CROP WILD RELATIVE CONSERVATION STRATEGIES

Planning and implementing national and regional conservation strategies

Proceedings of a
Joint Nordic/ECPGR Workshop

19-22 September 2016, Vilnius, Lithuania

Nigel Maxted, Juozas Labokas and Anna Palmé (compilers)

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Front cover photograph: Chives *Allium schoenoprasum* (Birutė Karpavičienė)

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Acknowledgement

We are pleased to acknowledge the financial support of the ECPGR Project "CWR Conservation Strategies" and of the Nordic Council of Ministers, without which it would not have been possible to organize and hold this meeting.

1. Workshop Context

(Juozas Labokas, Anna Palmé and Nigel Maxted)

An important background document for wild species conservation activities is the *ECPGR Concept for* in situ *conservation of crop wild relatives in Europe*. It states that "achieving effective and systematic *in situ* conservation of CWR diversity in Europe centres on two core levels of conservation strategy planning: national and regional (European). At each level, priority CWR populations (Most Appropriate Wild Populations) are designated for inclusion in an *in situ* management network of national and regional MAWPs as part of an integrated CWR conservation strategy for Europe. The integrated strategy therefore combines complementary national (bottom-up) and regional (top-down) approaches to conservation planning". This requires input from different stakeholders at both levels. The implemented EC-funded projects PGR Forum, AEGRO and PGR Secure have stimulated the development of National CWR conservation strategies and the identification of priority CWR populations in Albania, Armenia, Azerbaijan, Belarus, Bulgaria, Cyprus, Czech Republic, Finland, Greece, Ireland, Italy, Lithuania, Portugal, Norway, Spain, Sweden and UK. A regional CWR conservation strategy for Europe is being developed as part of the PhD research by Shelagh Kell at the University of Birmingham, UK. Yet, a lot of questions remain unanswered and much work is needed to achieve effective and systematic CWR conservation, particularly, the creation of the integrated European CWR conservation strategy, for which the basis is national CWR strategies. The experts from the Wild Species Conservation in Genetic Reserves Working Group (short name “Wild Species Conservation WG” in this document) and the Nordic CWR project acknowledge that it is of crucial importance to effectively share knowledge and experience between as many European countries as possible, not only including scientists interested in this field but also the agriculture and nature conservation stakeholders.

To tackle these issues, project proposals were sent in to the ECPGR and the Nordic Council of Ministers. The ECPGR project "Promoting implementation of national and regional crop wild relative (CWR) conservation strategies through sharing of knowledge and experience to create an integrated European strategy for CWR conservation" (Acronym: "CWR Conservation strategies") and the Nordic project “Ecosystem services: Genetic resources and crop wild relatives” were both approved for funding. To involve as many experts as possible and to generate an added value it was decided to organize a joint workshop between the two projects and employ Internet broadcast of the main sessions.

The joint Nordic/ECPGR workshop was held 19–22 September 2016 in Vilnius and hosted by the Nature Research Centre, Vilnius, Lithuania.

2. Workshop Overview

<table>
<tr><th>Time</th><th colspan="2">Monday 19 September</th><th colspan="2">Tuesday 20 September</th><th colspan="2">Wednesday 21 September</th><th colspan="2">Thursday 22 September</th></tr>
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<tr><td>AM 9-11</td><td rowspan="2">ECPGR in-country reports on CWR conservation</td><td rowspan="2"></td><td rowspan="2" colspan="2">National and regional CWR conservation strategies</td><td colspan="2">Ex situ conservation and integration with in situ conservation</td><td rowspan="2">ECPGR Discussion 3 on post-workshop activities, horizon scanning</td><td rowspan="2">Nordic project meeting</td></tr>
<tr><td>AM 11-13</td><td>ECPGR Discussion 2 session on integrated CWR conservation strategies</td><td>Nordic Discussion 2 session and summing up</td></tr>
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<tr><td>PM 14-16</td><td colspan="2">Introduction and policy context</td><td rowspan="2" colspan="2">Discussion session 1</td><td rowspan="2" colspan="2">Field trip to Trakai Historical National Park</td><td rowspan="2"></td><td rowspan="2">Meeting of the Nordic and Baltic National programmes</td></tr>
<tr><td>PM 16-18</td><td colspan="2">CWR conservation planning</td></tr>
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(Green: common sessions; Blue: ECPGR only sessions; Yellow: Nordic only session; No colour: associated meetings)

3. Summary of presentations

(The presentations are available online from the Joint Nordic/ECPGR Workshop webpage.)

3.1 Progress with national CWR conservation (ECPGR alone)

3.1.1 In-country Report Albania *(Alban Ibraliu)*

The vascular flora of Albania consists of about 3250 species. Of these, 27 and 150 species are endemic and sub-endemic, respectively. The Flora of Albania can be divided into four main types – Mediterranean, Balkan, European and Euro-Asian. About 400 plant species are crop wild relatives (CWR). About 230 different wild plant species are included in a priority list of CWR or wild harvested plant (WHP) species in Albania. Crop wild relatives (CWR) and wild harvested plant species (WHP) constitute an important element of the nation's plant genetic resources (PGR) available for utilization. Our survey's result suggests that there is an urgent need to identify and effectively conserve crop wild relatives. While increased habitat conservation will be important to conserve most species, those that are predicted to undergo strong range size reductions should be a priority for collecting and inclusion in our genebank.

3.1.2 In-country Report Belarus *(Safiya Dzmitryieva)*

Development and implementation of the concept of CWR conservation includes many successive stages. First is the inventory of CWR, which is basically completed. The number of CWR species is about 600 in Belarus, or 30% of the natural flora. The list has not yet been published as it is not final and could be extended. We have decided to include in the CWR list only those ornamental plants, which are rare in our country, as well as the most popular species, like *Tulipa*, *Gladiolus* and *Iris*. As for medicinal plants, we include in the list of CWR only those species which are used in official medicine, e.g., *Valeriana officinalis*, *Leonurus cardiaca*, etc. The second stage in CWR conservation planning is their classification in order of priority. The classification (ranking) of CWR species into five groups (ranks) is based on their phylogenetic relatedness to the culturally and economically important cultivated plants. The most valuable are the species belonging to the ranks 1 and 2, that have high potential value as they were the source of cultivated varieties. They should be the object of priority attention for conservation. The number of CWR species of the 1st and 2nd ranks is 150, or 25% of the total number of CWR species. Examples are species of *Trifolium*, *Medicago*, *Festuca* and others. Further stage of implementation of CWR conservation will involve analysis of representativeness (frequency of occurrence) of taxa per area. The frequency of CWR occurrence in the country, i.e. species of the 1st and 2nd ranks is as follows: 42.5% are common, 27.4% found occasionally, and 30.1% found rarely or very rarely. Species that occur frequently are not currently given conservation priority, the conservation focus is on rare and very rare species. For example, the rare *Gladiolus imbricatus* showed that a moderate anthropogenic impact plays a positive role in species survival suggesting more detailed studies of the biological features of rare species to ensure their successful conservation. *Ex situ* conservation plays an important role in CWR conservation: 850 samples of seeds of economically useful plant species have been submitted for *ex situ* conservation; they belong to 405 species, 243 genera and 50 families.

3.1.3 In-country Report Bulgaria *(Katya Uzundzhalieva)*

CWR accessions with Bulgarian origin are 5531. They belong to 176 plant species. The largest number of species belongs to the genera *Trifolium, Vicia* and *Aegilops*. The number of CWR preserved in the National genebank counts about 18 621 accessions, from 26 plant families, 88 genera and 176 species. Most species belong to the Poaceae, Fabaceae, Solanaceae, Linaceae, Cucurbitaceae, Asteraceae, Pedaliacae and Brassicaceae. The main activity of the Botanical garden is the creation and maintenance of scientifically organized and documented collection of plants with Bulgarian origin for the study of PGR conservation and sustainable use. The *in vivo* collection comprises 443 species, divided thematically as follows:

- Crop Wild Relatives – *Hordeum bulbosum, Secale rhodopaea, Vicia incisa, Silybum marianum, Chenopodium bonus-henricus,* etc.
- Demonstration collections, including old varieties, populations and forms from traditional and alternative crops – *Triticum spelta, Amygdalus nana, Vicia ervilia, Cynara scolymus,* etc.
- Rare, endemic and protected species – *Haberlea rhodopensis, Tulipa rhodopaea, Anemone blanda, Alissoides bulgaricum, Iris reinchenbachii, Paeonia tenuifolia,* etc.

Thanks to a project funded by the Ministry of Environment and Waters on "Inventory, summarize the information, conservation, use and future politics about Bulgarian CWR" about 600 Bulgarian CWR were prioritized and a database was created.

3.1.4 In-country Report Cyprus *(Angelos Kyratzis)*

The national strategy of Cyprus for the conservation of crop wild relatives was developed in 2012 and encompasses 178 priority taxa. The main recommendation concerning *in situ* conservation is the establishment of 10 priority sites containing the genetic diversity of 75% of priority taxa. This recommendation was forwarded to the competent authorities of Cyprus for *in situ* conservation and it was included among the proposed actions in the draft document for the implementation of the national strategy for the enforcement of the Convention of Biodiversity. The national strategy in expected to be finalized soon and hopefully the *in situ* conservation of CWR will be one of the selected actions for implementation. The main recommendations for *ex situ* conservation were (1) the collection of taxa without any accession and (2) the collection of additional accessions for the taxa that are not well represented in the *ex situ* collections. The competent authority for the implementation of the *ex situ* conservation is the Agricultural Research Institute. Major progress has been made since 2012. More than 1000 accessions have been collected filling most of the gaps that were identified in the national strategy. Germination and regeneration protocols have been developed. Future actions include the regeneration of the remaining accessions, targeted collecting missions to fill the remaining gaps, research activities for the characterization and evaluation of the collected material, and repetition of the gap analysis that consider the recent CWR-related activities.

3.1.5 In-country Report Finland *(Heli Fitzgerald)*

The Finnish crop wild relative diversity comprises of 1905 wild relatives of food, forage, forestry, medicinal and ornamental crops. To help implement *in situ* and *ex situ* conservation of wild relatives, priority species were selected and ecogeographic and gap analysis carried out. The 209 priority taxa are distributed throughout Finland and are found mainly in rural biotopes, cultural areas and shorelines. The *ex situ* gap analysis found majority of the priority species missing from *ex situ* collections. During the last few years, a couple of species have been added to the collections, yet the conservation gaps are still large. The *in situ* gap analysis found several potential sites for genetic reserves, however there has not so far been action towards establishing them, but this will hopefully change soon.

3.1.6 In-country Report Germany *(Lothar Frese and Matthias Ziegler)*

Conservation and use of wild plants for food and agriculture (WPFA) including crop wild relatives is an integral part of the agrobiodiversity strategies launched by the Ministry of Food and Agriculture (BMEL) as well as the national biodiversity strategy launched by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). Both Ministries provide funds for model- and demonstration projects. BMEL supported *in situ* conservation projects for wild apple, wild grapevine and currently funds a pasture plant species project as well as wild celery project. Experiences from these projects will contribute to the development of a concept with the draft title “Long-term conservation and sustainable use of wild plants with use potential for agriculture and food in Germany” which will be finalized in 2017. In parallel elements are being developed which will be required to implement the concept such as an online check list of WPFA (2884 species), a draft WPFA priority list (545 species) as well as a website showing how the German network of crop-specific genetic reserves will look like.

3.1.7 In-country Report Ireland *(Tom Curtis)*

Using the standard methodology, an inventory of 171 CWR was established in 2009. Fifty-seven species were considered Priority, under half of which are Forage Crops. Subsequently, between 2010 and 2013 seeds of 48 species covering 223 accessions were collected and are now stored in the *ex situ* facilities at Back Weston Seed and Gene Bank of the Department of Agriculture, Food and the Marine (DAFM). Ecogeographic data were then collated for these Priority taxa and gap analysis performed by the National Biodiversity Data Centre. Thus, core gap areas were identified and parts of South-west of Ireland are to be the focus for future work as well as parts of the North-west. The Strategy Report compiled in 2014 highlighted several areas which needed attention with respect to long-term *in situ* measures, a core one being the lack of liaison between the agency charged with managing Protected Areas and DAFM. A publication on CWR in Ireland is currently being prepared to bring the topic to the attention of a wider public and especially farmers, foodies and foragers. It will appear in spring 2018.

