant genetic resources with a major focus on cereals.

An inherent problem in Germany results from its **decentralised structure**. The national government has to rely on the *Laender* to implement national programmes, resulting in more or less ambitious approaches with different priorities.

Other actors

Approved breeders associations and breeding companies according to the Animal Breeding Act have to fulfil certain requirements such as identification and herdbook registration of all breeding animals, existence of a breeding programme and evidence of the necessary breeding population and testing capacities, and qualified personnel. With these requisites these organisations would be equipped very well for conduction conservation programmes for endangered breeds. However, there are no concrete regulations, as how to compensate such organisation for carrying out such socially desired tasks.

Further organisations comprise not-approved breeding organisations, numerous associations dealing with poultry and rabbits and NGOs with interests in the field of conservation of genetic resources. An important NGO in Germany is the *Gesellschaft zur Erhaltung alter und gefährdeter Haustierrassen e.V.* (GEH, Association for the conservation of traditional and endangered domestic animal breeds) that coordinates animal keepers, keeps contacts with breeding organisations, provides information, initiates scientific research and carries out projects, as well across borders of the *Laender*,

concerning conservation and utilisation of endangered farm animal breeds and marketing of products. Another important organisation is the *Deutsche Gesellschaft für Züchtungskunde (DGfZ)*, German Society for Animal Production). Its commission dealing with the conservation of genetic diversity of farm animals consists of representatives of the *Laender* and the federal state, of breeding organisations, private organisations and scientists. This commission was central in working out the national report and management plan.

Several institutions have been involved in the conservation of plant genetic resources: several ministries, other public institutions on national and *Laender* level, research institutions such as universities and botanic gardens, the private sector with different breeders and agricultural organisations, and NGOs. An example is the *Verein zur Erhaltung der Nutzpflanzenvielfalt e.V. (VEN)*, Association for the conservation of diversity of crops), whose focus is on the conservation of old vegetable varieties. Its members grow endangered varieties in their own gardens, the association disseminates seeds and organises information, seminars and communication with other interested parties on national and international level.

4.2 Animal Genetic Resources

As a contributing paper to the FAO Report on the State of the World's Animal Genetic Resources, the German Government together with the *Laender* has produced a national report about animal genetic resources in 2003. It is based on a proposal of DGfZ, describes the structure of animal breeding in Germany and depicts the situation of animal husbandry. Existing measures for the conservation of endangered breeds are highlighted.

Situation of animal husbandry and structure of animal production

As in other countries, animal husbandry in Germany has been characterised by intensification within the last decades and selection strategies focussing on economic performance resulting in a standardisation of breeds and the use of few remaining breeds suitable for intensive production. Of high importance are cattle and pigs. According to the National Report, in 1989, more the 76 per cent of cattle registered in herdbooks were of just two breeds, *Holstein* and *Fleckvieh*. For pigs, two breeds made up nearly 86 per cent of all herdbook registered animals. Only five out of 35 indigenous breeds of cattle remain (Wolff, 2004). Within the dominant breeds often only a few 'Top-Breeders' are dominating, posing the threat of inbreeding in the long term. The situation is slightly different concerning sheep where 32.47 per cent of herdbook-registered animals belong to an endangered breed.

Table 1: Numbers of (herdbook registered) animals and (endangered) breeds for important domestic animal species in Germany (Source: National Report, numbers from 2000)

	Number of animals	%age of herdbook-registered animals	Number of breeds	Number of endangered breeds
Horses	506249	29.29	104	14
Dairy cows	4569800	54.74	16	8
Suckler cows	724600	8.95	38	4
Pigs (breeding sows)	2559300	1.95	15	5
Sheep (breeding ewes)	1677700	5.88	50	13
Goats	163336	7.32	14	3

The central German legislation is the *Tierzuchtgesetz* (Animal Breeding Act) (covering horses, cattle, sheep, goats and pigs). The Act and its associated regulations provide a national framework. The *Laender* are largely independent concerning their animal breeding administration. They implement and monitor the national legislation and may issue their own ordinances. The national legislation doesn't define concrete measures for the conservation of animal genetic resources or specific authorisations for the *Laender*, although one of its aims is the conservation of genetic diversity³.

The Animal Breeding Act defines requirements for breeding, e.g. documentation and scope and kind of testing and recording of animals suitable for breeding. The formulation of breeding programmes is obligatory. The selection criteria as the basis for performance tests and the assessment of breeding quality are oriented at economic performance. The responsible state agencies of the *Laender* are approving and controlling the various breeding organisations, which often have the status of a registered association or cooperative, some insemination centres and embryo transfer institutes are private or limited companies. As their influence can be limited regionally, the result is, that often for one breed different breeding organisations each with their own herdbook exist in different *Laender* or even within the *Laender*, although their work is often coordinated by an organisation at a higher level. Some breeding organisations are approved above *Laender*-level or nationwide.

A fragmentation exists between the *Laender* concerning support measures, documentation, herdbooks and cryoconservation. E.g. some endangered livestock breeds (such as heavy horses, Rotes Höhenvieh, various breeds of *Landschaf* and *Sattelschwein*) are kept in separate herdbooks in the different *Laender* and are often subject of different support mechanisms. For breeds that only occur in one region this is not a severe problem, but if breeds are traditionally kept in different parts of Germany the existence of different herdbooks, responsible breeding organisations and different support programmes

³ Animal Breeding Act (§1.2(4), § 4.1)

can prevent a successful conservation programme. Sometimes even the names are different for genetically related populations.

There is a different structure for small animals and poultry. They are not covered by the Animal Breeding Act. In case of poultry the high influence of commercial breeding (according to the Position Paper (2004) over 90 per cent of the world market for hens are controlled by only few companies, the commercially used hens can all be traced back to the same breed) resulted in only few breeding lines, that are being used commercially, and others that are almost exclusively kept by hobby breeders. There is low interest of the commercial breeders to include any of the numerous non-commercial breeds into their breeding programme.

Measures for the conservation of animal genetic resources

A **National Management Plan for the Conservation and Sustainable Utilization of Animal Genetic Resources** has been published in 2003 and has to be implemented by the Federal Government and the *Laender* in cooperation with the participating breeding organisations. One of its main objectives is to develop rules on documentation and procedures for a national cryoconservation scheme. Another focus is the clarification of the responsibilities and the coordination of the different breeding organisations and conservation programmes for endangered breeds.

Following the publication of the National Management Plan two central institutions have now been implemented:

- **An Expert Panel for Genetic Resources** as an advisory and coordinating committee its members being experts from animal breeding management at national and *Laender*-level, breeding organisations, non-governmental promoting organisations and from research.
- **A Central Documentation and Information Agency**, where, on behalf of the Expert Panel, data about all *in situ* and *ex situ* conservation programmes will be collected, stored and processed, the programmes will be monitored and necessary information provided. This agency has been created by expanding the German animal resources database (TGRDEU) at the ZADI/IBV.

Documentation of animal genetic resources

The central database is hosted by the IBV. The ***Zentrale Dokumentation Tiergenetischer Ressourcen in Deutschland*** (TGRDEU; Central Documentation of Animal Genetic Resources in Germany) contains animal numbers and characterisation of all breeds of the important farm animal species in Germany. The approved breeder's associations and insemination centres as well as institutions in the area of biotechnology (transfer of embryos) are listed. An important task is the yearly recording of all herdbook-registered animals and the documentation of deep-frozen semen and embryos in German insemination centres. The TGRDEU provides information about specific projects for the conservation of endangered breeds. Still, breeding animal stocks by private breeding

companies are not included in this central documentation, although these are hardly connected with endangered animal breeds, anyway. What would be important for proper planning of concrete conservation programmes are more data about individual identification of single animals and better documentation of the extent of inbreeding.

