PROTECTED AREAS AND THE CHALLENGE OF CONSERVING CROP WILD RELATIVES

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ABSTRACT

Crop wild relatives are a critical resource for sustaining future food security. It is widely recognized that many of the world's protected areas contain CWR diversity. Despite this, it has not yet proved possible to undertake significant actions to conserve the CWR they contain. Many challenges and obstacles need to be addressed in order to improve this situation. Recent initiatives have started to address these challenges and uncovered some key lessons. Still, the need for action is urgent and the paper concludes by drawing attention to the need for a global approach to conserving priority and threatened CWR in the wild.

INTRODUCTION

Crop wild relatives (CWR) - wild plant species closely related to crops to which they may contribute beneficial genes - constitute an enormous reservoir of genetic variation for crop improvement and are an important socio-economic resource. Genes from wild plants have provided crops with resistance to many pests and diseases and improved their tolerance to extreme temperatures, salinity and drought - a value of CWR that is of growing importance under the changing climate. CWR have also contributed more generically to improving variety, yield and quality. Most modern crop cultivars contain some genes that were derived from wild relatives (Maxted & Kell, 2009) and the worldwide value of these new gene introductions in increasing crop yields per year has been estimated at US$115 billion (Pimentel et al., 1997). A review of the use of CWR in crop improvement programmes by Maxted and Kell (2009) found that for 29 crop species important for food security, there are at least 183 CWR taxa containing useful traits for crop improvement. The authors found that reported uses of CWR for crop improvement have increased significantly in the last 40 years and that the most widespread CWR use has been in the development of pest and disease resistance, with the references citing disease resistance objectives accounting for 39 per cent, pest and disease resistance 17 per cent, abiotic stress 13 per cent, yield increase 10 per cent, cytoplasmic male sterility and fertility restorers 4 per cent, quality improvers 11 per cent and husbandry improvement 6 per cent of the reported inter-specific trait transfers. It is also worth noting that the same study found breeders' use of CWR taxa was increasing year on year, even though it was recognized that they were still far from being systematically exploited.

Some idea of the scale of benefits may be obtained from published estimates referring to a selected number of crops. For example, the desirable traits of wild sunflowers (*Helianthus* spp.) are worth an estimated US$267 to US$384 million annually to the sunflower industry in the United States; one wild tomato species (*Lycopersicon peruvianum* (L.) Mill.) has contributed to a 2.4 per cent increase in solids contents worth US$250 million; and three wild peanuts (*Arachis batizocoi* Krapov. & W. C. Gregory, *A. cardenasii* Krapov & W. C. Gregory and *A. diogoi* Hoehne) have provided resistance to the root knot nematode, which costs peanut growers around the world US$100 million each year (Hunter & Heywood, 2011). Of course, the commercial contributions of the majority of CWR are likely to be on a much smaller scale. Godfray et al. (2010) acknowledge the important role that CWR are playing and will continue to play in broadening the current narrow genetic base of the world's important food crops, improving food production and contributing to the food security of a world projected to be home to nine thousand million people by 2050.

However, it cannot be assumed that this valuable resource will continue to be available for current and future exploitation. CWR occur in a wide range of habitats, but as numerous assessments testify, habitats

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Ugam Chatkal Nature Reserve, Uzbekistan © S. Djataev

continue to be lost or degraded across the world, putting many of these economically important species at risk. For most parts of the world, information is lacking on the occurrence and status of CWR. Bolivia was the first country to publish a Red List specifically dedicated to CWR. It lists 152 CWR species of which 45 are threatened (VMABCC-Bioversity, 2009). In a recent joint IUCN/ European Commission initiative to produce a European Red List, a selection of 572 native European CWR of high priority human and animal food crops were regionally assessed. At European level, at least 11.5 per cent (66) of the species are threatened, with at least 3.3 per cent (19) of them being Critically Endangered, 4.4 per cent (22) Endangered and 3.8 per cent (25) Vulnerable – a further 4.5 per cent (26) of the species are classified as Near Threatened and one species (*Allium jubatum* J.F. Macbr.) is Regionally Extinct (Bilz et al., 2011; Kell et al., 2012). The remaining species were regionally assessed as Data Deficient (29 per cent) or Least Concern (54.7 per cent); however, of the species assessed as being of Least Concern, around a third are threatened at national level (Kell et al., 2012).