3.1.8 In-country Report Lithuania *(Juozas Labokas)*

The following authorities and stakeholders are involved in the CWR conservation activities in Lithuania: Ministry of Environment, Nature Research Centre, Plant Gene Bank, Lithuanian Research Centre for Agriculture and Forestry, protected areas authorities and some forestry enterprises. The initial prioritization of CWR, based on national flora methodology, has resulted in 180 species, 26 families and 78 genera (Labokas et al. 2016). The new approach focuses on CWR for food and agriculture by applying three categories of CWR priority regarding species occurrence and threat status: (1) Red Data Book species, (2) not protected, but not frequent species, and (3) widely distributed species. This results in the total number of up to 160 priority species with 2/3 of forage and 1/3 of food species. The National Landscape and Biodiversity Conservation Action Plan for 2015−2020 provides for four genetic reserves for CWR conservation to be established by 2020. Among the sites most suitable for the *in situ* conservation are considered naturally or otherwise protected sites, like riversides, islands, peninsulas, coastal areas as well as border zones. Some hotspots of forage species, wild garlics and wild strawberries are already identified as potential sites for genetic reserves.

Labokas J, Karpavičienė B, Rašomavičius V, Gelvonauskis B. 2016. Developing a national crop wild relative *in situ* conservation strategy for Lithuania: creation of national CWR inventory and its prioritization. In: Maxted N, Dulloo ME, Ford-Lloyd BV (eds.) Enhancing Crop Genepool use: Capturing Wild Relative and Landrace Diversity for Crop Improvement. pp. 217-230. CAB International.

3.1.9 In-country Report Portugal *(Miguel A.A. Pinheiro de Carvalho)*

The recently published concept “Europe Integrated Conservation Strategy” for CWR, proposes to integrate national conservation strategies (NCS) of the contributing countries into the European Regional Strategies. The NCS for CWR presupposes the existence of i) a national inventory of CWR diversity; ii) a plan targeting the priority CWR groups; iii) the development of a national conservation plan based on the gap analysis of CWR diversity and identification of most appropriate wild population(s) for conservation purposes; and finally, iv) the implementation of an action programme for *in situ* and *ex situ* CWR conservation. Thanks to the efforts made by several researchers and institutions aiming to solve specific concerns encountered at different NCS phases, the development of the Portuguese strategy for CWR conservation is warranted. The existence of different botanical realities in the main country regions, e.g. Azores, Madeira and the Portugal mainland, imposes the need to revisit the early CWR national survey published by Magos Brehm et al. (2008). Criteria for species’ classification as CWR need to be better defined and CWR prioritization should be based on national agriculture interests including food crops as well as other crops of economic importance (i.e. fibre, forages, etc.). Efforts need to be made towards elaboration of the national plan for conservation and use of the prioritized CWR, along with monitoring of occurrence and diversity of the species. The coordination between Institutions and conservation bodies developing *in situ* and *ex situ* conservation programmes needs to be improved. Geographical localization of Portugal amongst the richest European regions per unit are and countries dictates the urgency for the development of a robust CWR NCS aiming to secure and improve the use of these genetic resources.

Magos Brehm JM, Maxted N, Ford-Lloyd BV, Martins-Loução MA. 2008. National inventories of crop wild relatives and wild harvested plants: case-study for Portugal. Genetic Resources and Crop Evolution 55:779–796.

3.1.10 In-country Report Turkey *(Necla Taş, Shelagh Kell and Nigel Maxted)*

Turkey demonstrates high richness with respect to both plant genetic resources and crop wild relatives due to its situation at the intersection of two important Vavilov gene centres (Mediterranean and Near East) which have a key role in the emergence of cereals and horticultural plants as well as having five "micro-gene centres" as defined by Harlan (1992). Turkey CWR Check list with 9046 taxa prepared by the PGR Forum CWR Catalogue was prioritized to select a limited number of taxa that can be conserved actively. The native status of CWR, the socio-economic value of the crop to which the wild species are related, the potential ease of use or known value of the wild species and the relative level of threat to the CWR were used for prioritization of the CWR checklist: 36 crop genepools/groups which belong to 64 genera based on economic value of the crop and Annex I of the ITPGRFA were selected as priority crops. The next step for prioritization of CWR by potential or known use of CWR species taxa was concluded for 80 genera in 43 crop genepools/groups. The Red Data Book of Turkish Plants and IUCN Red List of Threatened Species were applied for threat assessment of CWR taxa. At least 82% (369) of the CWR species and 2% (5) of the CWR species are considered threatened respectively at national level and at the European level. Besides, only 14 CWR species were assessed as 'Least Concern' at global level.

Harlan JR. 1992. Crops and Man. American Society of Agronomy, Madison.

3.1.11 In-country Report UK *(Hannah Fielder, Julian Hosking and Nigel Maxted)*

Despite the UK's commitments to improve the conservation of agricultural genetic diversity outlined in international policy documents such as the Aichi targets of the CBD Strategic Plan for Biodiversity, there are currently little active, long-term *in situ* measures and only partial *ex situ* conservation of these valuable resources. Using the standard methodology, an inventory of 223 priority CWR was established. Ecogeographic data were collated for these priority taxa and gap analysis performed. The *in situ* gap analysis reveals key sites both within the current protected area network and outside, and the first formal UK genetic reserve has been established on the Lizard peninsula in SW England. *Ex situ* gap analysis identifies large gaps in the completeness of current collections of UK CWR that will need to be filled. Finally, recommendations were outlined for the *in situ* management of CWR populations on the Lizard peninsula; by establishing active and long-term conservation of CWR within the UK, these resources and their associated genetic diversity can be secured and utilized in the future.

3.1.12 National CWR conservation strategies and action plans status in Europe *(Juozas Labokas)*

Responses have been received from 30 countries of those 39 addressed by the questionnaire. There are several countries which have published and approved their national CWR conservation strategies. Among the leaders are the UK, Finland, Denmark, and Azerbaijan. Published, but not yet fully approved strategies are present in Cyprus, Israel and Russia. There is a group of countries that are well-advanced in the development of their national CWR strategies, such as Portugal, Spain, Italy, Armenia, Czech Republic, Norway, Ireland, Romania and Bulgaria. As for the structure of the strategy, nine countries (Bulgaria, Cyprus, Finland, Germany, Israel, Lithuania, Netherlands, Norway and UK) have all six main elements included in their strategies, i.e., creation of national CWR checklist, its prioritization, diversity analysis of priority CWR, gap analysis and statement of priority conservation actions required, implementation of *in situ*/*ex situ* CWR conservation priorities by appropriate agencies, increased awareness of CWR value, need of conservation and use of CWR diversity by various user communities. There exist different approaches as for the occurrence status (autochthony) of the priority CWR included in the strategy, from only native species (Armenia, Belarus, Bulgaria, Cyprus, Greece, Italy, Turkey) to the native, archaeophyte and neophyte species included (Czech Republic, Denmark, Ireland, Israel, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, UK, Sweden) with different datum lines for the archaeophytes and neophytes. Regarding the categories of crop use to be selected to prioritize the nation's CWR, three countries, Portugal, Norway and Sweden, responded that all crop use categories – human food, animal

food, forestry species, cultivated medicinal and aromatic plants, industrial crops, cultivated ornamental plants and others – are to be selected. Diverse criteria have been applied in prioritization of CWR, the most common being relative level of threat (23 countries), economic value of the related crop (21 countries), and utilization potential of the CWR (based on degree of relatedness to crop and/or known potential for conferring useful traits) (20 countries). Various types of CWR conservation actions are proposed by the countries, however, only very few genetic reserves are formally established – one in UK and one under process in Norway. There are very varying data for the percentage of CWR taxa with more than 5 accessions of priority CWR conserved *ex situ* as seed accessions in genebanks – from less than 1% in Romania to 77 and 82% in Israel and Cyprus, respectively. Among the limitations found in the generation of national strategies, the highest impact was attributed to the lack of an EU agency for genetic resources – 4.5 points out of 5 on average, as well as the lack of political interest at the EU level – 4.1 points.

3.2 Opening session and policy context (Nordic and ECPGR groups)

3.2.1 Welcome to the workshop *(Vincas Būda and Juozas Labokas)*

It is our pleasure to welcome you in this joint workshop here in Vilnius, the capital city of Lithuania. This is the second international meeting of plant genetic resources (PGR) experts hosted by the Nature Research Centre over the last six years. The first one, a Joint PGR Secure/ECPGR workshop took place in Palanga in 2011 and was attended by 101 participants from 38 European countries and one from the United States of America (http://www.pgrsecure.bham.ac.uk/palanga_workshop) and was quite successful. Some of you were organizers and participants of the Palanga workshop and some of you are for the first time in Lithuania now. We hope you will like this place and our people, who are doing their best to facilitate the achievement of our common goals and objectives – to safeguard crop wild relatives and promote their sustainable use.

We wish you fruitful discussions and overall success for the workshop as well as having a nice time during your stay here in Vilnius Old Town and on your excursion to Trakai Historical National Park. The Nature Research Centre is open to cooperation with all of you now and in the future.

3.2.2 Introduction to the ECPGR project *(Nigel Maxted)*

The need to establish a network of experts working on the *in situ* and on-farm of PGRFA was recognized by the ECPGR Steering Committee who recommended in 1999 the establishment of the *In situ* and On-farm Network to promote this relatively new form of conservation. ECPGR established the Network with two Task Forces working on *in situ* conservation of CWR diversity and on-farm conservation of landraces and the first meeting was held on Isola Polvese, Italy, in May 2000 to discuss the functions of the Network; the second meeting of the On-Farm Task Force was held in June 2006 in Stegelitz, Germany, and the third meeting of the On-Farm Task Force was held in October 2007 in Ljubljana, Slovenia and focused on home gardens conservation. *In situ* / On-farm conservation was given priority status by the ECPGR Steering Committee in Phases VIII and IX and subsequently the two Task Forces were made Working Groups and held a joint meeting in Madeira, Portugal in September 2010. The Wild Species Conservation WG held a joint conference with EUCARPIA in June 2014, NIAB Innovation Farm, Cambridge, UK focusing on Enhanced Genepool Utilization. The WG was also recently involved in two Activities funded by the ECPGR Grant Scheme, partnering with the Forages and *Beta* WGs applications.

Also in 2015 the ECPGR Steering Committee asked the Wild Species Conservation WG to establish a Task Force to develop an *ECPGR Concept for* in situ *conservation of crop wild relatives in Europe*. The 'Concept' provides a guide to European regional and national policy development which can be used as a blueprint to drive concerted actions throughout the region. The developments of the science of *in situ* CWR are also reflected in the Newsletter *Crop Wild Relative* Issues 1-10 (http://www.pgrsecure.bham.ac.uk/). A meeting of many members of the Wild Species Conservation WG was held in Vilnius, Lithuania, as part of the Activity CWR Conservation Strategies, and is reported here.

The major achievements of the Wild Species Conservation WG are raising professional and public awareness of the value of CWR and their conservation *in situ* with *ex situ* backup. Much of the work of the WG has been taken forward through three EC-funded projects: PGR Forum, AEGRO and PGR Secure. These generated a series of publication of methodologies and established a vibrant community of experts focusing on cataloguing, conserving and using CWR diversity. Looking forward, the WG is currently preparing a Horizon 2020 coordination and support action for the Work Programme 2016-2017 – Farmer's Pride – which calls for the building of new partnerships and tools to enhance European capacities for *in situ* conservation.

3.2.3 Introduction to the Nordic project *(Anna Palmé)*

The Nordic project "Ecosystem services: Genetic resources and crop wild relatives" was initiated with the long-term aim to assure conservation and sustainable use of the genetic resources that can play a role in assuring future food security. There is an increasing threat to crop wild relatives (CWR) in nature and actions are needed to safeguard these important resources. The national efforts on CWR conservation planning are at different stages in the Nordic region, but in general, progress has been slow and implementation of conservation actions on CWR has been limited. The goals of the project are to increase Nordic cooperation and networking in this field, exchange knowledge on *in situ* and *ex situ* conservation, facilitate interactions between *in situ* and *ex situ* conservation actors and influence CWR policy in the Nordic countries. We anticipate that this will stimulate the national processes and make national conservation actions more efficient by achieving Nordic synergy. The outputs of the projects include two workshops with Nordic stakeholders and international experts (Stockholm 2015, Vilnius 2016), the first common Nordic conservation approach for CWR, policy recommendations on CWR conservation and facilitated use, and a Nordic webpage dedicated to CWR (www.nordgen.org/cwr). The project is funded by the Nordic Council of Ministers.

3.2.4 The Nagoya protocol *(Katileena Lohtander)*

The Nagoya Protocol (NP) under the Convention on Biological Diversity (CBD) is an international, legally binding treaty, which entered into force in 2014. The objective of the Protocol is to provide clear access framework to genetic resources and ensure fair and equitable sharing of benefits arising from their utilization. According to the Protocol, countries have sovereign rights over the genetic resources found on their territory and users must apply for Prior Informed Consent (PIC) before the resources (from countries regulating access) are acquired and utilized for research and development activities. The Protocol may have an impact for collections and seed banks as well. The impact of the NP is likely to be minimal for *in situ* conservation as such. However, there might be implications for both *in situ* and *ex situ* conservation in case material from countries regulating access of genetic resources is sent to researches.

