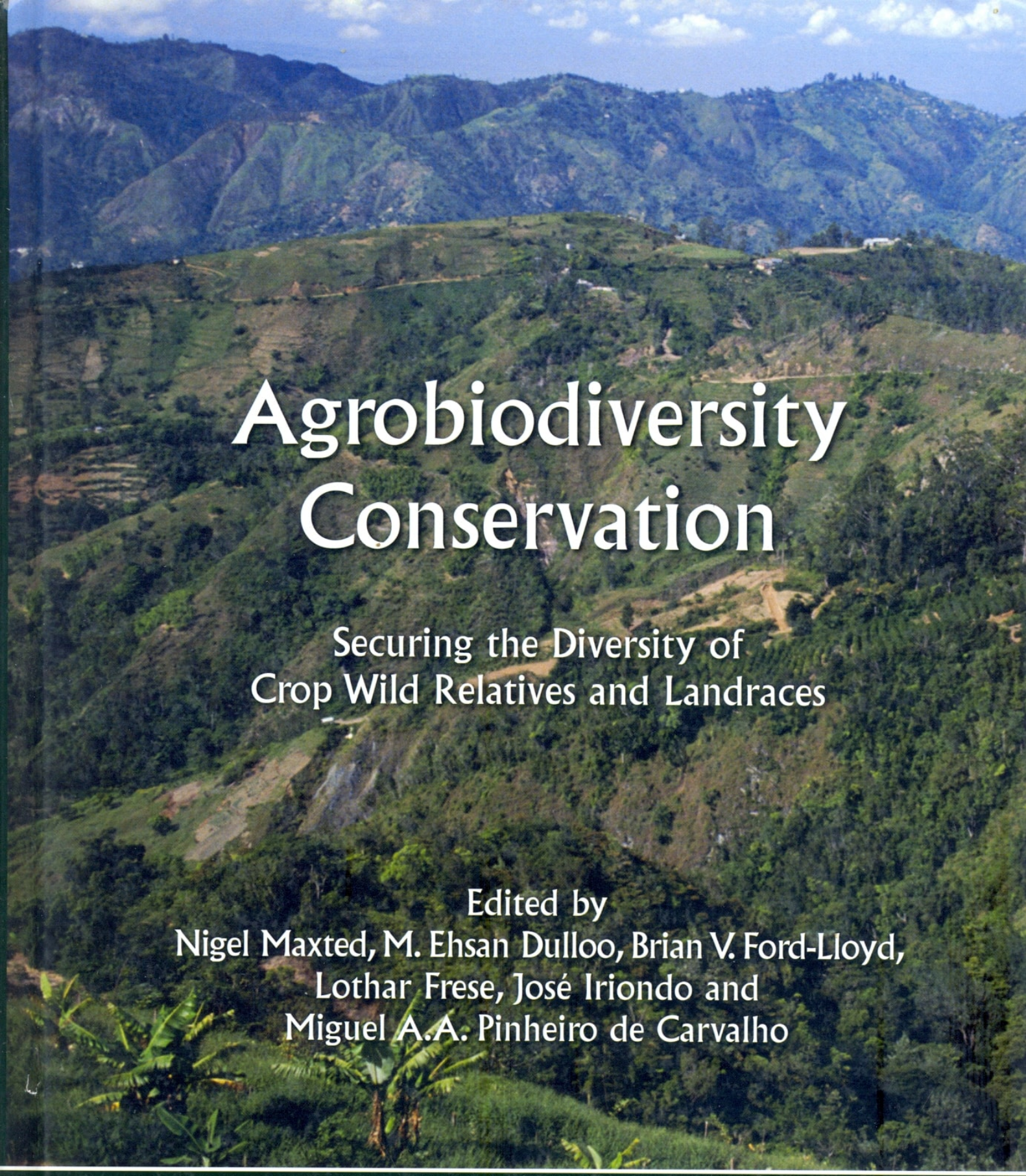

Agrobiodiversity Conservation

Securing the Diversity of Crop Wild Relatives and Landraces

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FCT Fundação para a Ciência e a Tecnologia
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42 European On-Farm Conservation Activities: An Update from Six Countries

