Chapter 6

Developing National CWR Strategies and Action Plans

The Convention on Biological Diversity calls for each Party to develop a National Biodiversity Strategy and Action Plan (NBSAP) to guarantee that the objectives of the Convention are undertaken at all levels and in all sectors in each country (CBD, 2010).

Importance and purpose

Under Article 6 of the Convention on Biological Diversity (CBD), the parties are required to develop national strategies, plans or programmes for the conservation and sustainable use of biodiversity. Guidance on their preparation was given in the national biodiversity guidelines published by the United Nations Environmental Programme (UNEP), the World Resources Institute (WRI) and the International Union for Conservation of Nature (IUCN) (Miller and Lanou, 1995). Such strategies can be considered a call to action and set a national direction for biodiversity conservation. A sample survey showed that most countries' biodiversity strategies and action plans do not specifically refer to CWR or even to the *in situ* conservation of targeted species but, such is the importance of CWR, that it is clearly desirable for countries to develop a separate national strategy and action plan for their conservation and sustainable use. On the other hand, some countries have developed national plant conservation strategies in response to the Global Strategy for Plant Conservation (GSPC). In such strategies, CWR are included in several targets; CWR are specifically covered by target 9 of the European Strategy for Plant Conservation (ESPC).

Prior to the UNEP/GEF CWR Project, very few countries had developed a CWR strategy or included one on CWR in their national biodiversity strategy and action plans, so there are few country examples that offer guidance. The one exception is Turkey, which produced the National Plan for *In Situ* Conservation

Box 6.1 Main objectives and expectations of the National Action Plan for *In Situ* Conservation of Plant Genetic Diversity in Turkey

- The Turkish National Plan for *in situ* conservation of plant genetic diversity is the first example of its kind in the world. It could serve as an example for other countries.
- The implementation of the National Plan for *in situ* conservation of selected (target) species of the wild relatives of herbaceous and woody plants and important forest trees will provide efficiency and continuity in conservation programmes in Turkey by establishing gene management zones (GMZs) for target species throughout the country.
- Since the GMZs are accepted as one of the most effective ways of *in situ* conservation, allowing the evolutionary changes and continuity of genetic diversity in target species in the National Plan, the alternatives for the selection criteria, management responsibility and policy for GMZs, as well as the methods for utilization of genetic material from GMZs will be also developed for target species with special requirements.
- The basic purposes of all environmental actions are to prevent environmental problems before they occur, and to sustain the quality and quantity of the biotic and abiotic components in ecosystems. With the implementation of the National Plan, the plant genetic resources which are seriously threatened by various environmental problems will be efficiently conserved and managed *in situ*.

Source: Albayrak (2004)

of Plant Genetic Diversity in Turkey (Kaya et al, 1997) as an output of the World Bank/GEF-sponsored project '*In Situ* Conservation of Genetic Biodiversity' (Tan and Tan, 2002) (see Box 6.1).

Why develop a strategy?

Given the importance of CWR, a national strategy is needed to provide a coherent and coordinated approach to their conservation and utilization. Further, the many challenges highlighted and addressed elsewhere in this manual, such as lack of collaboration across sectors, absence of policy and legislative reforms, lack of technical expertise and limited finances demand a strategic approach. To implement the strategy, a plan of action is needed to implement future coordinated actions to achieve its goals. It may also be used by countries to meet the targets they have committed to under international agreements such as the CBD and its GSPC and other global strategies such as the Global Strategy for Conservation and Use of CWR (see below).

A national CWR strategy or action plan should seek to:

- ensure coordination of planning and implementation of CWR conservation so that collaboration occurs and activities are harmonized between the relevant stakeholders and actors involved;
- institutionalize the practice of CWR conservation by embedding it in national planning mechanisms supported by relevant policy, legislative and financial measures;
- promote the public awareness and understanding of the importance and value of CWR and their conservation; and
- provide a mechanism for reporting on progress towards targets and plans agreed under other agreements – e.g. the CBD.

The experience gained during the UNEP/GEF CWR Project has shown very clearly the value of a CWR national strategy. The preparation by the countries of their strategies has been a valuable exercise, highlighting the need for greater coordination and collaboration between ministries, agencies and institutions, and for improved partnerships and more effective planning across sectors and thematic areas. The Project has helped draw attention to the importance of CWR, both nationally and globally, and the growing threats that they now face. Furthermore, a national strategy can be a useful instrument to help secure funding for CWR in a climate of financial difficulty and competition from other demands. It might also assist a country to better align its CWR activities with other relevant international initiatives such as the GSPC and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).

Once a strategy has been prepared and approved, an action plan for its implementation will need to be developed. The action plan is likely to be phased over a period of years, according to the availability of resources and finances. Full implementation is likely to take many years in countries with numerous CWR.

