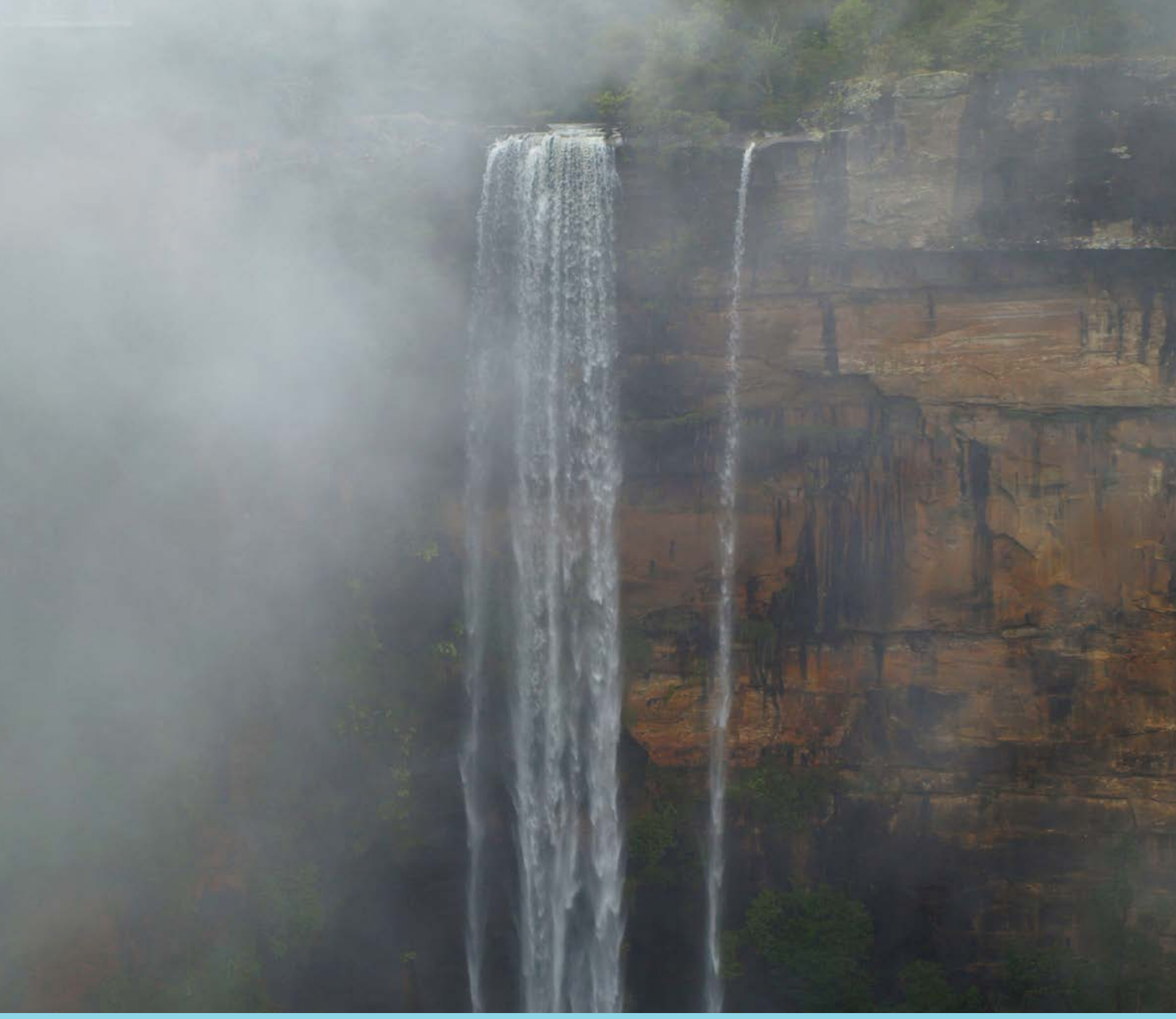

CHAPTER 6

VALUES AND BENEFITS OF PROTECTED AREAS

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TITLE PAGE PHOTO

Fitzroy Falls, Morton National Park, NSW Australia
Source: Graeme L. Worboys

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Introduction

Protected areas are places where conscious efforts are made to preserve not only wild species, but also the ecosystems in which species live. In parts of the world where most of the landscape has already been transformed by agriculture or industry, protected areas may be the only natural or near natural ecosystems remaining for large areas. The wider socioeconomic and cultural values of these natural ecosystems are increasingly being recognised, as are the important ecosystem services they provide (see Box 6.1). Until recently these services have often been taken so much for granted that their values have been underestimated, forgotten or simply never noticed. The acknowledgment of ecosystem services was boosted by a seminal paper by Robert Costanza (1997), who noted ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions. In 2003, the Millennium Ecosystem Assessment suggested a simple typology to summarise the various services from natural ecosystems (MEA 2003). This typology has been expanded and adapted for different purposes, including for protected areas (Kettunen and ten Brink 2013). Figure 6.1 outlines the various ecosystem services we might expect from protected areas and lists the benefits associated with these services (these benefits are introduced in more detail in the next section).