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42.1 Introduction

There has been a growing interest in on-farm conservation in Europe in recent years and the membership to the On-farm Conservation and Management Working Group of the ECPGR (European Co-operative Programme for Plant Genetic Resources) has increased as a consequence. The Working Group presently has 31 state members and one representative from NGOs. The aim of the Working Group is to promote the conservation and use of landrace diversity on-farm across Europe. A number of activities and tools were prepared by the group in the last couple of years to raise awareness of the on-farm conservation community. Two publications (Bailey *et al.*, 2009; Veteläinen *et al.*, 2009) reviewed the status and problems related to on-farm and home garden conservation in Europe, a website was launched to facilitate the sharing of information (www.sharinginformation.eu) and an on-farm data recording scheme was established and put online (see www.ecpgr.cgiar.org/Networks/Insitu_onfarm/Docs/OnfarmDescr_DRAFT271107.pdf) to help recording information on-farm. Finally, contacts were established with several stakeholders (especially farmers, farmer organizations and NGOs), European funded projects (AEGRO, FSO, PGR secure and SOLIBAM) and other ECPGR Working Groups.

A survey on the status of the national plans for preserving genetic resources was carried out during the first joint meeting of the 'Wild species in genetic reserves' and 'On-farm conservation and management' Working Groups, of ECPGR *In-situ* and On-farm Conservation Network, held in Funchal, Madeira, in September 2010. It showed that most countries have initiated the inventory of their landraces and old cultivars, and one (Switzerland) has completed its own (B. Schierscher-Viret, Madeira, 2010, personal communication). The survey revealed the following constraints in fulfilling inventory tasks:

- Lack of resources;
- Lack of proper methodology; and
- Lack of purposely developed national policies and local difficulties in applying the present EU seed legislation.

It seems that there is a long way ahead before complete inventories will be available for each country. This severely hampers possible conservation, rescue and further dynamic use of European landraces and old cultivars.

Following the 2008/62/EC, 2009/145/EC and 2010/60/EU Commission Directives on seed commercialization of conservation

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varieties, 110 of them were registered in the European common catalogue (Table 42.1). Most of them are open-field crop (bread and spelt wheat, barley, oat, maize, potato, swede and *Vicia* spp.) varieties coming from Austria, Estonia, Finland, Germany, Italy, Romania, Slovenia, Spain, Sweden and the UK (Table 42.1). Only a few horticultural crop conservation varieties have been registered to date, probably because the relative Directive has not been received at each National level yet. These (including cardoon, pepper, leek, celery, common bean, pea and tomato) conservation varieties come from Italy and Spain (Table 42.1). It should also be mentioned that Finland also has landraces (two potato, two white clover and four timothy) registered as varieties. It is yet to be seen whether, overall, these Directives will benefit landrace and on-farm conservation. They do not specifically address conservation *per se* but only seed production and marketing and it is unlikely that it will be possible for all the surviving landraces to be commercialized.

42.2 Updated Reports from Individual Countries

42.2.1 Azerbaijan

Agriculture appeared in Azerbaijan several millennia BC, as evidenced by the excavations

Table 42.1. Landraces registered as conservation varieties (CV) by each single country and in total in January, 2011.

Latin name	Member state	CVs	Latin name	Member state	CVs
×*Triticosecale* Wittm. ex A. Camus	RO	2	*Pisum sativum* L.	IT	1
Total		2	Total		1
Allium porrum L.	IT	1	*Secale cereale* L.	FI	6
Total		1		DE	1
Apium graveolens L.	IT	1	Total		7
Total		1	*Solanum tuberosum* L.	EE	1
				ES	2
Avena sativa L. (including *A. byzantina* K. Koch)	RO	2		SE	14
	SE	5		DE	4
Total		7	Total		21
Brassica napus var. *napobrassica* (L.) Rchb.	UK	4	*Sorghum bicolor* (L.) Moench	AT	1
Total		4	Total		1
Capsicum annuum L.	ES	1	*Triticum aestivum* L.	AT	2
	ES	2		DE	2
	IT	3		RO	9
Total		6		SE	14
Cynara cardunculus L.	IT	1	Total		27
Total		1	*Triticum spelta* L.	AT	1
Hordeum vulgare L.	FI	1	Total		1
	RO	2	*Vicia faba minor* L.	DE	1
	SE	7	Total		1
	UK	1	*Vicia sativa* L.	RO	1
Total		11	Total		1
			Zea mays L.	ES	5
Lycopersicon esculentum Mill.	ES	1		IT	8
Total		1		SI	1
Phaseolus vulgaris L.	ES	1	Total		14
	IT	1			
Total		2	Overall total		110

in Chalagantapa, Aghdash region, and Misharchay Jalilabad region, which show evidence of settlements sowing grain-crops 5000–6000 years ago. Azerbaijan also has quite different pedoclimatic conditions, resulting in the presence of more than 75% of the higher plants of the Caucasus (i.e. 4500 species).