As already highlighted, most countries have well-established arrangements for the preparation and implementation of National Biodiversity Strategies and Action Plans (NBASPs), as required by the CBD. Some government departments also have considerable experience in developing strategies and action plans for thematic topics, as do other national organizations. It should be noted that NBSAPs and related reporting to the CBD is generally carried out by a country's ministry of environment, whereas CWR often fall under the responsibility of the ministry of agriculture. A CWR strategy can therefore help to bring these different sectors together.

Considerable expertise already exists in most countries; it is good practice to seek out this expertise, as well as other resources and tools which may be relevant to the CWR strategy and action planning process.

Who should be involved?

The relevant government department or agency(ies) with a mandate or responsibility for CWR conservation may wish to establish a working group or task force to oversee the drafting of the national CWR action plan. Countries should also consider designating a national focal point for CWR; this person would be responsible for coordinating CWR-related activities, including the design and implementation of the national action plan for CWR. It is important that the working group includes individuals from other relevant agencies and sectors if there is to be ownership of the final action plan. Cross-sector support and buy-in will also be a key to the success of the action plan; such support is necessary to ensure that actions are integrated into relevant agency work plans and budgets.

The agency may wish to employ a consultant to prepare an initial draft of the national CWR action plan if no in-house expertise exists.

Guidelines for preparation

In the absence of previous examples of national strategies for the conservation of CWR, little published guidance on how they may be produced is available. However, as the preparation of a national action plan for CWR conservation and use was one of the outputs of the UNEP/GEF CWR Project, the subsequent action plans/strategies for Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan represent a unique resource. These are discussed below. In addition, a major component of the CWR Project was the development of a national information system on CWR (as well as an international information system); this represents a major source of information for use in preparing a national strategy/action plan. Similarly, if a national CWR database has already been constructed for a country, it will contain much of the information needed for inclusion in the strategy.

The preparation of national CWR strategic action plans was one of the main objectives of the draft Global Strategy for the Conservation and Use of CWR proposed by the PGR Forum Project and First International Conference on Crop Wild Relatives Conservation and Use in 2005 (Heywood et al, 2008).

A national strategy for the conservation and sustainable use of CWR may be prepared as:

- a free-standing document, as in the case of Armenia, Bolivia and Uzbekistan;
- incorporated into the country's National Biodiversity Strategy and Action Plan, as in the case of Sri Lanka; or
- included in a country's plant genetic resources strategy, as in the case of Madagascar, where the process of outlining a national strategy for CWR is ongoing. It has been agreed that CWR will be integrated into Madagascar's National Management Strategic Plan for Forest Phytogenetic Resources, which is under revision.

Box 6.2 Components and actions for preparing a CWR national strategy/action plan

- Provide the background context for CWR:
  - state of biodiversity conservation in the country;
  - international agreements entered into, relevant to CWR, e.g. CBD, ITPGRFA, Global Plan of Action for Conservation and Sustainable Utilization of PGRFA, GSPC;
  - national legal framework relevant to CWR;
  - national biodiversity strategy and action plan;
  - national and international information system on CWR;
  - lientification of stakeholders.
- Compile a national inventory of CWR and lists of other potential economically important target species – forestry species, medicinal/aromatic plants, indicating their conservation status (where known).
- Review existing national data sources on CWR, with regard to their current state of conservation:
  - their occurrence in protected areas;
  - any *in situ* actions affecting them (including recovery plans);
  - their representation in genebanks.
- From the national inventory, select a list of priority species of CWR for which conservation action is proposed, either *in situ* or *ex situ* or both.
- For the priority species, make a baseline assessment of their ecogeographic status and undertake a threat assessment.
- Undertake a gap analysis to establish where gaps exist in conservation measures.
- For priority species, outline proposals for *in situ* conservation action (including threat management), both within protected areas, preferably as a network of genetic reserves, and outside currently protected areas.
- For priority species for which *ex situ* conservation is required, make proposals for their sampling and storage in national or international genebanks, botanic gardens or other long-term facilities.
- Make proposals for other actions to protect CWR outside protected areas, such as easements, incentive-based schemes or micro-reserves.
- Make proposals for complementary conservation.
- Determine the policy framework changes needed.
- Review adequacy of existing legislative and determine what further action, if any, is required.
- Assess budget and funding issues and develop a financing plan.
- Make proposals for ensuring national awareness of the importance of conserving and using CWR sustainably, preferably within the framework of a communications strategy.
- Devise a capacity development plan.
- Arrangements for implementation of the strategy and allocation of management responsibilities.

There is no single, right way to prepare a national CWR strategy, but the key elements are provided in Box 6.2. An outline scheme and further information for the development of a national CWR strategy are presented by Stolton et al (2006). Given that, in most countries, an array of different strategies and action plans, national reports and assessments on various aspects of biodiversity and conservation have been produced, every effort should be made to draw on these and avoid duplication of effort.