In addition, the limited studies that have so far been undertaken on the potential impacts of climate change indicate that individual CWR species vary significantly in their likely responses and that in some areas CWR species will significantly decrease in their range, with some possibly going extinct by the middle of this century (Jarvis et al., 2008). It can also not be taken for granted that the wide genetic diversity of CWR is safeguarded and available in the world's gene banks. In Europe, for example, based on data available via EURISCO[1], only around nine per cent of total germplasm accessions in gene banks are of wild origin (Dias et al., 2012). Further, the ratio of the number of accessions of cultivated species to wild species is striking, with an average of 167 for each cultivated species and 14 for each wild species, giving a ratio of 12:1, which is particularly surprising, given that most diversity is located in wild species (Maxted et al., 2008a). Both editions of the *Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (FAO, 1997, 2010) draw attention to this and highlight the limited and precarious nature of the world's gene bank holdings of CWR accessions. CWR, despite recognition of their importance, remain seriously under-conserved both *in situ* and *ex situ*.

CROP WILD RELATIVES AND THE IMPORTANCE OF PROTECTED AREAS

In situ conservation of CWR allows natural evolutionary processes to be maintained, thus providing a continuous source of novel genetic variation for crop improvement. However, despite the immense global value of CWR species and the emphasis placed on their *in situ* conservation by international treaties, conventions and agreements, as well as international organizations and academics, relatively little evidence to date of practical action to implement their conservation *in situ* exists (see review by Heywood & Dulloo, 2005). Underpinning the conservation strategy of most countries is a protected area system and this is reflected in the Convention on Biological Diversity (CBD), where the main thrust of biodiversity conservation is *in situ*. We know that populations of many CWR occur in these protected areas (Figure 1); however, although some of them have been in existence for centuries and many changes have been made in the ways they are managed, significant actions to conserve the CWR protected areas contain have only been undertaken in a few cases (Maxted & Kell, 2009; Maxted et al., 2012; and Box 1).

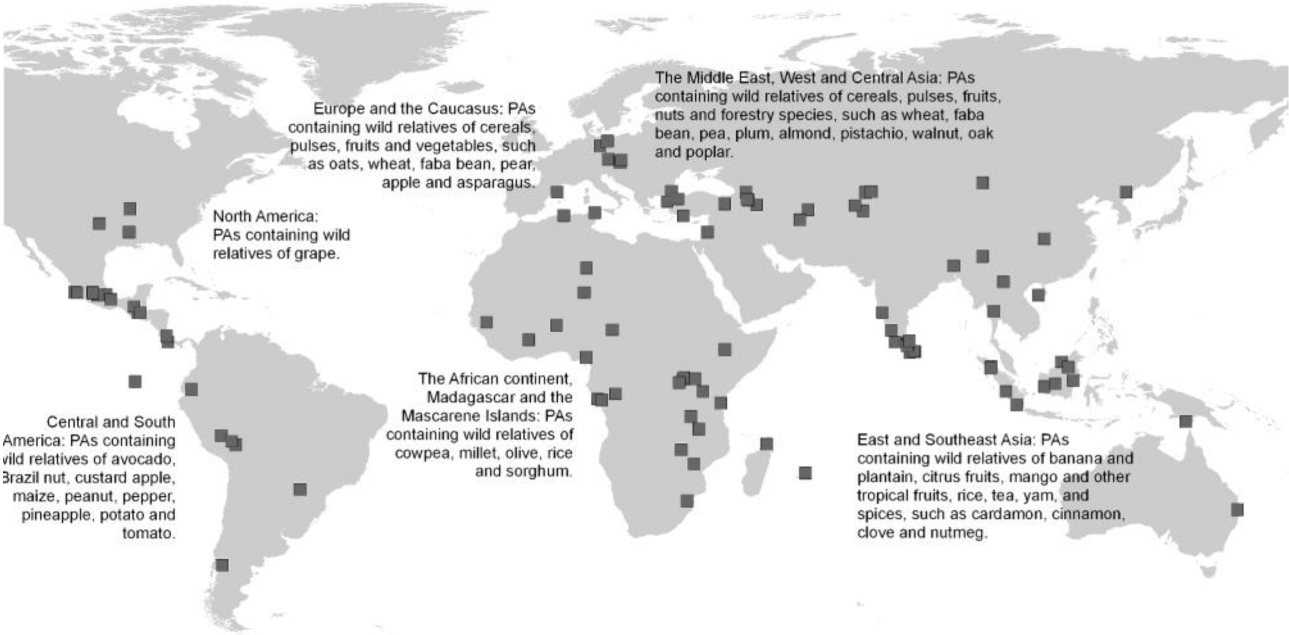

Figure 1. 105 global protected areas known to contain CWR diversity (Source: Maxted et al., 2010a)