A wide diversity of modern fruit crops' wild relatives is present with more than 149 species of fruit crops belonging to 39 genera and 15 families. For example, Azerbaijan sea-buckthorn *Hippophae rhamnoides* L. has over 80 forms. This species is widely used as a medicinal plant, as food and feed, as well as an ornamental and as protective belts and fences for the prevention of erosion and for soil reclamation. Three cultivars of the Azerbaijan sea-buckthorn were bred and released by the Genetic Resources Institute using the natural diversity. They showed high yield (18–25 t/ha), big fruit (fruit weight, 50–60 g) and weak or absent thorns (Musayev, 2008).

In addition, each region of the country is famous for different fruits: for example, Shirvan for its quince and pomegranate, Nakhchivans for its apricots and peaches, Zakatala for its nuts and walnuts, Apsheron for its figs and grapes, Guba for its apples and pears. There is an uncountable number of ancient varieties for each species and each of them is peculiar for the taste and the quality of the fruit. Exploration missions carried out by the Genetics Resources Institute recorded a high number of species present, but also documented that many wild species (including wild relatives) and landraces are at risk. This instigated the creation of germplasm collections for their conservation and use.

42.2.2 Cyprus

Ex situ conservation activities began in the late 1970s (Della, 2002) and led to the current National Gene Bank, which hosts 26 barley and 58 durum wheat, 19 lentil, 28 chickpea, 15 bitter vetch, 12 ochrus vetch, 19 grass pea, 29 lucerne and 6 pea landrace accessions. In the framework of the EU-funded RUBIA project endemic and rare plants, medicinal and aromatic plants, pistachio, almonds and carob trees (Della *et al.*, 2006) and tomato, melon, and bean landraces were also collected as part of the INTERREG IIIC Programme (see http://farvaldi.maich.gr/home/). These actions provided the necessary framework upon which present on-farm conservation activities of barley and vegetable species' landraces have been initiated (Fasoula and Kyratzis, 2010; Fasoula, 2011) between the Agricultural Research Institute in Nicosia and the Ministry of Agriculture, Natural Resources and the Environment. Local farmers have been preserving landraces with various degrees of persistence and success, depending on the region and their individual capacity. However, many of them have already disappeared, mostly due to the ageing of farmers and the spread of new cultivars. At present, the Agricultural Research Institute is trying to identify, register and locate the surviving landraces and serve as a focal point for their conservation, to monitor their most efficient propagation and evolution in the field, and to make available the seeds to interested farmers. There is a growing interest among younger farmers in their use. It is hoped that this approach will contribute to the revival of some of the most valuable landraces, along the lines of other previously successful cases in the EU, e.g. cowpea landraces in Italy (Polegri and Negri, 2010).

42.2.3 Czech Republic

After political changes in the Czech Republic, there were important changes in agricultural priorities. The Czech market has opened up for useful traditional materials especially in connection with organic farming, due to the rise in demands for both vegetarian and health foods and for the diversification of species and crops. In this context it would be useful to use crops that are unique for the traditional use for which they were bred, cultivated and valued, as in

the case of the Carpathian emmer wheat, *Triticum dicoccon* Schrank, that was used for making peeled hulled grain for blood sausages and for soups. Several attempts have been made to set up on-farm conservation activities that involve national parks, regional organizations, museums (addressing educational and demonstration needs) and private citizens (addressing landrace production), all based on reintroduction from material preserved in gene banks. While on-farm conservation of fruit trees presently seems to be very successful for the future, long-term on-farm conservation of herbaceous plants is usually temporary and not as certain.

Several typical landraces, from various Czech regions, have been chosen for on-farm conservation trials (Holubec *et al.*, 2010), among them landraces of emmer and einkorn wheat from the Czech-Slovak border, perennial tufty rye, grass pea, common bean, medicinal and condiment plants, shallot onion, red cabbage, lettuce and several fruit trees (apples, pears, cherries, plums and rowan). As for fruit trees in particular, based on the plant determination and description in the different regions of the Czech Republic, landraces were selected for the establishment of on-farm conservation fields (Paprštein *et al.*, 2010) that were established in Vrchlabí, Krkonoše National Park, in Neratov, Orlické Mts, in Znojmo, Podyjí National Park and in the Šumava National Park (Table 42.2). Several more places are presently being proposed and discussed among stakeholders as conservation sites.