Provide the background context for CWR

As noted above, most countries will have already prepared a number of strategies, action plans or other instruments that document the state of biodiversity. Some of these will correspond to reporting requirements, such as national reports under international treaties or other agreements that have been entered into, including the CBD, ITPGRFA, Global Plan of Action for Conservation and Sustainable Utilization of PGRFA and GSPC. There may also be useful background information in past and current country reports submitted for the *State of the World Report on Plant Genetic Resources* and in the consolidated report itself. In addition, there may be regional agreements with similar reporting requirements – for example, in Europe, the European Union Habitats Directive and the Council of Europe Bern Convention. National biodiversity or agrobiodiversity institutes will also hold relevant information. While these documents may not specifically mention CWR, they will provide much background on the species that might be identified as CWR and the areas in which they occur.

Data sources for the national inventory

The backbone of a national CWR strategy is the inventory or listing of CWR. In very few cases, such a list will already exist as in the case of Armenia, where a catalogue of the wild relatives of food crops was prepared by Gabrielian and Zohary (2004). The main source of data for the inventory will normally be the national Flora(s). For most countries, one or more standard Flora(s) exist: these are the Floras generally acknowledged by botanists in the country or region as the most reliable sources of information on plants occurring there and, consequently, those that are the most widely used. Lists of standard Floras for Europe are given by Tutin et al (1964–1980; 1993) and for the Mediterranean Region by Heywood (2003); a guide to the standard Floras of the world has been compiled by Frodin (2001). In addition, many countries have a published or online checklist of existing Flora.

Unfortunately, a number of countries do not have a comprehensive Flora or even a catalogue. In such cases, the cooperation of local taxonomists should be sought. For example, in the case of the five UNEP/GEF CWR Project countries, Bolivia, which has an estimated 20,000 species (Ibisch and Beck, 2003), does not have a complete Flora nor a recent checklist; the last listing of the ferns and flowering plants of Bolivia was that of Foster's *Catalogue* (Foster, 1958). On the other hand, a handbook of the economic plants of Bolivia was published by the

Box 6.3 A Catalogue of the Vascular Plants of Madagascar

The Vahinala project aims to bring together information on all native and naturalized vascular plant species in Madagascar, evaluating the available taxonomic literature and specimen base for each taxon. The project will result in the 'Catalogue of Vascular Plants of Madagascar', comprising an online database and, eventually, a printed version. The project is led by the Missouri Botanical Garden in collaboration with numerous institutional and individual partners. The harmonized list of accepted species is nearing completion; it aims to have evaluated all genera and compiled distributional, ecological, and conservation status information for all accepted species by the end of 2010.

Source: Missouri Botanical Garden, St Louis, USA

Bolivian botanist, Cárdenas, in 1969 (Cárdenas, 1969), which has proved to be a useful source of information on CWR. A checklist of the Bolivian Flora is under preparation in association with the Missouri Botanical Garden and the New York Botanical Garden. Other partial sources of information include the 'Checklist of New World Grasses'[1] and the 'Preliminary Checklist of the Compositae of Bolivia,' published in 2009.[2]

Likewise, there is no comprehensive Flora of Madagascar, estimated to have at least 9500 species, although the 99 sections of the *Flore de Madagascar et des Comores*, which commenced in 1936 have been published. The Vahinala project, based at the Missouri Botanical Garden, USA, plans to produce the 'Catalogue of the Vascular Plants of Madagascar' (see Box 6.3). The aim is to create a practical, up-to-date, online synthesis of the flora of Madagascar for a diverse group of users, including systematists working on Malagasy plants, ethnobotanists and natural products chemists, natural resource and protected areas managers, conservation scientists and government agencies. It is now possible to prepare this catalogue only because baseline taxonomic data on all names applied to Malagasy plants have already been compiled over the past 25 years into the TROPICOS database (see below).

In the case of Armenia, extensive studies of higher vascular plants have been carried out since the 1950s and have culminated in the production of nine volumes of the 'Flora of Armenia' (Takhtajan, 1954–2001) documenting dicotyledonous vascular plants. A further two volumes on monocotyledons are expected to be published. However, in comparison to these two groups, others are not well studied. At present, not all groups of Armenian flora (lower and higher plants) are equally well known – those most studied are fungi and flowering plants (Plant Genetic Resources in Central Asia and Caucasus: http://www.cac-biodiversity.org/arm/arm_biodiversity.htm).

Another invaluable source of information is herbarium material. Most countries have a national herbarium or one or more major herbaria, as well as university and local herbaria. These herbaria vary enormously in the scope and number of collections they hold. The two herbaria in Madagascar (Parc de

Botanique et Zoologique de Tsimbazaza and Centre National de la Recherche Appliquée au Développement Rural), both in Antanarivo, each hold about 40,000 specimens, the National Herbarium of Bolivia in La Paz houses 100,000 specimens, while another 150,000 specimens are housed in other Bolivian herbaria. The main herbarium in Sri Lanka, at the Royal Botanic Gardens, Peradeniya, contains 130,000 specimens, while the main herbarium in Armenia, at the Institute of Botany of the National Academy of Sciences, Yerevan, has 500,000. Finally, the herbarium of the Scientific Production Centre (SPC) Botanika of the National Academy of Science, Uzbekistan has over 1 million specimens.

