Chapter 9

Protected Areas and CWR Conservation

> *In general, the idea that the conservation of agrobiodiversity is a potentially valuable function of a protected area is as yet little recognized. … Indeed, a study by WWF found that the degree of protection in places with the highest levels of crop genetic diversity is significantly lower than the global average; and even where protected areas did overlap with areas important for crop genetic diversity (i.e. landraces and crop wild relatives) little attention was given to these values in the management of the area* (Amend et al, 2008).

The role of protected areas in CWR conservation

A system of protected areas constitutes the basic underpinning of the conservation strategy of most countries. On the other hand, the predicted impacts of accelerated climate change are beginning to bring our reliance on such an approach as our main tool for *in situ* conservation of biodiversity into clear focus (Spalding and Chape, 2008). Questions are being raised about the effectiveness of protected areas as a long-term strategy in conserving biodiversity and several surveys have been undertaken to assess this (e.g. WWF, 2004). This is discussed in more detail in Chapter 14.

> *It is apparent that nature conservation has become one of the most important human endeavours on the planet, and the area under protection now exceeds the total area of permanent crops and arable land* (Chape et al, 2008).

Protected areas cover at least 114,000 sites and occupy more than 19 million km^2, representing 12.9 per cent of the earth's land surface. Data for the five project countries are given in Table 9.1.

Table 9.1 *Areas protected, by country (2005)*

Country	*Land area (km^2)*	*Total protected area (km^2)*	*Total number of sites*
Armenia	29,800	2991	28
Bolivia	1,098,580	230,509	50
Madagascar	587,040	18,458	60
Sri Lanka	65,610	14,877	264
Uzbekistan	447,400	20,503	24

Some of them have a long history while others are of recent creation. In Sri Lanka, for example, wildlife sanctuaries were set up in the 3rd century BC by King Devanampiya Tissa in the area around Mihintale, apparently the first in the world.

Protected area (PA) is a general term used to cover a wide variety of situations. The definition adopted by the International Union for Conservation of Nature (IUCN) has recently been revised as 'a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values' (Dudley, 2009). A similar definition is given by the Convention on Biological Diversity (CBD): 'A geographically defined area which is designated or regulated and managed to achieve specific conservation objectives'. Protected areas vary enormously in size, ranging from tens of thousands of hectares to many which are relatively small (1000–10,000ha), often representing remaining fragments that, although valuable, may be inadequate for maintaining large-scale processes. There is also a great diversity of types of area in terms of their conservation objectives, the degree of human activity permitted and the extent of involvement of stakeholders. There are also evident gaps in coverage of existing protected area networks and urgent priorities for the expansion of the global protected area system include the Andes, Madagascar and Sri Lanka (Chape et al, 2008: Chapter 2).

The relevant targets of the Global Strategy for Plant Conservation (GSPC) are given in Box 9.1; although, it should be noted that these are currently (April 2010) under review. A summary of Madagascar's progress towards the GSPC Targets 4 and 5 is given in Box 9.2.

The different categories of protected areas recognized by IUCN are widely used. It should be noted, however, that they have recently been redefined as indicated in Box 9.3. A set of guidelines on how to apply these categories has been published by Dudley (2009). It is recommended that in applying the categories system, the first step is to determine whether or not the site meets the IUCN definition (see above) and the second step is to decide on the most suitable category.

Categories 1 and 2 are likely to be the most appropriate for CWR conservation, but CWR occur in all types of protected areas even though the suitability of

Box 9.1 Targets 4 and 5 of the GSPC referring to protected areas

Target 4: At least 10 per cent of each of the world's ecological regions effectively conserved

The target implies: 1) increasing the representation of different ecological regions in protected areas; and 2) increasing the effectiveness of protected areas. Effective conservation is understood to mean that the area is managed so as to achieve a favourable conservation status for plant species and communities. Favourable conservation status is not defined.

Target 5: Protection of 50 per cent of the most important areas for plant conservation

Important plant areas are defined by criteria such as endemism, species richness and/or uniqueness of habitats and take into account the provision of ecosystem services.
The failure to agree on a set of defining criteria makes implementation at a national level difficult to apply or assess.

Box 9.2 Progress in implementing Targets 4 and 5 of GSPC in Madagascar

Target 4: Protected areas represented only 3 per cent of the total area of the country, but during the World Parks Congress in Durban in 2003, Madagascar pledged to extend the protected areas to cover 6 million hectares (10 per cent of the country's area) by 2010. This is known as the Durban vision. In 2009, all the future new protected areas (NAP) have been identified and half of them (2 million hectares) have already been given a temporary protection status. The creation of the rest of the protected areas is ongoing. All the existing and future protected areas will be part of what is called the System of Protected Areas of Madagascar or SAPM.