The assumption is often made that all species in protected areas are passively conserved if the entire ecosystem or habitat is stable and there are no threats to individual species. However, without monitoring and active management of individual species, the genetic diversity within and between CWR populations could be eroded over time and entire populations could even go extinct (Maxted et al., 2008b). Furthermore, management interventions in protected areas for other species, such as burning, erosion control, increasing tree cover and productivity (in the case of forest reserves) and other habitat disturbance may not be suitable, or worse, may be to the detriment of the CWR populations that occur there. Shands (1991) cites the example of the establishment of a genetic reserve for the maize relative *Zea diploperennis* in the tropical forest of Sierra de Manantlan, Mexico. Initially all grazing at the site ceased but routine monitoring of population sizes showed that wild maize populations within the reserve were decreasing because they were being out-competed by other forest plants. In this case, a certain level of grazing was required for the target CWR population to thrive. Also, as Hunter and Heywood (2011) note, nature reserve design and management practices that focus on the landscape level, community level or species level may conflict with one another.

Apart from two reserves for the *in situ* conservation of CWR (in both cases wheat relatives) that were established in the 1980s – the Erebuni Reserve in Armenia and the Ammiad Project Reserve in Israel – and a number of reserves for wild fruit trees (see below), it is only in the last 10–15 years or so that some serious efforts have been made to conserve CWR in their natural wild habitats. These include two major Global Environment Facility (GEF)/World Bank-funded projects on the conservation of genetic diversity in Turkey (1993–1998) and the Fertile Crescent (2000–2006) in which CWR of wheat, barley, lentil, faba bean, pea, olive, pistachio, sweet chestnut, fir and pine (*Triticum*, *Hordeum*, *Lens*, *Vicia*, *Pisum*, *Olea*, *Pistacia*, *Castanea*, *Abies* and *Pinus* species) were selected as

BOX 1: CONSERVATION OF *CINNAMOMUM CAPPARU-CORONDE* IN SRI LANKA

The Sri Lankan endemic species *Cinnamomum capparu-coronde* is a wild relative of commercial cinnamon (*C. verum*) or 'true' cinnamon. It occurs in a number of the country's protected areas and forest reserves (FR): Sinharaja Forest Biosphere Reserve, Kanneliya-Dediyagala-Nakiyadeniya Biosphere Reserve, Gilimale-Erathne FR, and Walankanda FR. The Sri Lanka component of the UNEP/GEF CWR Project selected the Kanneliya-Dediyagala-Nakiyadeniya reserve as a priority area for the conservation of this CWR and worked closely with the protected area's governing body – the Department of Forest Conservation – to modify the existing management plan for to include a species management plan for *Cinnamomum capparu-coronde*. The species is normally harvested for medicinal and commercial purposes. Awareness-raising activities were also carried out to inform local communities of the importance of preserving these species and CWR in general.

target species for *in situ* conservation in genetic reserves – natural and semi-natural areas that are designated for maintaining genetic diversity in a natural setting for the species concerned. However, it is not known in all cases to what extent the results of these projects were sustainable (i.e. that the genetic reserves are still in existence and that the CWR populations are monitored and managed).

Unfortunately, there are very few examples of *in situ* conservation of CWR in the tropics. Rare exceptions include the establishment of genetic reserves for various species of fruit tree such as the gene sanctuary for citrus species in the Nokrek National Park, in northeast India, which was created in 1981 and apparently the first reserve specifically set up for the *in situ* conservation of tropical trees; the genetic reserves for the conservation of wild relatives (and landraces) of rice, taro, litchi, citrus and tea in Vietnam established under a GEF-supported project; and in Mexico an *in situ* reserve that was created in 1987 in the Biosphere Reserve of the Sierra de Manantlán for *Zea diploperennis*, a wild relative of maize (*Zea mays*). For examples of Forest Genetic Reserves see FAO/DFSC/IPGRI (2001, 2004).

More recently, the United Nations Environment Programme (UNEP)/GEF-supported project, '*In situ* conservation of crop wild relatives through enhanced information management and field application' (CWR Project)[2], coordinated by Bioversity International in five countries – Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan – has expanded substantially the previously limited body of knowledge on *in situ* CWR conservation in developing countries. Through the involvement of protected area authorities and other relevant stakeholders, such as indigenous and local communities, the project has facilitated the development of CWR species management plans for implementation in protected areas, as well as the adaptation of protected area management plans to take into account the needs for CWR conservation[3]. The project has also highlighted the considerable challenges and obstacles facing CWR conservation in protected areas.