A key measure of the national management plan is regular investigation and **monitoring and assessing of status of endangerment**, according to definitions based on their effective population size (N_e):

- $N_e < 200$: Conservation population CP (highly endangered population for which a conservation programme must begin as soon as possible)
- $200 < N_e < 1000$: Monitoring population MP (endangered population for which cryoconservation programmes should be implemented)
- $N_e > 1000$: Non-endangered population NP.

Populations with less than 50 individuals should be protected from total distinction through cryoconservation, although their conservation as genetic resource is not viable in the long term. **Programmes for *in situ* conservation** are to be developed (as well above *Laender* level; concerning poultry: incentives for hobby breeders to become involved in book-keeping) and the conservation of rare breeds should be integrated into **sustainable production programmes** or **new measures of utilisation** established. First approaches for monitoring of stock-sizes of not commercially used poultry breeds are being made by the IBV/ZADI and the Federation of German Poultry Breeders. The TGRDEU is about to build up a documentation for poultry, and is planning an extension to rabbit species as well. These efforts are important because among poultry and rabbits are many endangered breeds, which should be conserved

Support within agri-environment schemes of the German *Laender*

Measures for the promotion of *in situ* conservation of endangered farm animals are offered in most of the German *Lander*. They support rearing of certain rare animal breeds within schemes according to Reg. (EC) No. 1257/99. The German national framework plan doesn't provide for national cofinancing of such measures.

As each *Land* can set up its own measures, most times cofinanced by the EU, but as well only using own funds (which is the case for all measures in Bavaria, Mecklenburg West-Pomerania, Rhineland-Palatinate and Schleswig-Holstein), requirements, breeds and the respective premium vary within Germany. Whereas in Lower Saxony 15 breeds are subject to support payments, Hesse and Rhineland-Palatinate only list one breed (the Glandrind). Altogether, 64 breeds of endangered animals (13 horses, 13 sheep, 12 cattle, 5 pigs and 3 goats) are being promoted in at least one region, their risk status according to

the FAO being almost solely endangered or critical⁴. Some breeds such as *Rotvieh Zuchtrichtung Höhenvieh* (cattle) or the German *Sattelschweine* ('saddleback pig') are supported in five *Laender* whereas for others (e.g. five breeds of sheep in Bavaria) a measure only exists in one region (ZADI web-site). The national report of Germany makes out two different concepts of promotion: Some *Laender* (such as Lower Saxony and North Rhine-Westphalia) support various breeds, not just those typical for their Land. Others (Bavaria, Rhineland-Palatinate) chose fewer breeds, typical for their region. In the latter case sustainable conservation programmes are better to ensure than with a rather undifferentiated approach. But EU-confinancing favours the support of individual animals and not a programme-oriented funding. Such kind of funding is being realised with pure *Laender*-funded measures, that exist e.g. in Rhineland-Palatinate for the *Glandrind* (cattle) and in Lower Saxony for the *Bentheimer Schweine* (pigs). Beyond these measures, listed in Annex 2, there are a few programmes for other animal species such as geese, ducks and rabbits (e.g. *Diepholzer Gänse* in Lower Saxony and *Pommern Gans* and *Pommern Ente* as well as four breeds of pigeons and two breeds of rabbits in Mecklenburg West-Pomerania).

Further *in situ* measures

GEH, as the only organisation acting nationwide, carries out and supervises *in situ* conservation measures, such as the *Arche-Hof-Projekt* (ark farm project), which gives support to farms that are committed to keep a number of endangered breeds in breeding groups (currently 85 participating farms, according to the GEH-web-site). As well GEH gathers information about endangered farm animals and their coordinators and organisers for different breeds cooperate with animal holders. GEH has developed a 'Red List' of endangered farm animals as a system of warning in advance. The GEH started to establish first systematic conservation breeding for old poultry breeds, and for *Diepholzer Gänse* (geese) they are recorded in a breeding book, although only very few breeders (five per cent) participate.

In addition, according to the national plan **provisions for special diseases** and hygiene-related measures are to be developed for the protection of endangered breeds in case of an outbreak of animal diseases (e.g. foot-and-mouth disease).

⁴ Status of supported animals (according to FAO):

Endangered: Hinterwälder Rind, Limpurger Rind, Braunvieh alter Zuchtrichtung, Gland-Rind, Deutsches Shorthorn, Murnau-Werdenfelser, Pinzgauer, Schweres Warmblut, Schleswiger Kaltblut, Sächsisch-Thüringisches Kaltblut, Rheinisch Deutsches Kaltblut, Schwarzwälder Kaltblut, Deutsches Sattelschwein, Schwäbisch Hällisches Schwein, Skudde, Weiße gehörnte Heidschnucke, Braunes Bergschaf, Brillenschaf, Steinschaf, Waldschaf, Thüringer Wald Ziege

Critical: Ansbach-Triesdorfer, Rotvieh alter Angler Zuchtrichtung, Ardenner Kaltblutpferd, Mecklenburger Kaltblut, Dülmener, Senner, Rottaler, Angler Sattelschwein, Buntes Bentheimer Schwein, Erzgebirgsziege

Ex situ conservation (Cryoconservation)

According to the National Report the technique for cryoconservation of semen of the five big farm animal species is sufficient for conservation programmes. Concerning the conservation of embryos, there are still major problems with pigs and horses. In case of cattle, sheep and goats conservation of embryos is practicable and a systematic programme should be envisaged in the future to complement cryoconservation of semen. For poultry, there are no measures for cryoconservation in Germany.

A drawback in Germany is the fact, that there is no national programme for cryoconservation yet. Cryoconservation is not carried out systematically and clear standards for identification and documentation are missing. An exception is Bavaria with a collection of considerable scope. 20 different public and private organisations are involved nationwide, but in most cases important details are not given (e.g. number of semen samples from for each single father animal and sometimes even its identification and origin). It is not resolved in how far these different institutions are involved in conservation programmes and how they could be included in a new national concept. A Central Documentation and Information Agency has been established for central recoding and documentation of all measures of cryoconservation, and the development of standards for cryoconservation is a focus of the national management plan.

Recent developments

Examples for steps taken in 2003 are (ZADI-web-site):

- Development of the TGRDEU into an instrument for monitoring within the framework of the National Management Plan
- Assessing and recording of risk status of animal breeds
- Update of recoding of animal breeding organisations and of animal number of the various domestic animal breeds
- Nationwide breeding programme for the *Bunte Bentheimer* (pigs)
- Establishment of breeding circles for geese (*Lippegens und Leinegens*)
- Coordination of breeding programmes of heavy horses based on the breed of *Rheinisch-Deutsches Kaltblut*
- Extensive measures for cryoconservation in sheep breeding

4.3 Plant genetic resources

Current situation and legislation

Field crops cover about 68 per cent of agricultural land in Germany with about 25 species being used, among which cereals, rapeseed, potato and sugar beet are dominating. About 70 species of vegetables, 30 fruit species, and 70 species of medical plants and herbs are cultivated on roughly one per cent of the land (BMVEL, 2002). Of the about 3,240 species of wild flowering plants in Germany, roughly 1,000 are considered as genetic

resources. Most commercially grown crops, vegetables and soft fruits are dominated by few high-yielding varieties. Especially for annual crops there is hardly any cultivation of old varieties. It is estimated that compared to the first half of the twentieth century, 75 per cent of cultivated plants in agriculture and horticulture have disappeared (UBA, 2002 in: Wolff, 2004). Although Germany has a long history of scientific research into plant genetic resources, there is no complete inventory of cultivated plant species and varieties, let alone written comprehensive information about management and utilisation techniques. In the case of vegetables, fruits and herbs private gardens surely still hold a higher variety of plants. On-farm management happens e.g. in agricultural and historical open-air museums.