We should not forget that nature conservation remains the primary aim of protected areas. Conservation of biodiversity—of species, genetic diversity within species and of habitats and ecosystems—underpins ecosystem function (Cardinale et al. 2012) and has many practical, utilitarian benefits, as described below.

There is in addition wide agreement that we have an ethical obligation to maintain the full range of the planet's living diversity—in other words, not to speed up the rate of extinction beyond what would be expected in natural circumstances. We are manifestly failing in this aim at present, with species declining and disappearing all the time, often before they have even been recognised and described by scientists. Nonetheless, research across multiple data sets provides strong evidence that protected areas are one of the most effective tools for slowing the rate of biodiversity loss and many species continue to survive only because of the protection provided by national parks, nature reserves and other protected areas (see Chapter 21). The ethical basis of biodiversity conservation is recognised by signatories of the Convention on Biological Diversity, nationally through wildlife protection and protected area legislation, by senior members of all the world's major religions (Palmer and Finlay 2003), and by much of the general public.

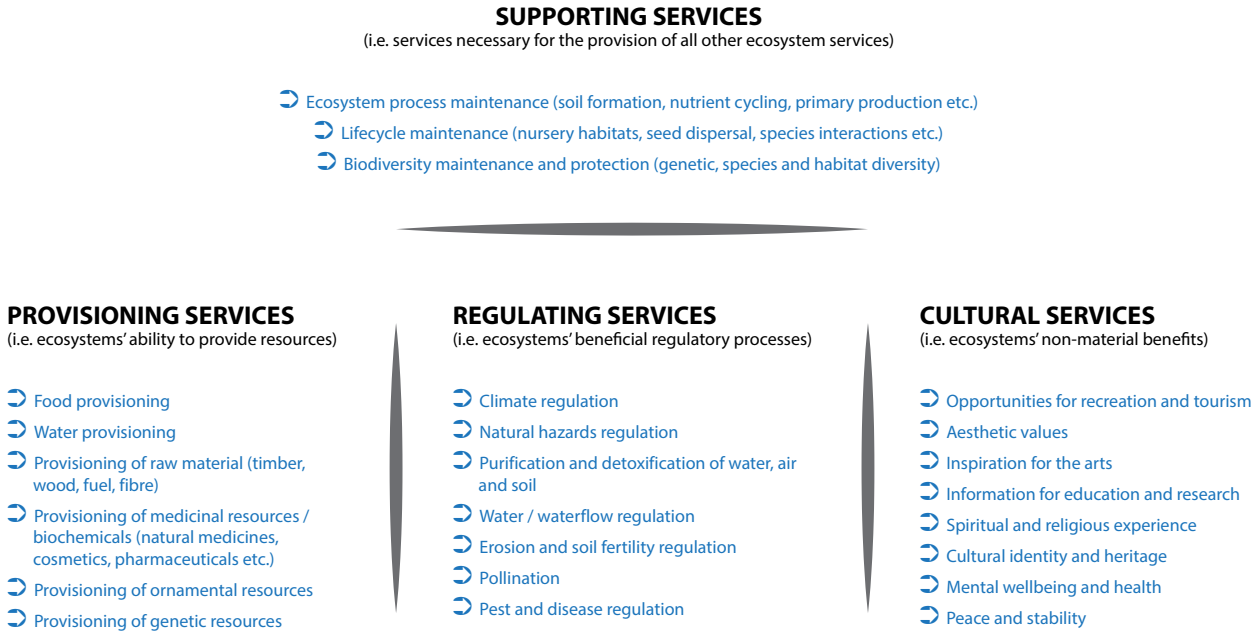


Figure 6.1 Ecosystem services and related goods from protected areas

Sources: Kettunen and ten Brink (2013); adapted from MEA (2003); de Groot et al. (2010); and UK NEA (2011)

Box 6.1 What happens when we lose ecosystem functioning and ecosystem services?

Nigel Dudley

Ecosystem services are a perfect example of the old truism that we only really value things once they are gone. When natural ecosystems become degraded, lose key aspects of their ecological functioning or disappear altogether, we almost always suffer in consequence. But when those ecosystem functions and the services they maintain were lost a long time ago, or are disappearing so gradually no-one notices, the resulting problems sometimes remain disconnected from ecology in the minds of many people. Loss of natural vegetation in dryland ecosystems creates deserts, dust storms and frighteningly high levels of respiratory disease in cities like Kuwait. Overfishing has dramatically reduced fish populations in many oceans, but we need to look at old fishery records to really understand what we have lost. Felling of mangroves has left coastal communities vulnerable to storms and sea surge in South-East Asia and elsewhere. Many African cities are facing a crisis of contaminated water and infant diarrhoea due to loss of upland forests. In parts of China farmers now have to pollinate their crops by hand with paintbrushes because pollinating insects have declined so dramatically. When we say that protected areas provide us with irreplaceable resources, for once the term 'irreplaceable' is, in many parts of the world, not in any way an exaggeration, and our ability to adapt to these losses is becoming ever more difficult.

