Generic European LR diversity *in situ* (on-farm) conservation strategy

European landrace conservation strategy

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1. Premise

Currently, landrace (LR) diversity is threatened in all European countries (as well as in the entire world) and in need to be preserved both *in situ* and *ex situ*. Those countries which are signatories of both the CBD and the International Treaty have an obligation and responsibility for LR conservation.

The EC FPVII PGR Secure project (http://www.pgrsecure.org/). The project aims are to develop conservation strategies for European crop wild relative (CWR) and landrace (LR) diversity and to enhance their use as a mean of underpinning European food security in the face of climate change. Within the PGR Secure project (WP4) UNIPG (University of Perugia, Italy,) MTT Agrifood Research Finland and University of Birmingham UK focused on developing tools and strategies for on-farm LR conservation.

This deliverable reports the development of a European strategy for *in situ* conservation of LR for all crops.

It was initially recognized among PGR Secure Partners that a European strategy should be based on the main recommendations from i) the European continental perspective and from ii) the national perspective of the exemplar countries.

As for the former, the recommendations included in the 'European specific LR conservation strategy for target crops' (Deliverable D4.4) and the 'Present constrains and opportunities for LR *in situ* (on-farm/in garden) wider cultivation in Europe' (http://www.nordgen.org/ngdoc/plants/Samarbeten_och_natverk/PGR_secure_workshop2013/5_LR_Conservation.pdf) PGR Secure documents were duly taken into account. In addition, also the recommendations included in the 'The ECPGR concept for *in situ* (on-farm) conservation in Europe' (available from http://www.pgrsecure.org/, LR helpdesk) were considered. This document was prepared during the PGR Secure life time, but outside its context, on request of the European Cooperative Program on Genetic Resources Steering Committee. The contribution of Paul Freudenthaler, Fuad Gasi, Isabelle Goldringer, Pedro Mendes Moreira, Silvia Strãjeru, Ayfer Tan, Merja Veteläinen, Rudolf Voegel and, Jens Weibull, as its co-authors, is then warmly acknowledged.

As for the latter, the recommendations from the national perspectives (Deliverables 4.1, 4.2 and 4.3) came from Finland, Italy and UK that represent different situations across Europe for pedo-climatic conditions, LR on-farm diversity and socio-economic context.

Common recommendations arisen from both the European continental perspective and from the national perspectives were considered to be the best structure of a future European conservation LR strategy.

2. Introduction[1]

In most European countries a rapid decline of agro-biodiversity is taking place (Wood and Lenné, 1999). As far as the diversity of cultivated plants is concerned the decline is due mainly to a series of economic and institutional factors which have encouraged the spread of varieties that maximize productive efficiency within intensive farming systems. Traditional crop varieties, generally known as 'landraces' (LR), but also called 'farmer varieties,' 'local varieties,' or 'primitive varieties have been rapidly and widely substituted by modern varieties. However LR, have been continuously maintained by people within their local biological, cultural and socio-economic context (Negri *et al.,* 2009; Veteläinen *et al.,* 2009a, 2009b, 2012) and are an important fraction of agro-biodiversity.

2.1. Landrace definition and importance

It is not easy to define what a LR is. Recently the following categorization was proposed (Negri *et al.*, 2014) depending on the continuity or discontinuity of their growing history.

i) *sensu stricto* landraces (LR), including all the elements variously put in evidence by several definitions and Authors, *sensu stricto*, a LR should be defined as a 'variable population, which is identifiable and usually has a local name, (generally) lacks formal crop improvement, is characterized by a specific adaptation to the environmental conditions of the cultivation area (tolerant to the biotic and abiotic stresses of that area) and is closely associated with the uses, knowledge, habits, dialects and celebrations of the people who have developed and continue to grow it (Negri *et al.*, 2009; Polegri and Negri 2010). They are structured populations made up of several subpopulations. Also for clonally-propagated crops (e.g. vines, olive trees and other crops) LR are often constituted of multiple genotypes (Fornek *et al.*, 2003; Cipriani *et al.*, 2002).

In short, they are extant LR, which have continuously maintained their link with the territory of adaptation. *Sensu stricto* LR are often under threat of extinction and thus deserve the highest attention.

ii) Re-introduced LR, are *sensu stricto* LR that were once cultivated in a certain area, later *ex situ* preserved to genebanks and then reintroduced in cultivation (from genebanks) in the same area of previous cultivation after a certain period of time. After some period of time re-adaptation may occur.

iii) Introduced LR, are LR that originated in an area different from that where they are presently grown.

LR are important components of Plant Genetic Resources for Food and Agriculture (PGRFA). As Esquinas-Alcazar (1993) writes "The heterogeneous varieties of the past have been and still are the plant breeder's raw material. They have been a fruitful, sometimes the sole, source of genes for pest and disease resistance, adaptation to difficult environments, and other agricultural traits like the dwarf-type in grains that have contributed to the green revolution in many parts of the world". This is particularly important in a period of climate changes and unpredictability.

In addition, when they are maintained *in situ* (on-farm) they allow to:

[1] This section is largely taken from 'The ECPGR concept for *in situ* (on-farm) conservation in Europe' (Negri *et al*., 2014)

- to maintain and develop diversity for local communities and breeding (including participatory plant breeding), as a pre-requisite to ensure food security, productivity as well as resilience to biotic and abiotic stresses in a scenario of climate change and unpredictability,
- to develop new (e.g. environmentally friendly) farming systems that are based on 'diverse' varieties and answer the needs of farmers (like organic farmers) and the consumer demand for a sustainable production systems,
- to develop farming systems that rely on LR to produce high value typical products,
- to maintain and develop different traditions and uses of a crop while extending crop and varietal uses,
- to maintain viable agro-ecosystems and useful agro-ecosystem services,
- to increase farmer capacities that are related to selection and conservation methods, improving yield and quality.

Due to the modernization of agriculture and breeding for uniformity (Negri 2005; Negri *et al.*, 2009) the loss of LR is has been, and continues to be, extensive and therefore there is a pressing need to actively conserve extant LR *ex situ* and *in situ*.

2.2. Landrace conservation *in situ* and *ex situ*

2.2.3. On-farm conservation definition

In the most relevant documents that bind signatory countries to a proper conservation of Plant Genetic Resources (PGR), the following definitions for *in situ* conservation can be found, i.e.:

- The 'Convention on Biological Diversity' (CBD 1992, Definition Article 2: Use of Terms) and the 'International Treaty on Plant Genetic Resources for Food and Agriculture' (ITPGRFA, FAO 2001, Article 2: Use of Terms):
  "In-situ *conservation means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties*".