Some of the major world herbaria have massive collections and may contain material that is highly relevant for the study of other countries' CWR. For historic reasons, there may be more of a particular country's material in foreign herbarium collections than in those of the country itself, given that much of the plant exploration and collection of herbarium specimens and other material was undertaken by botanists from other countries before appropriate national institutions were established. For example, the herbarium of Phanérogamie at the Muséum National d'Histoire Naturelle, Paris, with 8 million specimens, is of major importance for the study of the Madagascar flora. The major herbaria such as those of the Royal Botanic Gardens, Kew; Natural History Museum, London; Botanischer Garten und Botanisches Museum Berlin-Dahle; New York Botanical Garden; Missouri Botanical Garden, St Louis; and the Central National Herbarium of the Botanical Survey of India, National Botanic Garden, Howrah, all of which have 1 to several million specimens with special emphasis on particular geographic regions or individual countries other than the host country, may be consulted. However, access to such collections to obtain data on CWR may be difficult due to the costs involved, though some information may be accessible electronically.

Herbarium specimens, through their label data, can provide valuable information on the distribution, abundance and, to some extent, the ecology and conservation status of CWR. Obtaining data from herbarium specimens can, however, be time-consuming and laborious and there are many pitfalls. Two of the most serious downfalls include the incorrect naming of material and the use of names which differ from those employed by the standard Floras or checklists, leading to confusion and misunderstanding. Incorrect determination is usually difficult to detect without professional assistance; therefore, the help of taxonomists should always be enlisted. The problem of synonymy – the use of different names for the same plant – is a fact of life and, again, may require the services of a professional taxonomist to resolve. It is beyond the scope of this manual to go into further details in this regard.

In recent years, considerable progress has been made by herbaria across the world in digitizing herbarium material. Digitization involves the process of capturing data such as a plant species' name, the names of collectors and the date of collection, as well as other descriptive and ecological data obtained mainly from the specimen's label. The image of the specimen, itself, is then scanned and stored in digital form along with the aforementioned data. The process is not without its problems: in a project to digitize the herbarium specimen label data from the

Box 6.4 Major initiatives contributing to the digitization of herbaria collections

The Mellon Foundation is supporting work to digitize all the plant type specimens anywhere in the world, coupled with institutional initiatives:

http://www.mellon.org/internet/grant_programs/programs/conservation#current.

These include:

The African Plants Initiative (API), an international partnership collaborating to produce an online database of scholarly information about African plants. The partnership currently (December 2009) includes 44 botanical institutions representing 20 countries in Africa, Europe and the US. http://www.aluka.org/action/doBrowse?sa=1&sa_set=1.

The Latin America Plant Initiative (LAPI) and the Global Plant Initiative (GPI) covers Mexico, Central America and the Caribbean, and all of South America. http://www.rbge.org.uk/science/herbarium/digitisation-of-collections/the-latin-american-plants-initiative-and-global-types-initiative.

For a case study of the East African Herbarium (EA) digitization process see: http://www.e-biosphere09.org/posters/H21.pdf.

The Royal Botanic Gardens, Kew, has made substantial efforts in this area in the last five years: http://apps.kew.org/herbcat/gotoProjects.do. This site contains links to many other initiatives that enhance digitization of records and which may be important sources of information, some of which is relevant to Madagascar. Kew has implemented an electronic catalogue for its herbarium specimen collections, known as HerbCat – a relational database that stores information about specimens including collection details (where, when and by whom) and naming history (what taxon has this specimen been assigned to now and previously, when and by whom). Other information such as the part of the plant collected, related material in Kew's collections, and any restrictions on the use of the specimen, are also recorded where appropriate. Each specimen is given a unique barcode and represented as a separate record in HerbCat. http://apps.kew.org/herbcat/navigator.do.

Botanical Research Institute of Texas, Fort Worth, USA, a preliminary survey showed that only 41 per cent of the specimens' labels could be translated into error-free, computer-readable text with off-the-shelf OCR (optical character recognition) software. The remaining 59 per cent of the labels were older, poorly hand-typed or handwritten, and could not be digitized by machines alone, and a system whereby humans could work with computers to transform label data had to be devised. Once digitized, the information can then be readily disseminated and made available to those who do not have direct access to the collections. Some of the major digitizing initiatives are given in Box 6.4.