Emerald toucanet (*Aulacorhynchus prasinus*), Monteverde Cloud Forest Reserve, Costa Rica

Source: Charles Besançon

There are three aspects to transforming these recognised ecosystem services into measurable socioeconomic benefits for human communities: 1) quantifying and assessing (often qualitatively) the value of the various benefits; 2) understanding them in relation to other benefits including benefits forgone by retaining the ecosystem; and 3) understanding who receives the various benefits. None of these is particularly straightforward.

We summarise information on several techniques for quantifying and valuing benefits in economic and other terms below. But the benefits also need to be understood in the context of competing benefits (so-called trade-offs)—for example, retaining a forest to protect water also means that the timber in the forest is not available for sale or the land for conversion to agriculture or development—and that these benefits and their relative values accrue to different people. One of the persistent challenges in securing ecosystem services is that many services maintained by sustainable management or protection of ecosystems are diffuse in nature, providing many people with a small number of a hard-to-measure benefits (for example, non-monetised and with no clear ownership rights), while unsustainable use provides one or a few people with a lot of benefit (for example, well-monetised with clear ownership rights).

So, the landowner who chops down a forest in a watershed and sells the timber receives a pile of money in their pocket, while the city downstream loses water quality and pays in extra purification costs or extra stomach upsets. The net watershed values to society as a whole may be much greater than the net timber value gained, but not to the landowner who has clear ownership rights to the timber, while the city-dwellers downstream have no clear ownership rights to the clean water produced by the forest.

This means in turn that the perception of and attitudes to the benefits from protected areas will alter with who is benefiting. At an extreme, people who suffer from poverty and inequality and have been displaced from their traditional lands to create a protected area are likely to remain resentful and largely oblivious to any wider regional or global values. On the other hand, people who benefit culturally, spiritually, through direct or indirect jobs and through recognised ecosystem services will probably have a very different perspective. And the way people view protected areas can also change over time as benefits are more widely appreciated, fair access and equitable sharing of any benefits are assured and management learns to respond more sensitively to the needs of a wide variety of stakeholders.

Finding ways of rewarding people for retaining ecosystem services is one of the critical steps in concretely capturing the socioeconomic value of protected area benefits and, consequently, retaining or regaining support for protected area policies. Protected area managers who are aware of both the full range of protected area benefits and the range of stakeholders affected have a far better chance of managing successfully. In the remainder of this chapter, we provide an overview of the range of benefits that can come from protected areas and look at how these can be measured, utilised and managed.

Protected area benefits: Maintaining our life-support systems

Exactly what are the benefits from protected areas? A very short summary follows; more detailed sources are available (Stolton and Dudley 2010a; Kettunen and ten Brink 2013). Although most of these benefits can come from any natural ecosystem, protected areas often have the advantage that they are already established as efficient, successful and cost-effective tools for sustainable ecosystem management, with associated laws and policies, management and governance institutions, knowledge, staff and capacity. They thus often maintain a wider range of ecosystem services than other areas and they also come with far more associated security than unmanaged, unregulated areas that are more open to rapid degradation and change. We are not, however, claiming that protected areas are the only such vehicle: other well-managed land and water controlled by communities, governments and companies can play similar functions.

High-altitude paramos water catchment area of Cayamba-Coca Ecological Reserve, Ecuador, which provides ecological services (water) for the capital city of Quito

Source: Graeme L. Worboys

Supporting services

At a time when many agricultural systems are becoming increasingly reliant on inputs of fertilisers, pesticides and large amounts of fossil fuel energy, natural ecosystems that are self-regulating and powered solely by the sun are more rare. 'Supporting processes and functions' refer to the basic running of an ecosystem: soil formation and nutrient cycling; life-cycle maintenance for species by provision of services like fish nursery habitats, means of seed dispersal and continued species interactions; along with conservation of the full range of biodiversity. By protecting functioning ecosystems, protected areas provide services to surrounding ecosystems, both through the direct spillover of soils, nutrients and intercepted solar energy and from the potential to use protected areas as baselines of information and raw materials for restoration within the rest of the landscape.

For example, demonstration of the opportunities for land restoration through dryland habitat protection amasses important information, and builds confidence, for authorities to tackle desertification issues in the Arabian Peninsula. Reductions of desertification and dust storms

Mangroves, Pelican Cayes, Belize
Source: Eduard Müller

are two concrete results that can become apparent in a small number of years; however, major challenges here are that a generation or more of people have grown up believing that the highly degraded ecosystems covering most settled parts of the peninsula are 'natural'. Policy changes rely not only on proof that protection and restoration can work, but also on a long-term effort to build understanding about ecology in the countries concerned.

Provisioning services

Of more immediate interest to people are the various tangible resources that protected areas either provide directly or support.