We can eventually note that, similarly,

- The Commission Directives 2008/62/EC 20 June 2008 and 2009/145/EC 26 November 2009 states:
  "*conservation* in situ *means the conservation of genetic material in its natural surroundings and, in the case of cultivated plant species, in the farmed environment where they have developed their distinctive properties*".

No specific mention to the term 'on-farm' conservation is given in these documents, although it should be acknowledged that, with specific reference to cultivated taxa, the term 'on-farm conservation' came into use.

Considering the principal need to refer to the above mentioned documents, by virtue of their binding nature, we will:

- maintain the exact meaning of '*in situ conservation*' that is given by the CBD and the ITPGRFA and consequently define 'on-farm conservation' as the ''*conservation of ecosystems and natural*

habitats and the maintenance and recovery of viable populations of domesticated or cultivated species in the surroundings where they have developed their distinctive properties''

- refer about *in situ* (on-farm) conservation in this document. The term '*in situ* (on-farm)' will be used for conservation activities that are carried out on-farm, but also in home and community gardens. All the same the term 'farmer/s' is meant to include 'gardener/s'.

The same was meanings and reference terms were used in the document prepared for the 'ECPGR concept for *in situ* (on-farm) conservation in Europe' (Negri *et al.*, 2014).

2.2.3 *In situ* (on-farm) conservation focus

In the context of the definition given above, and taking into account available bibliography on the matter (Maxted *et al.*, 2002; Negri 2005), there are two possible focuses for *in situ* (on-farm) conservation (Negri *et al.*, 2014):

- on a certain cultivated LR *per se* and
- on a certain agro-ecosystem where a/several LR is/are cultivated, i.e. a holistic approach

At present, *in situ* (on-farm) conservation is in most cases oriented to conserve *sensu stricto* LR or introduce or reintroduce LR into cultivation (from genebanks).

Never the less, the CBD and ITPGRFA, that we used to define on-farm conservation [and also the definitions given by European Union (EU) Directives on the commercialization of 'conservation variety' seeds] implicitly suggest a comprehensive approach that takes into consideration all the biotic and abiotic components of a certain agro-ecosystem, i.e. a holistic approach to conservation. In addition, the CBD definition of *in situ* (on-farm) conservation implies that a certain genetic resource is maintained in its environment of adaptation, i.e. within the abiotic and biotic context where it evolved its distinctive characteristics. Then, this should be the true perspective to look at *in situ* (on-farm) conservation. However, the topic has been largely neglected up to now. Beside the presence of intraspecific diversity (i.e. different varieties and variable materials of the same crop), the diversity of other living beings (i.e. interspecific diversity) and of the agro-ecosystems should all be considered in a 'holistic' approach.

The areas that are richest in the above mentioned components should be considered the Most Appropriate Areas (MAPAs) where to set or enhance *in situ* (on-farm) conservation activities. Among them, those areas where other important and threatened genetic resources (like Crop Wild Relatives, CWR) are present appear to deserve the highest attention and priority. It has to be noted that agriculture is a process that indeed belongs to nature, also when it takes advantage of resources that have been developed by mankind (as LR), since mankind is part of nature; there is no substantial reason why the dichotomy between natural world and mankind world (including agriculture) should be maintained. On the other hand, agriculture does take advantage of wild species that are components of agro-ecosystems (e.g. nitrogen fixing wild legumes or wild pollinators) and, in some cases, is based on wild species (e.g. natural grasslands). Negri *et al.* (2012) considered as MAPAs the areas where different LR of different crops, different types of agro-ecosystems, high number of protected areas and of CWR species, have the highest concentration. The concept of MAPAs develops that of 'High Nature Value Farmland', initially proposed by Baldock *et al.* (1993) and Beaufoy *et al.* (1994), and defined at the EU level (SEC(2011) 540 Final) as ''*farmland/forested areas characterized by high biodiversity*''. As suggested in the Italian strategy (PGR Secure Deliverable 4.2) and in the Italian Guidelines for the Conservation of Genetic Resources for Food and Agriculture (http://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/305) this areas can also be used as 'core' areas from which reintroduce LR on nearby areas.

The introduction of this concept appears to be fully justified also taking into account the following relevant documents. The 'Second Global Plan of Action (GPA) for Plant Genetic Resources for Food and Agriculture' (2nd GPA, FAO 2011) recommends that "*agricultural biodiversity and biodiversity more generally are not addressed as separate entities*", underlines that ''*ecosystems contain important PGRFA, including rare, endemic and threatened CWR and wild food plants*'' and suggests to ''*include, as appropriate, among the purposes and priorities of national parks and protected areas, the conservation of PGRFA, in particular appropriate forage species, CWR and species gathered for food or feed in the wild, including in their biodiversity hotspots and genetic reserves*'' and to '' *consider integrating the conservation and management of PGRFA, particularly CWR and wild food plants, in land-use plans in their centres of origin, centres of diversity and biodiversity hotspots*''. While the EU 2020 Biodiversity Strategy (the European Parliament Resolution, 2012) first target is: "*Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss*"; the second is the 2050 vision: "*By 2050, EU biodiversity and the ecosystem services it provides – its natural capital – are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided*." It also "*calls for a strengthening of Pillar II* [of the Common Agricultural Policy, CAP] *and for drastic improvements in all Member States to the environmental focus of that pillar and to the effectiveness of its agri-environmental measures, including … support for High Nature Value and organic farming*…". On the other hand, ''*Maintain and restore ecosystems and their services*'', ''*Increase the contribution of agriculture and forestry to maintaining and enhancing biodiversity*'', ''*Halting biodiversity loss*'' were clear targets (T2, T3, T6, respectively) in the 'Accompanying the document communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. our life insurance, our natural capital: an EU biodiversity strategy to 2020' (SEC(2011) 540 Final).

2.2.4. *Ex situ* conservation definition and focus

The CBD (CBD 1992, Definition Article 2: Use of Terms) and the ITPGRFA (FAO 2001, Article 2: Use of Terms):

> "*Ex-situ conservation*" means *the conservation of components of biological diversity outside their natural habitats"*.

By definition *ex situ* conservation focuses on a single genetic resource. *Ex situ* conservation is carried out in seed repositories, in vitro collections or living collections (as arboreta or plant collections) at public (genebanks, botanical gardens) and private institutions (plant breeding companies, farmer networks).

2.2.5. *In situ* vs *ex situ* conservation and complementarity

There is an obvious fundamental difference between these two strategies: *ex situ* conservation involves the sampling, transfer and storage of a population of a certain species away from the original location where it was found whereas *in situ* conservation involves the designation, management and monitoring of the population at the location where it is currently found and within the community to which it belongs. Further the primary characteristic of *in situ* (on-farm) conservation is its dynamic nature in contrast with *ex situ* conservation which is mainly static. In addition, *ex situ* conservation is generally focused on a single genetic resource, while a complex of populations can be preserved and evolutionary processes can continue through *in situ* (on-farm) conservation. Provided their genetic diversity is wide, i*n situ* (on-farm) populations continue to evolve in response to biotic and abiotic pressures and to adapt to their environment. They are, therefore, an always updated source of genes for crop improvement, particularly of

crops that are growing in adverse environmental conditions resulting from climate change (see for example Negri and Tiranti, 2010; Nevo *et al.*, 2012; and references therein).

