Chapter 2

Crop Wild Relatives in the Project Countries

> *Increasing our knowledge of the biodiversity of a country with great riches of natural and cultural resources like ours, and contributing to the sustainable development of the natural resources that lead to a reduction in poverty, is not only a major need but a great challenge* (René Orellana Halkyer and Juan Pablo Ramos Morales, 2009).

This chapter provides background information on the five countries involved in the UNEP/GEF CWR Project and reviews their experience and policies regarding CWR conservation.

The background for *in situ* conservation in the project countries

Although the five participating countries of the UNEP/GEF CWR Project include significant numbers of globally important taxa of crop wild relatives (CWR), by 2004 little progress in CWR conservation had been made. Armenia and Uzbekistan executed limited CWR surveys decades before, and a small number of reserves were created in each country with some consideration given to CWR; however, neither country established CWR management plans for these reserves and no conservation projects or CWR monitoring actions were initiated. In Bolivia and Madagascar, governments were aware of the importance of CWR and some plant genetic resources (PGR) materials were conserved *ex situ*. Nonetheless, national inventories had not yet been undertaken and information management focusing on CWR was non-existent. Both countries had established protected areas, but none included management plans concerned with CWR use and conservation. In Sri Lanka, several CWR conservation and awareness-raising projects had been conducted for selected taxa.

Reasons for the relative weakness of CWR conservation efforts include limited technical capacity to develop conservation plans for such a diverse range of species; absence of coordination and partnership between disciplines (agricultural and conservation sectors and social and economic sciences); and political, administrative and infrastructural obstacles.

At the time the project was initiated, none of the CWR Project countries had developed clear, coherent national strategies or action plans to conserve and use CWR, although all countries recognized the need to improve national agrobiodiversity conservation programme planning, decision-making and implementation frameworks to support effective *in situ* CWR conservation. Collaborative agreements, necessary for coordinating and implementing conservation actions, were largely absent or occurred only on an *ad hoc* basis in these countries. Notable limitations also existed in identifying priority actions and developing necessary management plans for the conservation of target taxa and priority areas.

While the CWR Project countries were aware that relevant information was available to assist in the planning process, they noted that such data was usually dispersed and not readily accessible. Useful information necessary to determine the likely location of CWR populations existed in herbaria and *ex situ* genebanks for each country. Further, information on the extent and distribution of protected areas was available from responsible agencies in the Ministries of environment, forestry, planning and so forth. Institutions linked to the Ministry of Agriculture, universities and colleges also possessed data on CWR utilization. However, in Armenia and Uzbekistan, little information was actually available in computerized form; in all countries, most location data had not yet been digitized. Where information was available in an electronic format (e.g. Bolivia, Madagascar and Sri Lanka), different agencies had developed independent information management systems with unique data structures and formats. Combining information from different sources for the necessary integrated analyses was, therefore, difficult and complex.

In common with most other countries, the absence of a supportive legal framework for the conservation and utilization of CWR proved to be a further impediment. The CWR Project countries did not have any legislation in place consistent with new international agreements such as the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the Convention on Biological Diversity (CBD), resulting in little commitment by governments to apply constitutional provisions and recognize international norms as part of their national legislative framework. Further, none of the countries had developed legislation and procedures adequately addressing benefit-sharing issues for CWR.

Generally, the limited development of CWR conservation efforts in each country reflected low levels of awareness among decision-makers and the general public of the importance of these resources and the need to maintain and use them wisely. This was evident in the low priority given to CWR in national budgets and research agendas, as well as the general lack of enabling policies and actions.

Armenia

The mountainous nature of Armenia, and the Caucasus Mountains in particular, determines much of the character of the country's landscapes, climate, vegetation, soils and biodiversity.

Armenia is home to around 3600 species of vascular plants, including more than half of the flora of the Caucasus (about 7200 species), even though the country only occupies 6.7 per cent of the Caucasus region. Over 125 species are endemic to Armenia. As one of the centres of origin of cultivated plants, the country is known for its diversity of native species of cereals; vegetables, in particular cucurbits; oil-bearing plants and fruit crops.

Forests cover some 20 per cent of the country and are generally found at mid-elevations on mountains, at altitudes between 500m and 2100m in the north (up to 2500m in the south). In central Armenia, forests occur in small areas rather than as a continuous zone and can also be found on steep slopes and in other areas with limited human access.