42.2.4 Finland

The multidisciplinary project 'On farm conservation in Finland' (2006–2008), carried out by MTT Agrifood Research, studied the on-farm management and the social and cultural aspects and values anchored to landraces that motivate farmers to grow cereal landraces at the present time and in the future. In total 34 farms were contacted, 47 notifications of cereal landraces or old cultivars in cultivation were received and 14 thematic interviews were carried out.

There is a wide range of reasons for landrace cultivation. Aged farmers valued strongly the use value of their landraces in traditional cooking (e.g. baking bread). They also underlined the good cultivation properties (e.g. yield reliability). Young farmers considered it as a family heritage and had very personal, close and intimate connection to the landrace itself. The more market-oriented landrace farmers saw landraces' potential to niche markets because of their rarity, taste and history. In contrast, hobby farmers highlight the cultural and historical as well as genetic diversity values and their own searching for specialities and flavour experiences as motivation to cultivate landraces.

A broad and versatile range of actors are needed to keep cereal landraces in cultivation (Heinonen, 2009). The recent national support system for on-farm maintenance of some crops is targeted to active farmers, but it was not seen suitable or useful by most of the landrace farmers. However, the national implementation of the EU directive 2008/62/

Table 42.2. On-farm conservation of fruit trees in the Czech Republic (Paprštein *et al.*, 2010).

	No. of landraces per region			
Fruit species	Vrchlabí, Krkonoše NP 2002	Neratov, Orlické Mts 2004	Znojmo, NP Podyjí 2005	NP Šumava - 2008
Apple	25	29	5	14
Pear	4	21	8	3
Sweet cherry	10			
Sour cherry	4			
Plum	4	2		
Total	47	52	13	17

EC which led to register several conservation varieties in the national list (Table 42.1) has raised somewhat the awareness of landrace cultivation or even functioned as an incentive. This can be seen by the increased number of contacts from farmers and private persons to the National Programme for PGR so that there is evidence of a slight positive trend. However, it needs to be stressed that new activities, such as product development of landrace-based products and cultural activities, will promote the continuity of the cultivation of landraces. Local museum gardens have a potential to demonstrate and to promote especially heritage plants. A comprehensive national inventory on landraces, especially on horticultural crops, is still needed for further promoting landrace conservation.

42.2.5 Germany

The Federal Ministry of Agriculture (BMELV) has launched programmes for conservation and use of plant genetic resources since 2002. Up to now 58 projects have been granted, 39 of them covering plant genetic resources. Objectives and themes are widespread, including orchards and fruit trees, regional inventories of cherries, *in situ* measures for wild apple, database establishment of regional crop wild relatives, managing and testing of regional lettuce collections for small scale and commercial use and the establishing of a gene bank for selected crop wild relatives under national responsibility.

EC agro-environmental programme (ELER-Directive 1698/2005) is used by Nord-Rhein-Westfalen and Brandenburg federal member states, offering advice and subsidies for the cultivation and use of rye, wheat, barley and oat cultivars and landraces of historic importance. As a result, a network of farmers dedicated to old cultivars' cultivation and to food technology for new products, has been established involving about 500 ha, 60 farmers and more than 50 varieties.

A national list of available and described landraces and old cultivars was brought up as a draft (BMELV/BLE 2010) and is recently under discussion. For the purpose of the common agro-environmental measures (ELER-Dir. 1698) a regional inventory of described, available and tested grains has been published (www.isip.de/coremedia/generator/isip/Start, documentId =103084.html). Further activities are running under the EC scheme of LEADER+- and INTERREG programmes and under a national umbrella of programmes for renewable resources. The national implementation of the EC-directives for conservation varieties actually sees eight varieties listed (Table 42.1). Although a growing community of gardeners and farmers has become engaged to plant for genetic resources conservation in the past, commercialization, industrial techniques in agri- and horticulture and the present restrictive behaviour of European seed legislation still limit their use and conservation.