3.2.5 CWR [in][and] the EU Biodiversity strategy *(Jens Weibull)*

The EU biodiversity strategy – launched in 2011 and involving six targets – aims at increasing the contribution of agriculture and forestry to biodiversity. Genetic resources (GR) are mentioned explicitly as a vital component of biodiversity. One means to achieve the target included making more use of agri-environmental measures. Five years later both the Council and the European Parliament (EP) have been reviewing the (relatively lack of) progress made. In a parallel exercise during 2013-2015, the EP initiated the so-called *Preparatory Action on Plant and Animal Genetic Resources*. Outcomes of this action comprised recommendations that included incorporating GR in the value chain and creating supporting policies and legislation. The CWR community is encouraged to make use of a momentum currently at hand. Firstly, the FAO Commission on GR for Food and Agriculture will meet early 2017 to dwell on central issues such as the first State of the World's Biodiversity, a proposal for a global network on *in situ* conservation and on-farm management of PGR, and draft guidelines for national level conservation of CWR. Secondly, active lobbying both nationally and towards the EP is considered an underestimated activity that may very well pay off.

3.3 CWR conservation planning

3.3.1 National and regional conservation strategies *(Heli Fitzgerald, Nigel Maxted)*

Methodologies developed for crop wild relative conservation planning have been widely used in creating national conservation strategies. Regional conservation strategies are in development for example in Europe. *In situ* conservation aims to ensure the conservation of maximum genetic diversity actively and long term. It starts from individual sites or populations forming a national conservation network. Ideally national, regional and global conservation networks will be planned to complement each other in future.

3.3.2 Prioritization of CWR species for action *(Shelagh Kell)*

Prioritization is a fundamental step in the CWR conservation strategy planning process. A pragmatic and systematic approach for prioritizing CWR can be applied nationally, regionally and globally based on three main criteria: 1) priority crops; 2) utilization potential; and 3) relative level of threat. When selecting priority crops, approaches vary using the geographic scope of conservation planning (global, regional, national). At regional and national levels, the choice of priority crops is governed by the intrinsic floristic diversity of the area (i.e., wild relatives of priority crops are present) and food supply and/or economic values. Due to their importance for food security, human food crops are always assigned high priority—although other crops of high economic importance (e.g., forage/fodder, ornamental, medicinal) may also be afforded high priority status. Examples of the selection of priority crops and CWR were provided and an evaluation of the different methods of applying the three main prioritization criteria made. A proposal for the most pragmatic approach to applying the three criteria was given that reduces the likelihood of missing priority taxa in the conservation planning process. Finally, some online resources fundamental to the prioritization process were highlighted.

3.3.3 Climate change and conservation planning *(Jade Philips)*

Climate change is likely to be one of the most important factors affecting our future food security. To mitigate this, we will require our crops to be more genetically diverse, with such diversity available in crop wild relatives (CWR). Conservation of such genetic resources resides within the nation where they are found; therefore, national level conservation recommendations are fundamental to global food security. We investigate the potential impact of climate change on CWR richness in Norway. The results indicate a pattern of shifting CWR richness from the south to the north, with increasing taxa turnover as well as an increase in the number of threatened taxa. Based on these predictions, conservation needs include ensuring that the protected area network facilitates movement of species from the south to the north, targeting the 'core' of populations within reserves and incorporating corridors at the landscape level to enable migration. For *ex situ* conservation, collection of seeds from the trailing edge of populations is recommended, with those that are predicted to become severely threatened the highest priority to conserve. We acknowledge the limits of our climate change models but stress the need for this long-term conservation planning. We will experience the effects of a 1.5°C temperature rise and complementary conservation actions at both the *in situ* and *ex situ* levels will be more necessary than ever.

3.3.4. Proposed standards for CWR genetic reserve *(Joana Magos Brehm, José M. Iriondo, Shelagh Kell, Brian V. Ford-Lloyd, Carlos Lara-Romero, Juozas Labokas, Hannah Fielder and Nigel Maxted)*

The adoption of quality standards is crucial when implementing CWR genetic reserves. They are a management tool as they facilitate the adoption of protocols considered as 'good practice' by the CWR conservation community, they facilitate the improvement of conservation measures and they make the process of decision-making more transparent. They also facilitate the evaluation of management efficacy leading to an efficient CWR conservation in genetic reserves. And finally, they tend to generate greater credibility in the institutions in charge of executing conservation actions and to improve public awareness of the relevance of CWR conservation. Quality standards for CWR genetic reserve conservation can be used by managers interested in conserving CWR in their conservation areas and may be used when selecting

sites for a network of genetic reserves when multiple alternatives exist. The quality standards are divided into three categories: (i) for genetic reserves within existing protected areas, (ii) for the protected areas that were selected for the establishment of genetic reserves, and (iii) for genetic reserves to be implemented outside protected areas. Each of these categories has a set of minimum and optimal standards and are generally related to location, protection, spatial structure, target species to be actively conserved, populations of target species and management.

3.3.5 Draft conclusions from the Nordic CWR project *(Jens Weibull)*

The two-year Nordic project, that will close at the end of 2016, has sparked several activities and yielded concrete outputs. Firstly, there is now a higher level of understanding among the project participants of CWR and *in situ* conservation, as well as a higher commitment and determination to get things going in the Nordic countries. Secondly, a common Nordic taxon list including a draft priority list of 137 species and subspecies have been compiled based on economic value, relatedness and estimated breeders' value criteria. A set of draft recommendations on how to further pursue Nordic CWR conservation has been presented, including national and regional conservation planning and management, and integration of *ex situ* and *in situ* conservation. It is proposed to present these recommendations at the upcoming meeting this autumn of the Senior Officials of the Nordic Council of Ministers (Environment as well as Aquaculture, Agriculture, Food and Forestry).

3.4 National and regional CWR conservation strategies (Nordic and ECPGR groups)

3.4.1 Protected areas in Lithuania *(Algirdas Klimavičius)*

The actual share of protected areas (PAs) in the country is 17.6% (terrestrial area), while it was only 5% in 1990. There are four categories (conservation priority, recuperation priority, ecological protection priority and integrated) and 15 types of PAs in Lithuania. Two of these categories deal with plant genetic resources: PAs of recuperation priority with recuperative and genetic sites as well as PAs of conservation priority with genetic reserves. The purpose of the former is restoration of specific natural resources (e.g., the resources of berries, medicinal plants, animals, peat, underground water and other renewable resources) and preservation of genetic resources. The purpose of genetic reserves is preservation of species, their habitats and populations of wild plants, animals and mushrooms valuable as genetic resources. The other types of PAs encompass a broad concept of conservation and sustainable use of natural resources. Plant genetic resources are often registered in strict nature reserves, state parks or other types of nature reserves. In total, there are 96 state forest genetic reserves with a total area of 1753 ha, 35 genetic reserve zones in other types of PAs with a total area of 1612 ha, and 21 seed (genetic) sites of medicinal and aromatic plants with a total area of 123 ha. According to the Law on National Plant Genetic Resources, *in situ* conservation without granting the status of PA is also possible (seed sites, forest seed stands, tree groups or individual trees).

3.4.2 ECPGR Concept for *in situ* conservation of CWR *(Nigel Maxted)*

There was an imperative to develop and implement a comprehensive strategy for *in situ* conservation of the valuable CWR genetic resources native to Europe because historically these taxa have fallen between the conservation priorities of both the agricultural and conservation communities. These wild plant resources, which are related to the many socio-economically important crops cultivated in the region (food, forage, fodder, beverage, food additive, oil, medicinal, ornamental and forestry crops), contain a wide pool of genetic diversity that is of value for crop improvement. CWR are therefore an important resource for the maintenance of food security and for safeguarding the substantial economic gains to Europe through crop production in the region. However, despite their recognized value, the conservation of CWR has been largely neglected, in part due to the disconnection between the agencies responsible for

the conservation of plant genetic resources for food and agriculture and those responsible for the conservation of wild plant populations in general or the habitats in which they grow.

Recent advances in our understanding of CWR diversity in the region, as well as in planning for their complementary conservation (i.e., both *in situ* and *ex situ*), provide us a solid foundation for the development of a strategic approach to their conservation in Europe based on a range of commonly agreed and widely tested scientific concepts and techniques. However, achieving effective conservation and utilization of European CWR diversity to promote food and economic security in the region will require a coherent, regionally coordinated policy and the appropriate resources to fund their conservation, characterization and evaluation. To achieve sustainable conservation of CWR and maximize their sustainable exploitation in Europe, there is an imperative to develop an EU-led policy to harmonize their conservation, characterization, evaluation and use with existing biodiversity conservation and agricultural initiatives, and to develop new initiatives where necessary.

The Concept for *in situ* conservation of CWR will act as a guide to EU and national policy development which can be used as a blueprint to drive concerted actions throughout the region. The objective was to agree and adopt the Concept with a view to offering it to the European Commission for its consideration when formulating future European policy on *in situ* conservation of CWR diversity. This policy would substantially aid and secure the implementation of the wider EU strategy for the conservation of genetic resources in food, agriculture and forestry in Europe.

The Concept is presented in seven sections: (1) an outline of the Concept and its key elements; (2) a proposal for the designation of Most Appropriate Wild Populations — a new paradigm for CWR conservation; (3) a description of the two core levels of CWR conservation strategy planning needed for the development of a comprehensive pan-European conservation strategy; (4) a vision of how an integrated CWR conservation strategy for Europe can be established and administered; (5) rationale for new policy required to establish and support the ongoing operation of the integrated strategy; (6) proposals for enhancing the utilization of conserved CWR resources in Europe; and (7) options to promote awareness and raise additional funding for *in situ* CWR conservation with complementary management of *ex situ* germplasm samples. Specific recommendations for taking forward the *in situ* conservation strategy for CWR in Europe are also included. The Concept has been endorsed by the members of the (former) ECPGR *In situ* and On-farm Conservation Network and represented the Network's vision of how *in situ* conservation of CWR diversity could be achieved in Europe, as well as forming the basis of an action plan for ECPGR activities on CWR conservation over the next ten years. The document has also been endorsed by the ECPGR Steering Committee in March 2015.

3.4.3 European CWR strategy *(Shelagh Kell)*

Europe is an important centre of diversity of many crops and their wild relatives and these CWR are potential genetic resources for crop improvement and food security, as well as for safeguarding the substantial economic gains to Europe through crop production in the region. Recent advances in our understanding of CWR diversity in the region, as well as in planning for their complementary conservation, provides a solid foundation for the development of a strategic approach to their conservation in Europe based on a range of commonly agreed and widely tested scientific concepts and techniques. In this presentation, a concept for conservation of Europe's CWR diversity integrating two core levels of conservation planning—national and regional—was presented, as well as a proposal for the selection of regional priority species and Most Appropriate Wild Populations (MAWPs) for complementary (*in situ* and *ex situ*) conservation. The fundamental requirement for the integrated strategy to meet the interests of the user community was stressed, and the need for a coherent, regionally coordinated policy and the appropriate resources to fund the conservation, characterization, evaluation and dissemination of Europe's CWR diversity was emphasized.

3.4.4 Common Nordic conservation action plan *(Heli Fitzgerald)*

Conservation of Nordic crop wild relative diversity is planned within a project 'Ecosystem services – genetic resources and crop wild relatives'. A common CWR checklist and priority list were created for the five

Nordic countries: Denmark, Finland, Iceland, Norway and Sweden. The priorities were established by considering the value and use of each CWR species in the region. The next phase of the study is to continue by finding the potential *in situ* conservation sites, considering ecogeographic land characteristic maps, and giving recommendations for future conservation of CWR in the Nordic region.

3.4.5 Regional strategy for the SADC region

(Joana Magos Brehm, Shelagh Kell, Hannes Gaisberger, Eve Allen, Imke Thormann, Ehsan Dulloo and Nigel Maxted)

As part of an EU-ACP-funded project, conservation planning for CWR diversity of the Southern African Development Community (*S*ADC) region is currently being undertaken. Among the more than 1900 CWR species found, 102 have been prioritized for immediate conservation action based on the regional and global food security and economic value of the crops to which they are related, and their potential for utilization in crop improvement programmes. CWR of regionally and/or globally important crops, such as coffee (*Coffea*), cottonseed (*Gossypium*), cowpea (*Vigna*), eggplant (*Solanum*), millets (*Echinochloa*, *Eleusine*, *Eragrostis*, *Panicum* and *Pennisetum*), rice (*Oryza*), sorghum (*Sorghum*), watermelon (*Citrullus*) and yam (*Dioscorea*) are amongst those prioritized. The preliminary results of diversity and conservation gap analyses for these regional priority CWR, as well as the main conservation recommendations were presented. In addition, questions about how to integrate national and regional conservation priorities were raised, and conservation planning tools that were developed during the project were presented, namely: a checklist and inventory tool, an occurrence data collation template, a national strategic action plan and background document templates, and the *Interactive Toolkit for CWR Conservation Planning*.