Protected areas

A network of specially protected areas was first established in Armenia in 1958, to protect ecosystems, habitats and rare, endemic and threatened species. There are currently five state reserves, 22 state reservations and one national park registered, which together cover around 311,000ha, or 10 per cent of the surface of the country.

The Erebuni Reserve, located in close proximity to Yerevan city, was established in 1981 specifically to protect wild relatives of grain crops. It covers roughly 89ha on either side of the road from Yerevan to Garni and harbours populations of *Triticum araraticum*, *T. boeoticum*, *T. urartu*, *Secale vavilovii* and *Hordeum spontaneum* (Damania 1994, 1998; Damania et al, 1998; Harutyunyan et al, 2008).

Crop wild relatives

Armenia has many species of wild relatives of domestic crops, including three of the four known wild species of wheat (*Triticum boeticum*, *T. urartu* and *T. araraticum*), many species belonging to the genus *Aegilops* (i.e. *Ae. tauschii*, *Ae. cylindrica*, *Ae. triuncialis*, etc.), and wild relatives of rye and barley. Wild apple and pear species grow in most of Armenia's forests, together with wild forms of other fruits and nuts (e.g. quince, apricot, sweet and sour cherry, walnut, pistachio and fig). A survey of the wild relatives of food crops of Armenia was made by Gabrielian and Zohary (2004). During the course of the CWR Project, 2518 species out of about 3600 vascular plants reported for Armenia's flora (about 70 per cent), were identified as CWR. They represented 431 genera and 119 families.

Bolivia

Bolivia possesses great biological richness in terms of plant and animal species and is home to a diversity of environments and ecosystems. It houses approximately 20,000 species of higher plants and more than 2600 species of vertebrates. Bolivia is a country of deserts and tropical rainforests, deciduous forests, savannas, lakes and rivers, with elevations ranging from 150m to 6500m and an annual rainfall of between 0mm and 6000mm (MDS-VRFMA-DGBAP, 2004). The country's location within the Andean region, where several important biomes are represented within a limited geographical area, and where mountain ecosystems form one of the major components, means that it is rich in natural biodiversity.

In this natural environment domestication took place of some of the most important crop species feeding much of world population, including potatoes, squash, peanuts, chilli peppers and other crops, some of which are only now beginning to receive attention, such as quinoa and cañahua (*Chenopodium pallidicaule*), grown in the Andean region of Bolivia (MDS-VRFMA-DGBAP, 2004). In the lowlands of Bolivia, more than 100 species of wild fruits occur (Vasquez and Coimbra, 1996) and nearly 3000 medicinal plant species with potential as genetic resources for industrial, pharmaceutical and cosmetic uses are found (Ibisch and Mérida, 2003).

Threats to biodiversity

The genetic diversity found in the production systems of rural communities and indigenous peoples, as well as in the wild ecosystems of Bolivia, is now facing various threats. The genetic diversity of cultivated plants is increasingly threatened by:

- increased substitution of crops and native varieties by introduced crops and varieties of more value or appreciation in the market;
- insufficient land, leading farmers to prioritize which crops and cultivated varieties to grow;
- weakness of traditional knowledge regarding the marketing of genetic quality of seeds;
- effects of climate change on rural economies, leading to abandonment of fields and farmer migration to cities, destroying the systems of traditional production;
- climatic change – drought, hail and frost.

Crop wild relatives

Bolivia lies within one of the world's centres of crop domestication and within the centres of diversity of important crops such as potato (*Solanum* spp.), sweet potato (*Ipomoea batatas*), maize (*Zea mays*), peanut (*Arachis hypogaea*), cassava (*Manihot esculenta*), cotton (*Gossypium barbadense*), tobacco (*Nicotiana tabacum*), cocoa (*Theobroma cacao*), beans (*Phaseolus* spp.) and peppers (*Capsicum* spp.), as

well as several local Andean tubers (e.g. *Ullucus tuberosus*, *Oxalis* spp.), quinoa (*Chenopodium quinoa*), tarwi (*Lupinus mutabilis*), and others. Most of the CWR of these and other Bolivian species are characterized by environmental and soil stress tolerance, disease resistance and other adaptive traits useful for crop improvement programmes.