Target 5: In the frame of a project conducted by GSPM (Madagascar Plant Specialists Group*) and Botanic Gardens Conservation International (BGCI) in 2008 to 2009, which aimed at the conservation of wild plants for food and medicine, all protected areas were assessed according to the important plant areas (IPA) qualification processes, e.g. Plantlife criteria (threatened species presence, floristic richness, and presence of threatened habitats) or Priority Area for Plant Conservation (PAPC) criteria. The assessment revealed that 40 out of the 52 current PAs managed by Madagascar National Parks are IPAs, while 26 out of the 35 NAPs are also IPAs. In addition, all the Madagascar Key Biodiversity Areas (20) identified by Conservation International and other sites assessed through the PAPC process are also IPAs.

* GSPM is a member of IUCN Species Survival Committee and is, above all, responsible for the validation of the status of the species submitted to the IUCN Red List.

many of them for genetic conservation is limited. The problems of adapting existing protected areas for targeted CWR conservation are discussed in the section, 'Protected area management'.

It should be noted that, in practice, many, if not most, countries use different or additional categories and definitions. For example, in the UNEP/GEF CWR Project countries: specially protected nature areas in Armenia can have the status of state reserve, national park, reservation and nature monument; in Sri Lanka, there are basically eight types of national protected areas, depending on their objective: strict nature reserves, national parks, nature reserves, jungle corridors, refuges, marine reserves, buffer zones and sanctuaries.

It should also be noted that national parks occur in all six categories and as Dudley (2008) points out, 'the fact that a government has called, or wants to call, an area a national park does not mean that it has to be managed according to the guidelines under category II. Instead, the most suitable management system should be identified and applied; the name is a matter for governments and other stakeholders to decide'.

A small number of protected areas are specifically tailored for the genetic conservation of target species such as genetic reserves, gene management zones, *in situ* gene conservation forests, gene parks and genetic resources management units (see Heywood and Dulloo, 2005: 2.2.5; Iriondo et al, 2008). Thomson and Theilade (2001) suggest that a case can be made for designation of *in situ* gene conservation areas as a special category of protected area on the basis that:

- they have conservation of within-species genetic variation as the major objective;
- the gene pools of concern are primarily of economic species; and
- provision is made for the use of the gene pool by researchers, tree breeders and for *ex situ* conservation purposes.

Sacred groves, forests, sites

An important type of traditional nature conservation, practised as part of the religion-based conservation ethos of ancient people in many parts of the world, is the protection of small areas of forest as sacred groves or forests or of particular tree specimens as sacred trees. A characteristic of such traditional ecosystem approaches is that they require a belief system that includes a number of prescriptions, such as taboos, that regulate human behaviour and lead to a restrained use of the resource. Such sacred sites (including sacred natural sites and landscapes) that fit into national and international definitions of protected areas can potentially be recognized as legitimate components of protected area systems and can be attributed to any of the six IUCN protected area categories. If the site's management objectives meet the IUCN definition of a protected area and the requirements of a particular category and if the faith group so desires, particular sacred natural sites can be formally included in national protected area systems. Examples of sacred sites in Sri Lanka are Yala National Park (Category Ia), which is significant to Buddhists and Hindus and requires high levels of protection for

Box 9.3 The IUCN protected area management categories

CATEGORY Ia: Strict nature reserve – strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring. Their primary objective is to conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/or geodiversity features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact.

CATEGORY Ib: Wilderness area – protected areas that are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition. Their primary objective is to protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas.

CATEGORY II: National park – protected areas that are large natural or near-natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities. Their primary objective is to protect natural biodiversity along with its underlying ecological structure and supporting environmental processes and to promote education and recreation.

CATEGORY III: Natural monument or feature – protected areas that are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value. Their primary objective is to protect specific outstanding natural features and their associated biodiversity and habitats.

CATEGORY IV: Habitat/species management area – protected areas that aim to protect particular species or habitats and management reflects this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category. Their primary objective is to maintain, conserve and restore species and habitats.

CATEGORY V: Protected landscape/seascape – a protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values. Their primary objective is to protect and sustain important landscapes/seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices.

CATEGORY VI: Protected area with sustainable use of natural resources – protected areas that conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area. Their primary objective is to protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

Based on Dudley, 2008

Box 9.4 Ankodida, a community-managed protected area and sacred forest in Madagascar

Ankodida is a newly established, community-managed Category V protected area in south-eastern Madagascar, which protects a sacred forest, the former home of a pre-colonial Tandroy king. The forest also shelters spirits that play an important role in the spiritual life of the Tandroy tribe and provides the bulk of household income for local populations, thereby making it of great cultural, spiritual and material importance. Six of the protected area's seven zones are composed of traditional village territories managed under devolved management contracts and, in addition, there is a priority conservation zone covering the sacred forest managed by local communities according to traditional regulations. Management of Ankodida is focused on the reinforcement of management through the legal empowerment of its traditional guardians. Ankodida houses two critically endangered *Aloe* species, the endangered palm *Ravenea xerophila* and 30 to 40 per cent of the world's population of the triangle palm, *Dypsis decaryi*.