42.2.6 Italy

Following the publication of the National Plan for Agricultural Biodiversity and the implementation of the above mentioned Commission Directives on seed marketing of conservation varieties at the national level, the Italian Ministry of Agriculture has funded a work aimed to promote and facilitate the implementation of the plan and of the Directives at the national level. The first step of this work is to provide the Italian Regions, which have jurisdiction for preserving plant genetic resources, with a set of operative instruments. Prior to the EU regulations, Italy and some Italian Regional Governments passed and implemented laws to safeguard genetic resources and to implement the provisions of the FAO Treaty (Lorenzetti *et al.*, 2009; Porfiri *et al.*, 2009). These led to regional inventories of genetic resources. In order to help the Regions to inventory landraces, a manual on *in situ* (on-farm) and *ex situ* conservation problems, methods and possible outcomes is being developed (Marino,

2010) by a group including experts, NGO representative persons, officers of the Variety Registration office, gene bank manager, professors and researchers of several Universities, the National Research Council and the Agricultural Research Council. The manual would also help in identifying those landraces that are compliant with the requirements foreseen by EU Directives on marketing of seed of conservation varieties and be useful to other countries to develop an appropriate approach to *in situ* on-farm conservation.

42.3 Conclusions

This short review of significant updates shows an increased awareness of landrace importance serving farmer needs. It is hoped that it will help in further enhancing on-farm conservation activities.

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43 Current and Future Threats and Opportunities Facing European Crop Wild Relative and Landrace Diversity

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43.1 Introduction

Conservation budgets are increasingly under pressure from alternative demands for funding and, as conservation is largely funded from the State and there are many competing funding demands, there is an imperative to maximize the efficiency of conservation expenditure. Any activity that helps target expenditure is thus a priority. Addressing this issue is as important for those conserving agrobiodiversity as it is for those with a more generic biodiversity conservation mandate.

Identifying both short and longer term priorities were discussed and prioritized during the first joint meeting of the 'Wild species in genetic reserves' and 'On-farm conservation and management' Working Groups, of the European Cooperative Programme for Plant Genetic Resources (ECPGR) *In situ* and On-farm Conservation Network. This meeting, held in Funchal, Madeira, on 16 September 2010, was held at the end of the symposium 'Towards the establishment of genetic reserves for crop wild relatives and landraces in Europe', which was the final dissemination meeting of the EC AGRI GENRES 057 project An Integrated European In Situ Management Workplan: Implementing Genetic Reserve and On-farm Concepts (AEGRO). For the *In situ* and On-farm Conservation Network meeting 41 delegates from 31 countries were present. The aim of the Network is to promote the conservation and use of landraces and crop wild relative diversity on-farm and in genetic reserves across Europe. As such the short and longer term priorities discussed and prioritized relate to these aims.

The particular relevance of horizon scanning as a participatory approach to establishing future priorities is increasingly recognized by governments (King and Thomas, 2007), commercial organizations and conservation agencies

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(Sutherland *et al.*, 2008, 2010). It is now routinely making a contribution to strategic planning, risk management, research priorities and policy making. For policy makers and practitioners to make informed resource allocation decisions, they require an evidence base and a comparative assessment of the potential options for conservation action. This evidence base needs to cover all relevant policy aspects: political, social and economic, as well as environmental and scientific (Sutherland *et al.*, 2010). Sutherland and Woodroof (2009) suggested that horizon scanning could identify both potential new threats to biological diversity (in terms of structure, composition and function) and new opportunities for its conservation. Information and evidence to support policy choices concerning agrobiodiversity conservation may not be readily available at the right time, e.g. who would have foreseen 25 years ago the current imperative of climate change modelling, assessment of resilience and mitigation? However, many agrobiodiversity conservation challenges are the result of technical developments, evolving consumer demands and market changes or agroenvironmental change. Many changes will have known or suspected impacts on agrobiodiversity, while others result from an acceleration of current patterns of change or new legislation. Examples of previous issues in European plant genetic resources include the impact upon agrobiodiversity conservation targets of genetic pollution, lack of appreciation of the significance of crop landraces, or disconnect between the agrobiodiversity and biodiversity communities in Europe. On the other hand conservation, particularly genetic, and digital technology has been advancing so rapidly that we can now answer questions that previously were not even considered; for instance, historically, ecogeography was routinely used as a proxy for genetic distance when planning collecting, but now genetic markers are used routinely to review population differentiation and genetic distance in currently conserved germplasm accessions, so that the decision can be made whether additional collecting is warranted and if it is, in which geographic locations the collecting should be targeted.