Bolivia has published the 'Red Book of the Crop Wild Relatives of Bolivia' (*Libro Rojo* de *Parientes Silvestres de Cultivos de Bolivia*) (VMABCC-Bioversity, 2009 in hard copy and as an interactive CD ROM). In addition, an atlas of CWR (http://www.cwrbolivia.gob.bo/atlaspsc/) was prepared by the Fundación Amigos de la Naturaleza (FAN-Bolivia) in 2001–2002, under the scope of a Letter of Agreement signed between the International Plant Genetic Resources Institute (IPGRI, now Bioversity International) Colombia, the United States Department of Agriculture (USDA) and FAN-Bolivia on 25 July 2001, to support the elaboration of the atlas of Bolivian CWR.

The database for the atlas includes records of 2486 samples from herbaria and accessions in genebanks, representing 14 families, 18 genera and 161 species of CWR. The atlas also includes a series of maps of the country (political divisions, roads, populated towns, hydrology, climate and ecoregions), maps of the current distribution of 161 species of CWR, their distribution in protected areas and communal lands of indigenous peoples, potential distribution maps for 57 of the most abundant species (using FloraMap and DIVA-GIS), and maps of diversity and richness for gene pools, as well as for CWR species. The atlas provided key information for the National Report of Bolivia on CWR, elaborated in the preparatory (PDF-B) phase of the UNEP/GEF CWR Project.

National legal framework on genetic resources

The legislation of Bolivia pertaining to access to genetic resources was approved by the Supreme Decree No. 24676 on 21 June 1997. It stipulates that in order to access genetic resources of which Bolivia is a country of origin, users must sign an access agreement or contract with the national competent authority. This legislation considered the elements agreed by the CBD and by the Decision 391: Common Regime on Access to Genetic Resources of the Andean Community Countries, adopted on 2 July 1996.

Bolivia adopted a National Strategy for Conservation and Sustainable Use of Biodiversity on 19 March 2002, for a period of ten years. The strategy recognizes the importance of CWR, which are useful for genetic improvement of crops, but does not establish a set of specific actions for the conservation of these; emphasis is instead on the *ex situ* conservation of plant genetic resources. In February 2009, Bolivia approved a new state policy which, unlike previous versions, includes articles related to genetic resources and established the following responsibilities for the state:

- The native species of plants and animals are a natural heritage and the state shall establish the necessary measures for their conservation, utilization and development.

- The state shall protect all genetic resources and micro-organisms that are found in the ecosystems of the territory, as well as the knowledge associated with their use and exploitation. For their protection, a register system will be established to help safeguard their existence, and the intellectual property of the state or local social subjects that claim it. For those resources that are not registered, the state shall establish procedures for their protection by law.
- The entry and exit of genetic resources of the country shall be controlled and mechanisms established for the repatriation of genetic material obtained by other countries or international research centres and to ensure their preservation in *ex situ* conservation centres within the country.

The management of natural resources located in the territories of indigenous people will be shared, subject to the particular rules and procedures of indigenous nations and farmers. Where overlaps exist in protected areas and indigenous territories, management of the areas must be shared and will be carried out subject to the particular rules and procedures of the indigenous peoples and farmers, while respecting the objective for the creation of these areas.

Protected areas

The National Protected Areas System (NPAS) for the management of protected areas in Bolivia was established in 1997 through Supreme Decree No. 24781. Its objective is to 'maintain representative samples of biogeographic provinces, through the implementation of policies, strategies, plans, programmes and rules to generate sustainable processes within the protected areas to achieve the objectives of biodiversity conservation by incorporating the participation of the local population and benefits for actual and future generations'. The NPAS comprises more than 66 protected areas of national, departmental, municipal or private interest. They account for more than 15 per cent of the national territory. There are five categories of management that define the kind and extent of use of natural resources within the protected areas. The categories of 'Park', 'Shrine' and 'Natural Monument' are aimed at strict protection and preservation of the richness in biodiversity of the protected areas, while the categories of 'Wildlife Reserve' and 'Integrated Management Natural Area' allow the sustainable management of the natural resources under legal and technical conditions. Finally, there exists a transitional legal regime that defines the category of 'Natural Reserve of Immobilization', which corresponds to areas that are deemed protected after a preliminary assessment, but for which further studies are required for their definitive characterization and zoning (MDS-SERNAP, 2001).