WORKING IN PROTECTED AREAS TO CONSERVE CROP WILD RELATIVES – SOME LESSONS LEARNED

Populations of many CWR occur in existing protected areas (Figure 1), although the lack of inventories means that detailed information on their distribution is seldom available. However well managed these areas may be, passive conservation alone is not sufficient to ensure the effective *in situ* conservation of CWR, which should be accompanied by some degree of active management or at least recurrent monitoring of the populations of the target species, particularly if these species are threatened (Maxted et al., 1997, 2008b; Hunter & Heywood, 2011; Iriondo et al., 2012).

Until recently, there have been limited examples of protected area management plans that incorporate specific CWR management practices. Further, there has been little information published or documented that provides guidance in working with protected area authorities and managers or other relevant actors. For example, no mention is made of CWR, genetic reserves or genetic resource management in the global guide for managing protected areas by Lockwood et al. (2006). Attention should be drawn, however, to the detailed recommendations and case studies for the *in situ* conservation and management of forest genetic resources, including CWR, given in volumes 1 and 2 of the guides published by FAO, FLD (Forests & Landscape Denmark) and IPGRI (2001, 2004) (see Box 2). Recently detailed guidelines on the planning and implementation of genetic reserves for CWR *in situ* conservation have been published by Iriondo et al. (2008) and a set of CWR *in situ* conservation quality standards has also been proposed by Iriondo et al. (2012). However, although considerable attention has been devoted in recent years to the theory of design, establishment, management and

BOX 2. THE MAIN STEPS IN PLANNING A PROGRAMME TO CONSERVE THE GENETIC RESOURCES OF A PARTICULAR TREE SPECIES

1. Set overall priorities, i.e. identification of genetic resources at the species level based on their present or potential socioeconomic value and their conservation status.
2. Determine or infer the genetic structure of the priority species at the landscape level.
3. Assess the conservation status of the target species and their populations.
4. Identify specific conservation requirements or priorities, typically at the population level for single species and at the ecosystem level for groups of species, i.e. identify geographical distribution and number of populations to be conserved.
5. Identify the specific populations to be included in the network of *in situ* conservation stands.
6. Choose conservation strategies or identify conservation measures.
7. Organize and plan specific conservation activities.
8. Provide management guidelines.

(from: Thomson et al., 2001)

Discussing the implications of wild yam conservation for local communities bordering Ankarafantsika National Park, Madagascar © SJ. Ramelison

monitoring of CWR diversity in reserves or protected areas, practical implementation on the ground has remained limited (Maxted et al., 2010b; Hunter & Heywood, 2011). Further, Meilleur and Hodgkin (2004) drew attention to the weak links existing between site selection and/or management recommendation processes and the official protected site and/or management designation processes, along with lack of clarity as to whom recommendations are made to or who is ultimately expected to act on them.

Examples of the kinds of active management that may be needed to conserve CWR populations are actions to counter or contain threats to the survival of the population such as:

- Weeding to remove competitors
- Removal of invasive species
- Control of unregulated cattle grazing
- Restrictions or promotion of burning
- Effective control of illegal seed or fruit collection
- Halting the decline in population size
- Habitat restoration and population reinforcement
- Control of fungal disease
- Strengthening legal protection
- Nutrient and soil erosion control
- Restrictions or promotion of disturbance
- Human cultural education

The likely intervention will be CWR and location specific and may be opposite in two diverse locations, so in one grazing/fire may need to be decreased, while in the other levels of grazing/fire may need to be increased. See Maxted et al. (2008b) for a detailed discussion of the options for CWR population management intervention. Several reasons can be suggested for these shortfalls. For example, it has too often been assumed that affording CWR conservation in protected areas is a relatively easy task that can be achieved with minimal effort. Also, where intervention in the area might be required to achieve conservation of the target species, the CWR community has generally left the task up to the protected area manager, assuming that modifying the management plan and the corresponding management actions are sufficient for effective CWR conservation. This reasoning is partly a result of the failure to distinguish between the management needs of an area and that of a target species; the latter in many cases requiring a dedicated management plan. With rare exceptions, the management of protected areas does not address the conservation of genetic variation in individual species, but is usually concerned with maintaining overall biodiversity and ecosystem function and interactions between species within the area. However, it is possible to conserve the ecosystem properties of a protected area but still lose individual species (Maxted et al., 1997; Kjaer et al., 2004). The effective conservation of target species/ populations of CWR, especially if they are threatened, usually requires specific interventions. The preparation of a species/population management plan requires a large amount of information about the distribution and ecology of the populations that comprise the target species and the nature and distribution of the genetic variation within it (Thomson et al., 2001; Iriondo et al., 2008; Hunter & Heywood, 2011). This is not a task that a protected area manager would be expected to undertake. Also, one has to take into account the many other duties and responsibilities of a protected area manager (in terms of time and resources) and the fact that management plans do not exist for most protected areas. Moreover, limited technical and financial resources are available to protected area authorities in developing countries. Another reason is the fact that most practical experience of *in situ* conservation of target species has been obtained from the design and implementation of recovery plans for endangered species, mainly in Australia, the United States and several European countries (Heywood & Dulloo., 2005; Hunter & Heywood, 2011) and to a lesser extent in the forestry sector (see above). There is a general lack of awareness by these different sectors of each other's work.