Source: Gardner et al, 2008

faith reasons; and Peak Wilderness Park, (Sri Pada-Adams Peak), a sacred natural site for Islam, Buddhism, Hinduism and Christianity, attracting many pilgrims of all these faiths. Such sacred sites or forests may be of interest for *in situ* conservation of any target species that occur within them as they provide a degree of protection and are a focus of community interest. An example from Madagascar is given in Box 9.4. An overview and examples of cultural and spiritual values of protected landscapes is given by Mallarach (2008).

Protected area ownership and governance

Enormous variation exists in the ways in which protected areas are owned and governed. They may be managed by government, community or co-managed or they may be private. In many countries, public protected areas are supplemented by extensive private reserves or other forms of protection. In the US, for example, The Nature Conservancy currently owns and manages approximately 15 million acres of the national territory and globally protects more than 116 million acres of the most ecologically important places in the US and 28 other countries.

The main types of governance of protected areas are given in Table 9.2. Any of these can be associated with any management objective.

In the UNEP/GEF CWR Project countries, for example, the Chatkal State Biosphere Reserve, Uzbekistan, was established in 1947 and has had a varied history, changing in size several times (in 1952, 1960, 1993 and 1996) and in status, being designated as a United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve in 1978 and part of the State Committee for Nature Protection. Since 2001, the reserve has been a separate

Table 9.2 *Modes of protected area governance*

Mode	*Type*
Government	National
	State or province
	Local
	Delegated (to another government agency)
	Delegated (to statutory authority)
	Delegated (to local government or community group)
Co-management	Collaborative
	Joint
Private	Individual
	Not-for-profit organization
	Commercial organization
Community	Indigenous
	Local

Source: Chape et al, 2008

legal entity as part of Ugam-Chatkal State Nature National Park, reporting to the Khokim (Governor) of Tashkent Oblast.

In Armenia, the Erebuni Reserve was established in 1981 in the vicinity of Yerevan, specifically to protect wild cereal species – *Triticum araraticum*, *T. urartu*, *T. boeticum*, four species of *Aegilops*, *Hordeum glaucum* and *Secale vavilovii*. It is the

Figure 9.1 *The Chatkal State Reserve, Uzbekistan*

Table 9.3 *Governance of protected areas in Madagascar*

Type of governance	*A: PA managed by government*			*B: PA under participative management (co-management)*			*C: Private PA*			*D: PA of community patrimony*	
Category of PA according to IUCN	*National or federal ministry or national agency*	*Local or municipal ministry or agency*	*Delegated management by the government (i.e. NGO)*	*Trans-boundary management*	*Collaborative management*	*Joint management*	*Declared and managed by owners as individuals*	*Managed by non-profit organization such as universities, NGOs*	*Managed by profit-making organizations such as tourism firms*	*Declared and managed by indigenous communities*	*Declared and managed by local communities*
I. Natural integral Reserve	✗		✗		✗						
II. National park	✗	✗	✗		✗	✗					
III. Natural monument	✗	✗	✗		✗	✗	✗	✗	✗		✗
IV. Special reserve	✗	✗	✗		✗	✗	✗	✗	✗		
V. Protected landscape or seascape					✗	✗					✗
VI. Natural resources PA	✗	✗	✗		✗	✗					✗

smallest reserve in Armenia (89ha) and is the only reserve which is not a 'state non-commercial organization' (SNCO) with a charter approved by the government and which does not have its own management system but remains under the jurisdiction of the 'Reserve Park Complex' of the Ministry of Nature Protection of the Republic of Armenia.

Protected areas constitute the Madagascar National Parks (MNP) formerly known as ANGAP (*Association Nationale pour la Gestion des Aires Protégées*) network and are managed by the MNP itself or by NGOs. MNP is the national association that managed all the protected areas before the creation of other categories of PA within the framework of the Durban vision (see Box 9.2).

The Kanneliya-Dediyagala-Nakiyadeniya (KDN) Biosphere Reserve in Sri Lanka is managed by the Forest Department along with other biosphere reserves and national heritage and wilderness areas and conservation forests, whereas 60 per cent of Sri Lanka's protected areas are under the jurisdiction of the Department of Wildlife Conservation. There are 78 villages surrounding the reserve, and 50 per cent of the households are below the poverty line and depend on the forest for timber and non-timber forest products, such as medicinal plants, fuelwood, poles and posts for subsistence rather than trade. Their needs have been taken into account by the Forest Department in the Management Plan for the forest.