Some protected areas have a dual category, such as the National Parks and Integrated Management of Natural Areas and National Parks and Indigenous Territories (MDS-SERNAP, 2001).

Madagascar

Madagascar is one of the most important biodiversity hotspots in the world and is characterized by the richness of its flora (12,000 spp. of vascular plants) and the great diversity of its ecosystems.

Vegetation and ecosystems

The variety of the ecosystems can be explained by (1) the existence of many types of soils and rocky substrates; (2) an altitudinal gradient ranging from 0m to more than 2500m; (3) the contrasting climate among the eastern, western and southern regions; and (4) the fact that the country extends over about 13° of latitude, from 12.2°S to 25°S.

The last vegetation classification was established in 2007 as a result of collaboration among the Royal Botanic Gardens, Kew; Missouri Botanical Garden; and Conservation International; with the contribution of national expertise from research centres and universities (see www.vegmad.org). The vegetation of Madagascar comprises various ecosystems that belong to five main domains: the wet eastern domain; the wet Sambirano domain in the northern part of Madagascar; the centre domain, wet on its eastern part and dry on its western part; the western domain, which is dry; and the south-western domain, which is arid.

The different types of ecosystems encountered in Madagascar are divided into several categories: humid forest, littoral forest (east); western humid forest; western sub-humid forest; western dry forest; south-western dry spiny forest-thickets; south-western coastal bush land; mangroves, tapia or *Uapaca* sclerophyllous forest; wetlands; degraded humid forest; degraded south-western dry spiny forest; wooded grassland–bush land mosaic; and plateau grassland–wooded grassland mosaic (Moat and Smith, 2007).

Flora

The flora of Madagascar is characterized by an 85 per cent endemism level. Schatz (2000) has shown that endemism is as high as 90 per cent for the tree flora. The endemism at the generic level is also high (30 per cent). In addition, there are seven families that are only found in Madagascar, the largest of which is the Sarcolaenaceae. Regarding particular groups, the Pteridophytes of Madagascar comprise 586 species and 106 genera, representing 6 per cent of the Pteridophyte flora of the world (Rakotondrainibe, 2003). A monograph of the Madagascar palms (Dransfield and Beentjee, 1995) has shown that there are 175 species in the country, while the whole flora of the nearby African continent only contains 110 species. A recent taxonomic study of the family of Balsaminaceae, which is not yet treated in the flora of Madagascar and Comoros, ended with the description of 50 new species (Gautier and Goodman, 2003). At the genus level, the case of the baobabs should be cited: six out of the eight species of *Adansonia* are endemic to Madagascar. Considering the *Coffea* genus, Madagascar possesses

about 50 wild species that are largely caffeine free, belonging to the *Mascarocoffea* section. The genus *Dioscorea* has at least 40 endemic species in Madagascar, representing 10 per cent of world diversity in the genus. The same applies to the genus *Helichrysum*, which numbers about 180 species endemic to Madagascar. Even the traveller's tree, *Ravenala madagascariensis*, previously thought to be a single species, has been shown to contain at least six different variants that can be considered as subspecies (Blanc et al, 2003; Hladik et al, 2000). It should be noted, however, that knowledge of Madagascar plant diversity is incomplete and much taxonomic and inventory work is still required.

Useful plants

Madagascar flora contains a multitude of useful plants, including more than 5300 species of medicinal plants, which corresponds to about 50 per cent of the Malagasy flora. Many woody species are used for timber, some of them providing prized cabinet wood such as *Santalina*, *Diospyros*, *Dalbergia* (rosewood and palissander), *Ocotea* and *Canarium*. Timber species are heavily exploited and many are now endangered. Ornamental plants are also very well represented in the country's flora, including the flagship species, *Ravenala madagascariensis* and *Delonix regia*, which are now grown throughout the tropics. Other species are listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendices, among them orchids and species of *Pachypodium*, *Aloe* and *Euphorbia*.

Although Madagascar is not a centre of origin for food plants, parts of several wild species are used as food, among them: fruits (*Eugenia*, *Sygygium*, *Adansonia* or *Uapaca*), tubers (*Dioscorea*, *Tacca*), leaves (*Moringa*) or apices (hearts) (*Dracaena*, *Ravenala*, various palms). Many species, both herbaceous (*Lepironia*, *Heleocharis*, *Cyperus*) and woody, are utilized by local populations for crafts.