It should not be assumed that persuading the protected area manager to amend the area's management plan to meet the management needs of a target species will be a simple matter. This is by no means certain and often protected area managers are resistant to such proposed changes for a variety of reasons. Managers tend to be generalists and are interested in matters that relate to the current concerns and issues in their park. The distribution of genetic variation amongst the populations of a target species is unlikely to have much management relevance unless the area was set up with the needs of the target species specifically in mind. Of course, many CWR are exploited by local communities (e.g., for timber, fuel wood, food and medicine) and in preparing a management plan, delicate and difficult negotiations between the various stakeholders may be needed if restrictions or even prohibition of access for such purposes are to be included. Likewise, agreement will have to be reached on permitting controlled access to the genetic resource in the form of seed or vegetative propagules so that it can be exploited for breeding purposes or other scientific use. However, in many countries, the need for protected area managers to demonstrate the 'value' of their reserve and, perhaps as a result of this pressure, the recent recognition of the importance of maintaining ecosystem services means that the conservation of CWR diversity in existing protected areas should now be viewed as a priority for both individual protected area managers and national protected area networks. This has been demonstrated by the scoping exercise for the establishment of the first genetic reserve for CWR conservation in the UK by Natural England (Hopkins & Maxted, 2010).

Generally, there still remains a disconnection between the CWR conservation community (i.e., researchers, project managers and others interested in CWR conservation) and protected area managers. For example, the International Union for Conservation of Nature and Natural Resources (IUCN) has a World Commission on Protected Areas and has established the CWR Specialist Group of the Species Survival Commission. However, limited communication occurs between the two groups, which could collaborate more to bridge such 'weak links' and thus safeguard this vital resource. The establishment of actively managed genetic reserves for the *in situ* conservation of CWR diversity will require collaboration between the CWR and protected area communities as well as greater appreciation of the effort, time and resources required to facilitate the integration of CWR conservation into protected area management. We now have a useful body of knowledge, including recommendations, lessons learned and good practice on how to achieve the effective conservation of CWR based on experience from the five countries involved in the recent UNEP/GEF CWR Project (Hunter & Heywood, 2011). For the first time, comprehensive CWR species management plans were prepared for wild yams (*Dioscorea maciba, D. bemandry, D. antaly, D. ovinala* and *D. bemarivensis*) in Ankarafantsika National Park, Madagascar; wild cinnamon (*Cinnamomum capparu-coronde*) in Kanneliya Forest Reserve, Sri Lanka (see box 1); wild almond (*Amygdalus bucharica*) in the Chatkal Biosphere Reserve, Uzbekistan; wild wheat (*Triticum araraticum*, *T. boeoticum*, *T. urartu* and *Aegilops tauschii*) in Erebuni State Reserve, Armenia; and wild cacao (*Theobroma* spp.) in the Parque Nacional y Territorio Indígena Isiboro-Secure, Bolivia. More importantly, the project