Good governance

IUCN has identified the following principles of good governance, any of which can be associated with any management objective (Dudley, 2008):

- **Legitimacy and voice** – social dialogue and collective agreements on protected area management objectives and strategies on the basis of freedom of association and speech with no discrimination related to gender, ethnicity, lifestyles, cultural values or other characteristics.
- **Subsidiarity** – attributing management authority and responsibility to the institutions closest to the resources at stake.
- **Fairness** – sharing equitably the costs and benefits of establishing and managing protected areas and providing a recourse to impartial judgement in case of related conflict.
- **Do no harm** – making sure that the costs of establishing and managing protected areas do not create or aggravate poverty and vulnerability.
- **Direction** – fostering and maintaining an inspiring and consistent long-term vision for the protected area and its conservation objectives.
- **Performance** – effectively conserving biodiversity while responding to the concerns of stakeholders and making a wise use of resources.
- **Accountability** – having clearly demarcated lines of responsibility and ensuring adequate reporting and answerability from all stakeholders about the fulfilment of their responsibilities.
- **Transparency** – ensuring that all relevant information is available to all stakeholders.

Box 9.5 Activities that may be involved in establishing and maintaining a network of protected areas

- preparation of information and publicity material;
- scientific studies to identify and designate sites – survey including inventory, mapping, condition assessment;
- administration of selection process;
- consultation, public meetings, liaison with landowners, complaints;
- pilot projects;
- pre-designation phase;
- preparation and review of management plans, strategies and schemes;
- establishment and running costs of management bodies;
- provision of staff (wardens, project officers), buildings and equipment;
- consultation – public meetings, liaison with landowners;
- costs for statutory and case work (environmental impact assessments, legal interpretation, etc.);
- management planning and administration;
- conservation management measures – e.g. maintenance of habitat or status of species;
- management schemes and agreements with owners and managers of land or water;
- fire prevention and control;
- research monitoring and survey;
- provision of information and publicity material;
- training and education;
- visitor management;
- 'ongoing' management actions and incentives;
- restoration or improvement of habitat or status of species;
- compensation for rights forgone, loss of land value, etc.;
- land purchase, including consolidation;
- infrastructure for public access, interpretation works, observatories and kiosks, etc.;
- habitat type survey and GIS data.

Source: Natura, 2000; http://ec.europa.eu/environment/nature/natura2000/index_en.htm

- **Human rights** – respecting human rights in the context of protected area governance, including the rights of future generations.

The setting up and maintenance of a protected area covers a wide range of activities (Box 9.5) and involves many kinds of professional and stakeholders.

Protected area management

Although protected area management is the responsibility of those in charge of the area, it is important that those engaged in targeted *in situ* species conservation are aware of the main issues involved when cooperating with protected area managers or negotiating with them over management interventions for target species. It would not be appropriate in this manual to enter into details of protected area management, which is a vast and highly complex topic and is beyond the remit of this manual, so the reader is referred to the IUCN *Guidelines for Management Planning of Protected Areas* (Thomas and Middelton, 2003), which will provide information on the key management planning processes in protected areas and on developing management plans; the *Management Guidelines for IUCN Category V Protected Areas: Protected Landscapes/Seascapes* (Phillips, 2002) will also be a useful resource.

According to Thomas and Middleton (2003), the most commonly found contents of a management plan include:

- executive summary;
- introduction (e.g. purpose and scope of plan, reason for designation of protected area and authority for plan);
- description of the protected area;
- evaluation of the protected area;
- analysis of issues and problems;
- vision and objectives;
- zoning plan (if appropriate);
- management actions (list of agreed actions, identifying schedule of work, responsibilities, priorities, costs and other required resources);
- monitoring and review.

The quality and effectiveness of the management of protected areas varies considerably and can be a cause of major concern. Various tools and guidelines have been developed to assess management effectiveness (Chape et al, 2008). Management challenges include land encroachment, illegal logging or permitted destructive logging practices, unsustainable agricultural practices in buffer zones and lack of proper management mechanisms and institutional capacity.