No comprehensive global checklist or database of plant species exists although target 1 of the CBD Global Strategy for Plant Conservation aims to

Box 6.5 International Plant Names Index (IPNI)

IPNI is a list of plant names giving place of publication, storing around 1.5 million scientific plant names. Comprising data from three hitherto separate indexes (Index Kewensis, Gray Card Index and the Australian Plant Name Index), IPNI is the result of collaboration between the Royal Botanic Gardens, Kew, the Harvard Herbaria and the Australian National Herbarium, Canberra. IPNI data is copyright protected under the Plant Names Project. Website: www.ipni.org

Box 6.6 The Catalogue of Life

The aim of Species 2000 and Integrated Taxonomic Information System (ITIS) Catalogue of Life is to become a comprehensive catalogue of all known species of organisms on earth. The 2010 edition comprises some 1,257,735 species from 77 databases, representing approximately two-thirds of the world's known species. Species 2000 and ITIS teams peer-review databases, select appropriate sectors and integrate the sectors into a single coherent catalogue with a single hierarchical classification. Two products have thus far been published by the Catalogue:

- Species 2000 and ITIS Catalogue of Life: 2010 Annual Checklist
  The Annual Checklist is published each year as a fixed edition that can be cited and used as a common catalogue for comparative purposes by many organizations; http://www.catalogueoflife.org/annual-checklist/2010.
- Species 2000 and ITIS Catalogue of Life: Dynamic Checklist
  The Dynamic Checklist is a virtual catalogue operated on the internet and available both for users and as an electronic web-service at http://www.catalogueoflife.org/dynamic-checklist. The Dynamic Checklist harvests taxonomic sectors and associated strands of hierarchical classification dynamically from the source databases across the internet. The Dynamic Checklist is presently less extensive than the Annual Checklist because fewer taxonomic sectors have been connected so far. It differs in concept from the Annual Checklist in that (i) the taxonomic records may be updated and the catalogue changed more frequently than in the Annual Checklist, and (ii) the Dynamic Checklist contains additional regional species checklists (such as the Regional Checklist – Europe, effectively a Pan-European Species Checklist) not included in the Annual Checklist.

Source: http://www.catalogueoflife.org/

produce a working list by 2010.[3] Major databases and information systems such as GBIF, TROPICOS, IPNI (see Box 6.5), the Catalogue of Life (see Box 6.6) and the electronic Plant Information Centre (see Box 6.7) are also important resources. In addition, there are countless regional, national or local databases and information systems relating to particular areas. For an increasing number of

Box 6.7 The electronic Plant Information Centre (ePIC)

The ePIC is a major resource discovery project to provide a single point of search across all Kew's major specimen, bibliographic and taxonomic databases on the internet. In addition, Kew plans to add digital images and electronic documents into the available resources, and to develop links to external sites with complementary information. The website will be developed through successive releases, with additional data and features being made available at each one. The main components of ePIC are the website; software to enable the cross-database searching and provide ancillary services; hardware to store the data and support the website; and the data itself.

Source: Royal Botanic Gardens Kew, http://epic.kew.org/index.htm, accessed 21 August 2009

Box 6.8 World Checklist of Monocotyledons

A database of accepted names, synonyms, geographical distribution and life forms for monocot plants. Currently, the checklist includes roughly 65,000 accepted taxa in 78 families. When complete, it will include approximately 80,000 accepted taxa for all monocot families. Generic concepts follow *Vascular Plant Families and Genera*. Citation of authors follows *Authors of Plant Names* and terminology for life forms is based on the Raunkier system (1934). Geographical distribution is comprised of a generalized statement in narrative form, and TDWG Level 3 codes. Website: www.kew.org/wcsp/monocots

Source: The Royal Botanic Gardens, Kew

families, global taxonomic databases exist and can be found through normal search engines. Examples are the International Legume Database and Information Service (ILDIS) and the World Checklist of Monocotyledons (see Box 6.8).

Data standards

A major difficulty in working with taxonomic, ecological and geographical information is the lack of consistency, not just in terminology – something that has been addressed in developing the CWR Global Portal – but in the ways names of plants and the literature about them (books and journals) are cited, the application of geographical terms and so on. These issues have been addressed by the Biodiversity Information Standards (TDWG, formerly known as Taxonomic Database Working Group), an international not-for-profit group that develops standards and protocols for sharing biodiversity data. Standards are available from the TDWG website and some of them, especially the earlier ones, are relevant for developing a national CWR catalogue (see Box 6.9). In particular, the so-called Darwin Core (often abbreviated as DwC) is now increasingly adopted

Box 6.9 TDWG standards

The following earlier TDWG standards[4] may be relevant to the preparation of a national CWR strategy:

- Economic Botany Data Collection Standard;
- Plant Occurrence and Status Scheme: Status and Categories;
- Plant Names in Botanical Databases Best Current Practice;
- Authors of Plant Names;
- World Geographical Scheme for Recording Plant Distributions;
- XDF – A Language for the Definition and Exchange of Biological Data Sets;
- Botanico-periodicum-huntianum/supplementum;
- Index Herbariorum. Part I: The Herbaria of the World: Status and Categories;
- International Transfer Format for Botanic Garden Plant Records;
- Floristic Regions of the World: Status and Categories; and
- Taxonomic Literature, ed. 2 and its Supplements.