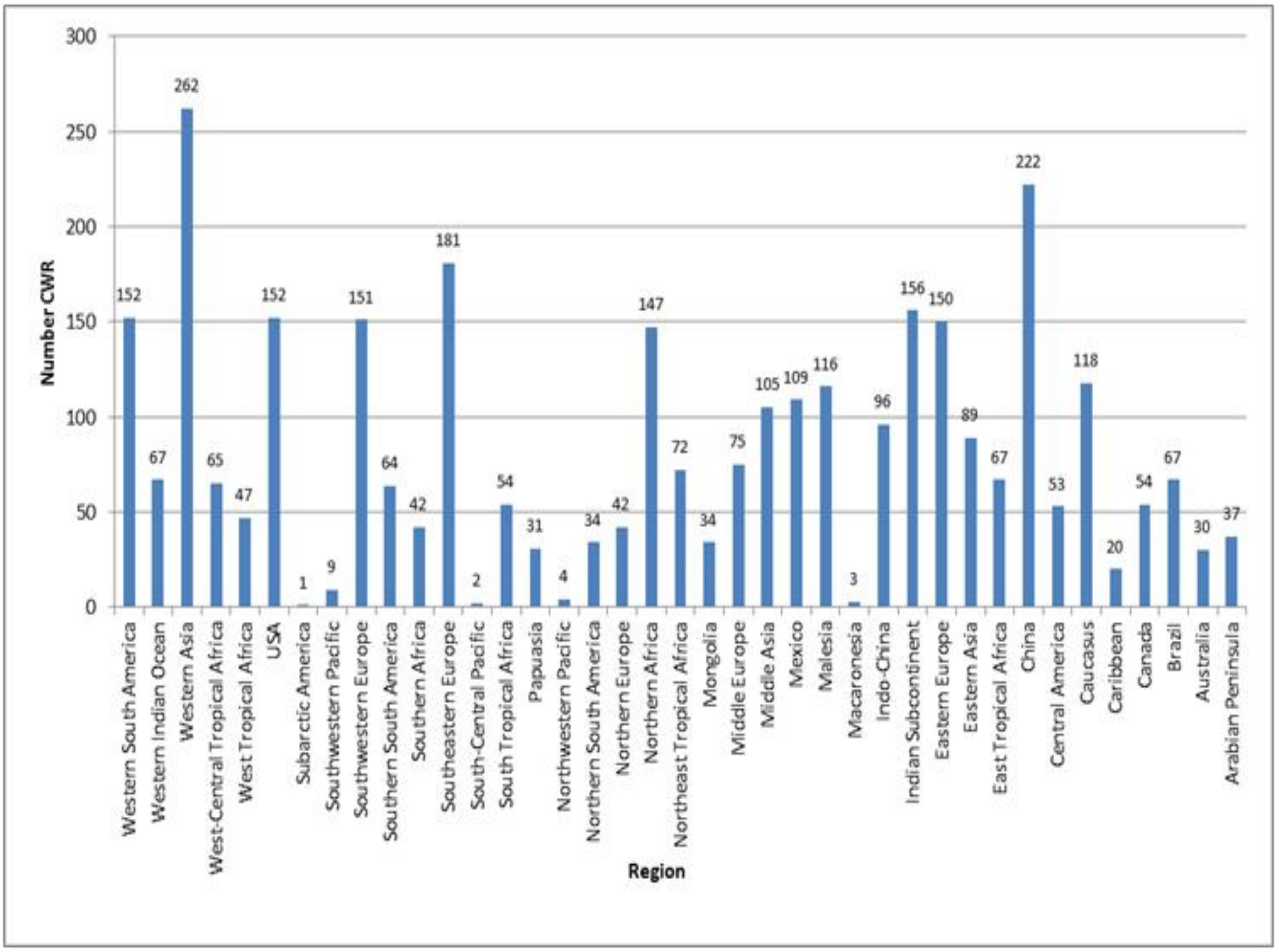

Figure 2. Number of priority CWR per world region (Source: Vincent et al., In Press)

generated tried and tested methods for establishing effective working partnerships among the agriculture sector, protected area staff and local and indigenous communities that can be used by other countries to guide future work in this area[4].

FUTURE PROTECTION: A CALL FOR ACTION

Despite some good examples, there is a serious lack of *in situ* conservation of CWR in protected areas on a global scale — a situation of great concern and requiring urgent action. It has been known for some time that CWR are not spread evenly across the world, but are concentrated in relatively small regions often referred to as 'centres of crop diversity' and subsequently known as 'Vavilov centres' (Vavilov, 1926). As a proxy for the assessment of their global conservation status, the World Wide Fund for Nature and the Nature Conservancy compared levels of habitat protection and habitat loss in centres of crop diversity against global averages for terrestrial ecoregions (Stolton et al., 2008). Based on ecoregion descriptions and related literature, the research identified 34 ecoregions that overlap with these centres of crop diversity and that contain habitats particularly important for CWR. The extent of habitat protection was calculated as the per cent area of each ecoregion covered by a designated protected area according to the 2004 version of the World Database on Protected Areas. In total, 29 (82 per cent) of the 34 ecoregions that include major centres of crop diversity have protection levels of under 10 per cent, and six areas (18 per cent) have protection levels of one per cent or less. Furthermore, a recent study by Vincent et al. (in press) established a global CWR list, prioritized on the basis of their degree of relationship to the associated crop and/or published evidence of their use or potential use as trait donors to crops. The list includes 1,392 species for 183 temperate and tropical crops, with the highest diversity found in Western Asia and China (see Figure 2)[5]. Yet, these centres of crop diversity have experienced proportionately greater habitat loss. Globally, 21.8 per cent of land area has been converted to human dominated uses, whereas average habitat loss in centres of crop diversity is 35.9 per cent with a maximum of 76.6 per cent. That the world's centres of crop diversity have relatively little habitat protection and considerable habitat loss should be a clarion call for protected area strategies to maximize *in situ* conservation of priority and threatened CWR.