Malagasy farmers grow many different cereals (mainly rice and maize), tubers (potato, cassava, taro and sweet potatoes), legumes (beans, peas, voandzou) and leafy greens which are important in the diet of the Malagasy people. Fruit plants, both tropical and temperate, are also grown.

Protected areas

The greatest conservation effort in Madagascar has been the creation of a system of protected areas. Before 2003, the protected areas network covered 2 million hectares and was managed by Madagascar National Parks. The areas included natural integral reserves, national parks and special reserves. In 2003, Madagascar pledged to triple the area under protection by 2010, bringing the total area to 6 million hectares, corresponding to 10 per cent of the country's surface area. These 6 million hectares are now part of the System of Protected Areas of Madagascar (SAPM) and correspond to IUCN Categories 4, 5 and 6. They will be managed by Madagascar National Parks, NGOs or a consortium of different managers, including local communities. To date (2009) all potential protected areas have been identified and about 2 million hectares are now under temporary protection status.

Crop wild relatives

Madagascar is home to more than 150 CWR distributed among approximately 30 genera. Some are relatives of food plants such as *Ficus*, *Ipomoea*, *Oryza*, *Prunus*, *Rubus*, *Asparagus*, *Vanilla*, *Poupartia*, *Ensete*, *Solanum*, *Eugenia* or *Sygygium*. They include two wild relatives of rice (*Oryza staminata* and *O. punctata*), which possess virus and pest resistance, one wild relative of sorghum (*Sorghum verticiflorum*), two wild relatives of *Vigna* (*V. vexillata* and *V. angivensis*) and a wild relative of banana (*Musa perrieri*). The two most important genera are *Coffea*, which contains more than 50 caffeine-free or low-caffeine species (Sect. *Mascarocoffea*), and *Dioscorea* with 40 species, most of which are consumed by local populations, even when they are known to be toxic. Some other genera are relatives to ornamental plants such as *Delonix*, *Bauhinia*, *Mimosa*, *Gardenia*, *Hibiscus* and *Caesalpinia*. Finally, there are some wild species belonging to *Gossypium* or *Linum*, which contain textile species of global economic importance. Mention should be made of a wild species of *Jatropha* related to *Jatropha multifida*, which is now cultivated in Madagascar as a source of biofuel.

These different CWR are distributed throughout the country, but the majority are found in the forest ecosystems of the island. They are subject to a range of threats, mainly habitat loss because of forest exploitation leading to deforestation, slash and burn practices, soil impoverishment due to bush fires and mining.

Sri Lanka

Sri Lanka is a biodiversity hub of worldwide significance; the country possesses globally significant agricultural ecosystems and agrobiodiversity central to the livelihood strategies of small-scale farmers, rural communities and indigenous peoples. It is currently estimated that about 1.8 million families and 75 per cent of the country's labour force depend on agriculture and on the diversity in agricultural ecosystems, which includes some 237 fruit species, 82 vegetable species, 16 cereal and legume species, 20 species of spices and 1550 medicinal plant species.

Sri Lanka's ecosystems include forest, inland wetland, coastal, marine and agricultural ecosystems.

Agricultural ecosystems are represented by paddy lands, horticultural farms, small crop holdings, crop plantations, home gardens, *chena* lands, village small tank systems and *owita* agroecosystems. Sri Lanka has been an agrarian-based society for over 2000 years. Agriculture currently contributes around 20 per cent of the country's gross national product (GNP), second only to the manufacturing sector. The agricultural landscape is dominated by paddy cultivation and rice is the major staple crop. Sri Lanka's traditional agricultural systems, such as forest gardens, represent diverse landscapes and play a vital role in the *in situ* conservation of agrobiodiversity selected by farmers over generations, but today they are threatened and efforts are needed to encourage and sustain the multi-cropping practices and high agrobiodiversity inherent in these systems. Although Sri Lanka

is an important centre for CWR diversity, many populations are under threat due to habitat destruction and other human activities.

Crop wild relatives

Prior to 2004, little attention was given to conserving and utilizing CWR and few had been comprehensively studied or researched. An inventory of food CWR in Sri Lanka was compiled using already published material on the Sri Lankan flora (Hasanuzzaman et al, 2003) and the records of the national herbarium. The list includes 410 species of food CWR, belonging to 47 families and 122 genera. Of these, 366 are native species and 77 are endemic relatives of food crops, while 44 species are naturalized exotics. This is only a preliminary list, which needs to be further refined. To recognize the true genetic relationships of these species, detailed studies must be carried out.