Food

Well-managed natural ecosystems play a key role in food security, particularly for the poorest members of society, many of whom are still leading a subsistence lifestyle and are dependent on a diversity of edible products from protected areas. For example, freshwater and marine protected areas and coastal mangroves provide valuable breeding grounds for fish, ensuring the populations do not collapse and providing spillover into surrounding waters (Roberts and Hawkins 2000). Many marine protected areas also allow sustainable fishing for local communities, or follow traditional seasonal closures. Terrestrial protected areas also enhance food security, by such measures as providing emergency grazing during times of drought in drylands, sources of fodder as long as this is harvested in a sustainable manner and even allowing controlled extraction of food species from within the protected area boundaries. Illegal overhunting within protected areas is conversely a major problem. The use of protected areas as 'emergency' food supplies is highlighted, for instance, in some parts of northern and eastern Africa (Dudley et al. 2008).

Water

Some ecosystems also increase the net amount of available water, particularly watersheds containing cloud forests, where leaves 'scavenge' water from mist and cloud, condensing it on specially evolved leaf parts and then funnelling it down branches and trunks. The city of Tegucigalpa in Honduras is one of several large Latin American cities that protect surrounding cloud forest to guarantee water supplies, in this case in the La Tigra National Park (Hamilton 2008). In some ecosystems forests can hold more rainfall in the catchment than cleared land, reducing water export and (depending on geology) increasing aquifer storage (Siriwardena et al. 2006).

Raw materials

Many protected areas have been established explicitly to conserve natural resources such as timber and valuable plants. But an increasing number also sanction some level of collection, usually by local communities and focusing on items like poles for building and fencing, grasses for thatching, firewood and more valuable timber for carving, boatbuilding and numerous other non-timber forest products (NTFPs). Some extractive reserves (IUCN Category VI) have been set up explicitly to allow sustainable harvesting of key products from natural ecosystems; here protection and production inherently go hand-in-hand. Rubber collecting in Amazonian extractive reserves is the original, classic example. The Mamirauá Sustainable Development Reserve in Brazil is part of a large conservation complex of more than 6 million hectares where biodiversity conservation is balanced with the needs of sustainable development. But today such approaches are being used in land and water-based protected areas throughout the world; it is now the fastest-growing of all protected area management categories (Bertzky et al. 2012).

The Kosciuszko National Park high mountain catchments, part of the Australian Alps national parks, generate approximately 9600 gigalitres of high-quality water per annum, worth an estimated US$9 billion annually (Worboys and Good 2011)

Source: Graeme L. Worboys

Medicinal resources

Protected areas help support public health in a number of ways: by providing a sustainable source of medicinal herbs that are still the medicines of choice for the majority of the world's poor people, and providing genetic resources for pharmaceutical companies, some of which have signed agreements to pay prospecting rights to individual protected areas. Ethno-botanical studies have been conducted in numerous protected areas, showing not only the wide range of values these places contain, but also that in many parts of the world some species, and sometimes also the knowledge on using these species, is increasingly being confined to protected areas. In countries such as Nepal, access to medicinal herbs has declined so steeply in some areas that management agreements to collect small amounts in national parks are now the only remaining option (Stolton and Dudley 2010b).

Genetic resources

As mentioned above, biodiversity has more than simply aesthetic or ethical values, but provides raw material for a range of products including the pharmaceuticals already highlighted and particularly crop wild relatives (CWR)—wild species that are closely related to domesticated crops and which can supply valuable genes for breeding to address issues such as drought tolerance or resistance to disease (Stolton et al. 2006; Hunter and Heywood 2011). Crop wild relatives already support the multi-billion-dollar annual seed business and the need for CWR is increasing all the time as environmental conditions shift rapidly under climate change, throwing agriculture under additional stress. Several micro-reserves have been established in Armenia, for instance, to protect important CWR in one of the global centres of crop diversity (see Boxes 6.2 and 6.6).

Regulating services

Well-managed natural ecosystems also maintain a range of beneficial processes and functions with direct relevance to human wellbeing. These so-called regulating services refer mainly to the role of natural ecosystems in helping to control aspects of climate, hydrology and the water cycle, weather events and key natural systems that impact on agriculture, such as pollination. Our understanding of the value of these systems is increasing all the time.

Storing and sequestering carbon

Although only recognised comparatively recently, the role of natural ecosystems in both storing and sequestering carbon, and thus reducing the rate of climate change, is now for many people a primary reason for conservation. Natural ecosystems form critical carbon stores, including vegetation such as forests, grasslands, wetlands and marine vegetation including seagrass and kelp beds, along with subsurface storage in humus-rich soils and particularly peat. Conversely, their destruction and subsequent release of carbon are factors currently leading to runaway climate change. Protected areas thus help both by preventing further losses of carbon to the atmosphere and, in healthy ecosystems, by sequestering additional carbon (Dudley et al. 2009). The UN Environment Programme's World Conservation Monitoring Centre (UNEP-WCMC 2008) has calculated that a minimum of 15 per cent of the world's stored carbon is already within protected areas. The opportunity to add to this through sequestration means that role of restoration in protected areas thus becomes increasingly important (Keenleyside et al. 2012). Canada is amongst the countries to have estimated the carbon storage benefits of its existing national park system.