Article 9 of the CBD (1992) stresses that the two conservation strategies should not be viewed as alternatives or in opposition to one another but rather should be practiced as complementary approaches to conservation, each providing a safety backup for the other. The goal of applying the two conservation strategy is ultimately to serve the present needs of plant breeders on one side and the need to maintain genetic resources always tuned with environment for future unpredictable changes on the other side.

3. The International Context

Twenty two years after the landmark 1992 Earth Summit in Rio and the CBD (1992), the Rio+20 declaration on 'The future we want' reaffirmed the need to improve food security, based on sustainable agricultural practices that preserve natural resources, including genetic diversity, by building on enhanced agricultural research and stronger international cooperation. During the past 15 years, there have been major policy developments with impact on the conservation, use and exchange of PGRFA. Undoubtedly, the ITPGRFA (FAO 2001) and the 2nd GPA (FAO 2011) are the most important and reflect a wide consensus among states and have a binding nature for many European states and the European Union (EU).
Through its Multilateral System, the International Treaty facilitates access to PGRFA and allows the fair and equitable sharing of benefits arising from their use. It was negotiated by FAO Commission on Genetic Resources for Food and Agriculture in the context of the Nagoya Protocol, and engages parties to conserve plant agricultural biodiversity both inside (including on-farm) and outside ecosystems and natural habitats and to sustainably use genetic resources. The Parties agree to engage in measures covering agriculture, research and breeding and to facilitate access to plant genetic resources. The Treaty recognizes the role and rights of farmers in conserving, using and improving agricultural genetic resources and sharing the related benefits.

In particular the ITPGRFA (art. 5) calls each Contracting Party, subject to national legislation, and in cooperation with other Contracting Parties, where appropriate, *to promote an integrated approach to the exploration, conservation and sustainable use of plant genetic resources for food and agriculture and in particular, as appropriate:"*

a) *"Survey and inventory plant genetic resources for food and agriculture, taking into account the status and degree of variation in existing populations, including those that are of potential use and, as feasible, assess any threats to them;"*
b) *"Promote the collection of plant genetic resources for food and agriculture and relevant associated information on those plant genetic resources that are under threat or are of potential use;"*
c) *"Promote or support, as appropriate, farmers and local communities' efforts to manage and conserve on-farm their plant genetic resources for food and agriculture;"*
d) *"Promote in situ conservation of wild crop relatives and wild plants for food production, including in protected areas, by supporting, inter alia, the efforts of indigenous and local communities;"*
e) *"Cooperate to promote the development of an efficient and sustainable system of ex situ conservation, giving due attention to the need for adequate documentation, characterization, regeneration and evaluation, and promote the development and transfer of appropriate*

technologies for this purpose with a view to improving the sustainable use of plant genetic resources for food and agriculture;"

f) *"Monitor the maintenance of the viability, degree of variation, and the genetic integrity of collections of plant genetic resources for food and agriculture."*

g) *"Take steps to minimize or, if possible, eliminate threats to plant genetic resources for food and agriculture*".

Article 6 of the Treaty also calls each Contracting Party to promote the sustainable use of PGRFA with measure such as:

a) *"Pursuing fair agricultural policies that promote, as appropriate, the development and maintenance of diverse farming systems that enhance the sustainable use of agricultural biological diversity and other natural resources;"*

b) *"Strengthening research which enhances and conserves biological diversity by maximizing intra- and inter-specific variation for the benefit of farmers, especially those who generate and use their own varieties and apply ecological principles in maintaining soil fertility and in combating diseases, weeds and pests;"*

c) *"Promoting, as appropriate, plant breeding efforts which, with the participation of farmers, particularly in developing countries, strengthen the capacity to develop varieties particularly adapted to social, economic and ecological conditions, including in marginal areas;"*

d) *"Broadening the genetic base of crops and increasing the range of genetic diversity available to farmers;"*

e) *"Promoting, as appropriate, the expanded use of local and locally adapted crops, varieties and underutilized species;"*

f) *"Supporting, as appropriate, the wider use of diversity of varieties and species in on-farm management, conservation and sustainable use of crops and creating strong links to plant breeding and agricultural development in order to reduce crop vulnerability and genetic erosion, and promote increased world food production compatible with sustainable development;" and*

g) *"Reviewing, and, as appropriate, adjusting breeding strategies and regulations concerning variety release and seed distribution."*

The 2nd GPA (FAO 2011), prepared under the aegis of the Commission on Genetic Resources for Food and Agriculture, updates the Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture, adopted in 1996, at the Fourth International Technical Conference on Plant Genetic Resources. The 2nd GPA responds to the needs and priorities identified in the Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture, a global assessment that FAO published in 2010. It was prepared through a series of regional consultations, with the participation of 131 countries and representatives of the international research community, the private sector and civil society. The Global Plan of Action provides the technical blueprint for the funding decisions of the ITPGRFA and the Global Crop Diversity Trust also established in 2004.

The tenth meeting of the Conference of the Parties to the Convention on Biological Diversity adopted a revised and updated Strategic Plan for Biodiversity for the 2011-2020 period, which the United Nations General Assembly declared the United Nations Decade on Biodiversity, with a view to contributing to the implementation of the Strategic Plan.

In particular, the 2nd GPA (FAO 2011) calls for

a) *"Surveying and inventorying PGRFA;"*

b) *"Supporting on-farm management and improvement of plant genetic resources for food and agriculture;"*
c) *"Assisting farmers in disaster situations to restore crop systems;"*
d) *"Promoting in situ conservation and management of crop wild relatives and wild food plants;"*
e) *"Supporting targeted collecting of PGRFA;"*
f) *"Sustaining and expanding ex situ conservation of germplasm;"*
g) *"Regenerating and multiplying ex situ accessions;"*
h) *"Expanding characterization, evaluation and further development of specific subsets of collections to facilitate use;"*
i) *"Supporting plant breeding, genetic enhancement and base-broadening efforts;"*
j) *"Promoting diversification of crop production and broadening crop diversity for sustainable agriculture;"*
k) *"Promoting development and commercialization of all varieties, primarily farmers' varieties/LR and underutilized species;"*
l) *"Supporting seed production and distribution;"*
m) *"Building and strengthening national programmes;"*
n) *"Promoting and strengthening networks for PGRFA;"*
o) *"Constructing and strengthening comprehensive information systems for PGRFA;"*
p) *"Developing and strengthening systems for monitoring and safeguarding genetic diversity and minimizing genetic erosion of PGRFA;"*
q) *"Building and strengthening human capacity;"*
r) *"Promoting and strengthening public awareness on the importance of PGRFA*."