3.4.6 Swedish challenges and how to possibly solve them

(Jens Weibull and Mora Aronsson)

The Swedish conservation of crop wild relatives, CWR, operates within a multi-policy context: the FAO Global Plans of Action 1 & 2, the Aichi Biodiversity Target 13 (genetic diversity), and the EU Biodiversity Strategy. Notwithstanding, the issue of CWR soars indecisively between agricultural and environmental sectors, as in most other countries. In 2013, a Government Bill commissioned "agency cooperation about the mapping and monitoring of genetic diversity in wild and domesticated plants and animals". While such inter-agency cooperation has not been fulfilled, individual agencies have implemented certain actions aiming at conserving genetic diversity. The State Forestry Agency has developed a strategy for gene conservation in protected areas (PAs), including a database containing genetic information of such areas. The Swedish Environmental Protection Agency have developed guidelines for management of protected habitats, e.g. meadows and (semi)natural grasslands, and The Swedish Board of Agriculture currently supports ca. 100 000 hectares of diversity-rich areas through agri-environmental measures in the Rural Development Programme. Recent analyses, however, show a continuing loss of these valuable areas. Despite this apparent lack of progress, Swedish is well prepared through a set of powerful tools: the Swedish Species Observation System (ca. 7.5 million observations of vascular plants), the Swedish Taxonomic Database DYNTAXA, and a well-developed citizen science network of flora guardians. A short-term, four-step strategy for increased overall action is proposed to include (1) a revision and update of the report *Genetic variation in wild plants and animals* (from 2008) with greater focus on genetic diversity for use, (2) true implementation of governmental decision (from 2012) regarding mapping and monitoring of genetic diversity, (3) an immediate launch of *in situ* conservation of valuable genetic resources in PAs, and (4) launching of a national gap analysis.

3.4.7 Obtaining and digitizing georeferenced data

(Necla Taş)

Georeferencing is about referencing a locality description using a coordinate reference system, thus enabling representations into maps. Occurrence data of plant species have been compiled from multiple sources, namely genebank databases, herbaria, researchers' archives, national programmes, international agricultural research centres, online databases, scientific literature and individual scientists. All passport data which do not include geographical coordinates but do include available localities can be georeferenced using either gazetteers or automated online gazetteers such as GeoNames (www.geonames.org) and BioGeomancer (http://www.biogeomancer.org) as well as Google Earth. This process is called Georeferencing which assigns geographical coordinates to collection records or

observation data missing such coordinates. BioGeomancer is a web-based automated georeferencing toolkit that allows the submission of locality descriptions, either singly or in batch mode and passes the data through several validation tests to check for possible errors in already georeferenced data. Google Geocoding API (https://developers.google.com/maps/documentation/geocoding) is also used to assign coordinates to locality description of plant species. The free DIVA-GIS software (http://www.diva-gis.org/) consists in many useful tools such as export/import of grid and shape file data, conversion of latitude/longitude data to other projections, geo-positioning of unreferenced base map images, GPS data import (as points, lines, or polygons). Thanks to technological advance it is possible to easily share and download the spatial data of plant species via the Internet. One of the key resources is the Global Biodiversity Information Facility (GBIF) (www.gbif.org) which provides free and open access to taxon and accession distribution, conservation and environmental data, and is the biggest biodiversity database on the Internet. The other important database available via the Internet is Bioversity International Collecting Missions (http://bioversity.github.io/geosite/) which provides access to original passport data of more than 220 000 samples collected around the world during Bioversity International supported missions.

3.4.8 Working with biodiversity / non-PGR stakeholders *(Vojtech Holubec)*

PGR including CWR in the Czech Republic are under the responsibility of crop curators working in 12 cooperating institutions within the National Programme for PGR conservation. The institutions comprise public and private research institutes, universities and private companies. Conservation of wild biodiversity is managed by the Agency of Nature and Landscape Protection under the Ministry of Environment. Other biodiversity stakeholders are NGO conservationists, farmers, breeders, companies engaged in bioproducts, botanists, horticulturists, botanical gardens and experienced hobby gardeners. National Programme partners invite those stakeholders to workshops and attempt to educate them and other interested general public on conservation issues and conservation strategy in agricultural and horticultural shows, workshops, TV, radio, websites etc.

3.4.9 From planning to implementation *(Lothar Frese and Maria Bönisch)*

The project "Genetic reserves for wild celeriac species (*Apium* and *Helosciadium*) as component of a network of genetic reserves in Germany" was planned on request of the Ministry of Food and Agriculture (BMEL) and started in 2015. The task is to establish genetic reserves for *Apium graveolens, Helosciadium inundatum*, *H. nodiflorum* and *H. repens* in 2018. The work started with the acquisition, compilation and harmonization of occurrence data. Using this inventory and with the assistance of local experts 350 potential genetic reserve sites have been selected in Germany. The experts travelled to the sites to verify the existence of the species. Feasibility studies were produced for each site and used to plan the next step, i.e. sampling of leaf probes of 100 occurrences for genetic studies. Based on the genetic and the feasibility studies an average of 9 occurrences per species will be chosen and recommended as genetic reserves. Semi-structured interviews were conducted in 2016 to understand to which extent nature conservation agencies and land owners would welcome and support the establishment of genetic reserves. A conclusion derived from the interviews is that the *ECPGR Concept for* in situ *conservation of crop wild relatives in Europe* (Maxted et al. 2015) should be underpinned by a communication and funding strategy.

Maxted N, Avagyan A, Frese L, Iriondo JM, Magos Brehm J, Singer A, Kell SP. 2015. ECPGR Concept for *in situ* conservation of crop wild relatives in Europe. Wild Species Conservation in Genetic Reserves Working Group, European Cooperative Programme for Plant Genetic Resources, Rome, Italy.

3.4.10 European governance structure *(Nigel Maxted)*

The text of this presentation is an extended summary as it addresses critical issues for the development of a European or Nordic regional in situ *network and it has thus far not been addressed in other publications.*

Before we address specifically the issues of providing a governance structure for a European network of *in situ* sites to conserve CWR populations, the point must be explained why we cannot just rely on *ex situ* conservation of CWR diversity alone. It is well established that both the application of *in situ* and *ex situ* techniques have advantages, see summarizing table below:

In situ **advantages**	*Ex situ* **advantages**
1. Appropriate for all organisms 2. Dynamic conservation in relation to environmental changes 3. Permits species/pathogen interactions, so continuing dynamic evolution possible especially concerning resistance to pests and diseases 4. Provides easy evolutionary and genetic study 5. Best for "recalcitrant" species 6. Possibility of multiple target taxa reserves	1. Efficient and reproducible for many species 2. Medium- and long-term storage is feasible 3. Easy access for evaluation for resistance to pests and diseases 4. Easy access to breeding and other form of utilization 5. Little maintenance once material is conserved (seed at 10 US$ / year)

And the reasons why we cannot just rely on *ex situ* conservation of CWR diversity alone can be summarized as follows:

- *In situ* conservation allows continued evolution in the environment, *ex situ* literally freezes evolutionary adaptation (including climate change adaptation);
- *Ex situ* conservation involves sampling populations in the sense of numbers of populations and within populations, but with *in situ* you are concerning whole populations. It is impossible to maximize CWR *ex situ* because of the sampling process;
- Collections for *ex situ* are often targeted to short-term goals, whereas *in situ* concerns whole populations and so conserves more overall diversity;
- Genetic diversity is lost when regenerating *ex situ* accessions and we would need to go back to the wild to collect more;
- If *ex situ* only and material is lost or used, *ex situ* may not be able to recollect if not conserved *in situ*.

Therefore, complementary conservation is needed as both techniques have advantages and disadvantages!

Given the requirement for complementary conservation and therefore, the need for a network of sites to conserve *in situ* CWR populations, there appears to be three alternative options:

Option 1. National network(s) alone:

- Advantages:
  - Strong national commitment and support for the network;
  - Good linkage to the national user community;
- Disadvantages:
  - Multiple national networks taken together may not provide sufficient regional coverage of CWR diversity and that element of CWR regional diversity not represented in the network would be left vulnerable to extinction or erosion;
  - Multiple national networks alone may also lack regional support and resources to maintain purely nationally designated sites.

Option 2. Regional network(s) alone:

- Advantages:
  - Good regional coverage of CWR diversity;
  - Good linkage to regional user community (notably European commercial and governmental breeders);
  - Relatively easily linked to regional policy instruments (e.g. CAP, Natura 2000);

- Disadvantages:
  - Lack of commitment from national authorities to establishing sites which may not be a national priority;
  - Likely to require regional funding to maintain regionally important sites if they are not a national priority;
  - Some countries with regional important CWR diversity may not wish to be involved in the integrated regional network, undermining the regional network itself.

Option 3. Integrated national and regional network:

- Advantages:
  - Good national and regional commitment and support,
  - Good national and regional coverage of CWR diversity,
  - Good mixture of national and regional funding to resource site management,
  - Useful links to the regional and national user community
  - Useful links to regional policy instruments (e.g. CAP, Natura 2000)
- Disadvantages
  - Some countries containing regionally important CWR diversity may not wish to be involved in the integrated regional network.

The conclusion being that scientifically establishing an integrated national and regional network would be the best holistic model and would provide the maximum CWR diversity coverage, such a network of networks could be said to be bottom-up, inclusive, decentralized and individual site would be locally owned, but the final decision would need to be made collectively by the nations involved. Such an integrated national and regional network was proposed in the *ECPGR Concept for* in situ *conservation of crop wild relatives in Europe* (Maxted et al. 2015).

Rather than each site working independently, they would be integrated to enhance their overall function, they would effectively form a meta-network, and the key functions of such a European integrated regional CWR *in situ* network might include:

- Facilitating the coordination of the many ongoing initiatives dealing with *in situ* conservation and management of CWR populations in Europe;
- Fostering stronger partnerships (funding) at national and regional levels, as well as providing a means of integration with the global network (the so-called Vavilov Network) being developed by FAO (2013, 2014);
- Impacting positively on activities at country-level and demonstrating benefits that directly support the ultimate custodians of CWR diversity, the local communities that may be found in and around protected areas/reserves and/or farmers and farming communities who are involved in day-to-day management of CWR populations;
- Achieving the desired fundamental outcome of *in situ* conservation: the safeguarding in perpetuity of important wild genetic resources for use either directly by famers or by plant breeders and other scientists in crop improvement. Thus, another important function of the network(s) is to catalyse better linkages between conservation and sustainable use of CWR diversity for the benefits of current and future generations.

To be sustainable, the integrated national and regional European CWR network would require some form of network governance. Governance is defined by Wikipedia (Sept. 2016) as “the way the rules, norms and actions are structured, sustained, regulated and held accountable”. In the context of the European CWR network this would require identifying which European body has appropriate geopolitical and administrative stature to provide the necessary oversight? At the European level, organizations such as ECPGR, EEA, EU Environment (who manage the existing Natura 2000 network), EUROSITE or EUROPARK might be considered. However, if linked to the global Vavilov Network then international options might also be considered such as: FAO Globally Important Agricultural Heritage Systems, FAO IT, CG Centres, UNESCO Man and Biosphere Programme, UNESCO World Heritage Sites, CBD Programme of Work on

Protected Areas and IUCN Key Biodiversity Areas. Other issues that require resolution would be whether the European CWR network was managed by the organization providing the governance structure directly, or was a virtual network where individual sites were managed locally/nationally but chose to affiliate themselves with the European CWR network because of the associated benefits. Further whether the sites should be formally established protected areas or whether they include formally established protected areas and less formally designated sites that were still managed to maintain CWR diversity. Again, these decisions would need to be made collectively by the countries involved. However, it would be important, in line with the CBD and ITPGRFA, to maintain national sovereignty over the CWR genetic resources located in Network sites that are located in a country and so fall under national legislation. Therefore, sites included in the European CWR network would need to follow three precepts: all sites are nominated by national PGRFA coordinators, all sites remain under the jurisdiction of national agencies, and access to CWR material held in sites is controlled by national authorities using ITPGRFA accepted SMTAs.

The agency supplying network governance would in turn accept management and coordination responsibilities for the network, setting and maintaining minimum criteria for inclusion in global network, establishing that:

- The CWR population is native at that location or, if introduced, has existed at that location for at least 15 generations.
- The population contains distinct or complementary genetic diversity (ecogeographic diversity may be used as a proxy for genetic diversity) or specific traits of interest that enhances the overall value of the network.
- The population is actively and sustainably managed according to the minimum quality standards for genetic reserve conservation (Iriondo et al. 2012).
- The population is routinely sampled and held in a backup *ex situ* facility every 15 generations.
- The population is 'healthy' with a good chance of long-term survival (normally thought to mean 100 years) and so threats from development or climate change are minimal.
- The population is accessible for research or utilization in accordance with the International Treaty via the appropriate national agencies and samples must be available on request from a specified *ex situ* facility as part of the multilateral system.
- The population is nominated by the appropriate national PGR authority for inclusion in the Network.