Box 6.2 Crop wild relatives

Danny Hunter and Nigel Maxted

Crop wild relatives contain a wealth of genetically important traits due to their adaptation to a diverse range of habitats and the fact that they have not passed through the genetic bottlenecks of domestication. The ability of breeders to increase or even sustain crop yield and quality in the face of a growing magnitude of threats is being questioned without much greater use of the natural range of diversity found in CWR taxa and the genetic traits they provide. The global value of the introduction of new genes from CWR to crops is estimated to be US$115 billion annually (Pimental et al. 1997). The taxa cannot, however, continue to be used by plant breeders to sustain food security if they are not conserved and available for utilisation. At present, CWR conservation is largely neglected, unfortunately, even in protected areas (Hunter and Heywood 2011; Maxted et al. 2012). CWR in these sites are likely to be passively conserved and they may come under threat or even be lost entirely.

Although sites where *in situ* CWR populations are actively managed are still rare, the position has improved significantly in recent years due to the growing threat to global food security and the realisation that they may offer at least a partial solution. The threat to CWR is very real; in a recent Red List assessment of 572 European species from 25 economically important crop groups, 11.5 per cent (66) of the species were threatened, with 3.3 per cent (19) of them critically endangered (Kell et al. 2012). The Convention on Biological Diversity Strategic Plan Target 13 calls '[b]y 2020, [for] the status of crop and livestock genetic diversity in agricultural ecosystems and of wild relatives [to have] been improved'. Although CWR are currently poorly conserved and threatened, their more active conservation in protected areas is essential to sustain humankind itself (Hunter et al. 2012).

In 2000, its then 39 national parks were estimated to store 4.432 billion tonnes of carbon (Kulshreshtha et al. 2000). Carbon management is seen as an important factor in persuading governments to conserve natural ecosystems, although current compensation schemes proposed under Reducing Emissions from Deforestation and Forest Degradation (REDD+) are not usually enough on their own to make up for values forgone in development. Carbon financing also expands the scope for the strategic growth of protected areas to encompass degraded or deforested land that is regrown, replanted or restored to protect ecosystems, endangered species or habitats, including corridors, which also contribute to adaptation to climate change.

Mitigation of natural hazards

Natural ecosystems also make cost-effective ways of mitigating various extreme weather events and the after effects of major earth movements; many of the former are becoming more frequent and more intense due to climate change. Natural ecosystems in protected areas can mitigate a wide range of hazards: 1) natural vegetation including particularly forests can help to control landslip due to snowfall and avalanche, hillside soil erosion or earth movement; 2) mangroves, coral reefs and sand dunes all act as barriers against storms, typhoons, sea-level rise and ocean surge following tsunamis; 3) riverside forest and protected natural floodplains help to absorb floodwaters; 4) natural vegetation in dryland and arid areas can prevent desertification, and reduce dust storms and dune movement; and 5) several intact forest ecosystems, particularly in the tropics, are far more resistant to fire than degraded or fragmented ecosystems (Stolton et al. 2008). The term mitigation needs to be defined clearly. No-one is suggesting that natural vegetation can prevent all damage from every extreme weather event, any more than can engineering solutions such as dykes, levees and firebreaks. But experience suggests that well-managed ecosystems can prevent or reduce damage from many, often most, such events and save money and lives in the process (Stolton et al. 2008).

Purification and detoxification of water, air and soil

In an increasingly polluted world, ways of reducing the pollution load are urgently required. Natural ecosystems, if not overwhelmed, can help reduce many forms of pollution. Forests and vegetation types such as paramos in Latin America naturally produce pure water, and some freshwater plants play an active role in detoxification of certain pollutants. For example, in Florida's cypress swamps, 98 per cent of all nitrogen and 97 per cent of all phosphorous entering the wetlands from wastewater were removed before this water entered the groundwater reservoirs (Ramsar Convention Bureau 2008). Research found that one-third of the world's 100 largest cities draw a substantial proportion of their drinking water from forest protected areas (Dudley and Stolton 2003). Similarly, forests and other vegetation types can absorb a certain amount of air pollution and provide valuable shading. The ability of an ecosystem to neutralise pollutants is significant and important, but by no means infinite, and high pollution levels are also a major threat to some protected areas, most dramatically in the case of ocean acidification due to rising carbon dioxide levels in the atmosphere. Wetland protected areas also provide valuable water storage services, and protection of buffer zones around lakes and rivers helps to prevent pollution.

Coral and mangroves, Pelican Caye World Heritage Property, Belize
Source: Eduard Müller

Pollination

Apart from its critical role in maintaining species diversity and vegetation patterns, pollination has direct utilitarian roles for humans, as an essential part of agriculture and fruit growing, and as a stimulant for the production of honey. In a world where pesticides, industrial pollution and habitat loss have had a catastrophic impact on insect numbers, protected areas are increasingly being seen as a tool for maintaining pollination services. Many protected areas allow local beekeepers to place beehives with native bee species within the protected area. Farmers benefit from pollination services maintained within the protected area itself and spilling out into farmland and orchards, and protected area planners are starting to realise that they need to include the retention and where necessary restoration of pollination pathways within conservation planning exercises.