Source http://www.tdwg.org/standards/

by bioinformatics projects. Darwin Core is a body of data standards that consists of a glossary of terms aimed at facilitating the discovery, retrieval, and integration of information about organisms, their occurrence in nature in space and time, as documented by observations, specimens and samples, and related information housed in biological collections (http://rs.tdwg.org/dwc/). The Simple Darwin Core [SIMPLEDWC] is 'a specification for one particular way to use the terms – to share data about taxa and their occurrences in a simply structured way and is probably what is meant if someone suggests to "format your data according to the Darwin Core"' (http://rs.tdwg.org/dwc/terms/simple/index.htm).

Data sources on CWR conservation

It is important to obtain data on which CWR occur in a country's protected areas, if at all possible. Inventories of the plants occurring in protected areas are sometimes published in protected area management plans or in scientific literature and may be available from the managers of the protected areas. Unfortunately, inventories are lacking or incomplete for the majority of protected areas. With regards to the UNEP/GEF CWR Project areas, the Erebuni Reserve in Armenia has a vascular flora of some 1800 CWR, according to unpublished data from M. Grigoryan cited in Khanjyan (2004), who also quotes approximate figures for other protected areas in the country. A list of species growing in the reserve is also given as an Annex to the Erebuni State Reserve Management Plan.

The project 'Plant and Vertebrate Animal Species Reported from the World's Protected Areas',[5] which aimed to provide databases containing documented, taxonomically standardized species inventories of plants and animals reported from the world's protected areas, was initiated by the Information Centre for the Environment (ICE), in cooperation with the United States Man and the

Biosphere program (US MAB), the Man and the Biosphere (MAB) programme of UNESCO, the National Biological Information Infrastructure, the US National Park Service, and the Biological Resources Discipline of the United States Geological Survey (USGS). The project, however, is still a work in progress.

Information on any actions being taken to manage or conserve CWR species' populations occurring in protected areas should be recorded when available. Again, such information may be available from protected area management plans (often officially published by the state), from the scientific literature or from conservation agencies or non-governmental organizations (NGOs).

Likewise, information on the existence of accessions of CWR in national and local genebanks, botanic gardens and arboreta should be recorded. Accessions may be held in genebanks or collections in other countries and in international genebanks such as those of the Consultative Group on International Agricultural Research (CGIAR) centres; United States Department of Agriculture (USDA), Fort Collins, USA; Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany; Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia; Vavilov Institute, St Petersburg, Russia; and the Brazilian Agricultural Research Corporation (EMBRAPA), Brazil. Information on *ex situ* collections may be obtained from the *ex situ* Collection Database, which is a component of the Food and Agriculture Organization of the United Nations' (FAO) World Information and Early Warning System of Plant Genetic Resources for Food and Agriculture (WIEWS).[6] It contains summary records of plant genetic resource holdings (more than 5 million accessions belonging to more than 18,000 species) reported by more than 1500 national, regional or international genebanks. Passport and phenotypic information for many *ex situ* collection holdings (including those from the CGIAR international collections, the European catalogue of genebank holdings and the USDA-ARS GRIN collections) will become available through a single portal (called the *Genesys* portal) to be launched in early 2011 as a result of a collaborative project between Bioversity International, the Global Crop Diversity Trust and the Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture. The PlantSearch database, maintained by Botanic Gardens Conservation International (BGCI), can be used to identify plants in *ex situ* collections of botanic gardens. Currently (May 2010), it contains over 575,000 records.

Published information on the conservation of CWR is scarce and the review of information sources by Thormann et al (1999), although somewhat outdated, is a useful resource.

Selecting a list of priority species of CWR

Many countries will have extensive lists of CWR, but resources will be limited and it will not be cost-effective to undertake conservation actions for all CWR, or even a great many. Therefore, it is necessary to undertake a process whereby CWR species can be prioritized. This topic is dealt with in detail in Chapter 7. A national action plan and strategy for CWR should elaborate a list of CWR (the long list) and then prioritize these into those that will be the subject of conservation action

in the short, medium and long term. This should be supported by a detailed plan as to what kinds of conservation activities will be applied to the species on these lists. A national strategy is not only about the few selected or prioritized species that any single project can hope to deal with. Instead, the strategy needs to indicate which of the listed species will be targeted, what will be the timeframe, how many species can be afforded protection over this period, what kinds of actions can be undertaken inside and outside protected areas, and so forth.

Baseline assessments of ecogeographic status and threats

Before conservation actions on a priority or target species can be undertaken, as much information as possible about it needs to be gathered in order to make informed decisions and set effective goals for conservation, a topic which is dealt with in detail in Chapter 8.