The governing agency would need to assess whether individual sites meet the minimum criteria for inclusion in the network and once included, periodically to review whether individual sites continue to meet the minimum criteria for inclusion in network and fulfil reporting obligations. Further they should:

- Promote access to *in situ* conserved CWR populations so linking conservation to sustainable utilization and benefit sharing;
- Increase awareness of value of CWR for agriculture and the environment among governments, commercial entities, institutions, decision-makers and the general public;
- Ensure and promote dynamic *in situ* conservation of CWR populations;
- Coordinate and provide expertise on *in situ* conservation CWR management (tools, protocols, exemplars, evidence-base, etc.);
- Assist with provision of grants from European and international funders, in-kind assistance and co-financing to support the network;
- Develop effective strategies for gathering, documenting and disseminating baseline information on CWR populations in Europe;
- Recommend research projects to countries and make proposals for the organization of regional or national cooperation;
- Coordinate regional cooperation between European States participating in the network, establish a European and national policy and legislative framework, e.g. EU Directive on PGRFA;

- Coordinate European scientific programmes, inclusion of CWR in EU Habitat Directive, promotion of nature and CWR diversity conservation collaboration;
- Consult with European non-governmental organizations on scientific or technical questions and helpdesk provision;
- Integrate European regional and European national *in situ* CWR conservation with the developing global network.

Finally, to get the European CWR network started it would be a good idea to have some 'ballpark' estimate of the level of costs involved in establishing the network. Table 1 provides such a 'ballpark' estimate. The estimate cost of €6M would enable the establishment of the network and its financing for the first ten years of its life. €600K per year may seem initially like a high price tag but given the costs of maintaining Europe's 170K CWR seed accessions (FAO 2010) at 10 USD per accession (Schreinemachers et al. 2014) is 1.7M USD or €1.6M and that figure does not include the initial collection and processing costs, then regeneration costs; the *in situ* conservation is not so high. Specifically, it is a very small fraction of the utilization value of $115-120 billion worldwide annually for use of these conserved resources (Pimentel et al. 1997; PwC 2013); then the figure becomes very reasonable. The point being that potential costs should not be a deterrent to establishing the European CWR network, especially when there are many European foundations, commercial breeding companies and the EU itself that might provide potential sources of funding.

Table 1. 'Ballpark' estimate for establishing European CWR network

Scale	Activity	Cost K€
Regional costs	Research European priority sites to establish CWR genetic reserves for IT Annex 1 CWR taxa	375
	Initial set of 25 CWR genetic reserves for CWR taxa established within 10 years of global network(s) @ €100 000 per CWR genetic reserve	2,500
	Network Secretariat staff and a Managerial Committee for first 10 years of global network @ €150 000 per annum	1,500
	Total international costs	*4,375*
National costs	Production of national CWR conservation strategies for 10 key countries in Europe @ €100 000 per national CWR conservation strategy	1,000
	Running costs of 25 national genetic reserves @ €25 000 per CWR genetic reserve for 10 years	625
	Total national costs	*1,625*
	Total costs of global European network(s)	**6,000**

FAO. 2010. Second report on the State of the World's Plant Genetic Resources for Food and Agriculture. FAO, Rome. Available at http://www.fao.org/agriculture/seed/sow2/en/ (Accessed 25 July 2015).

FAO. 2013. Towards the establishment of a global network for *in situ* conservation and on-farm management of PGRFA. Report of Technical Workshop held in Rome, Italy 13th November, 2012. Food and Agriculture Organization of the United Nations, Rome, Italy. Available at: http://www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/itwg/6th/technical-workshop/en/ (Accessed 05.04.13).

FAO. 2014. Concept note on global networking on *in situ* conservation and on-farm management of plant genetic resources for food and agriculture. Information document to the 7th Session of the Intergovernmental Working Group on Plant Genetic Resources for Food and Agriculture (CGRFA/WG-PGR-7/14/Inf.3, Commission for Genetic Resources for Food and Agriculture, Rome, Italy. Available at: http://www.fao.org/3/a-ml477e.pdf (Accessed 06.03.2015).

Iriondo JM, Maxted N, Kell SP, Ford-Lloyd BV, Lara-Romero C, Labokas J, Magos Brehm J. 2012. Quality standards for genetic reserve conservation of crop wild relatives. In: Maxted N, Dulloo ME, Ford-Lloyd BV, Frese L, Iriondo JM, Pinheiro de Carvalho MAA (eds.). Agrobiodiversity Conservation: Securing the Diversity of Crop Wild Relatives and Landraces. Pp. 72–77. CAB International, Wallingford, UK.

Maxted N, Avagyan A, Frese L, Iriondo JM, Magos Brehm J, Singer A, Kell SP. 2015. ECPGR Concept for *in situ* conservation of crop wild relatives in Europe. Wild Species Conservation in Genetic Reserves Working Group, European Cooperative Programme for Plant Genetic Resources, Rome, Italy. http://www.ecpgr.cgiar.org/fileadmin/templates/ecpgr.org/upload/WG_UPLOADS_PHASE_IX/WILD_SPECIES/Concept_for_in__situ_conservation_of_CWR_in_Europe.pdf

Pimentel D, Wilson C, McCullum C, Huang R, Dwen P, Flack J, Tran Q, Saltman T, Cliff B. 1997. Economic and environmental benefits of biodiversity. BioScience 47:747–757.

PwC. 2013. Crop wild relatives: A valuable resource for crop development. Price Waterhouse Cooper. [online] Available at: http://pwc.blogs.com/files/pwc-seed-bank-analysis-for-msb-0713.pdf

Schreinemachers P, Ebert AW, Wu MH. 2014. Costing the *ex situ* conservation of plant genetic resources at AVRDC – The World Vegetable Center. Genetic Resources and Crop Evolution 61(4):757–773.

3.4.11 Linking CWR conservation to use *(Lothar Frese)*

A strong link between conservation and use exists as evidenced by numerous examples of crop wild relatives used in plant breeding (e.g. Kole 2011) but not all uses are sustainable (Cowling 2012). Any human use of natural resources depletes the resource unless a system is being organized that allows the sustainable use of the resource. In addition, if we do not check whether use is indeed sustainable (Dempfle et al. 2015), the concept of sustainable use of plant genetic resources may go astray. This would not be in the interest of the plant genetic resources conservation community. Use systems are fully sustainable if they comply with the criteria for ecological, social and economic sustainability. Examples of uses of crop wild relatives at the habitat level (ecosystems service), species level (harvesting of medicinal plants in the natural habitat) and intraspecific level were presented, and it was discussed to what extent these uses can be considered sustainable.

Cowling WA. 2012. Sustainable plant breeding. Plant Breeding: 1-9.

Dempfle L, Frese L, Gregorius HR, Janßen A, Wedekind H. 2015. Nachhaltige Züchtung: Betrachtungen zum Umgang mit genetischen Ressourcen in Nutzungssystemen. Pflanzenbau – Tierproduktion – Forst- und Fischereiwesen. Agrobiodiversität, Band 38. Schriftenreihe des Informations- und Koordinationszentrums für Biologische Vielfalt, Bonn, Germany.

Kole C. (ed.). 2011. Wild Crop Relatives: Genomic and Breeding Resources, Cereals. Springer-Verlag Berlin Heidelberg, 497 pp.

3.5 *Ex situ* and *in situ* conservation integration (Nordic and ECPGR groups)

3.5.1 *Ex situ* conservation of CWR in the Nordic region *(Anna Palmé)*

The Nordic region has a strong history regarding cooperation on *ex situ* conservation of plant genetic resources. The responsibility is divided between NordGen (the Nordic regional genebank) and the Nordic National programmes. So far NordGen has been the major actor for *ex situ* conservation of CWR, but the new genebanks for threatened species in Finland and Norway might play an increasingly important role in the future. Also, botanic gardens have an important role, especially regarding communication on CWR.

NordGen stores a wide range of genetic resources and the mandate includes cultivars, landraces, breeding and research material, as well as wild accessions. About 20% of the collection consists of wild or semi-wild accessions, and this part is dominated by an international collection of barley CWR and collections of local Nordic forage grasses and legumes. In total, NordGen stores wild accessions from about 360 different taxa, but for most of these taxa the numbers of accessions conserved are low. However, a few high priority taxa have a dense geographic sampling that covers their Nordic distribution area. When comparing the taxa at

NordGen with those prioritized in national strategies, only a small proportion is conserved at NordGen (8 of 209 priority taxa in Finland and 24 of 204 in Norway).

To what extent *ex situ* conservation should be applied to CWR species is still undecided in the Nordic region. In general, *in situ* conservation should be regarded as the main conservation approach for most CWR species. However, to be able to assure long-term conservation, *in situ* conservation of important CWR populations should be backed-up with *ex situ* conservation. In addition, *ex situ* conservation could play a role in facilitating access to CWR accessions.

3.5.2 *Ex situ* conservation and reinforcement work

(Kristina Bjureke)

The Natural History Museum, University of Oslo, started with *ex situ* conservation of threatened native Norwegian plants in 2007. According to GSPC (Global Strategy for Plant Conservation) the goal is for 2010 Target 8: at least 75% of threatened plant species in *ex situ* collections, preferably in the country of origin, and at least 20% available for recovery and restoration programmes. Now in 2016 we have 50% of the threatened plant species on the Norwegian Red List 2015 in our National Norwegian Seed Bank, and approximately 50 species in living conservation plantations. Our aim is to have, if possible, seeds from five geographically separated populations. We should work hard to obtain the international goal. The Natural History Museum works actively with reinforcement and reintroduction programmes on six threatened plant species. Some of the plant species in our seed bank are also CWR.

3.5.3 Botanic gardens and CWR conservation

(Hjörtur Þorbjörnsson)

The activities of botanic gardens include acquisition, conservation, research, education, communication and exhibition of vascular plants. Conservation forms the backbone of these activities and many botanic gardens play an active role in both *in situ* and *ex situ* conservation. With limited resources, however, conservation activities are easily overshadowed by exhibition and education work. Thus, it is crucial not only to have international or regional understanding of the importance of conservation of plants, but also to anchor the importance within the local community itself and especially the funding bodies of the garden. Museums in general, and thus botanic gardens, can be thought as a collaborative process for translating knowledges that reside in and between the garden and the community. Conservation of CWR offers the garden a good opportunity for a discussion with the society on conservation issues and promotes an understanding on conservation of other groups of plants. By working on socio-economically important plants, such as the CWR, the botanic gardens increase the relevance of the garden in the communities within which they work.

3.5.4 *In situ* and *ex situ* conservation of *Beta patula*

(Miguel A.A. Pinheiro de Carvalho, Emanuel Silva, Gregorio Freitas, Humberto Nobrega)

One of the recommendations of the AEGRO project, grant 057 AGRI Gen Res 817/2004 was to develop a plan and guidelines to create a genetic reserve for endemic beet CWR, *Beta patula* Aiton. This plan presupposes the evaluation of ecogeographic and genetic baseline of the species and the implementation of a management programme aiming to monitor and maintain *in situ* and *ex situ* genetic diversity of this species. In the framework of the Life Recover project, LIFE12.NAT.PT.000195, actions A6, C8 and D11, implementation of this plan commenced in 2014. The survey of plant biodiversity on *Ilheu do Desembarcadouro*, Madeira, where the main population of *B. patula* was identified, revealed that 12 other CWR, including 8 endemics, share the same location. This feature makes *B. patula* genetic reserve a potential most appropriate wild population (MAWP) for *in situ* conservation of several priority CWR. Collecting ecogeographic data include the gathering of data on the habitat, soil and climatic conditions and their variations. Species population census and species richness and diversity indexes were determined, using 15 quadrates, with an area of 16 m^2 each. *B. patula* population absolute and effective size will be surveyed on a regular basis until the end of project in 2017. Measures of species richness and diversity allowed us to determine the most suitable and best population's spots to be included in the genetic reserve boundaries. The preliminary results show that the *B. patula* population has higher number of plants and is more resilient to fluctuations dictated by environmental conditions than was expected. The

seed soil bank has on average 2272 seeds per m^2, but contributes only 1 to 10% to yearly plant recruitment. The analysis of population genetic diversity and its spatial display is currently underway, based on the screening of 150 plant samples, using 14 polymorphic SSRs, from which 7 are linked with the traits of interest. A backup collection of plant germplasm with 19 accessions was created and stored in the ISOPlexis Genebank.