Plant breeding in Germany is mainly organised privately (except fruit and vine). The *Saatgutverkehrsgesetz* (SaatG, German Seed Trading Law) demands compulsory variety approval and registration, requiring compliance with the DUS-criteria and proof of Value for Cultivation and Use (VCU) (§30(1), 34 SaatG). VUC includes criteria such as quality of cultivation, resistance, yield and quality, yield still being the predominant indicator (Wolff, 2004). New varieties must show a distinct improvement compared to existing varieties, and around 90 per cent of applications fail because of these VUC requirements (Steinberger J. in Wolff, 2004). The testing is carried out by the *Bundessortenamt* (Federal Agency for Varieties) and is paid for by the breeders' organisation. Traditional seed-supply systems are lost almost completely (Efken, 2004).

Thus, there are new developments as well. There is a rising interest and need for varieties developed according to specific guidelines of organic farming associations. As the BMELV aims to increase the share of organically farmed land in Germany, the potential for on-farm management activities will rise accordingly (Efken, 2004). Interest in use of plants as renewable resources for materials or energy opens opportunities for a reintroduction of old species (such as flax and hemp), but the full range of uses is still to be developed.

Ex situ conservation of plant genetic resources happens at six places in two public research institutions, numerous botanic gardens and in around 20 special collections, but there is by far not enough capacity for a complete conservation because of the high genetic diversity of wild plants. Research on the conservation of plant genetic resources is dominated by the requirements and techniques for improving ex situ conservation. A great deal of research is being done in the field of the characterisation and evaluation. Little scientific experience has been gathered in the area of in situ and on-farm conservation. Practical and scientific work in this area is mainly carried out by a number of German nongovernmental organisations. Research on the potential use of nature reserves for the conservation of genetic resources was mainly carried out in the former GDR prior to reunification.

Measures for the in situ conservation of plant genetic resources

Till recently there were mainly informal initiatives for reintroduction and use of rare plant species: numerous private crop plant diversity organisations promote conservation and sustainable use of rare crops. They provide information, keep inventories and develop concepts and projects for conservation. For these initiatives it often proves very difficult to overcome the gap between small-scale ‚hobby‘ activities and more publicity and successful economic operations.

For plant genetic resources it is a problem to define what should be supported and how to control activities. This might be one reason for only very few existing AEMs for the conservation of plant genetic resources.

- Many *Laender* support **measures for nature conservation and extensive management of landscapes**, which is the most important measure for the conservation of wild plants. Various **grassland schemes** help to maintain habitats for rare grass species (and other animal and plant species), especially on grassland on poor soils or moist meadows. Landscape management would as well be an ideal field for rare undemanding cattle and sheep breeds, as regional breeds are often best adapted.
- In many areas **maintenance and management of traditional orchards**, which still harbour old and region-specific varieties of fruit trees while as well providing a habitat for many insects and other animals, is supported within an AEM. As well there exist ‚variety gardens‘ growing old fruit varieties and making them available to interested gardeners as well.
- Concrete rural development measures for genetic diversity of crops are rare. Within its cultural landscape scheme **Brandenburg** supports the **cultivation of endangered regional crop species and varieties** (cultivation of listed varieties of winter and summer barley, winter and summer rye, winter wheat, oat and potatoes with a premium of 75-350 €/ha). Within Art. 33-measures, **North-Rhine Westphalia** started **demonstration projects** for the promotion of crop plant variety, organised by its Chamber of Agriculture, as these provide an important link to farmers via their advisory services.
- There are seed production projects that e.g. serve organic farming, some of them connected to local Agenda21 programmes.

National Programme for Conservation and Sustainable Utilization of Plant Genetic Resources in Agriculture and Horticulture

The programme, adopted in 2002, is based on the Global Action Plan of the FAO and aims to implement its measures at the national level. It has been developed under the lead of BMELV together with representatives from the national level and the *Laender*, from universities, research institutions and public organisations. The programme aims to provide a basis for long term conservation and use, research and development of cultivated and wild plant genetic resources as well as suitable agricultural and horticultural ecosystems. An important objective is better documentation and information

about plant genetic resources, a greater transparency of the institutional settings, clarification of the responsibilities and a better cooperation of authorities and organisations involved in the conservation of plant genetic diversity. As well, the programme stresses the need for research on aspects for a framework for an effective on-farm management.

Anticipated measures are:

- Registration and inventarisation of plant genetic resources;
- Support of in situ conservation of wild animals species, that are relevant for food production;
- Support of on-farm management;
- Development of concepts for monitoring and management and
- Collection and ex situ conservation of agricultural and horticultural plants, including important special collections (fruit, vine, hop, tobacco and ornamental plants) (identification of existing collections, distribution of responsibilities, optimisation of procedures and conservation methods)

BMELV leads the implementation of the programme, together with a new Advisory and Coordinating Committee for plant genetic resources for food and agriculture, whose expert groups will support the different actors in this area. As in animal genetic resources, the IBV/ZADI will provide central accession to the different databases and compile comprehensive reports about measures. The *Laender* can set up own schemes or include some measures in existing programmes. Of high importance are cooperation and good communication between the different actors.

Recent developments

Examples for steps taken in 2003 are (ZADI-web-site):

- Continuing activities for the regional/local registration and recording of old vegetable species and cultivars.
- Development of concept for recording/inventory of crops (including old cultivars/landraces)
- Re-discovering of lost crops (*Bayerische Rübe*)
- Evaluation of barley cultivars within the national evaluation programme of plant genetic resources for cereals (EVA II), drawing together the private breeder's organisations, the public sector and research institutes.
- Completion of research project for the cultivation of lentils, including aspects of on-farm management

4.4 Future measures

New support measures of the Ministry

In February 2005, as an important contribution for the implementation of the national management plans, the BMELV issued an order, which regulates the **support of exemplary model and demonstration projects** in the area of protection and utilisation of biodiversity in agriculture, fishery and forestry and food. This programme aims at promoting conservation and development of genetic resources of crops in agriculture and horticulture, plants used in forestry, farm animals, aquatic animals and other plants, animals and microorganisms important for agriculture, forestry and fishery. Financial support will be given to projects, which help:

- to protect or enhance availability of genetic resources for the purpose of a future use for sustainable production, integrated rural development or securing the basic for the production of food, resources or energy sources together with documentation and public information. If possible, the results should be of use for organic agriculture and
- to strengthen sustainable utilisation of genetic resources, e.g. through the development of innovative products and procedures as well as new services for economic, social, ecological and cultural purposes.

The projects should link activities of different actors and offer new long term perspectives. Measures envisaged by the national management plans, projects across the *Laender* level or combining several measures, will be preferred. Examples are the development of urgently required ex situ collections, where they are not existing yet, the development and testing of new concepts and procedures of in situ conservation or breeding programmes or measures that aim to overcome technological, economic or institutional restraints that inhibit the utilisation of genetic resources.