Pest and disease regulation

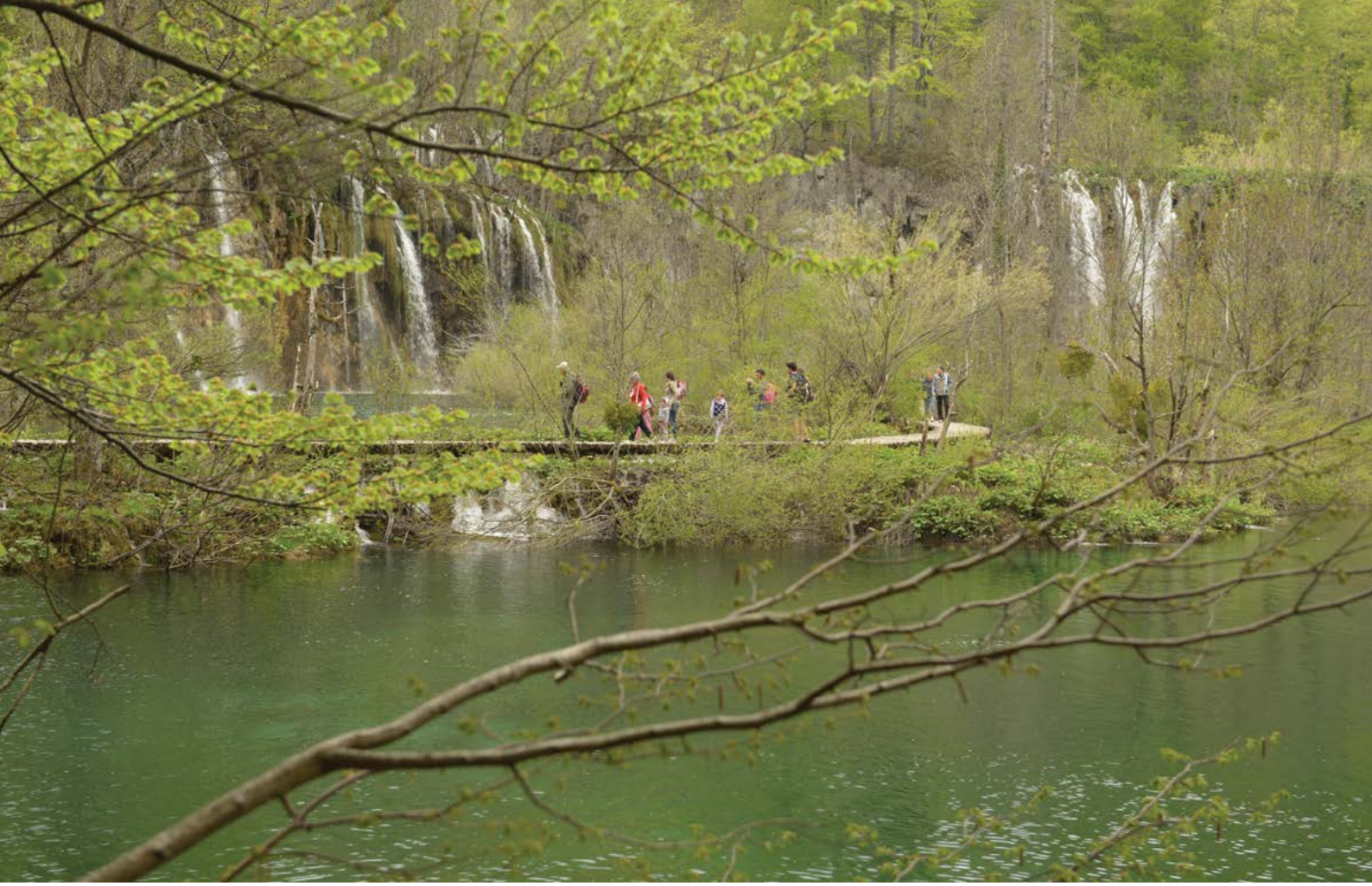
Controlling serious pests and diseases is increasingly important as the degree of threat from invasive alien species is recognised and climate change encourages the spread of pests and diseases into new ecosystems. Protected areas can help minimise these problems in a number of ways, particularly by physically blocking unwanted species: many invasive plants are coloniser species and do not penetrate into mature vegetation. The same is true of some insect pests like the tsetse fly, and malarial mosquitoes have also been recorded as moving far more slowly through dense forests.

Cultural services

Clearly not all the benefits we derive from natural ecosystems are narrowly utilitarian: humans enjoy a wealth of complicated cultural, psychological and spiritual links with the natural world. Because protected areas tend to be established in particularly beautiful and pristine parts of nature, these cultural services are particularly strongly represented (see Chapter 4).