As a party to the Convention on Biological Diversity (CBD 1992), the European Union (EU) agreed that by 2020 the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

The new EU Strategy, 'Our life insurance, our natural capital: an EU biodiversity strategy to 2020' (European Parliament Resolution, 2012) lays down the framework for EU action during this decade, in order to meet the commitments made by EU leaders in March 2010. The Strategy is also the EU's means of implementing the CBD Strategic Plan for Biodiversity into EU policies and actions, a 'National Biodiversity Strategy and Action Plan' (NBSAP) in the CBD terminology. In addition to the EU Biodiversity Strategy, nearly all EU Member States have also developed their own NBSAPs, further adding to the implementation of the CBD and related international agreements at national level through a wide range of national and sub-national policies and measures. Target 3 of the EU biodiversity strategy calls for "*increasing the contribution of agriculture and forestry to maintaining and enhancing biodiversity"* and Target 6 for "*helping avert global biodiversity loss"*. The resolution of the European Parliament on the EU 2020 Biodiversity Strategy also indicates that the key to the EU 2020 Biodiversity Strategy is the reform of the CAP […] which is "*designed to support farming that ensures food safety (in a context of climate change) and promote sustainable and balanced development across all Europe's rural areas, including those where production conditions are difficult*".

The June 2013 reform of the CAP is focused on three priorities: i) viable food production, ii) sustainable management of natural resources iii) balanced development of rural areas throughout the EU. It specifically mentions measures to "*help farming meet the challenges of soil and water quality, biodiversity and climate*

change. It also specifically mentions the need to favour crop diversification, … and conserving areas of ecological interest". For the Rural Development it foresees, among its six priorities," *restoring, preserving and enhancing ecosystems and the possibility for the Member States / regions to design thematic sub-programmes to pay especially detailed attention to [among others] the climate change mitigation / adaptation and biodiversity issues*".

The 'European Commission Report To The European Parliament, The Council And The European Economic And Social Committee - Agricultural Genetic Resources - From Conservation To Sustainable Use' (2013) is aimed at "*recalling the need to conserve and sustainably use genetic resources and at ensuring that this objective is properly catered for in the ongoing development of relevant policies and programmes, notably:*

- *the Rural Development Policy, via its agri-environmental measures to target the level of practical farming and via the European Innovation Partnership to bridge practice needs with research activities and foster interaction between relevant actors;*
- *the Research & Innovation Policy with its Framework Programme Horizon 2020 to build up the knowledge base on genetic diversity in agriculture*".

Member states have not received inputs from the Commission on how to or where to address exactly measures or programs in favour of agro-biodiversity conservation.

Specifically regarding LR conservation, the Commission Directives 2008/62/EC 20 June 2008, 2009/145/EC 26 November 2009 and 2010/60/EU 30 August 2010 on seed production and marketing opened a new way for their conservation because the Directives are aimed "*to ensure in situ conservation and the sustainable use of PGR*", as their premise states, although they focus on seed production and marketing instead of genetic resource conservation *per se*.
Previous European seed regulation made impossible to commercialise LR seed because the registration to the Common Catalogue required, beside distinctness and stability, uniformity a trait that LR do not have.
However, at present, their application has only partially favoured the registration of LR maintained on-farm or preserved in *ex situ* collections (see Spataro and Negri 2013 for a discussion).

4. The need for inventories for landraces *in situ* (on-farm) conservation

The need for LR inventories has been stressed by international policies and strategies for a sustainable use of Plant Genetic Resources for Food and Agriculture (PGRFA) since long time, and more recently by many papers specifically referring to Europe (Maxted *et al.*, 2009, 2012; Veteläinen *et al.*, 2009a, 2009b, 2012; Negri *et al.*, 2014).

Following the CBD (1992), the 2nd GPA (FAO 2011) policy and strategy for *In Situ* Conservation and Management stresses that ''*The surveying and inventorying of PGRFA should be considered as the first step in the process of conservation and reducing the rate of biodiversity loss*''.

In addition, the ITPGRFA (FAO 2001), of which many European countries and the EU are contracting parties, recommends that: "*Each contracting party should promote or support and appropriate farmers and local communities with efforts to manage and conserve on-farm and their plant genetic resources for food and agriculture*'' (article 5c).

To compile Plant Genetic Resource Inventories should also contribute to meet the targets of the EU 2020 Biodiversity Strategy (the European Parliament Resolution, 2012) since, at present; there is no *in situ* (on-farm) systematic conservation of LR in Europe.

PGR Secure, recognizing that the main drawback for drawing a conservation strategy for *in situ* (on-farm) conservation of LR was the lack of information on their existence, location and use, aimed at compiling their inventory for Europe.

To the purpose its initial activities were to increase awareness and capacities. In order to increase capacities and awareness, beside carrying out a ECPGR_NIFP LR training workshop (Palanga, LT), publishing the on line journal 'Landraces' and providing Europe with assistance through the PGR Secure helpdesk (where several documents and useful links are available from www.pgrsecure.org), tools to facilitate LR inventorying were made available: the 'Descriptors for Web-Enabled National In Situ Landrace Inventories' (Negri *et al.*, 2012a) a 'MS database for on-farm LR data recording' (PGR Secure D.4.6 and D.4.7, respectively, available from www.pgrsecure.org and CD-ROM).

These tools were proposed to ECPGR as an aid to compile a European inventory of LR in the 'The ECPGR concept for *in situ* (on-farm) conservation in Europe' (Negri *et al.*, 2014, available from http://www.pgrsecure.org/, LR helpdesk).

Although lack of funding hampered the compilation of LR inventories across all Europe, but inventories were compiled in Finland Italy and UK: it is on the information gathered during their compilation that national strategies for LR *in situ* (on-farm) conservation were drafted (see their synthesis below).

5. Means to define conservation priorities

In drafting any conservation strategy, either focused on a single LR or on agro-biodiversity rich environments, the assessment of conservation priorities should be taken into account because it can help in allocating the (usually limited) funding for conservation actions.

There is not much work carried out on means to identify the agro-biodiversity richest environments (e.g. MAPAs) where to set conservation actions with priority, although the topic is worthwhile to be investigated, especially considering the European perspective of halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020 and of protecting, valuing and appropriately restoring biodiversity by 2050 (European Parliament Resolution, 2012) and the recommendations of the 2nd GPA (FAO 2012) (see above). The only reference available (Negri *et al.*, 2012b) suggests to divide the territory in areas where to assess in subsequent steps i) the LR diversity, ii) agroecosystem ecological diversity and iii) the presence of Protected Areas.