The programmes on plant and animal genetic resources offer new approaches, but requirements for on-farm management are often vague and lack financial support. Because support measures with the objective to create a market for a specific product connected with genetic resources in agriculture always run the risk of failing, the *Laender* are often reluctant provide funding. The current support programmes might benefit from better coordination in the future. But there are successful examples, e.g. the establishment of a market for Schwäbisch-Hällisches Quality Meat, even above the region, which as contributes to the economic viability of small farms in a marginal area. Within the organic farming sector, a seed-supply system is already developing that differs from the conventional breeding sector. Such a different system would sustain the management of plant genetic resources on-farm.

5 Poland

5.1 Situation of agriculture and institutions involved in the conservation of genetic resources

After having suffered from an agricultural crisis in the 90s, resulting in land abandonment as a new phenomena in Poland and in a sharp drop especially of animal and milk production, new funds and instruments are becoming available with accession to the EU supporting agricultural production and offering possibilities for nature conservation. The integration of Poland in the EU will probably lead to more intensive production methods and enlargement of farms and field sizes, thus posing a threat to biodiversity, although single environmental problems, such as limiting the negative impact of small farms on water resources or better storage and use of fertilisers and pesticides, will be addressed more effectively. But experiences with SAPARD, which didn't lead to practical implementation of AEM, show, that environmental issues are not handled as a priority. As well, public awareness of biodiversity is low.

These developments and the introduction of commercial forms of food production also influence the genetic diversity in agriculture. The process of diminishing diversity of farm livestock and cultivated crops started in the 90s. Especially for sheep and horses but also pigs and poultry a decline of genetic diversity has been observed. Many genetically different varieties of crops are being replaced by modern and genetically similar varieties in the process of adaptation to EU-standards. But in some areas of Poland, many small farms with traditional management have still survived and together with them several old landraces of crops.

Systematic collection of plant genetic resources for agriculture has a long tradition in Poland and intensive work is undertaken to collect and document old local varieties of crops. Biodiversity of agriculturally utilised animals and crops in agriculture seems to be better explored than in the case of wild plant and animals. Knowledge at species and above-species (i.e. ecosystem) level is relatively good, while the intraspecific (genetic) level is much less investigated.

Institutions

For the different nature-related conventions and agreements the Department of Forestry and Nature and Landscape Conservation within the **Ministry of Environment (MoE)** provides the National Focal Point (Secretariat). The Ministry establishes the main goals for biodiversity protection, prepares programmes and strategies for their implementation, establishes new regulations on this field and coordinates the implementation of the National Strategy. For the protection of biodiversity in rural areas the MoE cooperates with the **Ministry of Agriculture and Rural Development (MoA)**. The MoA is responsible for the implementation of AEM and coordinates and supervises actions

concerning genetic resources in agriculture. As well it prepares regulations focusing on conservation of genetic resources.

On the regional level the Voivod and its offices (mainly the Voivodeship Nature Conservation Officer) are responsible for the implementation of the National Biodiversity Strategy. This involves the control of legislation for nature protection law by the Voivodeship Inspectorate of Environment Protection, Landscape Parks and cooperation with local authorities. The Main Inspectorate of Environment Protection is responsible for monitoring network.

The **Institute of Plant Breeding and Acclimatization (IPBA)**, where the **National Centre for Plant Genetic Resources** is located, coordinates and manages the gene bank for crops in Poland and is responsible for the dissemination of information. Concerning the conservation of genetic diversity, IPBA cooperates with National Parks and Botanical Gardens as well as with private persons protecting genetic variety in their gardens and parks. For livestock genetic resources, the **Central Station of Animal Breeding (CSAB)** and the **Zootechnical Institute** in Balice near Krakow are involved in storing genetic resources and providing information.

In Poland, 21 botanical gardens and arboreta, as well as 11 zoological gardens, numerous seed stands for forest trees and a centre for the breeding of game animals exist. There are several regulations⁵ regarding the conservation of the national genetic resources for food and agriculture and responsible institutions have a long tradition in the area. There is a well functioning system for ex situ conservation. Gene banks of plant and animal genetic resources receive annual funding from the national budget. However, the difficulties in a period of transformation have not allowed for funding of all needed actions.

⁵ **Act of the Statute on Crop Plant Protection. D.U. 01.22.248**

- Regulation of the Minister of Agriculture and Rural Development of 18 December 2001 on the conditions of breeding and storing harmful organisms subject to the duty of elimination, intended for research purposes or for work on creation of species to be cultivated.
- Regulation of the Minister of Agriculture and Rural Development of 8 May 2002 amending the regulation on combating harmful organisms.
- Regulation of the Minister of Agriculture and Rural Development of 25 July 2001 on the fees for services provided by Plant Protection Inspection.
- Announcement of the Minister of Agriculture and Rural Development of 9 May 2000 on the register of plant protection agents permitted for handling and marketing.
- Regulation of the Minister of Agriculture and Food of 28 December 1998 on the investment of the statute of the Head Plant Protection Inspectorate.

Table 2: Support for the conservation of genetic resources in Poland (Source: Questionnaire WP5 of MEACAP project; Poland: Zbigniew M. Karaczun)

	Plant genetic resource	Animal genetic resources
2001	2 498 500 (approx. 382000 Euro)	3 355 400 (approx. 916000 Euro)
2002	1 974 250 (app. 512000 Euro)	2 805 100 (app. 728000 Euro)
2003	2 100 000 (app. 463000 Euro)	1 781 400* (app.393000 Euro)

* first half of year 2003

Strategy and Action Plan for the Conservation and Sustainable Use of Biological Diversity

One means of Poland fulfilling its obligations concerning the CBD was the acceptance of the ‘**Strategy and Action Plan for the Conservation and Sustainable Use of Biological Diversity**’ in 2003. Its main aim is to protect the existing diversity of natural landscapes, species and genes for future generations. As one of its goals is named the ‘Conservation of diversity in agriculture, protection of species, subspecies and varieties of animals and plants used in agriculture’.

Measures being proposed within this framework are:

- Preparation of the national strategy for the protection of agricultural biodiversity (together with an implementation plan)
- Preparation of pieces of legislation regulating ex situ protection of genotype resources of cultivated plants and recognition of those resources as National Heritage
- Preparation and implementation programmes for the protection of native resources of farm livestock and fish
- Inventory and collection of old and local cultivated plant varieties and weeds (especially those in threat of extinction)
- Establishing of a National Bank of Plant Gene Resources (which now exists)
- Preparation of the National Strategy of Farm Animals Protection concerning breeds in threat of extinction
- Formal appointment of institution responsible for management of *ex situ* bank for farm animals
- Inventory of resources in existing ex situ banks
- Preparation of the Code of Good Agriculture and Fishery practices for biodiversity protection
- Maintenance of herds in situ e.g. by the implementation of agri-environment measures

Most of the activities proposed in this plan to halt the loss of biodiversity in the agricultural sector are rather general, more focused on passive protection than active conservation and dedicated rather to public institutions than to individual farmers.

5.2 Conservation of animal genetic resources:

Information about diversity of livestock is gathered by **National Database on Farm Animal Genetic Resources**. The data are sent to the CSAB, acting as National Focal Point for Animal Genetic Resources for Poland, where after validation they are registered in the national database, containing a description of every breed, variety or line of farm animals kept in Poland and a basic set of information (e.g. population size, performance results, special characteristics and endangerment status).