Conservation gap analysis

Gap analysis was initially put forward as a technique for conservation evaluation, aimed at identifying areas where selected elements of biodiversity are under-represented. Conservation planners regularly use the gap analysis technique to identify biodiversity that is not adequately conserved in protected areas or by other conservation approaches (Stolton et al, 2006). It is a technique that can be used to evaluate current gaps in CWR *ex situ* and *in situ* conservation; this topic is dealt with in Chapter 8.

Proposals for *in situ* conservation action inside and outside protected areas

This topic is dealt with in Chapters 7, 9, 10, 11 and 13.

Proposals for complementary conservation actions, including *ex situ* conservation

This topic is dealt with in Chapter 12.

Review of policy framework for CWR conservation

At the international level, the conservation and sustainable use of CWR are addressed in both the agriculture and environment sectors through the ITPGRFA and CBD. At the national level, it is important to undertake an analysis of relevant national policy documents, such as the national biodiversity and conservation strategies and national biodiversity action plans, to review their relevance to CWR conservation. Where it is weak it will be necessary to draft and promote necessary revisions to national policy. For a summary of the steps that may be involved in developing such a policy framework see Laird and Wynberg (2002).

Review of legal framework for CWR conservation

Most countries have a legislative basis for biodiversity conservation, which includes laws that are related to CWR conservation and use. It is important to review the national legal framework and assess whether it is suitable for PGR conservation, including CWR, and whether it is consistent with international agreements such as the ITPGRFA and CBD. The steps involved in drafting and implementing institutional policy are outlined by Laird and Wynberg (2002).

Box 6.10 Reviewing national legislation on plant genetic resources in Bolivia

Within the framework of the UNEP/GEF CWR Project, and with legal support from FAO, the government of Bolivia reviewed the adequacy of its legislation targeting the protection of plant genetic resources for food and agriculture and CWR. Results from the legal framework review showed that although the sustainable use of natural resources and the conservation of biodiversity were regulated to some extent by Bolivian legislation, particularly Decision 391 that regulates access to genetic resources in Andean countries, no specific legislation was in place for plant genetic resources or for the *in situ* conservation of CWR. Recommendations ensuing from the report suggested that new international priorities set by the ITPGRFA and the CBD be streamlined into Decision 391. The report further highlighted the need to improve national legislation to facilitate access to PGRFA and proposed that a new law be drafted, regulating the conservation, study, evaluation and use of CWR, taking into account traditional knowledge associated with CWR and the safeguarding of farmers' rights in indigenous communities. It also recommended Bolivia's ratification of the ITPGRFA.

Following workshop recommendations, the Bolivian government agreed to consider the issue of streamlining international priorities stemming from the CBD and the International Union for the Protection of New Varieties of Plants (UPOV) Convention into national legislation, and committed to developing a study on Bolivia's food security dependence on PGRFA species included in Annex I of the ITPGRFA. To build consensus at the institutional level for the ratification of the ITPGRFA, a workshop was organized bringing together Bolivian stakeholders involved in plant genetic resources' management. The aim of the workshop was to inform stakeholders of the benefits and obligations linked to the signing of the ITPGRFA and draft a set of recommendations to present to relevant government authorities as a basis for decision-making on the document's ratification. Although aware of the benefits that could stem from signing the ITPGRFA and gaining access to foreign PGRFA material, Bolivia has not yet ratified the agreement. The endorsement of the ITPGRFA remains a politically sensitive issue, particularly regarding plant genetic resources ownership, benefit-sharing mechanisms and farmers' rights, which are not, according to relevant stakeholders, clearly defined in the ITPGRFA.

Source: Beatriz Zapata Ferrufino, National Project Coordinator of Bolivia for the UNEP/GEF CWR Project

Assessment of budget and funding issues

Issues of finance and budgets are covered briefly in Chapter 4. Close attention must be given to budgets and financial support. Most countries will not allocate specific budgets for CWR conservation actions and sources of potential support are limited. This is why it is important that the national action plan has political support and agency buy-in. This might ensure that the action plan is integrated into the relevant agency annual work plan and budgetary mechanisms.

Arrangements for implementation of the national action plan

There are a number of important and challenging issues, many of them cross-cutting, which need serious consideration for the successful implementation of the action plan. Many of these are dealt with in detail elsewhere in this manual. The planning process and the importance of effective partnerships and participation for successful conservation actions are dealt with in Chapters 4 and 5. These chapters also provide information on collaborative agreements, identification of stakeholders and the allocation of management roles and responsibilities. The successful implementation of any action plan will depend on identifying what national capacity already exists and the current gaps that need to be addressed; this topic is dealt with in detail in Chapter 15 and should be addressed through the development and implementation of a capacity development plan. Likewise, communication, public awareness and education are all critical, yet complex and challenging, issues. These topics are covered in Chapter 16 and should be considered in the context of a well-developed communication strategy.