When the conservation focus is on a single LR, priority can be assigned on the basis of genetic erosion (or extinction) threat. Despite many authors have studied the problem and given different definitions of genetic erosion, at present, to the best of our knowledge, there is only one model that quantifies it in order to fund conservation activities.

This model was developed by Lazio Region in Italy to fund LR 'custodian' farmers with the European Agricultural Fund for Rural Development (EAFRD) under EU Regulations EC 1698/2005 (available from: http://faolex.fao.org/docs/pdf/eur54683.pdf) and 1974/2006 (http://faolex.fao.org/docs/pdf/eur68184.pdf) and through the Lazio Rural Development Plan.

The setting of criteria and indicators per each criterion to establish the level of genetic erosion has been a crucial step of the law application (Porfiri *et al.*, 2009). After discussion, the following were chosen:

a. existence of the product on the market;

b. presence of a LR on the catalogues of seed company or nurseries;

c. numbers of farmers still cultivating the LR;

d. cultivated areas of the LR in comparison with the total regional areas for that crops;

e. trend of new cultivation areas dedicated to that specific LR.

Each criteria was then associated to other conditions so to attribute a risk score (1 = low; 2 = medium; 3 = high, Table 1). The sum of different values gives a total level of erosion, with the following classification:

- low risk as total value ≤ 9
- medium risk as total value 10-13;
- high risk as total value ≥ 14.

Finally, considering the financial aspect, the higher the level of threat the higher is the possibility of funding *in situ* (on-farm) conservation activities through subsidies.

Table 1. Criteria and indicator scores per criterion to evaluate genetic erosion and levels of risk adopted by Lazio Region (from Porfiri *et al.*, 2009).

Criteria	Description [2]	Risk level	Score
A Presence of the product on the market	- Markets and/or producer's cooperatives - Sector: main variety in a certain DOC, DOP, IGP, IGT certified production	Low	1
	- Niche market: locally limited cultivated areas - Market section: secondary varieties in a DOC, DOP, IGP or IGT certified production	Medium	2
	- Only some fruits/few seeds available for consumption or research - No product on the market	High	3
B Presence in the catalogues of the seed companies/nurseries	- Fruits: presence in variety list A, B and C - Vegetables and plants: listed in the national register of varieties - Grapevine: listed in the regional register	Low	1
	- Grapevine: under registration to regional register - Propagation materials available by a few nurseries	Medium	2
	- Fruits: not registered in the variety list - Vegetables and plants: not registered in the national register of varieties - Grapevine: not registered in the regional register - No propagating material available out of the maintaining farm	High	3
C Number of cultivating farmers	>100	Low	1
	30÷100	Medium	2
	<30	High	3
D Areas under cultivation (as percentage on the total regional amount for the species)	>5 %	Low	1
	1÷5 %	Medium	2
	- <1% - Isolated plants or home garden cultivations	High	3
E New dedicated area trend	- New areas dedicated to LR present	Low	1
	- No new areas dedicated to LR present	High	3

[2] Data to be recorded by extension officers.

6. Elements taken into account for the development of a European strategy for *in situ* (on-farm) LR conservation

6.1. Main recommendations from the European continental perspective

6.1.1. Present constrains and opportunities for LR *in situ* (on-farm) wider cultivation in Europe

It is obvious that an effective and efficient conservation strategy should principally rely on overcoming constrains and reinforcing opportunities for *in situ* (on-farm) conservation of LR.

A review of present constrains and opportunities for LR wider cultivation on-farm and in garden in Europe was carried out by the authors within the frame of PGR Secure and presented at the Workshop in Wageningen, November 25–29, 2013 "On the conservation and sustainable use of plant genetic resources in Europe: a stakeholder analysis" (see http://www.nordgen.org/ngdoc/plants/Samarbeten_och_natverk/PGR_secure_workshop2013/5_LR_Conservation.pdf).

In summary, the *main constrains* are identified as follows:

- *Complete LR data* (species, number, location, traits, socio-economic environment etc) for all European countries on which to rely for drawing a precise European strategy for LR *in situ* (on-farm) conservation *are not available yet,*
- *Sound policies* in favour of LR *in situ* (on-farm) conservation exist only in some countries, and *still lack completely at European level*,
- *Many LR are not safely duplicated ex situ,* which both hampers conservation and makes difficult re/introduction into cultivation of LR
- *Farmers find it difficult to find LR seed on the market*, and this makes difficult their direct use,
- *Lack of knowledge on on-farm diversity level and evolution in the farms* prevents from defining proper management strategies for the diversity maintenance on the farms.

Altogether, many *successful examples of LR use across Europe* that can be followed at a wider extent for promoting their conservation *in situ* (on-farm):

- Produce and develop *typical local products, also awarded of European quality marks* like Controlled Designation of Origin (DOC) and Controlled Designation of Origin Guaranteed (DOCG) for wines derived from LR or Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) Traditional Specialty Guaranteed (TSG) for other products (many examples from Italy). Typical products awarded of quality marks are lucrative on the market because of the added value that the consumers attribute to the superior quality and the link with the history, culture and traditions of the area. Strengthening the relationships between the agri-food system and the community based management of plant genetic resources could lead to an effective *in situ* (on-farm) conservation. If LR exist and consumers are willing to pay a good price for them, a self-sustainable system could be triggered. In this way the cultivation of LR would become advantageous for local farmers and an effective *in situ* (on-farm) conservation could become a reality.

- Development of *new (e.g. environmentally friendly) farming systems based on 'diverse' varieties*. For example, in the German biosphere reserve of Schorfheide-Chorin, successfully marketed organic bread and bear obtained from LR and old cultivars were developed and successful networking of farmers, bakers and brewers was achieved. A similar approach has been taken for the marketing of Scottish whisky (Martin *et al.*, 2009). The use of 'diverse' materials, like LR are, in organic farming is increasing as well, consequently, the request of seed of such materials.

- Development of *local food supply systems*, including community and home gardens. For example, a very successful campaign of 'Coldiretti' (the main Italian farmer organization) promotes ''Food from 0 kilometer'' on the local markets that sometimes is obtained from LR. To link this sort of activities to a wider use of LR could greatly help in achieving their *in situ* (on-farm) conservation, beside satisfying other societal and environmental issues like the request of good, fresh food and a less polluted environment. The process can be facilitated by grouping consumers for obtaining reductions to the prices, improving agritourist services (like offering local food), enhancing motivation of restaurants in serving local food, etc.