Recreation and tourism

The day-to-day uses of nature for relaxation, exercise and psychological renewal stretch back way beyond recorded history and have been a major driver for protected area creation. Most visitors tend to cluster around the edges of large reserves and keep to footpaths—for walks, family outings, picnics and nature watching; a smaller subset of visitors likes to penetrate much deeper, walking, riding or canoeing for days inside the larger national parks. For these people, the sense of isolation and wilderness is a key part of the attraction. With tourism now arguably



Visitors, boardwalk and the spectacular cascading waterfalls of the Plitvice Lakes National Park World Heritage Property, Croatia

Source: Graeme L. Worboys

the world's largest single industry, the potential for ecotourism in protected areas is growing all the time and is already the largest foreign currency earner in countries such as Tanzania (see Chapter 23).

(Nature-based) physical and mental wellbeing

As well as the benefits from recreational use of protected areas, research and practice have found that people with physical and mental problems or alcohol and other drug addictions can benefit positively from immersion in an attractive landscape. Health authorities in the United Kingdom are encouraging use of local nature reserves as safe and appealing places for exercise, to combat a national obesity problem. The 'Healthy Parks Healthy People' movement, started in Melbourne, Australia, links protected area and health agencies and uses parks to provide relaxing places for people with mental health issues and/or substance addiction. These approaches have proved very encouraging and a pleasant environment has proven to be good psychological and physical therapy (Stolton and Dudley 2010b).

Aesthetic value and a sense of place and inspiration for arts, science and technology

Perceptions of beauty are culturally formed. The Romantic movement in the arts was a major stimulus for the development of national parks in Europe (Box 6.3). Iconic national parks like Yellowstone in the United States, the Blue Mountains outside Sydney, Australia, the Lake District in the United Kingdom and the Japanese Alps have inspired artists and writers for generations, and on a more local scale protected areas provide rich sources of ideas and energy for poets, painters, musicians and other artists. A 'sense of place' is also a useful concept for describing and understanding the attachments some people form with protected areas (Lin and Lockwood 2013). Such place attachments can include emotional (including identity) and functional aspects even for communities who have only recent connections with a protected area (Byrne and Goodall 2013).

Education and research

Protected areas provide an ideal location for ecological research as they are often in fairly pristine condition, and have sympathetic staff and sometimes facilities for visiting scientists. A proportion of reserves are set up specifically for research purposes, and these are amongst the most strictly protected areas in terms of access and disturbance, so ecological processes and interactions can be studied under the best possible circumstances. Other protected areas have extensive education programs, often developed in association with local schools and colleges, giving children an increasingly rare opportunity to interact directly with nature.

Spiritual and religious experience

Many protected areas contain sites of spiritual importance (see Chapters 4 and 23). Protected areas can, if sensitively managed, accommodate such interests, and can provide both additional protection and a pleasant surrounding environment for meditation and worship. In Amber Mountain National Park, northern Madagascar, local people can visit a sacred waterfall within the park, and in Donaña National Park in southern Spain every year a major pilgrimage takes place, linked to the Catholic Church. To an increasing extent, resident faith groups within protected areas are becoming actively involved in conservation, as in Rila National Park in Bulgaria, where the monks in Rila Monastery manage their own lands as a nature reserve, in accordance with teachings about the sanctity of nature (Mallarach and Torcal 2009).

Cultural identity and heritage

The cultural and historical values found within protected areas are also often very important although sometimes rather difficult to define. In the same way that iconic buildings, writers, musicians and football teams can come to embody the heart of a nation or region, so too can special views, landscapes or wild species. Climbing Mount Triglav, in the national park of the same name, is something many Slovenians intend to do at least once in their life. Further east in Europe, Mount Kazbegi has a potent mixture of cultural and spiritual values for many Georgians, who visit the ancient church built high in the mountains under its shadow. These issues are discussed in greater detail in Chapter 23.

Peace and stability

Many conflicts between nation-states focus on the borders between countries. The first trans-boundary conservation initiative in the modern sense of the term is attributed to the Waterton–Glacier International Peace Park, which was declared in 1932 to commemorate the peace and goodwill that exist along the world's longest undefended border, between Canada and the United States. Several other trans-boundary protected areas have been effective in helping resolve boundary disputes between countries. For example, the establishment of protected areas in the Carpathian Mountains in Central and Eastern Europe between 1949 and 1967 helped settle boundary disputes, and the Cordillera del Cóndor Transboundary Protected Area along a portion of the border between Ecuador and Peru was declared as part of the resolution of a boundary dispute between the two countries (Stolton and Dudley 2010b).