Acknowledgement: This work was funded by LIFE+ programme of European Union, through LIFE RECOVER NATURA project, LIFE12 NAT/PT/000195.

3.5.5 Future European and national *in situ* CWR conservation *(Lorenzo Maggioni)*

As part of the new mode of operation of ECPGR during Phase IX, the Working Group (WG) on Wild Species Conservation in Genetic Reserves operates with a list of 82 experts from 37 countries and is chaired by Nigel Maxted, UK. Wild species, mainly related to forages, vegetables and medicinal or aromatic plants, have started to be included in the European Collection established by AEGIS (A European Genebank Integration System), reaching 5881 accessions by September 2016, that is 20% of the European Collection. On the other hand, the EURISCO catalogue is documenting ca. 233 700 wild/weedy accessions conserved in European genebanks (13% of EURISCO accessions). Following the approval of the *ECPGR Concept for* in situ *conservation of crop wild relatives in Europe*, several related activities were funded through the ECPGR Grant Scheme. These concern a survey of genus *Patellifolia* (GeDiPa), the establishment of a workplan on *in situ* conservation of forage crops (Forages 2020), an inventory of wild *Vitis vinifera* and standards for *ex situ*/*in situ* conservation (InWiGrape), consequences of climate change for conserving leafy vegetables CWR in Europe (CCLEAFY), as well as 'CWR Conservation strategies'. The recent 14th ECPGR Steering Committee meeting held in Bosnia and Herzegovina took note that the Chair of the Wild Species Working Group received from its members the highest score of appreciation. National Coordinators and WG members were encouraged to promote *in situ* activities at country level, while the ECPGR Concepts for *in situ* conservation of crop wild relatives in Europe and for on-farm conservation and management of PGRFA were planned to be offered to the European Commission for consideration. A specific recommendation was also made to include in EURISCO data of *in situ* CWR conserved in genetic reserves. To such effect, representatives from the Wild Species Conservation in Genetic Reserves WG, the Doc&Info WG and selected Crop WGs should develop an agreed minimum data exchange format based on existing *in situ* descriptor lists. Finally, it was recommended that ECPGR member countries use the Standard Material Transfer Agreement (SMTA) for distribution of both Annex I and non-Annex I PGRFA, independently of whether material was conserved *ex situ* or held *in situ*.

4. Summary of workshop discussions

4.1 Discussion session 1: National planning/implementation

4.1.1 Nordic Discussion *(Anna Palmé and Ulrika Carlson-Nilsson)*

Below is a text summarizing the discussions in the two Nordic discussion groups. A large part of the discussion is centred on policy recommendations that will be presented to stakeholders in the Nordic countries. The content and phrasing of the recommendations was discussed and the texts listed below are compromises combining feedback from both groups.

General comments: In general, it is important to keep the policy recommendations short and concise if we expect them to be read by politicians/policy-makers. More details can instead be included in the Nordic project report. To give background and put the recommendations into context, some additional text is required. In addition to the policy recommendations listed below, we should in the final policy brief include a paragraph explaining what a CWR is and why they are important. The policy brief should be regarded as a means of kick-starting activities on CWR conservation in the Nordic countries.

Policy recommendation 1 (text updated after discussions at the workshop)

Each Nordic country should develop a national strategy for in situ *and* ex situ *CWR conservation and sustainable use in line with relevant FAO guidelines. The work done at the Nordic level can be used as a framework, or supporting information, for this. The Nordic and national work should be complementary to each other and also to European and global strategies.*

Comments: No specific country recommendations should be added to this point. This is a national matter and does not need to be addressed in detail in this document. In general, the policy recommendations should be kept as short, clear and as specific as possible. At a later stage, action plans will be needed for the implementation of the strategies.

Policy recommendation 2 (text updated after discussions at the workshop)

Each Nordic country should develop the policy instruments needed to facilitate conservation and sustainable use of crop wild relatives, involving all relevant sectors in this process. Suggested measures include evaluating what policy actions are needed for efficient implementation of conservation and use of crop wild relatives and/or analysing obstacles that hinder such effective conservation and use.

Comments: It is important to point out that collaboration and action integration of the agricultural and environmental sectors are essential for this work and that also other sectors, such as information and education, can play important roles in CWR conservation. On the national level, there is a need to clearly define the division of responsibility between the environmental and agricultural actors. Policy instruments or other actions that facilitate cooperation are essential (including specific funding).

Policy recommendation 3 (text updated after discussions at the workshop)

As a first step, implement in situ *conservation, in accordance with relevant international guidelines, in at least one site in each of the Nordic countries. The long-term aim should be to establish several complementary sites in each country representing different types of habitats.*

Comments: There is no need to specify specific criteria regarding the establishment of *in situ* conservation of CWR in the policy recommendations. International guidelines should be followed but it should be a national or local responsibility to define detailed criteria for establishment of genetic reserves. To implement *in situ* conservation, it is important to have strong links to habitat management and establish how the CWR conservation could be integrated into local management plans and local support schemes. Communication and meetings between local management people at both the National and Nordic levels can facilitate the process. Parts of the rural development programmes could potentially be used to support *in situ* conservation. Support schemes could be adjusted to include this type of areas, for example recommendations on grazing.

Discussion question 4

Are there other policy recommendations that you would like to add regarding the national level? For example, other steps/actions needed on the national level to achieve progress on conservation and use of PGR.

Comments: No additional policy recommendations were suggested.

4.1.2 ECPGR Discussion

4.1.2.1 ECPGR Discussion Group 1 *(Shelagh Kell, Matthias Ziegler and Dainis Rungis)*

NB: Questions/tasks in italics are taken from the discussion guidelines document. Not all questions/tasks were addressed, therefore, only those questions debated are included in this report.

Feasibility and scope. The establishment and management of CWR genetic reserves is complex but is feasible if authorities (agricultural and environmental ministries and agencies) collaborate and integrate

their actions. Also, the forestry authorities should be involved if CWR are growing in forests. In this respect, it is very important for the true value of CWR to gain wide recognition. The ITPGRFA and FAO CGRFA are the driving forces for the process. CWR data for international information systems (e.g., the ITPGRFA's Global Information System) and monitoring procedures (Second GPA with indicators for CWR) are relevant processes in this regard. To make data available for these processes, the role of National Inventories and National Focal Points should be strengthened. The documentation of *in situ* CWR populations within genetic reserves would add value for the use of PGR already complementarily conserved *ex situ*. National Inventories should therefore combine *in situ* and *ex situ* conservation data, as well as characterization and evaluation data for accessions or populations of CWR.

An important consideration for the establishment and management of genetic reserves could be the development of a programme or a mechanism which will allow the generation of income for landowners. This is feasible in the framework of voluntary participation. There must be a special discussion for the conservation of CWR outside of protected areas. Some countries have established protected areas only on public land. Complementary bottom-up solutions and top-down solutions should be combined. National genetic reserves seem feasible if there is an action or obligation foreseen from the top (e.g., action plans for CWR). The participation of many stakeholders in making priority lists may generate more interest in further actions. The involvement of a wider range of stakeholders at the initial stages of planning will increase the sense of ownership and responsibility felt by them, rather than have a finalized plan presented to them.

Technical skill required and available. Most technical skills are available, but seed science remains an important task for further scientific work. For some CWR, there is a need to establish germination protocols.

An overview of Germany´s national funding activities of the Ministry of Agriculture (BMEL) and the Federal Office for Agriculture and Food (BLE) for establishing genetic reserves for CWR (*Apium*, wild grape, grassland) is provided at the BLE website: www.genres.de/3/cultivated-and-wild-plants/conservation/in-situ-conservation/ (German only). Germany is aiming to realize genetic reserves in NATURA 2000 sites through agreements signed by all relevant stakeholders. These projects aim to fulfil the actions of the German national programme for PGR and are based on the experiences of the AEGRO project (http://aegro.jki.bund.de/aegro/) which are extremely valuable for the establishment of genetic reserves.

Tools required and available (including methods). Predictive characterization can be used to link conservation and use. However, to reveal useful adaptive traits in CWR, phenotyping and genotyping should be carried out. Agricultural stakeholders have expertise in observing infra-specific variation, traits for the use in breeding, or for direct use of the CWR (e.g., as wild food plants). There is a need to interest breeders at an early stage to support CWR conservation to overcome the gap between CWR conservation and use. Funding is needed to facilitate characterization as well as *in situ* conservation management and monitoring of CWR populations.

Major limitations. In some countries, a national system may not be feasible because of regional (sub-national) differences; therefore, a bottom-up approach needs to be taken. However, in this case it could be difficult to identify/motivate responsible stakeholders. There is a requirement for pre-breeding programmes to make traits in CWR available for use in breeding and to demonstrate the value of CWR to breeders and other stakeholders. The gap between CWR and users (breeders) cannot be bridged over the timescale of typical project funding (demonstrating the value of long-term public–private partnerships for pre-breeding).

Policy implications. Countries are interdependent in supporting conservation and use of CWR. A main constraint is the lack of funding for implementing the process at national and European levels. The frameworks of international treaties such as the ITPGRFA, CBD and Habitats Directive, as well as the *ECPGR Concept for* in situ *conservation of crop wild relatives in Europe* provide the international and European frameworks for *in situ* CWR conservation and use. In this respect, a European agency for genetic resources (including plant, animal and forest genetic resources) and an EU Directive could give strong support for the ongoing process. National GR councils can be used to advise ministries (e.g., by inviting experts to present proposals/projects) or by raising awareness for the actions foreseen in the National Programmes or in

FAO's Second Global Plan of Action. Consideration should be given to provision of technical support and funding to other regions as these may have important CWR for use in Europe (breeding and other uses). In some cases, e.g. cereals, CWR from other regions may be of more interest to breeders than European CWR (e.g., Germany is funding a capacity development project for seeds in Ethiopia (CD seed) – www.giz.de/en/worldwide/18920.html.

Other issues. There is a need to emphasize the potential value of CWR or to add value to currently protected species (i.e., use examples of already protected species with the added value that they are also CWR). Environmental protection plans can also benefit (by showing added value) from having CWR under their protection.

4.1.2.2 ECPGR Discussion Group 2 *(Vojtech Holubec)*

*Feasibility and scope***.** All countries considered National conservation planning feasible, some have already begun and other regard this as a future priority. Notable countries that have already developed their plans (UK, Czech Republic), while others have made significant progress (Latvia, Bulgaria). Most countries have already identified priority CWR. Communication among countries and methodological help is needed. There is lack of interest in CWR by Ministries, maybe related to lack of breeders' interest or breeding programmes (Bulgaria, Portugal). In Germany, there are large breeding companies and (pre-)breeders do appreciate the value of maintaining CWR diversity. Though in other countries it is important to raise public awareness of the importance of native CWR for crop improvement.

Technical skills availability. Some countries still miss technical skills but collaboration between countries or sending an expert within a project could help. Appropriate funding maybe needed to hire GIS experts/analysts.

Tools required and available. The basic tools are quality databases, methodology and software. There are databases available in most of the countries but of various quality. Both agricultural and botanical/environmental databases are needed. Usually each country has an agricultural database but not always available botanical data.

Major limitations. The limitations are: lack of communication between sectors (Environment and Agriculture, Forestry and other stakeholders) – need to mainstream across all stakeholders; lack of staff and skills; lack of national coordination and interest in ministries.

Policy implications / what is the national policy concerning CWR? The mainstreaming of CWR into agricultural and conservation policy is missing in all countries. CWR awareness only recently reached the policy level. It is desirable to communicate to Ministries about the need to implement CWR issues. Some countries do have policies related to CWR mainly within the Ministry of Environment.

4.2 Discussion session 2: Regional conservation planning and implementation

4.2.1 Nordic Discussion *(Anna Palmé and Ulrika Carlson-Nilsson)*

Policy recommendation 5 (text updated after discussions at the workshop):

Further develop a common Nordic approach on CWR conservation based on international guidelines and strategies. This approach should address future challenges on climate change and food security. The aim would be to facilitate the national process and identify areas where joint planning and/or cooperation would be more effective and efficient than independent national efforts.

Comments: The original version of this policy recommendation was too long. The details presented in bullet points in the earlier version should be included in the project report. It would also be important to consider communication in a future Nordic approach/strategy.

Policy recommendation 6 (text updated after discussions at the workshop):

Encourage research, infrastructure development and Nordic cooperation to further CWR conservation and sustainable use, aiming at ensuring high efficiency and quality in conservation planning and implementation. Research fields include, but are not limited to, conservation biology, trait evaluation, pre-breeding research using CWR, socio-economy value, diversity analysis, evolutionary ecology, taxonomy, habitat classification and ecosystem services.

Comments: Like recommendation no 5, this recommendation is too long and the details in the bullet points can instead be presented in the report. One bullet point should be added. "Promote cooperation on common standards on taxonomy, habitat classification, inventory protocols and initiate common Nordic presentation tools. The results should be presented in a common Nordic portal." It is important to encourage research but also other actions that can facilitate high quality conservation.