Adapting protected area management plans to cover the conservation needs of CWR

Many of the populations of the target species selected for *in situ* conservation will be found to grow in one or more protected areas and consequently benefit from some degree of protection (but see below). As already noted, most protected areas do not include genetic management as one of their management objectives. The management needs of the populations of the CWR target species are quite

Box 9.6 Management responses to deal with threats facing protected areas

- **regeneration**, which involves the recovery of natural integrity following disturbance or degradation, with minimum human intervention;
- **restoration**, which requires returning existing habitats to a known past state or to an approximation of the natural condition by repairing degradation, by removing introduced species, or by reinstatement;
- **reinstatement**, which means reintroduction to a place of one or more species or elements of habitat or geodiversity that are known to have existed there naturally at a previous time, but that can no longer be found at that place;
- **enhancement**, which involves introduction to a place of additional individuals of one or more organisms, species or elements of habitat or geodiversity that naturally exist there.
- **preservation**, which means maintaining the biodiversity and/or an ecosystem of a place at the existing stage of succession, or maintaining existing geodiversity;
- **modification**, which involves altering a place to suit proposed uses that are compatible with the natural significance of the place;
- **protection**, which requires taking care of a place by maintenance and by managing impacts to ensure that natural significance is retained;
- **maintenance**, which involves continuous protective care of the biological diversity and geodiversity of a place.

Source: ACIUCN, 2002; Chape et al, 2008

specific and separate from the management of the protected area itself which is why the concept of genetic reserves was introduced (see Chapter 3). Many management actions are responses to threats and unwanted changes to the area (see Box 9.6). Area-based management interventions include nutrient control, erosion control, burning, control of invasive species, habitat disturbance and grazing control (Maxted et al, 2008).

It is important to become informed of the management interventions that are practised in the candidate protected area as these may affect the decision as to whether to select that particular area for the conservation of CWR; there may well be potential management conflicts. For example, nature reserve design and management practices that focus on the landscape level, community level or species level may conflict with one another. If the management goal is to perpetuate natural fluctuations in landscape structure, then certain species dependent on landscape structure may fluctuate as well. Maintaining stable populations of these species may entail landscape manipulations that lower the value of the reserve for perpetuating landscape processes and structures. In the majority of cases, the management plan of the protected area in which CWR are found to occur will not include specific prescriptions that will favour the conservation of individual target species.

Box 9.7 Steps to enhance the conservation role of protected areas for forest genetic resources

- collate information on tree species present in PA;
- make a comprehensive botanical inventory;
- identify priority forest and tree genetic resources;
- for each priority species determine whether there is a need for special protective and management measures;
- develop overall and individual species management plans;
- conduct focused research on target species;
- implement species management plans;
- monitoring and detailed survey of priority species;
- review management plan(s).

Source: Thomson and Theilade, 2001

It may be possible, in some cases, to enhance the capacity of a protected area to protect target species, subject to the degree of flexibility of the management plans for the area and the willingness of the protected area manager to undertake the required actions.

In the case of forest genetic resources, the sequence of stages that may be followed so as to achieve this improved conservation capacity is given by Thomson and Theilade (2001) and apply equally well to other target species, including CWR (Box 9.7). The principles of genetic conservation in tropical forest management are analysed in detail by Kemp et al (1993).

It is often assumed that once the protected area in which the target CWR occurs has been selected and the management needs of the target species have been decided, it will simply be a matter of persuading the protected area manager to amend the area's management plan accordingly. This is by no means certain and often PA managers are resistant to such proposed changes for a variety of reasons.[1] 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 among 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. Consequently, in conserving CWR the project team will need to review the effectiveness of the protected areas in which it is planned to undertake conservation of targeted CWR, examine their current management policy and governance, and engage with protected area managers to assess what changes are needed to favour the maintenance of viable populations of these CWR and negotiate for the introduction of specific management interventions to achieve this. Of course, it may not prove possible to come to a satisfactory arrangement and a dedicated genetic reserve may have to be established if the circumstances and resources permit.

In order to undertake targeted management of CWR within protected areas, an assessment will need to be made of the changes to existing PA management plans that are required to favour the maintenance of healthy populations of CWR (i.e. targeted management) and allow implementation of specific management interventions to ensure the survival of the populations of the target species. Then negotiations will have to be entered into with protected area management to allow such interventions to take place.

In the very small number of cases where reserves have been established primarily to conserve the genetic resources of CWR, as in the case of the Erebuni Reserve, Armenia, the management plan of the reserve and management needs of the CWR may coincide to some degree; although, this depends on the size of the area and the number of populations of the target CWR being considered for management. The management plan of the protected area is primarily concerned with maintaining the integrity, functioning and health of the area as a whole, while