The **National Programme for the Protection of Genetic Resources** worked out in 1999 contains objectives and priorities for protection and precisely defined methods and organisational frameworks for the planned actions. An integral part of the Programme are the **breeding programmes** designed to ensure the protection of the genetic resources of different populations of livestock animals, giving justifications for their protection, detailed objectives, a timetable for action and a defined scope of measures for in situ and *ex situ* protection. Based on an agreement between a farmer and the National Coordinator Point for diversity protection in agriculture, financial support is granted to farmers for keeping protected breeds. The programmes also define the methods of breeding work and the responsible organisations. A total of 32 programmes for the protection of genetic resources are detailed, covering 75 breeds, varieties and lines animals (cattle, horses, pigs, sheep, poultry, rabbits, bees and fish). Still, these actions suffer from limited resources (see table 2). Between the year 2001 – 2003 funds spent on supporting farmers that kept protected breeds and varieties decreased by approximately 15 – 20%, resulting in some farmers resigning from these programmes.

Under SAPARD **agri-environment programmes** weren't implemented in practice. But for 2004 to 2006 three new horizontal AEM are included in the Rural Development Plan, targeted at the protection of local breeds of farm animals (11 breeds of horses, cattle and sheep), which are in danger of extinction (Bartoszuk, in BfN, 2005). The remaining breeds are still supported from the national conservation programmes.

Regarding the *ex situ* conservation of livestock genetic resources, collections are hold by the **CSAB** and the **Zootechnical Institute** in Balice. Seeds and embryos of cattle, sheep and goats are routinely frozen. Cryoconservation of seeds of pigs and horses is possible as well.

5.3 Conservation of plant genetic resources

Poland is a unique example for Eastern Europe, where several traditional landraces of crops survived owing to the ‘crumbled’ structure of farming. The most important area, where old varieties are cultivated, is the southern part of the country and includes the mountain regions of Beskidy, the Tatra and their forelands. Minor refugial regions have been discovered in eastern and south-eastern Poland in Polesie, Wyzyna Lubelska and in the basin of Sandomierz. Because of climatic, ecogeographic, and edafic conditions, in which local cultivars could compete with new varieties, and fairly primitive agricultural practices, those areas served as refuge for several local varieties. Well adapted to the specific environmental conditions, they guaranteed not high, but stable yields also in unfavourable years. Still, with structural and cultural changes in rural areas and abandonment of traditional farming methods, many of these old varieties are in danger of extinction. With many of these crops mainly being cultivated on small farms by old people who are strongly attached to tradition and who still harbour knowledge about methods of home multiplication of crops, this knowledge is at risk.

Main measures for the conservation of plant genetic resources in agriculture directly funded by the state are:

- support of botanical gardens, arboretums, gene banks and other institutions, and
- funding of almost yearly expeditions to search for and collect old cultivars and local landraces.

Collecting and both, ex situ and in situ conservation of plant genetic resources have a long tradition in Poland, beginning with activities of the Research Institute of Agronomy at Pulawy in 1922. The **Plant Breeding and Acclimatization Institute (IPBA)**, established in 1951, collected crops with particular consideration of the Polish local cultivars and ecotypes. In 1979 the **National Crop Genetic Resources Conservation Programme** was set up, aiming at preserving genetic material of major crops and their wild relatives for breeding and research through collection, evaluation, preservation and documentation of genotypes endangered with extinction. It is financed by the MoA and based on multi-institutional input. Three universities, 9 institutes, 7 experimental stations, and the Botanical Garden of the Polish Academy of Science carry the responsibilities for crop collections.

Systematic collection and conservation of indigenous plant genetic resources in Poland started in 1971 with expeditions being carried out almost annually with the following purposes:

- Collection of old cultivars and local landraces of agricultural and horticultural crops and their weedy and wild counterparts,
- collection of ecotypes of grasses,
- collection of plant material for research - special purpose collection,
- monitoring the progress of genetic erosion.

Whereas at the beginning the main focus was on field crops in the main regions of their occurrence, with increasing genetic erosion new groups of plants have been added. Systematic collection of vegetables began in the early 1990, while registration of old gardens of fruit trees and the collection of medical and ornamental plants found in house gardens are tasks recently assigned to the expeditions. The expeditions are organised by the Gene Bank Laboratory of the IPBA (agricultural crops and other species), the Botanical Garden of the IPBA (grasses) and the Department of Germplasm Collection of the Institute of Vegetable Crops (vegetables). This activity results in an inventory of the existing diversity of cultivated plants in Poland. The **National Centre for Plant Genetic Resources in the IPBA**, which as well manages the database of plants, coordinates *ex situ* conservation of plant genetic resources. It holds seed samples of all economically important plant groups: cereals, fodder plants, root crops, vegetables, fruit crops, herbage and industrial plants. The collections of hop, garlic, asparagus and fruit plants are maintained in the form of plantations; potato strains are stored *in vitro*.

In Poland, 73,000 genotypes of plants of importance for agriculture are preserved in different ways. Still, no measures for the conservation of local varieties of agricultural plants have been included in the Rural Development Plan of Poland.

6 Italy

Italy is the country with one of the highest number of breeds at risk within the EU15 but at the same time a comparably high level of support through AEMs (Signorello and Pappalardo, 2003). Following Reg. (EC) No.2078/92, there were AEMs within 15 regional programmes, which addressed ‘rearing animals of local breeds in danger of extinction’, and around 100 different animal breeds have been supported (Cicia et al. 2001). Under Reg. (EC) No.1257/1999, all regions, except Basilicata and Calabria, have set up AEMs for the conservation of breeds under risk of extinction (38,200 livestock units supported in 2002), with the regions supporting the highest number of livestock units being the Emilia-Romagna (10,000), Piemonte (7,500) and Lazio (5,700) (Oreade-Breche, 2005). In the Emilia-Romagna the spread of organic farming is said to have contributed to the interest in the measures. Some regions as well offer support for certain plant varieties. Such examples are the Emilia-Romagna, where premiums for certain species of apple trees and grape vines apparently have showed a strong effect (Oreade-Breche, 2005) or the Veneto, where some varieties of barley and maize are supported (Bonnieux et al., 2004).

Italy is an outstanding example in Europe of combining food culture and traditions with the conservation of genetic resources. In Italy, there has been an increased awareness of loss of environmental values connected with genetic erosion and at the same time increased demand for typical products derived from some endangered breeds (Cicia et al. 2001). E.g. the Emilia-Romagna tries to increase the commercial value of products from local breeds through the introduction of new quality marks (Oreade-Breche, 2005). The **Slow Food** movement, now an international association, was founded in Italy in 1986 and promotes food and wine culture, but also aims at preserving foods and cultivation and processing techniques inherited from tradition and domestic and wild animal and vegetable species. Of its 83,000 members worldwide, around 35,000 are from Italy (Slowfood 2005). In 2003 the Slow Food Foundation for Biodiversity was created. Its mission is to organise and fund projects that defend the world’s heritage of agricultural biodiversity and gastronomic traditions. While the Foundation promotes projects around the world, its direct financial contributions are especially dedicated to the world's less developed countries. So called Presidia projects try to defend typical products at risk of disappearing and especially support small-scale producers in the way that they facilitate cooperation between them and promotion of the products as well as creating a ‘network of experience’, including international exchanges. The primary partner of the Slow Food Foundation for Biodiversity is the Region of **Tuscany**, which has a long history of important cultural initiatives, linked to promoting and protecting biodiversity and coordinates various programmes for international cooperation. This Region promotes typical foods through a programme coordinated by the Rural Agricultural Development Agency (ARSIA), and in this context has supported many Slow Food projects. In addition, Tuscany was the first Italian region to institute a regional catalogue of traditional foods. In 2003 Slow Food in conjunction with the regional authorities of

Emilia-Romagna and Piedmont founded the **University of Gastronomic Sciences**, a unique private academic institution. Its objective is to create an international research and training centre, working to renew farming methods, protect biodiversity and focus on the relationship between gastronomy and agricultural science.