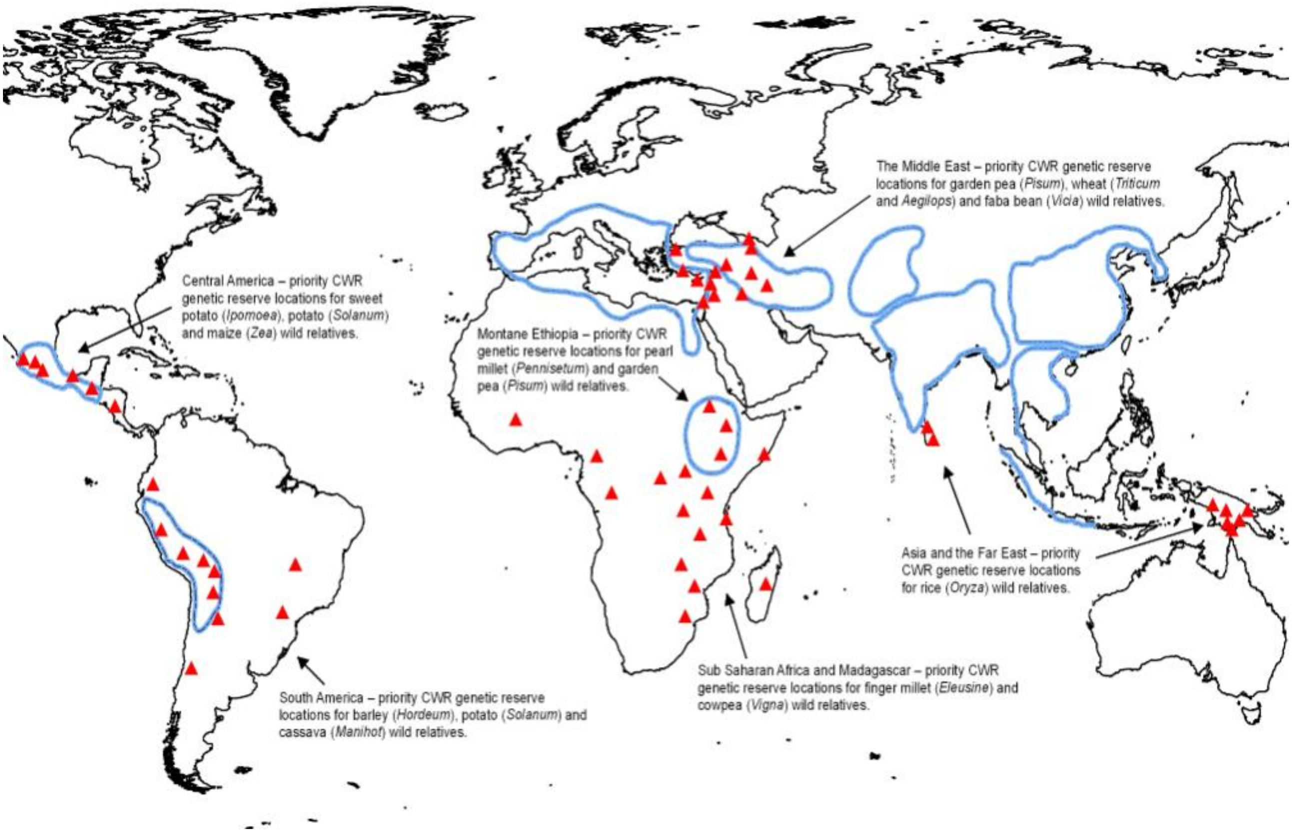

Figure 3. Global priority genetic reserve locations for wild relatives of 12 food crops. The 'centres of crop diversity' (indicated by the enclosed lines) are likely to contain further priority sites for other crop gene pools. (Source: Maxted & Kell, 2009)

In response to the growing concern over the lack of conservation of CWR diversity, the Commission on Genetic Resources for Food and Agriculture of the United Nations Food and Agriculture Organization (FAO) has called for the development of a global network of *in situ* conservation areas for CWR. In a background study to support the *Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (FAO, 2010) and as a basis for updating the Global Plan of Action, Maxted and Kell (2009) identified priority locations for CWR genetic reserve establishment in Africa, the Americas, the Middle East and Asia, and the Far East (Figure 3). The authors found that a high proportion of priority CWR (i.e., the closest wild relatives and those under greatest level of threat) are not currently found within existing protected areas and that there is therefore an urgent need to instigate the establishment of further protected areas as well as to investigate the conservation management status of the CWR populations recorded within existing designated sites.