Box 9.8 Species management actions in Erebuni Reserve Management Plan

Action	*Methodology*	*Timescale*
Collecting biodiversity data	Field surveys to collect herbarium specimens, living material or any other data regarding plants and animals of the reserve, including information on their distribution.	2008–2009
Creating updated maps of the distribution of CWR of the reserve	Field surveys to identify biological characteristics of the species of interest and collect data on their distribution.	2008–2009
Estimating resources of CWR	Field surveys to collect resource data of crop wild relatives.	2008–2009
Creating maps of the flora of the reserve	Field surveys for collecting specimens and distribution data with subsequent identification of collected material in the lab.	2008–2012
Creating maps of the fauna of the reserve	Field surveys for collecting specimens and distribution data with subsequent identification of collected material in the lab.	2008–2012
Creating a database to store information about the reserve	Developing a database to store information regarding current state, scientific, economical and social values, qualitative and quantitative characteristics of biodiversity components.	2010–2012

Source: Erebuni State Reserve Management Plan, 2007 – developed by the Institute of Botany, Armenian Agrarian University, Yerevan State University and Jrvegh Reserve Park Complex; http://cwr.am/index.php?menu=output

the species management plan is directed at the maintenance and survival of viable populations of CWR.

The Erebuni State Reserve is one of the very few specifically established for the conservation of wild relatives of cereal crops. It is characterized by the presence of wild wheats (*Triticum*), Vavilov's rye (*Secale vavilovii*), wild barley (*Hordeum*), *Amblyopyrum muticum*, goatgrasses (*Aegilops*), along with their rich inter-specific diversity. The main issue here is whether it is possible to conserve more than one CWR in the reserve without, in effect, creating a separate management regime for each of the species. It will be interesting to see how this works out in practice. A fully detailed management plan for the Erebuni Reserve has, in fact, been prepared and its action plan includes both habitat and species management actions (see Box 9.8).

Box 9.9 Central Asia Transboundary Biodiversity Project

The World Bank is currently developing a transboundary project in the West Tien Shan Mountains of Central Asia. The Central Asia Transboundary Biodiversity Project currently comprises four discontinuous protected areas in a three-country transborder region of the Kyrgyz Republic, Kazakhstan and Uzbekistan as follows:

- Aksu-Djabagly Reserve: Kazakhstan (IUCN Category Ia, 8575ha) (juniper forests, steppe and meadows);
- Sary Chelek Reserve: Kyrgyz Republic (IUCN Category Ia, 2390ha) (juniper forests with walnut, spruce, fir apple);
- Besh Aral: Kyrgyz Republic (IUCN Category Ia, 6329ha) (juniper forests, steppe and meadows);
- Chatkal Reserve: Uzbekistan (IUCN Category Ia, 3570ha) (juniper and tugai forests, steppe and meadows).

Discussions are underway on an interstate agreement for a West Tien Shan transboundary conservation area. Additional improvements to the network are underway, focusing on improving coverage of representative habitats and connectedness.

The West Tian Shan mountains house unique stands of walnut (*Juglans regia*) forest, wild ancestors of cultivated fruit-bearing species such as apple, pear, pistachio and almond, as well as medicinal plants and many endemic plant species.

Support is being provided to the four key protected areas through a mix of investments in capacity building (including training, transport, communications and infrastructure), community awareness and education, and research and monitoring. The project has established new technical standards for protected area management and methods for involving local communities. A small grants programme provides financial and technical assistance to buffer zone communities and community-based organizations to finance demand-driven activities in sustainable agriculture, alternative livelihoods and alternative energy systems.

Source: http://www.tbpa.net/case_07.htm

Transboundary protected areas

Some CWR have populations that occur in adjacent reserves in more than one country or administrative district in a country. Such areas are known as **transboundary protected areas (TBAs)**. They are defined by IUCN as:

> *an area of land and/or sea that straddles one or more borders between states, sub-national units such as provinces and regions, autonomous areas and/or areas beyond the limit of national sovereignty or jurisdiction, whose constituent parts are especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed cooperatively through legal or other effective means.*

In such areas, the interests and concerns of the different countries or administrations may be taken into account through their representation on their steering or management committees. The level of cooperation varies widely and a set of good practice guidelines has been proposed by the IUCN World Commission on Protected Areas (WCPA).[2] An example of a TBA that contains CWR is the Central Asia Transboundary Biodiversity Project (Box 9.9).

A project to establish protected areas to conserve biodiversity in the Javakhq border region of Armenia with Georgia and Turkey is planned to link up with a similar project in Georgia in order to form a transboundary cooperative arrangement (Box 9.10).

Enhancing protected areas for conserving forestry genetic resources

In some cases it will be possible to enhance the capacity of protected areas to protect target species, provided the management plans for the areas permit this. In the case of forest genetic resources, the sequence of stages that may be followed to achieve this improved conservation capacity is presented in a review by Thomson and Theilade (2001) (see also Box 9.11):

- broadening participation in design of protected area management plans and expanding the range of issues addressed by those plans;
- elaborating the management objectives to include the full scope of conservation of biological diversity and genetic resources;
- improving management and monitoring of protected areas;
- enhancing the ecological and social value of protected areas through land purchase and zoning outside the protected area;
- identifying, securing and developing new sources of financing for protection and management; and
- providing financial incentives for conservation on adjacent private lands.