- Development of *companies purposely dedicated to produce and sell seed/propagation material of LR*. For example the ''Programme for Diversity of Cultivated Plants: keeping the cultivated heritage alive" in Sweden, through a Public_Private Sector (including seed industries) cooperation, offers small seed samples/plants from the national genebank to be grown and propagated further. Such activities could be taken as exemplar to reintroduce LR from genebanks. Similar activities, but only based on efforts of the public sector, are also in progress in other countries (e.g. Hungary, Baktay 2014; Italy Negri, pers. comm.).

- The *LR use in breeding (and participatory breeding)* for obtaining varieties that maintain adaptation to local condition, offer products that are appreciated by consumer or satisfy special needs while maintaining their diversity is also a mean to *in situ* (on-farm) conservation. The "Vaso" project in Portugal developed new broad based cultivars of maize, as well as the FPVII 'Solibam' project for wheats, barley, broccoli and tomato.

- *Successful LR on-farm conservation policies in some European countries* (e.g. Italy, Finland) exist that can be followed to promote *in situ* (on–farm) conservation. In Italy a Regional legislation frame exists that protect agro-biodiversity and offers subsidies to 'custodian farmers' (Negri 2012; see also deliverable D.4.2)

- Finally a *favourable seed legislation policies* (Commission Directives 2008/62/EC 20 June 2008, 2009/145/EC 26 November 2009 on 'conservation varieties'), allowing the seed of variable population like LR to be commercialized under certain restrictions, is still in vigour in the EU of which take advantage for a wider use of LR in agriculture and for developing niche seed markets and purposely developed seed companies (Spataro and Negri 2013).

It should also be noted that the use of 'diverse' varieties, like LR are, on the farms perfectly fits within the new CAP (see above).

6.1.2. The recommendations made by 'The ECPGR concept for *in situ* (on-farm) conservation in Europe'

Within the lifetime of PGR Secure, a panel of experts within ECPGR was asked by the ECPGR Steering Committee to prepare a 'Concept on On-farm management and conservation of LR in Europe' in order to offer it to the European Commission for its consideration when developing a future EU strategy for the conservation of genetic resources in food, agriculture and forestry and to the European countries for their national strategies. The concept was also meant to be the basis for the conservation strategy of ECPGR for *in situ* conservation and on-farm management.

The 'ECPGR concept for *in situ* (on-farm) conservation in Europe' (Negri *et al.*, 2014, available from http://www.pgrsecure.org/) recognized as actions of primary importance for *in situ* (on-farm) conservation in Europe:

- *The compilation of both individual country and European on-farm activity and LR inventories;*
- *The compilation of individual country inventories and of a European inventory of agro-biodiversity hot spots (Most Appropriate Areas for Conservation), and*
- *The building of individual National and European networks of unique LR materials and on-farm sites for coordinated and integrated in situ (on-farm) conservation.*

6.1.3. European specific landrace conservation strategy for target crops (*Avena, Beta, Brassica* and *Medicago*)

The research carried out in PGR Secure identified the 'conservation' need as primary issue to be considered towards a European strategic approach to conserving LR of *Avena, Beta, Brassica* and *Medicago* (see Deliverable 4.4), and, in particular that the following actions were to be pursued immediately:

- to *gather information on LR still maintained in situ* (on-farm) that are known to exist, but have not been recorded yet;
- *to back-up in situ* (on-farm) *conservation with ex situ conservation*.

Other issues of concern were use, policies, legislation, public awareness and education, socio-economy, cooperation and, most relevant, improvement of knowledge on present level of *in situ* (on-farm) diversity, population dynamics (in relationships to factors such as migration, drift and human and environmental selection pressures), impact of climate change on diversity, usefulness of LR in environmental friendly agronomic systems and in breeding.

6.2. Main recommendations from the national perspective of Finland, Italy and UK

6.2.1. Finland

LR of crop plants adapted to far northern conditions are a globally unique genetic resource. They also represent the national cultural heritage and are a part of Finnish agricultural history. The several inventories on LR cultivation (cereals conducted in early 1980s, 1997-1999, 2005-2007 and during PGR

secure project 2011-2014, the latter including also apples and potato onions) showed that LR are still maintained to some extent in Finland (see Deliverable 4.1).

Currently (situation updated June 2014) 203 different LR varieties still in cultivation are officially recognized, scientifically identified and verified. 29 of them are conservation varieties; mainly there are cultivated in one single farm. 8 LRs are accepted to the National List of Plant Varieties and these have larger cultivating area with many farmers. 12 of the trademark FinE© (Finnish Elite) for the horticultural plant varieties which have proved to be valuable in cultivation, originate from the old local varieties. They are widely marketed by nurseries and therefore common in home gardens.

The LR apple in garden data collected during the PGR Secure project is based on search and verification of mother trees or in the case of the dead mother trees on old crafted trees one of each local variety. It is estimated 100 local varieties of apples originally born from seed in Finland. The total cultivation area of each LR apple variety ranges from a handful of gardens to hundred or in some cases to thousands of gardens. Approximately 1/3 of LR apples are available for home gardeners in nurseries. A handful of horticultural farms have commercial apple production of LR varieties.

Currently LRs are grown mainly for home consumption and only few LR products are available for consumers, with exception of a LR registered under the terms of Protected Designation of Origin (PDO) and the traditional turnip for slash-and-burn cultivation which are retail traded nationwide. Mainly LR products are occasionally sold in local market places, events, small bakeries and agritourism farms as typical or niche products. However, Finns are more and more interested on LR plant products. During the resent years many LR animal typical products have been available again to consumers and also some niche products have been developed. According to the recent national study 70 % of consumers are willing to buy regularly or occasionally LR plant products: LR potatoes, bread and apples.

At the national political level it is recognized the value of traditionally used plants and their old cultivated forms as Finnish cultural heritage. Following the obligations of CBD and FAO Global Plan of Action, a project aimed to activate on-farm conservation and use financed by the Government of Finland and implemented by the Finnish Food Safety Authority (Evira) was initiated in 1997.

Furthermore in 1998 the Council Directive 98/95/EC opened the possibility of establishing specific "conditions under which seed may be marketed in relation to the conservation *in situ* and the sustainable use of plant genetic resources". The Parliament of Finland included the idea in the Seed Trade Act of 2000 (728/2000) by allowing the seed of LR to be marketed uncertified in order to conserve genetic diversity. As a result of this cereal LR on-farm inventory project, the first European support system for *in situ* (on-farm) cultivation of LR and old cultivars was developed in Finland.

The support has been paid as a special subsidiary within EU agri-environmental scheme. During the first agri-environmental scheme 2000-2006, the cultivation of LR, old commercial cultivars and strains derived from old commercial cultivars of cereals and forages were subsidized. Later in the scheme for years 2007-2013, the paid support has been extended also to pulses (pea and broad bean).