Sometimes policy makers and conservationists can spot a problem in advance, but fail to act because of competing short-term interests or the problem identified may not be communicated well enough or there may be insufficient collaboration with other specialists when an interdisciplinary approach is necessary. We argue that these problems can be addressed by finding more effective ways for agrobiodiversity conservationists to work across disciplines (including social sciences) and for scientists and policy makers to communicate with one another across the boundaries between disciplines about future problems. In this paper we present the results of such an exercise in reviewing short-term priorities and longer term priorities through consensual horizon scanning. The aim is to identify the major issues that currently are challenging agrobiodiversity conservation and also future issues that might challenge conservation of agrobiodiversity (Crop Wild Relatives – CWR and Landraces – LR) conservation in Europe in the next 20–30 years. Our approach was to use the collaborative expertise of the ECPGR *In situ* and On-farm Conservation Network to identify and prioritize relevant issues.

43.2 Methods

To help identify the short-term agrobiodiversity conservation priorities a list of actions associated with effective CWR and LR was agreed and each country, via its ECPGR representative, was asked to comment on their country's status as regard to each action. For CWR diversity the actions were whether there existed: (i) a National Action Plan for CWR survey, monitoring and conservation; (ii) a National CWR inventory; (iii) a prioritization list of CWR species; (iv) a CWR information system; (v) systematic gap analysis had been used to aid CWR conservation;

(vi) *in situ* genetic reserves for CWR conservation; (vii) *ex situ* germplasm holdings of CWR diversity; (viii) threat assessment using IUCN Red List Criteria of CWR diversity; (ix) routine national utilization of CWR diversity; (x) public awareness of CWR value; and (xi) legislative/policy framework to enhance CWR conservation. For LR diversity the actions were whether there was a complete, partial or no national LR inventory, and if not complete what was the limiting factor. The data were collected for 32 European countries for the CWR conservation actions and 22 countries for LR conservation actions. The results of this data collation exercise would help identify the immediate priorities for CWR and LR conservation action both Europe-wide and also nationally.

To establish the longer term agrobiodiversity conservation priorities horizon scanning was used, amended from the approach taken by Sutherland *et al.* (2008, 2010). All 83 delegates at the symposium, whether members of the ECPGR *In Situ* and On-Farm Network, were asked to identify emergent issues that they felt were of European importance or may have a local effect on CWR and LR diversity in Europe in the future 20–30 years. For each issue they submitted they were asked to outline the Strengths, Weaknesses, Opportunities, Responsibilities and Threats associated with the issue for European diversity. This identified a set of 15 issues for CWR concerns and 13 issues for LR concerns; these issues were raised by 12 people from 10 European countries for CWR issues and 11 people from 9 European countries for LR concerns. The table of CWR and LR issues were written on white boards and open for amendment/discussion. At the end of the symposium all delegates were given five points and allowed to attribute their points to the CWR and LR issues they regarded as the highest European conservation priorities. The points were then added up to identify the priority CWR and LR conservation issues in the longer term between 2020 and 2035.

43.3 Results and Discussion

43.3.1 Short-term issues (2010–2020)

CWR-related issues

The results of the survey of short-term CWR-related conservation issues in 33 European countries are summarized in Table 43.1. The results indicate that nearly all countries have some *ex situ* conservation of CWR diversity, and most countries have some form of national CWR inventory and national CWR threat assessment, although IUCN Red List threat of CWR has been undertaken as part of overall national threat assessment and was not focused on CWR species. The EC-funded FP5 PGR Forum project generated national CWR inventories that were sent to all ECPGR National Coordinators, therefore all countries should be aware of their existence; however, the responses indicate this may not be the case. The recently EC-funded FP7 PGR Secure project should address this requirement as it will hold a workshop for national CWR focal points nominated by the ECPGR National Coordinators to develop and promote the use of national CWR inventories.

Most countries have some form of CWR information systems, commonly with a more generalized information system or in association with the EURSICO national inventory. Most countries also have some, though not systematic, use of CWR diversity in breeding and have some national public awareness of the value of CWR diversity. However, few countries have a prioritized list of national CWR species, have developed national CWR action plans, or undertaken genetic gap analysis for even their most important CWR species and it is rare to have specific mention of CWR conservation or protection in national conservation legislation. Perhaps most surprising, given the increasing publicity given to *in situ* CWR conservation in the last 20 years, is the minimal progress in establishing working genetic reserves to conserve CWR diversity, perhaps with the notable exception of Armenia, Azerbaijan, Israel, Turkey and