These CWR species of agricultural importance generally occur as members of disturbed communities within the major vegetation types of the country. Open canopy forest areas, secondary forests, disturbed grasslands and shrub jungles are rich in these plants. However, the relatives of fruit plants are largely associated with semi-evergreen, intermediate and wet evergreen forests. There are a large number of wild species of agricultural importance in different crop groups.

Protected areas

The total land area of Sri Lanka is 65,000km^2, a quarter of which is reserved for forests and administered by the Department of Forests and the Department of Wildlife Conservation. Currently, the country's 501 protected areas occupy around 26.5 per cent of the total land area of the country (see Table 2.1). A major part of the protected area system is under the control of the Department of Wildlife Conservation. However, within the 1 million hectares of state forests under the control of the Forest Department, there are a number of important protected areas, most notably: Hurulu and Sinharaja Biosphere Reserves, and Knuckles and Kanneliya-Dediyagala-Nakiyadeniya (KDN) Forest Reserves.

The Kanneliya Forest Reserve is notable for having the highest percentage of endemic woody species of any single wet zone forest in the country. Detailed studies of the floristic composition of the forest demonstrate that no single part of

Table 2.1 *Protected areas in Sri Lanka*

Extent of protected areas by IUCN Category (000ha), 2003:	
Nature reserves, wilderness areas, and national parks (categories I and II)	419
Natural monuments, species management areas, and protected landscapes and seascapes (categories III, IV, and V)	218
Areas managed for sustainable use and unclassified areas (category VI and 'other')	1129
Total area protected (all categories)	1767

it is representative of the whole, due to microclimatic differences (Ministry of Environment and Natural Resources, 1999). Kanneliya is also notable for having important wild relative species of *Cinnamomum*.

Threats to agrobiodiversity and crop wild relatives

Sri Lanka's natural forests contain a wide range of useful plant species. At the beginning of the last century, 70 per cent of the land area is said to have been covered by natural forests. The latest figures, however, show that natural forest cover has decreased to about 22 per cent of the land area. There are two factors that have posed serious threats to the preservation of natural floristic diversity in Sri Lanka. One is the heavy rate of deforestation due to various development projects, village expansion and settlement schemes. The second is selective felling of trees for timber and removal of plant species, particularly those with medicinal value. Thus many species, once plentiful, are now considered to be seriously threatened. In addition, unplanned land use, pollution and fragmentation have contributed to the loss of CWR.

Uzbekistan

Uzbekistan was identified by Vavilov as one of the centres of origin of many modern crop plants. It has some of the closest wild relatives of cultivated onion (*Allium oschaninii*, *A. vavilovii*, *A. praemixtum*, *A. pskemense*), as well as many wild fruit and nut species (*Vitis vinifera*, *Pistacia vera*, *Malus sieversii*, *Pyrus turkomanica*, and *Rubus caesius*). The flora of Uzbekistan contains some 4800 species. According to Professor U.P. Pratov (personal communication), more than 2500 useful wild species grow in the territory of Uzbekistan. Seventy species belonging to 48 genera of CWR are present, including nutritional, medical and ornamental plants of various life forms – trees, bushes and grasses.

Uzbekistan is a landlocked country of some 447,000km^2, bordered by Afghanistan to the south, Kazakhstan to the north and northeast, Kyrgyzstan and Tajikistan to the east and southeast, and Turkmenistan to the west and southwest. Most of the territory is steppe, desert (the Karakum and Kyzyl Kum deserts), semi-desert and mountains, while about 10 per cent comprises broad, flat intensely irrigated fertile valleys along the course of the rivers Amu Darya, Syr Darya (Sirdaryo) and Zarafshon. The Fergana Valley in the east is surrounded by the mountains of Tajikistan and Kyrgyzstan. Uzbekistan is one of the world's biggest producers of cotton and is rich in natural resources, including oil, gas and gold.

Main biogeographic zones

The main part of Uzbekistan's territory is occupied by valleys (almost 80 per cent); mountains are common only in the eastern part of the country. The valleys are occupied by desert vegetation; the low foothills by mountain, semi-desert vegetation; the high foothills by different grass and wheat steppe vegetation; the

mountains by wood and bush vegetation; and the high mountains by subalpine and alpine meadows.