Of all the conservation varieties only LR can be marketed as seed: old commercial varieties and old modified commercial varieties cannot. Seed production is also limited to species most commonly and/or traditionally grown in Finland: oats (*A. sativa*), barley (*H. vulgare*), rye (*S. cereale*), wheat (*Triticum aestivum* L. emend. Fiori et Paol.), red clover (*Trifolium pratense* L.), white clover (*T. repens* L.), alsike clover (*T.*

hybridum L.), timothy (*Phleum pratense* L.), meadow fescue (*Festuca pratensis* Huds.), smooth-stalked meadowgrass (*Poa pratensis* L.), cock's foot (*Dactylis glomerata* L.), red fescue (*Festuca rubra* L.), turnip for slash-and-burn cultivation (*Brassica rapa* L. subsp. rapa), swede (*B. napus* L. var. napobrassica (L.) Rchb.), broad bean (*Vicia faba* L.) and pea (*Pisum sativum* L.).

The aim of the subsidiary system is to enhance the continuity of cultivation of LR and old cultivars by offering annual economic support based on the contracted cultivated area (1 ha) to a farmer. Furthermore, the aim is also to enlarge the LR cultivation: the registration of a LR not existing on the National List of Plant Varieties gives the right to the farmer to market seed in Finland. For the new agri-environmental scheme for years 2014-2020 it is under negotiation to enlarge economic support also to those horticultural species most commonly and/or traditionally grown in Finland. In addition some reformation actions to ease and lower expenses of the farmer in registration process have been suggested to attract more farmers and also associations.

Registration of conservation varieties (undergoing a modified DUS-test) is a task of the Finnish Food Safety Authority (Evira), which decides on applications and keeps the register of approved conservation varieties. Evira is also the Designated Authority for seed certification in Finland and it approves the seed lots of LR for marketing. During the registration process Evira consults experts of the National PGR Program for Agricultural and Horticultural plants.

The National PGR Program for Agriculture and Forestry was prepared by a working group representing core stakeholders of public research institutes and universities, breeder companies, seed companies, NGOs, central unions of agricultural producers, rural advisory, and ministries (environment, agriculture and forestry). The program was launched in 2003. Public research institute 'MTT Agrifood Research Finland' is responsible for the coordination and implementing the program as regards agricultural and horticultural crop genetic resources. The National Advisory Board for Genetic Resources, with broad representation from ministries, universities, stakeholders and a NGO, governs and monitors the program. During the first 10 years of the program the implementation has been emphasized on arranging *ex situ* collections (esp. field collections) and developing cryo collections for safe conservation. During the recent years increasing interest is headed to LR inventories and on-farm management issues with project funding and raising public awareness.

In summary the Finnish socio-economic context appears to be a favourable context for future activities to promote on-farm (*in situ*) conservation and use of LR.

On the basis of the information gathered during PGR Secure the following recommendations for a future Finnish conservation strategy for LR were drawn (see Deliverable 4.1):

- *To continue the search of extant and introduced LR, and to complete the national inventory with all crops and ornamental plants;*
- *The more effort needs to put on collecting farmer/gardener based knowledge on their LR, cultivation practices and use to complete LR knowledge base;*
- *A need for increased DNA-identification of the LR genotypes especially for recognition of vegetatively propagated LR for more accurate information;*
- *To promote safe LR conservation: improvement and broadening of the active national LR on-farm/in*

garden conservation program and provide ex situ back up of in situ maintained LR;

- *Horticultural LR conservation need to be recognized beside the field LR;*
- *To promote the sustainable and active use of LR among breeders, farmers, food sector and other users in society (e.g. agritourisms, local museum gardens, schools);*
- *To stimulate more research on LR characteristics, especially nutrition and other quality properties for promoting LR use;*
- *To stimulate for develop market opportunities for LR products;*
- *To promote LR re-introduction from genebanks back to on-farm management;*
- *To continue promoting LR awareness among stakeholders and the public at local and national level including GR learning materials for syllabuses starting from elementary school level.*

6.2.2. Italy

LR are still largely used in Italy for several purposes (development and commercialization of typical products, use in difficult pedo-climatic conditions, use in environmentally friendly agricultural systems and in the preparation of particular dishes). Their products are sold in local and wide markets or used in the family or in the farm.

In Italy, Genetic Resource maintenance responsibility lies with Regions and Autonomous Provinces, which decide on the matter of agriculture (LR included) while the Ministry of Agriculture (Ministero delle Politiche Agrarie e Forestali, MIPAF) plays only an orientation and coordination role. All that matters with agriculture is discussed and agreed in a Permanent State-Region Conference.

Italy has been the first country in Europe to protect Genetic Resources (GR) and LR with specific Regional and national legislations. Italy was also the first in Europe that developed specific Guidelines for the Conservation of Genetic Resources for Food and Agriculture (http://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/305, in Italian), as a first step to meet its National Plan for Agro-biodiversity.

As for plants in particular, a Summary of these Guidelines was submitted by the Italian Government to the ITPGRFA (FAO 2001) for the implementation of Article 6 (http://www.planttreaty.org/sites/default/files/Submission_Italy.pdf,).

In the above mentioned Guidelines for the Conservation of Genetic Resources for Food and Agriculture above mentioned the focus is on *in situ* conservation of *sensu stricto* LR. This because many Italian typical products are based on the cultivation of LR, which is often profitable for farmers, of the strict link between a *sensu stricto* LR with its territory and people, the diversity of the landscape that has favoured the maintenance of LR cultivation in the country.

The main steps in the Italian approach to *in situ* (on-farm) LR conservation are identified by the Guidelines as follows:

1. Collection of information on existing LR (inventory) and collection of propagation material for ex situ back up and for characterization;

2. Identification of the priority areas to be allocated for in situ (on-farm) conservation (i.e. the choice of areas to implement this activity, with priority on the promotion, organization and monitoring of activities);

3. Characterization and assessment of the distinctiveness of local varieties;

4. Assessment of population size and genetic structure of local varieties maintained in situ (on-farm);

5. Monitoring the effectiveness of in situ/on-farm conservation (periodic assessment of the maintenance of an adequate level of genetic diversity and absence of genetic erosion);

6. Set up and operation of an information system for work related to in situ (on-farm) conservation.

These tasks are committed to the Italian Regions and Autonomous Provinces in a subsequent Phase B. Some of them have already taken these steps in the frame of their Regional laws, some others have not yet.

However, because of the MIPAF coordination role, the National Plan for Agro-biodiversity also foresees the collation of Regional data into an Italian inventory of genetic resources in the last Phase C which, taking advantage of this national inventory, also foresees the implementation of actions at national Level to protect and value PGRFA. The Italian LR conservation strategy (PGR Secure Deliverable 4.2), input on Phase C of the National Plan for Agro-biodiversity.