7 Resumee

7.1 Summary of case studies

Specific characteristics of the selected Member States

England:

- A national programme for the conservation of genetic resources is only evolving. Before Defra's review on genetic resources for food and agriculture in 2003, there has been no link between policy on genetic resources and policies on biodiversity and agri-environment. Defra now aims at connecting the conservation of genetic resources to the wider biodiversity policy, and a key priority is now the review of Defra policies impacting on genetic resources.
- There are no public incentive programmes. NGOs play a crucial role for the conservation of genetic resources. Especially conservation of livestock genetic resources has so far been dependent on NGOs and individuals.

Germany:

- A national concept with management plans for the conservation of livestock and crop genetic resources in Germany is already in place. Two central institutions for advice, information and documentation have been established (the German national evaluation programme for barley is now seen as a model for developing own information systems by the UK); several AEMs for endangered livestock breeds exist, but only little support for crops.
- Because of Germany's decentralised structure, a problem is constituted by the fact that a fragmentation exists between the *Laender* concerning support measures, documentation, herdbooks and cryoconservation. There are no consistent national guidelines for measures for conserving genetic resources, resulting in different emphasis and concepts throughout Germany. Especially concerning animal breeds, there is a need for better coordination of support measures over the different *Laender*.
There is no national programme for cryoconservation for livestock breeds yet. Cryoconservation of breeds is not carried out systematically and clear standards for identification and documentation are missing.

Poland:

- Systematic collection and conservation of indigenous plant genetic resources have a long tradition in Poland, and several traditional landraces of crops are still cultivated in less intensive 'traditional' farms
- A National Programme for the Protection of Genetic Resources has been worked out in 1999, establishing breeding programmes and support for farmers rearing certain animal breeds, but a big problem are limited financial resources dedicated to support genetic resources in agriculture.

Italy:

- Italy supports the highest number of breeds via AEMs in the EU and many regions have included measures for crops.
- The example of the strong Slow Food movement in Tuscany shows the success of a strategy of combining conservation of genetic resources of crops and farm animals with the promotion of traditional products.

Common measures and problems

Considering the case studies, many similarities can be found:

- **Ex situ conservation** of genetic resources is important as a backup for in situ conservation. If only few individuals of a variety or breed are left, it is the only possibility to preserve certain genetic material, as well in the case of an outbreak of diseases, which might threaten small populations. All countries of the case study support systems for ex situ conservation and take steps to improve systematic collection, registration and documentation of genetic resources and international cooperation in this respect.
- **In situ conservation** exposes the genetic material to natural conditions, which always involves a certain degree of adaptation to these circumstances. Livestock breeds and crops can be kept or cultivated on-farm. In all countries of the case studies rearing of certain livestock breeds is supported, sometimes within **AEMs** (Italy, most regions in Germany, Poland since 2004), according to **national breeding programmes** (in Poland) or by NGOs (in England support payments and information is given predominantly by **NGOs**). This kind of support does not cover all breeds, listed as critical or endangered, and the programmes can vary from one region to another. Support for the cultivation of certain varieties of crops is scarce.
- Problems with funding for such direct support measures are widespread, thus genetic diversity could benefit from a greater funding of Pillar Two.

7.2 Recommendations

Resulting from the above case studies, target actions for the conservation, collection and utilisation of genetic resources in food and agriculture defined by the EU in Regulation (EC) No.870/2004 and some recommendations mentioned in Oreade-Breche (2005), the following considerations are important for the conservation of endangered livestock breeds and plant varieties.

Documentation and evaluation of genetic diversity of breeds and crop varieties and international coordination

The case studies show the **importance of registration, documentation and evaluation** of genetic diversity of breeds and crop varieties and a need for improved coordination between regions and countries. As well according to EEA (2006b) it is difficult to draw

concrete conclusions on trends in the genetic diversity of livestock breeds and crop varieties, or to make reliable comparisons between Member States, thus data collection on livestock breeds and crop varieties and monitoring of their trends have to be improved and harmonised between all Member States. Especially conservation of animal breeds has to be subject of international **coordination beyond national borders** such as the development of joint conservation management plans, as many breeds exist in several countries, and cooperation as well has cost-benefits. Criteria for the categorisation and prioritisation of breeds and varieties should be standardised. Efforts have to be made for **more coordination between regions** within Member States (e.g. Germany) concerning protection efforts and related AEMs, linking of herdbooks, and building up a national programme for cryoconservation.

International exchange of information and coordination of conservation activities is an important target of Regulation (EC) No.870/2004. This includes:

- The development of a web-based, permanent and widely accessible network of national inventories on crop genetic resources as well as of animal genetic resources.
- Information exchange on methods, techniques and experiences of on-farm activities, including utilisation and marketing concepts
- Establishment and co-ordination of permanent European ex-situ collections for crops and cryo-conserves for animal genetic resources based upon the existing national or institutional ex-situ collections
- Characterisation and evaluation of crop and animal genetic resources used or potentially useful for food and agriculture
- Establishment and co-ordination of a European network of conservation and demonstration fields/gardens of endangered and under-utilised crop genetic resources, as well as of ‘Ark farms’, rescue-stations and farm animal parks for endangered European farm animal breeds
- Establishment of a standardised European performance testing regime for animal genetic resources in agriculture, and documentation of characteristics of endangered farm animal breeds and populations; development of common cross-national breeding programmes

Improving framework conditions

An important aspect in this respect is a **review of policies** impacting on genetic resources (as it is done in England), an identification of specific administrative, structural and normative restraints and possibly an adaptation of legal conditions in order to remove obstacles for the use and distribution of genetic resources (e.g. restrictive legislation concerning breeding of livestock or for circulating seeds from plant genetic resources; marketing and food quality requirements).

Support of in-situ conservation

In order to ensure on-farm management of genetic resources, national programmes and financial aid are needed, not only concentrating on farmers, but as well addressing further actors and organisations involved in the conservation of genetic resources. On-farm management provides the possibility to preserve or re-introduce a high variety of marketable products. This can be enhanced by information of the public in order to raise awareness and support of relevant projects.

AEMs address on-farm conservation of selected species (keeping of rare local breeds of farm animals and the cultivation of rare plant varieties). The intended impact is on genetic diversity but there can be positive impacts on landscape as well (EEA, 2006b). Still, according to Oreade-Breche (2005), some measures have suffered from low uptake due to low premiums for farmers (e.g. in Finland, Italy and the Netherlands). AEMs supporting on-farm management of plant and livestock genetic resources should be further developed and their financing be ensured. It should be investigated in how far actors other than farmers, e.g. hobby breeders could be included. Regulation (EC) 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) allows according to article 39 to grant agri-environmental payments to ‘other land managers’.

A general problem connected with AEMs, especially for the cultivation of certain crops, is that long term commitment of farmers is not guaranteed and that bureaucratic effort is comparably high, when supporting single species or plant variety on different farms. Contract area per rare variety, or number of rare breeds supported through AEMs will always remain rather limited, so that the administrative burden relative to the amount of grants is high compared to other AEMs. High administrative burden will result also from administration and control standards which do not fully fit with the conditions of in-situ conservation. In this aspects, the focus on AEMs as tool for in-situ conservation has been misleading. Obviously, there is a certain reluctance of Member States to implement AEMs especially in the field of rare crop varieties, which can partially be explained by high administrative burden and lack of specific know-how to run such programmes. Thus, AEMs should only complement a more institutionalised conservation, e.g. in **botanical gardens with a focus on agriculture** or **specialised projects and organisations, e.g. ‘Arc farms’**, whose activities comprise several species or varieties. These projects as well pose the possibility of being better connected internationally. There should be more focus on project support for relevant actors which often are non-farmers. However, regulation (EC) 1698/2005 does not provide a clear option to support such projects. Article 57 on ‘Conservation and upgrading of the rural heritage’ is rather restrictive, focussing on Natura 2000, or villages and landscape. The scope should be widened in order to allow for project support. Another option would be to include such activities under the LEADER approach (axis 4 of EAFRD).