Among priority species, only barley is widespread in the low and high foothills. The rest of the prioritized species – apple, walnut, pistachio, almond and onion – grow in the mountain zone and pistachio and almond in the high foothills.

In the eastern regions, desert valleys are bordered by a strip of loess mountain valleys and foothills. They account for 18 per cent of the land area and they are occupied by ephemerals, with a small number of perennial grass species. Mountains are characterized by unusual diversity of climate and nature. The richest vegetation of grass and wood species grows well on the northern slopes of mountains. Vegetation on the southern slopes is less developed but includes grass species as well as wood and bush species. In the low belts of the mountains, vegetation is represented by xerophytes, in the middle belts by mesophytic deciduous plant species and in the high mountains vegetation is represented by only coniferous plants, tree-like juniper with rare populations of deciduous plants. All five prioritized wild relatives identified during the UNEP/GEF CWR Project grow in the mountain belt.

Protected areas

Currently, the protected areas system consists of nine state reserves (Zapovedniks), with an area of 2164km^2; two national parks, with a total area of 6061km^2; one biosphere reserve (452km^2); nine special state reserves (Zakazniks), with an area totalling 12,186.5km^2; and one captive breeding centre for rare animals. The total protected area in Uzbekistan is 20,520km^2, which represents 4.6 per cent of the Republic's territory. However, in terms of strict/long-term protection (i.e. IUCN Category I and II, including the national parks, biosphere reserve and state reserves) only 8171km^2 or 1.8 per cent of the Republic's territory is covered (see Table 2.2).

Table 2.2 *Strictly protected areas in Uzbekistan*

State strict reserves (Zapovedniks) (IUCN category I)	*Area km^2*
Chatkal Mountain Forestry Biosphere Reserve 1947	356.8
S Gissar Mountain Archa (Juniper) Reserve 1983	814.3
Zaamin Mountain Archa (Juniper) Reserve 1926, 1960	268.4
Badai-Tugai Steppe-tugai 1971	64.6
Kyzylkum Tugai-sand Reserve 1971	101.4
Zerafshan Lowland Tugai Reserve 1975	23.5
Nuratin Mountain Walnut-tree Reserve 1975	177.5
Kitab Geological Reserve 1979	53.7
Surkhan Mountain Forestry Reserve 1987	276.7
State national parks (IUCN category II)	*Area km^2*
Zaamin People's Park 1976	241.1
Ugam-Chatkal Natural National Park 1990	5745.9

Further sources of information

The CWR Global Portal

A more detailed version of this background chapter, including illustrative maps and tables, can be found at the CWR Global Portal at: http://www.cropwildrelatives.org/index.php?id=2916.

National project websites

Project websites have been set up in each partner country to increase national knowledge and awareness of the importance and value of conserving CWR, to document the progress made by the project activities, and to disseminate results obtained to policy-makers and the wider public. Links to national project websites are provided below:

Armenia – www.cwr.am/
Bolivia – www.cwrbolivia.gob.bo/inicio.php
Madagascar – www.pnae.mg/cwr/index.php
Sri Lanka – www.agridept.gov.lk/other_pages.php?heading=CWR
Uzbekistan – www.cwr.uz/en

National information system websites

To gather as much data as possible on CWR and enable informed decision-making, the project also included a component on information management, which required countries to pool together existing information on these species. This led to the creation of five national databases, where detailed information for hundreds of CWR species was collected and is now available for others to use. National inventories can be accessed through the CWR Global Portal (http://www.cropwildrelatives.org/national_inventories.html).

State of the World PGR Country and Regional Reports

The Second Report on the *State of the World's Plant Genetic Resources for Food and Agriculture* was published in 2010. This report updates the first report with the best data and information available and focuses on changes occurring since 1996. The report provides a concise assessment of the status and trends of plant genetic resources and identifies the most significant gaps and needs. Country reports for Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan can be viewed by visiting the website below: http://www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/sow/sow2/country-reports/en/.

National biodiversity strategies and action plans

Further information regarding plans and actions to support the conservation and sustainable use of biodiversity in Armenia, Bolivia, Madagascar, Sri Lanka and

Uzbekistan can be found by searching the document database of the Convention on Biological diversity at: https://www.cbd.int/reports/search/.

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