Policy recommendation 7:

Suggested text: "*Develop a roadmap/manual for easy access conditions to genetic resources conserved* in situ *in the Nordic countries (including assembling data on legislation, access procedures, contact info, decision trees, etc.)*"

Comments: One group wanted to keep this recommendation and the other suggested that this policy recommendation should not be included in the final version of policy recommendations. There are many other more important issues to focus on and it is a bit premature to develop a roadmap. At the current time, the legal issues concerning access are not clear and clear national policies need to be developed before such a roadmap can be made. There can be multiple ways to facilitate use and the individual Nordic countries may use different approaches. However, this is an important issue and in the future, it would be good to clarify the rules and procedures for access to Nordic plant genetic resources. In the future, a roadmap would be useful.

Policy recommendation 8:

Suggested text: "*Consider broadening the Nordic PPP project on pre-breeding by increasing the number of, or exchanging, the current target crops and encourage the use of CWR. Any such changes would, however, need full support from the breeders' community.*"

Comments: It is suggested that also this recommendation be deleted. There are more important recommendations to focus on. This action is dependent on national funding that is not available now and on the interest of the breeders. It is instead suggested to add pre-breeding research into recommendation 6.

Discussion question 9:

Are there other policy recommendations that you would like to add regarding the regional level?

Comments: One additional recommendation was suggested: "Promote cooperation on common standards on taxonomy, habitat classification, inventory protocols and initiate common Nordic presentation tools. The results should be presented in a common Nordic portal."

4.2.2 ECPGR Discussion

4.2.2.1 ECPGR Discussion Group 1 *(Shelagh Kell, Matthias Ziegler and Dainis Rungis)*

List specific activities that have arisen out of the discussion here in Vilnius, with lead responsibility and completion dates. Validation of the regional priority list of CWR (lead: SK by end of the year). Need to work out a mechanism for obtaining endorsement from the user community: ECPGR WG members, National PGR committees, Breeders' associations, other ECPGR WGs (crop-specific). It was recommended that this might be implemented in stages (e.g., get feedback from the Wild Species Conservation WG members first before circulating more widely). SK to draft document detailing the prioritization process, list of species

and related information (regional CWR inventory) and specific feedback required from stakeholders. Suggestions for how to promote and implement integrated European *In situ* structure and associated funding once completed.

Promotion. Publish policy briefs (as was done for the Preparatory Action on GR: http://www.geneticresources.eu/) with links to relevant global and regional policy. Lobby EC and EU Parliament – actions need to come from member countries using the ECPGR 'concepts' developed for the purpose. Improve content of Wild Species Conservation WG webpage (lead: NM/SK in liaison with ECPGR Secretariat). Undertake a survey of projects (past/present/future) supporting CWR conservation and use and publish results online. Encourage the development of CWR National Inventories by providing training and a central repository for access (e.g., via EURISCO, ITPGRFA GLIS, GBIF, cwrdiversity.org?). This repository would also provide access to C&E data and conservation management protocols (e.g., genebank management standards). [SK note: the ITPGRFA Toolbox on Sustainable Use of PGRFA will be relevant in this latter context]. Convene national workshops on CWR to involve all relevant sectors (with a developed and standardized structure). Could be under the ECPGR Activity Grant Scheme? Provide a central repository to provide access to relevant information and tools to support CWR conservation planning and implementation (NB: this is effectively already provided by the CWR Global Portal – create a link from the ECPGR Wild Species Conservation WG webpage).

Implementation. The ECPGR 'concept' developed by the Wild Species Conservation WG should form the basis of discussions with the EC concerning funding but at present the community is in response mode responding to calls like for H2020 projects (e.g., SFS-04 [2017]) and projects arising from the EU Preparatory Action on Genetic Resources (NB: only short term). Long-term funding might be generated under the umbrella of an EU Directive on PGRFA conservation and sustainable use. Potential sources of additional project funding and future ECPGR funded meetings might potentially come from other EC sources such as LIFE+.

Development of a communication strategy for use with other stakeholders. Improve content of Wild Species Conservation WG webpage (lead: NM/SK in liaison with ECPGR Secretariat). Publish policy briefs with links to relevant global and regional policy. Emphasize links between the objectives of the WG and the Second GPA, ITPGRFA, CBD etc. How are we helping to meet the Aichi Targets, etc.? Include this information in WG webpage. It can be used to feed into the FAO's Third Report on the State of the World's PGRFA and could also be used as an argument for the value of/need for the establishment of a global *in situ* CWR conservation network. List any interactions that are required for collaboration with other crop WGs. Presentation on ECPGR WG activities at the Montpellier conference ECPGR side meeting? Endorsement of regional priority CWR list. Suggestions for targeting additional members. As noted above, encourage membership of the WG from the PA community. We may be able to obtain suggestions from existing members and NCs [Note that NCs must formally propose members to the ECPGR Secretariat].

4.2.2.2 ECPGR Discussion Group 2 *(Vojtech Holubec)*

Discussion topic 2 is like 1 with some specifications and/or generalization. Some countries have historical relationships/links or form phytogeographic regions (Danube basin, Baltic phytogeographic region) and so conservation of CWR can be planned at such regional/sub-regional level. Many transboundary projects on conservation have been solved (e.g. National parks on both or 3 sides of border) and sub-regional cooperation is subject of projects such as INTERREG. Do we first start with the national programmes and then combine them at regional level? It is very important to raise awareness about the need of sub-regional cooperation in conservation planning, because the plants do not follow political borders. Another issue is political: for small countries, it would be highly desirable to start at EU level and if governments get the conservation issues as necessary from EU, then national coordinators will have much better position to promote conservation strategy on national levels.

4.3 Discussion session 3: Integrated CWR conservation strategies

4.3.1 Nordic Discussion *(Anna Palmé and Ulrika Carlson-Nilsson)*

Discussion question 10:

Is there a role for *ex situ* conservation in the conservation of CWR species?

Comments: Yes, there is a role for *ex situ* conservation for CWR. This role can be: 1) to facilitate use, 2) to act as backup of *in situ* conservation, 3) to facilitate evaluation or 4) to be the main conservation approach. However, the main conservation approach for most CWR species should be *in situ* conservation, while *ex situ* acts as backup. To have an *ex situ* backup is especially important when a population is small and/or threatened. Ideally, all *in situ* conserved populations should have an *ex situ* backup. By conserving the CWR *in situ*, problems with for example genetic drift during regeneration in genebanks are avoided. In addition, the populations conserved *in situ* will continue to adapt to the local environment and thus also to changes in the climate. Decisions on the best conservation approach need to be made for each individual species separately as they have different properties and demands. Ideally, species conservation action plans should be made for all prioritized CWR species. The conservation and use of threatened species was discussed. If threatened species are conserved *ex situ*, access from the *ex situ* collection might lessen the threat to the natural site in some cases. On the other hand, a concern was expressed that free access to this material might be misused. Some types of *ex situ* conservation, such as conservation in Botanical gardens, are also important for communicating the role and importance of CWR. If *ex situ* conservation serves as backup of *in situ* conservation, the best approach to renew the samples when the germination level decreases over time will be to re-sample the *in situ* population if that population is still thriving. This will save money since sampling is cheaper than regeneration, and at the same time avoid some problems that can occur during regeneration (loss of genetic diversity, adaptation to cultivation, geneflow from other populations). Breeders are also likely to want populations adapting to a changing climate.

Policy recommendation 11 (text updated after discussions at the workshop):

Develop the Nordic networking and integration of in situ *and* ex situ *conservation. Establish a framework for cooperation between stakeholders working with* in situ *and* ex situ *conservation of CWR. The network created during the current project should be used as a basis and it should be linked to European networks.*

Comments: There is a need for a meeting point and for cooperation on this topic. To have regular workshops where relevant stakeholders are invited would be useful. However, it is too early to formalize this cooperation. There is a need for informal networks to further evaluate the national needs to implement *in situ* conservation. There is also a need to address scientific questions on CWR conservation. When formalizing a network later it is important to remember that there are existing formal and informal networks on for example nature conservation and *ex situ* conservation that should be linked to the new structure. In the Nordic Council of Ministers (NMR) there is cooperation between the agricultural and environmental sides. This could perhaps be something to build on. A proposal could be presented to NMR for funds. NordGen could act as coordinator. The model presented in Figure 1 is a good basis but needs to be slightly modified before it can act as model for CWR conservation in the Nordic region. For example, regeneration should not be performed for most CWR species since *in situ* conservation should be the main conservation approach and *ex situ* conservation should act as backup.

Discussion question 12:

How and to whom should the Nordic policy recommendations be presented?

Comments: They should be presented to the Nordic Council of Ministers for the Environment (MR-M) and the Nordic Fisheries and Aquaculture, Agriculture, Food and Forestry (MR-FJLS) as well as agricultural and environmental national authorities and stakeholders/forums on genetic resources.

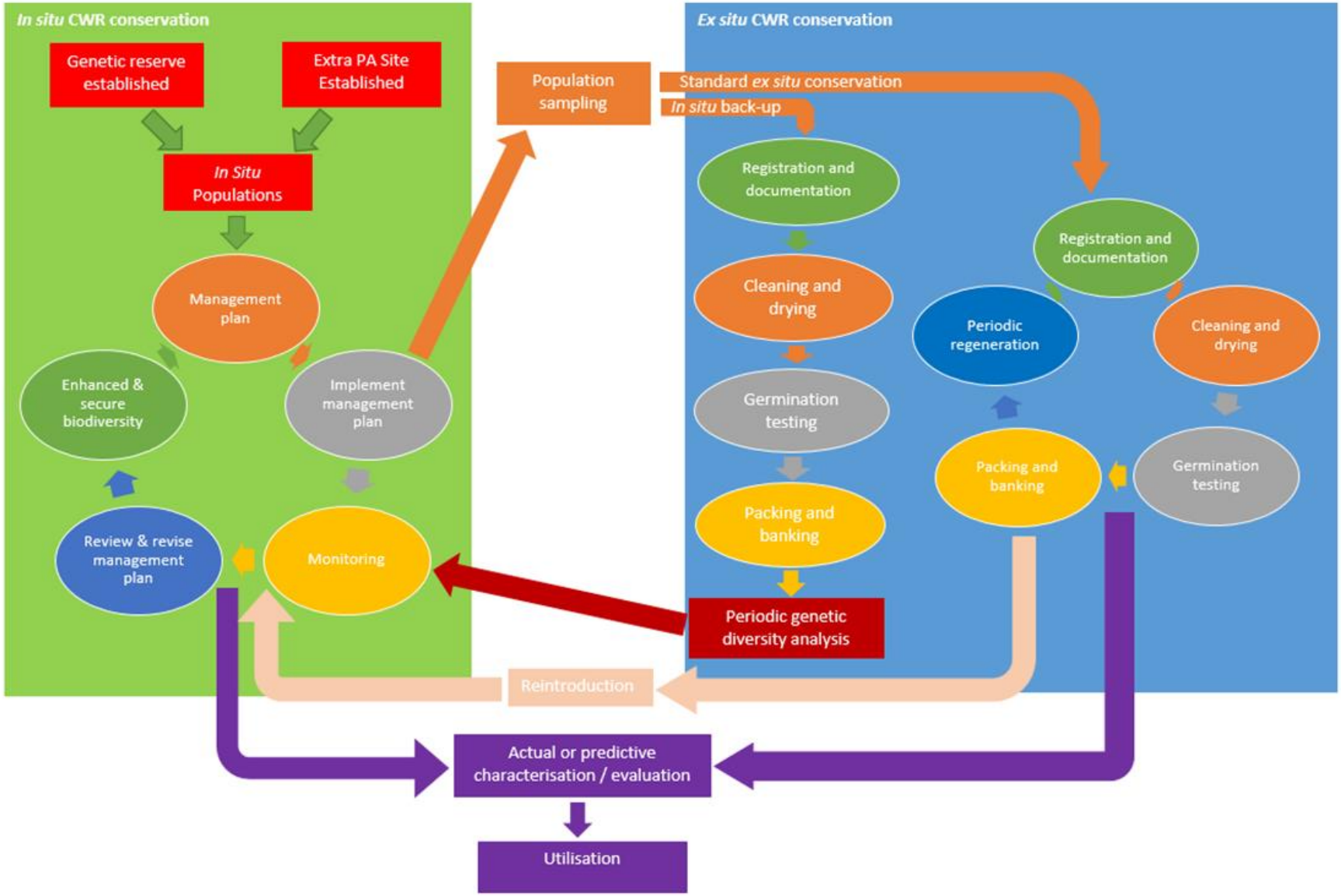

Figure 1. Integration of *in situ* and *ex situ* CWR conservation. (Figure from presentation by Nigel Maxted and Anna Palmé at the workshop "The impact of climate change on the conservation and utilisation of crop wild relatives in Europe, Barcelona, December 2015). PA=protected area.