Measures linked to nature conservation

As a focus of the MEACAP project is on land use, **on-farm conservation** and the **connection to landscape management** and nature conservation is especially interesting. An evaluation of AEMs under Reg. (EC) No.2078/99 underlined, that support of rare breeds could induce farmers to stay in marginal rural areas (Fadlaoui et al. 2005). On the other hand, abandonment of marginal farmland, where more often traditional breeds and crops are still being used, as the Polish example shows, could lead to rare breeds not being utilised any more.

- Wild relatives of crops can be preserved in natural surroundings, and can thus profit from measures directed at the **conservation of general biodiversity** e.g. within Natura 2000 areas, species rich grassland and other nature conservation measures. Here, as well the design of cross-compliance requirements concerning the **conservation of permanent pasture** play a role. These synergies should be considered.
- Traditional livestock breeds are often associated with high-nature value farmland (EEA, 2006), and **landscape conservation measures** can be dependent on hardy breeds (traditional breeds are often smaller than mainstream breeds and their feet do less damage to the ground; they can cope with the local climate and can sometimes digest poorer plants). This connection should be taken into account when designing support measures (e.g. the Dutch national scheme has already encouraged conservation organisations to use rare breeds for grazing in nature reserves (Oreade-Breche, 2005); in England and Wales the use of eligible traditional breeds in environmental land management projects in certain areas qualifies for extra support; the EC (2005b) found very positive impacts of AEMs supporting rare livestock breeds linked to transhumance). Minimum maintenance requirements for non-cultivated land through cross-compliance might enhance the need for such animals in areas that are not suitable for mowing.
- **Organic farming** relies on crop varieties and livestock breeds that can cope with less intensive management. Support of organic farming can increase interest in such breeds and plant varieties).

Providing information

Insufficient information about availability of measures and technical implementation has apparently been hampering the uptake of AEMs (e.g. in some Italian regions, see Oreade-Breche, 2005). The processing and use of products stemming from crops and livestock genetic resources is dependent on knowledge about them. It is crucial to increase awareness of consumers; farmers and processors of products about the existence and the use genetic resources.

Increasing the commercial value of genetic resources

The importance to develop strategies on how to **increase the commercial value of regional products** connected to rare breeds of plant varieties is mentioned by many sources (BMVEL, 2005; Oreade-Breche, 2005; Reg.(EC) No.870/2004; Signorello and Pappalardo, 2003).

- Mere in situ conservation is no compensation for diverse ecosystems and multifunctional agriculture. The most important option for the conservation of genetic resources has to be the **active utilisation of agrobiodiversity**, as a key motivation for farmers is to produce marketable goods. So far, efforts have mainly consisted in financial support for the conservation of genetic resources, and the link to product processing and marketing stays weak. Projects for on-farm management of genetic resources depend on the **development of possibilities for marketing** of emerging products (Efken, 2005). This is happening only on a small scale within some projects or initiatives, although there are successful examples for cooperation and building up networks between farmers and producers especially in Italy but as well in Germany. For an expansion of these activities and an effective framework for on-farm management, economic as well as biological aspects (socio-economic, marketing, processing, product quality, population genetics) have to be investigated. Examples show, that interest in a crop, local use, functioning village life, as well as some appreciation of local traditions, appear to be the key elements of functioning on-farm management projects (Efken, 2004). Agenda 21 programmes might pose a chance to organise such projects as community based activities. Development of marketing activities of products related to crop and livestock genetic resources should be supported. Here, possibilities of EAFRD support, e.g. LEADER, should be promoted.
- **Biomass production for non-food purposes** (e.g. for energy use) can contribute to genetic diversity, if traditional crops are used. Such innovative approaches should be supported, but need further investigation to identify such opportunities.
- Besides developing markets for products derived from rare genetic resources, the value of local breeds for environmental services and their **contribution to the multifunctional character of agriculture** (e.g. landscape conservation, maintenance of rural cultural diversity, tourism, etc.) should be identified and promoted.

Exchange of experiences and search for 'best practice'

In the area of supporting in-situ conservation, few experiences have been gathered and exchanged internationally so far. In future, conferences and cooperation activities in the field of agricultural biodiversity should include an exchange of experiences on policy options to support in-situ conservation, and how to connect such efforts with landscape management and marketing.

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Abbreviations

AEM: Agri-environment measure

BAZ: Federal Research Centre for Breeding Research on Cultivated Plants (*Bundesanstalt für Züchtungsforschung*)

BMELV (formerly BMVEL): Federal Ministry of Food, Agriculture and Consumer Protection

CBD: Convention of Biodiversity

CGRFA: Commission on Genetic Resources for Food and Agriculture

CSAB: Central Station of Animal Breeding

IPBA: Institute of Plant Breeding and Acclimatization

Defra: Department for Environment, Food and Rural Affairs

DGfZ: German Society for Animal Production (*Deutsche Gesellschaft für Züchtungskunde*)

DUS-criteria: criteria of distinctness, uniformity and stability

EAP: Environmental Action Programme

ECP/GR: European Cooperative Programme for Crop Genetic Resources Networks

GEH: Association for the conservation of traditional endangered domestic animal breeds (*Gesellschaft zur Erhaltung alter und gefährdeter Haustierrassen*)

IBV: Information Centre for Biodiversity (*Informationszentrum für Biologische Vielfalt*)

IPGRI: International Plant Genetic Resources Institute

RBI: Rare Breeds International

RBST: The Rare Breeds Survival Trust

RDP: Rural Development Plan

TGRDEU: Central Documentation of Animal Genetic Resources in Germany (*Zentrale Dokumentation Tiergenetischer Ressourcen in Deutschland*)

UPOV: International Union for the Protection of New Varieties of Plants

ZADI: German Centre for Documentation and Information in Agriculture (*Zentralstelle für Agrardokumentation (Informationszentrum für Biologische Vielfalt)*)

Annex 1: EU Monitoring Data for Rural Development Programmes – AEM for the support of livestock genetic resources in 2003