Box 9.10 Establishment of protected areas in Armenia's Javakhq (Ashotsk) border region

A project has been developed by WWF-Germany, WWF-Armenia and the WWF Caucasus Programme Office. In September 2007, KfW (the German Development Bank) and the Armenian Ministry of Nature Protection granted WWF the task of implementing the project in close collaboration with the Ministry. The project aimed to conserve the unique biodiversity of the Javakheti-Shirak plateau in Armenia along the border to Georgia and Turkey and, at the same time, enhance sustainable rural development in the northern Shirak region through establishment of the Lake Arpi National Park and implementation of a support zone programme, targeting around 15 villages. The project will explore new development opportunities in the region linked to summer and winter tourism, alternative energy production and climate change, but it will also explore how more traditional land-use activities can fit into a more dynamic future perspective. The overall budget of the project is €2.2 million. The project will also promote the area internationally. To ensure a connection to the local and regional agenda, a project implementation unit (PIU) has been established in the town of Gyumri – capital of the Shirak region. A regional advisory council, with representatives from four Ministries, the Shirak region, more than 15 communities, and other national and international stakeholders, serves as a reference body for the planning and implementation of the new national park and the support zone developments.

The Javakheti-Shirak plateau in Armenia is part of a large high mountain plateau of volcanic origin with mountain steppes, subalpine grasslands as well as lakes and wetlands. Due to its uniqueness in the Caucasus, the plateau was selected as a priority conservation area in an ecoregional conservation plan for the Caucasus launched at a Ministerial Conference in March 2006, with the governments of Armenia, Azerbaijan, Georgia and Germany.

The Javakheti-Shirak ecosystem is recognized as a globally important area for birds, reptiles and plants, of which several are listed as endangered in the IUCN Red Data Book. Preserving this unique ecosystem calls for a coordinated approach to nature conservation and management across national boundaries, accompanied by sustainable development measures for local people.

WWF has also been asked to implement a similar project on the Georgian side of the Javakheti-Shirak region, which creates interesting opportunities for synergy, learning and cooperation across the border. A transboundary cooperation board, with representatives from both countries, will be asked to facilitate the collaboration, supported by the Transboundary Joint Secretariat for the Southern Caucasus, with offices in all three countries, including Armenia.

Source: http://www.panda.org/who_we_are/wwf_offices/armenia/newsroom/?123460/Lake-Arpi-National-Park-Bringing-welfare-to-people-and-nature-in-the-northern-Shirak-Region-Armenia

Box 9.11 Main steps in planning a programme to conserve the genetic resources of a particular tree species

- 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.
- Determine or infer the genetic structure of the priority species at the landscape level.
- Assess the conservation status of the target species and their populations.
- 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.
- Identify the specific populations to be included in the network of *in situ* conservation stands.
- Choose conservation strategies or identify conservation measures.
- Organize and plan specific conservation activities.
- Provide management guidelines.

Source: Graudal et al, 2004

Further sources of information

Chape, S., Spalding, M. and Jenkins, M. (eds) (2008) *The World's Protected Areas,* Prepared by the UNEP World Conservation Centre, University of California Press, Berkeley.

Iriondo, J.M., Maxted, N. and Dulloo, M.E. (eds) (2008), *Conserving Plant Diversity in Protected Areas,* CAB International, Wallingford, UK.

Maxted, N., Kell, S., Ford-Lloyd, B. and Stolton, S. (2010) 'Food stores: Protected areas conserving crop wild relatives and securing future food stocks', in S. Stolton and N. Dudley (eds) *Arguments for Protected Areas: Multiple Benefits for Conservation and Use*, Earthscan, London.

Stolton, S., Maxted, N., Ford-Lloyd, B., Kell, S.P. and Dudley, N. (2006) *Food Stores: Using Protected Areas to Secure Crop Genetic Diversity*, WWF Arguments for Protection series, WWF, Gland, Switzerland.

Notes

1. Maxted and Kell (2009) are overoptimistic in their claim that it is relatively easy to amend the existing site management plan to facilitate genetic conservation of CWR species. While the changes required may, in some instances, be minor, getting them approved and implemented may prove difficult, if at all possible.
2. Sandwith et al, 2001.