Discussion question 13:

Are there other policy recommendations that you would like to add regarding integrated strategies and *ex situ* conservation?

Comments: None of the groups suggested additional policy recommendations on this topic.

Discussion question 14:

What should be the next steps on the Nordic level to further CWR conservation and use? How should we continue the work in the current project?

Comments: The first step should be to finalize the current project and deliver the recommendations to the appropriate authorities. Not much time was left to discuss this final question.

4.3.2 ECPGR Discussion *(Vojtech Holubec)*

The ECPGR Group stayed as one whole group for this discussion.

Feasibility and scope. Who will be responsible for managing and monitoring Most Appropriate Wild Populations (MAWPs)? Considering available human resources, can all MAWPs be effectively managed and monitored? Ministries of Environment (also Depts. of Forestry in some cases) should take overall responsibility because they are responsible for national protected area (PA) designation and management. However, the MAWP network will require the involvement of Ministries of Agriculture for funding and using/disseminating results (e.g., reporting to the FAO CGRFA under the Second GPA and contributing to national databases such as FloraWeb in Germany). Research institutes will also be involved but most likely only in specific projects. The situation regarding responsibility for management and monitoring of MAWPs outside PAs ('extra-PA' sites) is more complicated but should be specified in the site establishment documentation. Effective management and monitoring of MAWPs will depend on the current PA network in place, how many species are already captured and whether they are being actively managed and monitored. PA managers may be open to including additional species in their monitoring programmes but it will be very costly to monitor to the GR quality standards for all priority species. It may therefore be necessary to rank them based on their threat status/rarity/commonness etc. and initially focus efforts on the highest priority populations. The question of whether the nomination of MAWPs / GRs should be limited only to those that can be managed/monitored to a high standard or whether to include many MAWPs in the network even if they do not meet minimum standards was discussed. It was agreed that it is better to be inclusive (i.e., nominate priority MAWPs for inclusion in the network even if they cannot all be managed and monitored to high standards) to ensure important populations are not excluded and to meet breeders' needs for maximum diversity.

Technical skills required and available. Are any specialist skills required to manage and monitor MAWPs above and beyond existing PA management and wild plant species population monitoring? Are the required skills already available? It cannot be assumed that current PA managers have the required skills to manage and monitor MAWPs, especially because many PAs involve passive conservation, therefore populations may not be actively monitored and managed. New skills (e.g., demographic and/or genetic monitoring) may therefore be needed by PA managers and additional funding will be required to provide the necessary training. This training could be provided by the research institutes involved in identifying and designating MAWPs. It will be necessary to justify the value of putting money into management and monitoring of MAWPs to obtain appropriate resources for training and to support their long-term management.

Tools required and available. What methods and tools are required to manage and monitor MAWPs (e.g., field data collection and management software; germplasm collection protocols; genetic diversity analysis protocols? Are these tools already available? Descriptors and tools for managing data associated with CWR conservation have been under development in the context of several specific projects, most recently the SADC CWR project (www.cropwildrelatives.org/sadc-cwr-project/). These resources will be freely available for use by the end of 2016. The experiences of the AEGRO project (http://aegro.jki.bund.de/aegro/) are

extremely valuable for the establishment of genetic reserves. Germany is aiming to realize genetic reserves in NATURA 2000 sites through agreements signed by all relevant stakeholders. These projects aim to fulfil the actions of the German national programme for PGR and are based on the experiences of the AEGRO project. Dissemination and use of data resulting from population monitoring: it will be critical to make data (and material) visible to potential users to justify the existence of the MAWP network and ensure its ongoing funding. Data will need to be shared with Ministries of Agriculture to facilitate reporting to international agreements (e.g., the Second GPA) and for inclusion in national databases (e.g., FloraWeb in Germany). It was noted that regular evaluation of the effectiveness of management plans and interventions would also be vital.

Major limitations. What are the major limitations to effective management and monitoring of MAWPs (e.g., human resources; skills; time; long-term funding)? The current lack of a legal framework is the most critical limiting factor. An EU Directive on conservation and sustainable use of PGRFA in Europe is essential. This will need to make specific provision for the integrated CWR MAWP network. It will be necessary to raise awareness of the importance of *in situ* CWR conservation before putting a mechanism in place. However, the lack of existing case studies and experiences is a limiting factor. Good examples are needed to present to ministries. Insufficient funding is also a major limiting factor, as well as the complexity of actors involved (i.e. the ongoing issue of which ministry should take responsibility for CWR conservation) and the need for skills transfer to PA managers.

Policy implications. What policy(-ies) need to be in place to guide and govern effective management and monitoring of the European integrated MAWP network? What needs to be done to get these policies in place? Who will be responsible for governing the management and monitoring of the MAWP network? It was stressed again that a legal framework is needed but there is an urgent requirement to convince authorities of the importance and value of *in situ* conservation and the need for a clear structure and funding for *in situ* conservation. DG Agriculture would be responsible for an EU Directive on PGRFA conservation and sustainable use. The question of whether to wait for an EU Directive or implement an equivalent system to AEGIS under the umbrella of ECPGR for *in situ* CWR conservation was considered. The ethos is already established for *ex situ* conservation and it was suggested that the ECPGR´s AEGIS model could be used as a basis for the MAWP network, especially as its establishment, management and governance will involve many different players. Such a model would involve the establishment of memorandums of understanding (MoUs) between national actors.

Top 5 scientific priorities for ECPGR Wild Species Conservation WG action to be achieved by the end of next ECPGR Phase

The first issue discussed was the top 5 scientific priorities for ECPGR Wild Species Conservation WG action, with lead responsibility and completion dates. Note: it was assuming a sixth priority will be *in situ* documentation that will be a joint initiative with the Doc & Info WG, this is already in hand.

ACTIVITIES	**RESPONSIBILITY**	**COMPLETION DATE**
1. Development of national strategies for each country in Europe	National Coordinator (Chair of the WG should contact National Coordinators to ask for action)	- letter: by end of Oct 2016 - completion of strategies: Dec 2018
2. Estimate/investigate impact of climate change on GR conservation planning	Depends on funding, projects	-
3. Implementation of the European GR network	ECPGR WG	End of next Phase
4. Implementation of national GR networks	National Coordinator	
5. Linking conservation to use	Documentation and Information WG to provide tools	

Further a list of specific activities that will aid WG activities

Development of communication strategy:

- WG Chair to prepare an email and send to National Coordinators to request them to get the appropriate person from the environment/nature conservation to be involved in the WG, deadline of max. 2 months to appoint that person.
- University of Birmingham (UoB) to produce a general talk on CWR and share with the countries so they can use in their countries.
- UoB to produce three factsheets (general public, technical, policy-makers)
- Creation of Facebook page, Twitter, etc.
- There are three levels that should be addressed: Communication with the decision-makers (see first point); Participatory project planning leading to the establishment of the GR; and general public.

How to promote and implement integrated European *In situ* structure and associated funding once completed?

Promotion done via the *communication strategy*. EUFORGEN has a good communication strategy that we could probably use as an example, ECPGR Steering Committee is developing a communication strategy. How to include new sites? How to manage the GR? In the end, we will have scientifically important sites but also sites that were chosen due to political reasons. Development of 'green papers' which should outline how to implement the European GR sites (step by step). The driving force is the reporting for the GPA. Kell and Maxted to develop the 'green paper'.

Potential sources of additional project funding and future ECPGR-funded meetings?

Horizon 2020 – more effective lobbying is needed to get what we want in the call for ECPGR funding – to write a grant application for National funding (e.g. Federal Office for Nature Conservation) – each of us could look for alternatives at national level

Suggestions for what we can do about inactive Wild Species Conservation WG members to stimulate activity

Booklet about "Who's who in the WG".

Development of a communication strategy for use with other stakeholders

See previous points.

List any interactions that are required for collaboration with crop WGs

Large meeting together with the other WGs to be funded by the ECPGR (next call?) (Lothar + team to lead). Side meeting at the Montpellier meeting next May involving ECPGR and EUCARPIA.

Suggestion ways to improve *modus operandi* of ECPGR Wild Species Conservation WG, how can we make it more dynamic?

Within the group: ask Lorenzo about the WG ECPGR webpage. For outside the group: social networking (Facebook, Twitter, LinkedIn, blog…)

Suggestions for targeting additional members

Try to include members from other stakeholder groups: Policy-makers: Ministries of Environment, Agriculture National conservation sector and the Breeding sector.

Ideas for next ECPGR call

Large meeting together with the other WGs to find ways of closer collaboration to be funded by the ECPGR (Subsequently obtained).

5. Recommendations

5.1 Recommendations to ECPGR

These recommendations are based on discussions held within the ECPGR discussion groups and relate to future Wild Species Conservation WG actions.

1. Encourage National Coordinators to take a more proactive role in organizing and coordinating multi-stakeholder involvement in the development of effective national CWR strategies in European countries.
2. Raise awareness of CWR importance on European-wide scale by producing a general talk on CWR and share with the countries (University of Birmingham – UoB), factsheets for general public, technical and policy-makers (UoB), creation of Facebook page, Twitter, etc.
3. Foster the application of genetic reserve quality standards (Iriondo et al. 2012) in the development of national CWR conservation strategies.
4. Include investigation of the impact of global changes, i.e. climate change, on genetic reserve conservation planning as appropriate.
5. Improve cooperation between Wild Species Conservation and other Working Groups to facilitate the implementation of ECPGR objectives and, particularly, the Outcome 3, by starting with a large joint meeting.
6. Implement European and national genetic reserve networks through agreement on regional (European) and national MAWPs (Most Appropriate crop Wild relative Population) based on scientific and pragmatic argumentation.
7. Link CWR conservation to use by employing tools to be provided by Documentation and Information WG.
8. Lobby EU policy decision makers to establish an EU agency responsible for plant genetic resources conservation and utilization.
9. Search for funding opportunities for CWR research and networking projects both at national and European levels.
10. Develop more effective communication strategy for ECPGR with other stakeholders by employing examples of good practice (investigate successful approach of EUFORGEN).
11. Invite representatives from other stakeholder groups, primarily, policy-makers from ministries of environment and nature conservation sectors to join the Wild Species Conservation WG.
12. Put further efforts to promote cooperation with the nature conservationists at both national and European levels towards better integration of CWR conservation with other biodiversity conservation activities in Europe.

5.2 Recommendations to Nordic policy-makers

These recommendations are based on discussions held within the Nordic discussion groups.

The following six actions are recommended as imminent steps to assure conservation of the important CWR variation:

1. Develop a national strategy in each Nordic country for *in situ* and *ex situ* CWR conservation and sustainable use, in line with relevant international agreements and guidelines. The work done at the Nordic level can be used as a framework, or supporting information. The Nordic and national work should be complementary to each other and also to European and global strategies.
2. At national level, develop the policy instruments needed to facilitate conservation and sustainable use of CWR, involving all relevant sectors in this process. Suggested measures include evaluating

the policy actions necessary for effectively implementing conservation and use of CWR, and/or analysing obstacles that hinder such effective conservation and use.

3. Adopt *in situ* conservation as the main approach for safeguarding CWR diversity. *Ex situ* conservation should act as back-up and only in rare cases be the main conservation approach.
4. As a first step, implement *in situ* conservation of prioritised species, in accordance with relevant international guidelines, in at least one site in each of the Nordic countries.
5. In the long-term, establish complementary *in situ* conservation sites across the Nordic region. The sites should represent different types of habitats and climates, and should include the most important CWR species in the region (see www.nordgen.org/cwr).
6. Further develop a common Nordic approach on CWR conservation based on international guidelines and strategies. This approach should address future challenges of climate change and food security. The aim would be to facilitate the national processes and identify areas where joint planning and/or cooperation would be more effective and efficient than independent national efforts.
7. Encourage research, infrastructure development and Nordic cooperation to further CWR conservation and sustainable use, aiming at ensuring high efficiency and quality in conservation planning and implementation. Research fields include – but are not limited to – conservation biology, trait evaluation, pre-breeding research using CWR, socio-economy values, diversity analysis, evolutionary ecology, taxonomy, habitat classification and ecosystem services.
8. Develop Nordic networking and integration of *in situ* and *ex situ* conservation. Establish a framework for cooperation between stakeholders working with *in situ* and *ex situ* conservation of CWR. The network created during the current project should be used as a basis, it should be linked to European networks and NordGen should have a coordinating role.

Conclusions

CWR are one of several important tools for addressing the challenges on future global and national food security. It is therefore high time to move into action with planning and implementation of CWR conservation. Central for achieving this goal will be efficient cooperation between stakeholders in both the environmental and agricultural sectors, as well as across the borders of the Nordic countries

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