These priority sites can and should be used to begin recommendations and the search for sustainable long-term funding for the establishment of the global network of *in situ* conservation areas for CWR. To complement the long term need for secure *in situ* CWR conservation, a global project to sample and *ex situ* conserve CWR has already begun (see endnote 5) and this conservation is explicitly linked to CWR utilisation by breeders. However, conservation of CWR diversity in protected areas offers an almost unique opportunity for the biodiversity and agrobiodiversity sectors to work together to maintain evolving populations that can respond naturally to environmental and agro-environmental changes - a challenge that requires international attention.

RECOMMENDATIONS FOR ACTION

In conclusion, we recommend that protected area managers should consider taking steps to enhance the role of protected areas for CWR conservation, through:

- Taking into account the presence of CWR when planning new protected areas;
- Taking steps to enhance the protection of CWR in existing protected areas;
- Furthering the active management of CWR within protected areas by cooperating in the preparation and implementation of species/population management plans;
- Undertaking active monitoring and detailed surveys of CWR in protected areas;
- Improving linkages and coordination between the various agencies involved in CWR conservation,

forest genetic resources and those involved in protected area establishment and management;

- Involving all relevant stakeholders in the preparation of management plans for target species;
- Ensuring individual CWR genetic reserves or protected areas are linked with other national, regional or global genetic reserves or protected areas in networks to maximise conservation efficiency;
- Ensuring active *ex situ* complementary conservation that will facilitate exploitation by plant breeders and other stakeholders;
- Promoting greater awareness, education and understanding the importance of CWR in protected areas and promoting collaboration between the protected area and genetic resource communities.

ENDNOTES

1 EURISCO is a web-based catalogue that provides information on *ex situ* collections maintained in Europe, eurisco.ecpgr.org/

2 See: www.thegef.org/gef/node/3285 for an overview of the CWR project. In addition, the CWR Project has developed the Crop Wild Relatives Global Portal (www.cropwildrelatives.org) that links to national information systems in participating countries as well as other relevant information and resources.

3 See: www.iucn.org/about/union/commissions/wcpa/?5664/Crop-Wild-Relatives for further details regarding the CWR species and protected areas targeted by the UNEP/GEF CWR Project in Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan.

4 See: www.iucn.org/about/work/programmes/pa/pa_what/?5664/Crop-Wild-Relatives

5 See www.cwrdiversity.org/home/checklist/

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RESUMEN

Los parientes silvestres de cultivos (CWR, por sus siglas en inglés) son un recurso crítico para el futuro de la seguridad alimentaria. Es ampliamente reconocido que, si bien muchas de las áreas protegidas del mundo contienen diversidad de CWR, aún no ha sido posible materializar acciones importantes para conservar las CWR que contienen. Son muchos los retos y obstáculos que deben abordarse para mejorar esta situación. Algunas iniciativas recientes han comenzado a abordar estos desafíos y han puesto de manifiesto algunas lecciones importantes. Sin embargo, es preciso adoptar medidas urgentes, y el artículo concluye destacando la necesidad de un enfoque global para la conservación de CWR prioritarias y amenazadas en la naturaleza.

RÉSUMÉ

Les espèces sauvages apparentées aux espèces cultivées sont des ressources essentielles pour le futur de la sécurité alimentaire. Tout le monde s'accorde pour reconnaître que les aires protégées du monde entier abritent souvent une grande diversité d'espèces sauvages apparentées aux espèces cultivées,

mais malgré tout, il n'a pas été encore possible de mener des actions significatives pour les conserver. De nombreux obstacles et défis doivent être relevés pour améliorer cette situation. À cet égard, des initiatives ont récemment été mises en œuvre et les principaux enseignements tirés. Cependant, il est urgent d'agir et l'article conclut en attirant l'attention sur le besoin d'une approche mondiale pour conserver les espèces sauvages apparentées aux espèces cultivées prioritaires et menacées à l'état sauvage.