References

ACIUCN (2002) *Australian Natural Heritage Charter* (2nd edition) Australian Heritage Commission, in association with the Australian Committee for the International Union for the Conservation of Nature (ACIUCN), Canberra

Amend, T., Brown, J., Kothari, A., Phillips, A. and Stolton, S. (eds) (2008) *Protected Landscapes and Agrobiodiversity Values,* Vol 1 in the series Protected Landscapes and Seascapes, International Union for Conservation of Nature (IUCN) and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Kasparek Verlag, Heidelberg, Germany, p139

Chape, S., Spalding, M. and Jenkins, M. (eds) (2008) *The World's Protected Areas*, Prepared by the UNEP World Conservation Centre, University of California Press, Berkeley, CA, USA

Dudley N. (ed) (2008) *Guidelines for Applying Protected Area Management Categories*, International Union for conservation of Nature (IUCN), Gland, Switzerland.

Dudley, N. (ed) (2009) *Guidelines for Applying Protected Area Management Categories,* International Union for Conservation of Nature (IUCN), Gland, Switzerland

Gardner, C.J., Ferguson, B., Rebara, F. and Ratsifandrihama, A.N. (2008) 'Integrating traditional values and management regimes into Madagascar's expanded protected area system: The case of Ankodida', in J.-M. Mallarach (ed) *Protected Landscapes and Cultural and Spiritual Values,* Vol 2 in the series Values of Protected Landscapes and Seascapes, IUCN, GTZ and Obra Social de Caixa Catalunya, Kasparek Verlag, Heidelberg, Germany

Graudal, L., Yanchulk, A. and Kjaer, E. (2004) 'Chapter 3: National planning', in FAO, FLD, IPGRI, *Forest Genetic Resources Conservation and Management, Vol 1*, *Overview, Concepts and Some Systematic Approaches*, International Plant Genetic Resources Institute (IPGRI), Rome, Italy

Heywood, V.H. and Dulloo, M.E. (2005) In Situ *Conservation of Wild Plant Species – A Critical Global Review of Good Practices,* IPGRI Technical Bulletin, no 11, FAO and IPGRI, International Plant Genetic Resources Institute (IPGRI), Rome, Italy

Iriondo, J.M., Maxted, N. and Dulloo, M.E. (eds) (2008) *Conserving Plant Diversity in Protected Areas,* CAB International, Wallingford, UK

Kemp, R.H., Namkoong, G. and Wadsworth, F.M. (1993) *Conservation of Genetic Resources in Tropical Forest Management: Principles and Concepts*, Food and Agriculture Organization of the United Nations (FAO) Forestry Papers 107, FAO, Rome, Italy

Mallarach, J.-M. (ed) (2008) *Protected Landscapes and Cultural and Spiritual Values,* Vol 2 in the series Values of Protected Landscapes and Seascapes, IUCN, GTZ and Obra Social de Caixa Catalunya, Kasparek Verlag, Heidelberg, Germany

Maxted, N. and Kell, S.P. (2009) *Establishment of a Global Network for the* In Situ *Conservation of Crop Wild Relatives: Status and Needs*, FAO Commission on Genetic Resources for Food and Agriculture, Rome, Italy

Maxted, N., Dulloo, M.E., Ford-Lloyd, B.V., Iriondo, J. and Jarvis, A. (2008) 'Gap analysis: A tool for complementary genetic conservation assessment', *Diversity and Distributions*, vol 14, no 6, pp1018–1030

Phillips, A. (2002) *Management Guidelines for IUCN Category V Protected Areas: Protected Landscapes/Seascapes,* no 9, IUCN, Gland, Switzerland and Cambridge, UK

Sandwith, T., Shine, C., Hamilton, L. and Sheppard, D. (2001) *Transboundary Protected Areas for Peace and Cooperation,* IUCN, Gland, Switzerland and Cambridge, UK

Spalding, S. and Chape, M. (2008) in S. Chape, M. Spalding and M. Jenkins (eds) *The World's Protected Areas*, Prepared by the UNEP World Conservation Centre, University of California Press, Berkeley, CA, USA

Thomas, L. and Middleton, J. (2003) *Guidelines for Management Planning of Protected Areas,* International Union for Conservation of Nature (IUCN), Gland, Switzerland and Cambridge, UK

Thomson, L. and Theilade, I. (2001) 'Protected areas and their role in conservation of forest genetic resources', in FAO, DFSC and IPGRI (eds) *Forest Genetic Resources Conservation and Management, vol 2*, *Managed Natural Forests and Protected Areas (*In Situ), International Plant Genetic Resources Institute, (IPGRI), Rome, Italy

WWF (2004) *How Effective are Protected Areas?* Preliminary analysis of forest protected areas by WWF – the largest ever global assessment of protected area management effectiveness. Report prepared for the Seventh Conference of the Parties of the Convention on Biological Diversity, February 2004, World Wide Fund for Nature (WWF), Gland, Switzerland.