Based on the political context, the information gathered compiling the inventory and the comparison with other source of information, the "Italian LR conservation strategy" concludes that there are conservation and enhancement of use actions to be carried out and provides the following recommendations (see also Deliverable 4.2):

- *Complete the national inventory and continuously update it;*
- *Increase awareness about the importance of LR;*
- *Safe back up LR in ex situ conservation;*
- *Increase coordination in developing and implementing measures for LR conservation and use;*
- *Develop specific conservation actions for home garden LR (i.e. horticultural crop LR) which are major threat;*
- *Make adequate funds for ex situ and on-farm (in situ) conservation actions (initially concentrating efforts on MAPAs) and for research aimed to understand the level of LR genetic diversity, how LR evolve on-farm and to identify genes that underpin evolution and key genetic traits for robustness;*
- *Promote the registration of LR as 'conservation varieties;'*
- *Promote the use of home garden LR in community and home gardens;*
- *Promote the awarding of quality marks for products coming from LR;*
- *Promote typical, local products coming from LR;*
- *Promote campaigns aimed to promote local economies based on nearby products coming from LR.*
- *Promote the use of LR in plant breeding and participatory plant breeding programs, especially those aimed at creating varieties suitable to environmentally friendly agronomic systems.*

6.2.3. UK

An initial scoping exercises for UK crop LR indicated that there remains a significant wealth of LRdiversity in the UK but that it is often highly geographically localized and critically threatened with extinction. The development of the UK national strategy focused primarily on LR diversity in the UK cereal, vegetable and forage crops and collating current knowledge of *in situ* LR maintenance throughout the UK. Easily available information is limited, hence the need for research in this area and the production of a corresponding inventory. The inventory is needed to provide the baseline data to a) identify conservation needs, b) enact the systematic conservation of LR *in situ* and *ex situ*, c) monitor change (including the assessment of genetic erosion), and d) enhance their use in meeting changing market demands and in promoting UK food security.

LR data were collated from a wide range of sources, including existing data sets from four UK seedbanks that are central to the maintenance of LR diversity *ex situ*, and traditional varieties included in the UK National Lists of Varieties, 'B' List. Other data were collated following media releases and advertisements and by using a questionnaire, internet searches, email correspondence, telephone calls and face to face meetings, capturing a broad range of interest groups, companies and individuals.

Results of analysis of seedbank data do not yet reflect the full range of UK LR diversity available in *ex situ* collections maintained in the UK, mainly because a proportion of LR germplasm is not yet recognized in the seedbank information management systems. Nonetheless, the analysis is an important first step in the process of consolidating *ex situ* collections data for inclusion in the UK LR inventory. 'B' List varieties collectively form another important component of the inventory; there may be challenges in the future in keeping this part of the inventory of *in situ* maintained material updated due to a dependency on data provision by a number of commercial companies who are the official maintainers of a large proportion of the varieties.

The project identified and created an inventory of 67 wheat, barley and oats, 569 English and Welsh vegetables and 7 forage LR populations. A number of key *in situ* maintainers of UK LR diversity have been identified and these include commercial seed companies, non-governmental organizations, individual farmers, allotment-holders and home gardeners. Critically, this research has highlighted the fact that while the genetic diversity of our crops may have been impoverished through the loss of many traditional varieties in the past—diversity that is irreplaceable—new variation is currently being created through grower-based breeding. This may be as a result of deliberate or passive variety improvement through repeated cycles of selection and seed-saving or occasionally through accidental or deliberate cross-pollination leading to the production of a new variety. Therefore, while the loss of old varieties and the diversity that has gone with them is of concern, and recognizing that any new variation will not replace what has been lost, it is important to acknowledge that we may now be in a new period of expansion of locally-based crop diversity and therefore need to put in place strategies to capture this diversity and nurture the culture that is responsible for creating and maintaining it.

The "UK national study" concludes with a number of recommended actions that will be necessary to secure the diversity of UK LR as an agro-biodiversity resource critical for future food security, as well as a vital component of our biodiversity and cultural heritage. In summary these are:

- *Establish and maintain a comprehensive inventory of UK LR;*
- *Improve and standardize the management of LR data;*

- *Establish and maintain a list of LR maintainers and key contacts;*
- *Open and maintain dialogue with key groups and individuals;*
- *Initiate a LR protection scheme in England and Wales;*
- *Enhance ex situ LR collections with systematic representation of diversity;*
- *Stimulate LR use by plant breeders;*
- *Carry out research into LR diversity in the context of climate change;*
- *Educate and raise public awareness of local LR diversity;*
- *Review opportunities for supporting LR cultivation through policy and legislative instruments.*

7. Generic European LR *in situ* (on-farm) conservation strategy: recommendations

The elements considered to draft the main recommendations for a European LR *in situ* (on-farm) conservation strategy show that, in spite of the differences that exist among European countries, common needs and elements for a strategic and cooperative approach to *in situ* (on-farm) conservation do exist.

There are both conservation and enhancement of use actions that are recommended and detailed below.

Conservation actions:

- *Educate and raise public awareness of local LR diversity;*
- *Compile a European LR inventory and continuously update it;*
- *Safe back up LR in* ex situ *conservation;*
- *Promote LR re-introduction from genebanks back to on-farm;*
- *Increase European coordination in developing and implementing measures for LR conservation;*
- *Make available adequate funds for LR* ex situ *and* in situ *(on-farm) conservation actions;*
- *Make available adequate funds for carrying out research into LR diversity in the context of climate change and unpredictability.*

Enhancement of the LR use:

- *Promote the use of home garden LR in community and home gardens;*
- *Promote the registration of LR as 'conservation varieties;'*
- *Promote the awarding of quality marks for products coming from LR;*
- *Promote typical, local products coming from LR;*
- *Carry out campaigns aimed to promote local economies based on nearby products coming from LR.*

- *Stimulate the use of LR in plant breeding and participatory plant breeding programs, especially those aimed at creating varieties suitable to environmentally friendly agronomic systems.*

Many of these recommended activities can take advantage of the policy and legislative European opportunities for supporting LR cultivation that were mentioned above.

These conservation and promotion of use actions in favour of LR could be carried out initially concentrating efforts on the most threatened LR and on MAPAs.

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9. Most Used Acronyms

CBD: Convention on Biological Diversity

EU: European Union

EC: European Commission

EAFRD: European Agricultural Fund for Rural Development

GPA: Global Plan of Action

ITPGRFA: International Treaty on Plant Genetic Resources for Food and Agriculture (International Treaty)

LR: Landrace/s

PGR: Plant Genetic Resources

PGRFA: Plant Genetic Resources for Food and Agriculture