Summary of CWR national strategies/action plans of the UNEP/GEF CWR Project countries

The five UNEP/GEF CWR Project countries have approached the preparation of a national CWR strategy or action plan in different ways and without the benefit of prior agreed guidelines.

The outline of the CWR conservation national action plan for Armenia is given in Box 6.11.

In the case of Uzbekistan, work on the national strategy and national action plan went through various stages. At a national meeting of project partners, it was decided that the strategy would consist of nine chapters and annexes; responsibility for preparing these was shared among partner institutions, according to their interests. The chapters were put together and delivered to the experts of the technical advisory group and a draft version of the strategy was circulated among directors of the following government organizations for comment: Uzbek Research Institute of Plant Industry; Republican Scientific Production Centre on Ornamental Gardening and Forestry; Scientific Plant Production Centre 'Botanica' of the Academy of Sciences of Republic of Uzbekistan; Institute of Market Reform; Main Department of Forestry, Research Institute of

Box 6.11 Outline of the Crop Wild Relatives Conservation National Action Plan for the Republic of Armenia

Executive Summary
1. Conservation of CWR varieties in Armenia
1.1 *In situ* conservation
1.1.1 *In situ* conservation of CWRs in SPAs
1.1.2 *In situ* conservation of CWR outside of SPAs
1.2 *Ex situ* conservation
1.3 International agreements and cooperation national legal frameworks
1.4 National Legal Framework
1.5 Biodiversity National Strategy and Action Plan
1.6. Stakeholders related to CWR
1.6.1 Ministry of Nature Protection of RA (MoNP)
1.6.2 Ministry of Agriculture (MoA)
1.6.3. Ministry of Economy (MoE)
1.6.4 State Regional Administrative Bodies (Marz Administrations)
1.6.5 Local Self Administrative Bodies (LSAB)
1.6.6 Scientific Educational Institutions
1.7 Current status of CWR conservation
1.8 Use of CWR
1.9 Threats
1.10 CWR Information System
1.10.1 CWR International Information System
1.10.2 CWR National Information System

2. National Goals and Objectives
Literature
Annexes
N1 Schedule for the Implementation of the National Action Plan of the Republic of Armenia for the Conservation of Crop Wild Relatives (2007–2011)
N2 Crop Wild Relatives Species and Family Quantitative Distribution Growing in the Territory Of Armenia
N3 List of Endemic Crop Wild Relatives of the Republic of Armenia

Horticulture, Viticulture and Wine Production; and Ministry of Agriculture and Water Resources. After being further reviewed by a meeting at the Institute of Genetics and Experimental Plant Biology, publication was recommended. An implementation schedule has been agreed.

Sri Lanka appointed a team of stakeholders to discuss the best way to develop a national action plan for conservation of CWR. During a workshop held for this purpose, stakeholders unanimously agreed that the development of a separate national action plan for CWR conservation would be futile as the country is

already burdened with numerous conservation action plans and has limited adequate capacity to implement these. Therefore, the stakeholders suggested that CWR conservation should be included in other selected conservation action plans already being developed by the authorities. Accordingly, *in situ* conservation was included as a priority area in Sri Lanka's national action plan for biodiversity conservation (2007 addendum) and in provincial biodiversity conservation action plans (Southern, North-Western, Central). In all these action plans, CWR are recognized as an important component of biodiversity that should be given priority in conservation.

In the case of Bolivia, it was decided to employ a consultant to prepare a national strategy for the conservation and use of the CWR and a corresponding plan of action (Elaboración de una Estrategia Nacional para la conservación, uso y aprovechamiento de los parientes silvestres de cultivos de Bolivia y su respectivo Plan Nacional de Acción).

Issues and problems (legal, scientific, technical and logistical) encountered by Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan in preparing national CWR strategies

The main problems that arose during the preparation of the national strategies were mainly to do with (1) the fact that no prior models or experience could be called upon; (2) the need to involve or consult with many different national institutions that normally do not work together; (3) the lack of institutions specialized in conservation and monitoring, especially at the species level; (4) the generally low level of appreciation of the importance and issues involved in CWR conservation.

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Notes

1. *Catalogue of New World Grasses* (CNWG) is an ongoing project led by agrostologists from five US and South American institutions to create a database, using TROPICOS, and link all nomenclature, types, synonymy, current taxonomy and distribution for grasses occurring from Alaska and Greenland to Tierra del Fuego (http://mobot.mobot.org/W3T/Search/nwgc.html).
2. http://www.kew.org/science/tropamerica/boliviacompositae/index.html
3. Latest estimates (May 2010) suggest that the list will be 85 per cent complete by 2010, with some progress made on the remaining 15 per cent.
4. These are technically called 'prior standards' and while they are not currently being promoted by TDWG, are widely used.
5. http://www.ice.ucdavis.edu/bioinventory/bioinventory.html (accessed 21 August 2009)
6. http://apps3.fao.org/wiews/wiews.jsp

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