n.d. = no data; not appl. = not applicable									
Member State/Region	Supported livestock breeds (no of total LU) (Reg. 1257/1999)	cattle	sheep	goats	equidae	pigs	mixed	Supported livestock breeds (no of total LU) (Reg. 2078/92)	Supported livestock breeds (no of total LU)
AT/NAT	15861	11289	792	247	3498	35	0	0	15861
BE/FLA	2947	124	2392	142	289	0	0	757	3704
BE/WAL	1799						1799	1880,55	3679
DE/BAY	not appl.							n.d.	n.d.
DE/BDW	n.d.							n.d.	n.d.
DE/BER	0							0	0
DE/BRA	2296	2221	69	0	0	6	0	not appl.	2296
DE/BRE	0							0	0
DE/HAM	n.d.							n.d.	n.d.
DE/HES	not appl.							not appl.	not appl.
DE/MEV	not appl.							not appl.	0
DE/NSX	1430	346	1028	0	56	0	0	0	1430
DE/NWF	2084	418	789	0	795	22	60	277	2364
DE/RHP	not appl.							not appl.	0
DE/SAA	not impl.							not appl.	n.d.
DE/SAC	217	92	36	27	57	6	0	86	303
DE/SAN	238	84	63	17	74	0	0	69,9	308
DE/SWH	0							0	0
DE/THU	404	23	100	5	125	0	151	576,35	980
DK/NAT	not appl.							not appl.	
ES/ARA	n.d.							n.d.	n.d.
ES/BAL	n.d.							n.d.	n.d.
ES/CAT	not appl.							not appl.	not appl.
ES/LRI	n.d.							n.d.	n.d.
ES/MAC (nat. RDP)	23982	9654	5437	1464	5648	201	1578	878,7	24860
ES/MAD	not appl.							not appl.	not appl.
ES/MSA (Obj.1)	n.d.							n.d.	n.d.
ES/NAV	534	201	0	0	333	0	0	0	534
ES/PBA	816	476	0	0	340	0	0	0	816
FI/ALA	60	0	60	0	0	0	0	0	60
FI/FAM (nat. RDP)	3306	1162	1035	209	893	0	0	0	3306
FI/FCO	n.d.							n.d.	n.d.
FR/NAT	2789	n.d.	n.d.	n.d.	n.d.	n.d.	2789	3106,6	5896
GB/ENG	n.d.							n.d.	n.d.
GB/NIR	not appl.							not appl.	not appl.
GB/SCO	not appl.							0	
GB/WAL	not appl.							n.d.	n.d.
GR/NAT	8611	2469	3500	1112	1530	0	0	3844	12455
IE/NAT	n.d.							n.d.	n.d.
IT/ABR	n.d.							58	n.d.
IT/BAS	n.d.							0	n.d.
IT/BOL	1192	0	0	0	0	0	1192	256	1448
IT/CAL	n.d.							n.d.	n.d.
IT/CAM	n.d.							1170	n.d.
IT/EMR	7566	7349	14	0	202	2	0	1614,57	9181
IT/FVG	n.d.							n.d.	n.d.
IT/LAZ	3331	0	0	0	0	0	3331	0	3331
IT/LIG	134	25	81	0	28	0	0	454	588
IT/LOM	503	0	503	0	0	0	0	25,55	529
IT/MAR	not appl.							0	
IT/MOL	8	0	7	0	1	0	0	8	16
IT/PIE	8077	5557	1435	114	0	0	971	35,85	8113
IT/PUG	n.d.							828,661	n.d.
IT/SAR	not appl.	0	0	0	0	0	0	278	278
IT/SIC	146	146	0	0	0	0	0	637,24	783
IT/TOS	16947	3688	7807	0	2090	3362	0	540	17487
IT/TRE	1047	994	0	14	39	0	0	6	1053
IT/UMB	535	0	0	0	530	5	0	39	574
IT/VDO	667	667	0	0	0	0	0	0	667
IT/VEN	4631	0	0	0	0	0	4631	0	4631
LU/NAT	90	0	0	0	90	0	0	3	93
NL/NAT	not appl.							n.d.	n.d.
PT/ACO	294	294	0	0	0	0	0	17	311
PT/MAD	not appl.							0	not appl.
PT/PCO (continent)	63605	45923	5830	1749	2211	717	7174	1232	64837
SE/NAT	4450	2934	1235	222	0	59	0	n.d.	n.d.

Annex 2: Agri-environment measures for rare breeds in Germany

Agri-environment measures to support the keeping of rare animal breeds in the German *Laender* (source: national report and Rural Development Programmes of the *Laender* and their mid-term reviews)

Land	Measure	Premium	Support as well in:
Baden-Württemberg (BW)	AES ⁶ Marktentlastungs- und Kulturlandschaftsausgleich (MEKAI): C3 <i>Erhaltung gefährdeter regionaltypischer Nutzierrassen</i> (Conservation of regionally typical endangered animals breeds)		
	Schwarzwälder Fuchse (H ⁷) Altwürttemberger Pferd (H) Süddeutsches Kaltblut (H) Hinterwälder Rind (C ⁸) Limpurger Rind (C) Braunvieh alter Zuchtrichtung (C) Vorderwälder Rind (C) Schwäbisch-Hällisches Schwein (P ⁹)	100 €/female animal for breeding (only own funds)	NI NI BY NW
Bavaria (BY)	<i>Richtlinien für die Förderung der Tierzucht</i> (Guidelines on the Promotion of Animal Breeding) (only funds of the land)		
	Rottaler (H) Ansbach-Triesdorfer (C) Braunvieh alter Zuchtrichtung (C) Murnau-Werdenfelser (C) Pinzgauer (C) Braunes Bergschaf (S ¹⁰) Brillenschaf (S) Coburger Fuchsschaf (S) Rhönschaf (S) Steinschaf (S) Waldschaf (S)		BW NI
Brandenburg (BB)	AES within KULAP (cultural landscape programme) C: Conservation of genetic diversity: C1 <i>Züchtung und Haltung vom Aussterben bedrohter lokaler Nutzierrassen</i> (Breeding/keeping of animal breeds endangered of extinction)		

⁶ Agri-environment scheme

⁷ horse

⁸ cattle

⁹ pig

¹⁰ sheep

Saarland (SL)	AES <i>Erhaltung lokaler vom Aussterben bedrohter Nutzierrassen</i> (conservation of local endangered breeds) (KULAP according to Reg. 2078/92; phasing out)		
	Ardenner Kaltblutpferd (H) Glan-Rind (C)		
Saxony (SN)	AES <i>Umweltgerechter Landbau</i> (Environmentally sound cultivation): Part D <i>Erhaltung genetischer Ressourcen</i> (Conservation of genetic resources)		
	Sächsisch-Thüringisches Kaltblut (H) Rotvieh Zuchtrichtung Höhenvieh (C) Deutsches Sattelschwein (P) Leineschaf (S) Skudde (S) Erzgebirgsziege (G) Thüringer Wald Ziege (G ¹¹)	153€ up to 2 years: 76€; >2 years: 127€) 100€ 18€ for sheep and goats	TH TH, HE, NW, ST, NI BB, MV, TH NI BB TH
Saxony-Anhalt (ST)	Within AES <i>Markt- und standortangepasste Landbewirtschaftung (MSL)</i> : F4 <i>Erhaltung lokaler, heimischer und vom Aussterben bedrohter Nutzierrassen</i> (Conservation of endangered local animal breeds)		
	Altmärkisches Kaltblut (H) Schweres Warmblut (H) Rotvieh Zuchtrichtung Höhenvieh (C) Braune Harzer Ziege (G)	102€/LU (female animals for breeding)	TH, SN HE, NW, TH, SN, NI
Schleswig-Holstein (SH)	Support of animal production (only funds of the Land: grants for buying, keeping and raising animals, for genetic tests, to organisations for coordination and identification)		
	Schleswiger Kaltblut (H) Rotvieh alter Angler Zuchtrichtung (C) Deutsches Shorthorn (C) Angler Sattelschwein (P) Rotbuntes Husumer Schwein (P)		NI NI NW
Thuringia (TH)	AES Programme for support of environmentally sound agriculture (KULAP); measures within part C:C8 <i>Zucht vom Aussterben bedrohter, einheimischer Nutzierrassen</i> (breeding of endangered animal breeds)		
	Schweres Warmblut (H) Sächsisch-Thüringisches Kaltblut (H) Rotvieh Zuchtrichtung Höhenvieh (C) Deutsches Sattelschwein (P) Rhönschaf (S) Leineschaf (S) Thüringer Wald Ziege (G)		SN, NI SN SN, ST, NW, HE, NI BB, MV, SN BY NI, SN SN

¹¹ goat