Aesthetic translucent blue of a geothermal boiling water pool, Yellowstone National Park, USA

Source: Graeme L. Worboys

Understanding and managing benefits

Recognising socioeconomic benefits is only the first step; we also need to understand the related value (including relative values compared with alternative uses of the natural resources) and have an agreed plan for their management. Over the years, a variety of tools has been developed for measuring and valuing natural resources, including those within protected areas. These range from detailed and costly economic and social valuation techniques to simple questionnaire-based approaches,

Box 6.3 Aesthetic links with Snowdonia National Park, Wales

Nigel Dudley

The national park movement in the United Kingdom draws on a sensibility that derived from the Romantic movement, typified by poets such as William Wordsworth, who reversed millennia of disdain for wild, rugged landscapes and converted them into places of particular importance in people's minds. Like all UK national parks, Snowdonia in Wales was first designated primarily for its landscape values of mountains, steep valleys and moors. Artists like Richard Wilson first popularised wild mountain scenes despite the objections of some of the cultural critics of the day. But these areas were not wilderness in any usual sense of the term: most of the uplands are used for sheep pasture and forestry and these uses overlay a dense history of prehistoric settlements and more recent mining and quarrying. The whole landscape has been transformed and scarred. Nor was designation a local concern; decisions were made in parliament in London, driven primarily by middle-class English who had absorbed the Romantic aesthetic. Transforming these external sensibilities into a vehicle for biodiversity conservation and ecosystem services, supported by the communities who live there, remains a challenge today (Hourahane et al. 2008).

which are quicker to use but provide more approximate information. While economic valuation is important, it is not the only way in which to assess the value of the natural world and/or resources, and over-reliance solely on economic values can be dangerous, overlooking the range of broader welfare benefits and associated values outlined above.

Categorising and illustrating values

'Value' is a vague word, although a number of typologies exist to help provide more detail (Harmon and Putney 2003; Pagiola et al. 2004; van Beukering et al. 2007).

First, assessments often distinguish between 'intrinsic value' and 'value to humans' (or 'instrumental value'). The meaning of the latter is fairly clear and the subject of much of this chapter. Intrinsic value on the other hand attempts to capture values that are distinct from human interests. This is inevitably difficult: humans are the ones who are trying to define non-human values so that we are still viewing these through our own eyes, but the attempt is important. The intrinsic value of species is their place in the evolutionary process, which is responsible for the continuation of life on Earth; they hold that value whether or not they have any direct or indirect use to people, or even if their continued existence is antithetical to people's interests. Development of theories of intrinsic value marks an important step forward: particularly in the West, people used to believe that nature only had value to the extent that it was of use to us and had no 'rights' independent of humans. These ideas (which were never accepted by most Eastern philosophies) are being increasingly challenged.

The overall value of the natural world to humans consists of both economic values and broader cultural and other non-economic values and can be captured in the following typology. While easier to define than intrinsic values, the human values also contain a number of nuances and it should be noted that the distinctions outlined below are not necessarily clear-cut.

Direct use values

These refer to the immediate uses we make of ecosystem services. Examples might be catching fish whose populations are maintained within marine protected areas, or the jobs that the protected area provides. They often refer to some kind of harvesting and are often provisioning services. Generally, it is relatively easy to understand direct use values and also to assign them socioeconomic values.

Indirect use values

These refer to values that come in more diffuse form, often affecting a large number of people and sometimes including populations far from the origin of the value. They tend to be non-consumptive values and are often regulating services. Indirect use values tend to include such benefits as clean water from a forested watershed or disaster risk reduction from coastal protection and soil stabilisation. Although indirect use values have important economic and welfare consequences, they are relatively more difficult to assign economic values and more difficult still to link with particular beneficiaries.

Non-use values and/or options for future use

These refer to the values of leaving a natural species or ecosystem in place even when we are not benefiting immediately from its existence. Several categories exist, including: option values, which relate to maintaining an area in case it may be needed for its natural resources in the future; bequest values of leaving things in place for future generations; and existence values that we consider important even though we do not benefit ourselves.

International border between Canada (left) and the USA (right) and the trans-boundary peace parks: Waterton National Park (Canada) and Glacier National Park (USA)

Source: Graeme L. Worboys

Option and bequest values are both clearly use values, while existence values could also be regarded as a kind of anthropogenic indicator of intrinsic values. Attempts have been made to assign economic and welfare values to non-use values, although the adequacy of these attempts is contested.

Assessing socioeconomic benefits

Today managers of protected areas—whether they are government officials, private charities or communities—are increasingly expected to show the wider benefits of their sites in terms of society, poverty reduction and development. Protected area specialists are divided about how these benefits should be portrayed. Some believe that valuation, especially in economic terms, is critical so that conservationists can talk with governments and industry in their own language. The Economics of Ecosystems and Biodiversity (TEEB) approach (TEEB 2011) has highlighted the role of economic assessment, although TEEB is careful to note that this is only one form of valuation. Others remain concerned that economic valuation is dangerous, not least because clever economists can often argue that using a resource now is more valuable than leaving it for the future and partly on the philosophical grounds that we have no right to reduce the rest of nature to figures on a balance sheet. We recognise the pitfalls but nonetheless believe that careful use of economic valuation can be useful.

Assessing multiple benefits to multiple stakeholders

When approaching protected area valuations, it is important to consider all values and all stakeholders over a lengthy period. We have pointed out that for the individual, non-sustainable extractive uses (like felling timber) are often immediate and highly profitable to the owner of the resource, while the costs (such as soil erosion, poorer water quality and the release of carbon into the atmosphere) are borne to a small extent by many people over a much longer period. Eventually all the 'small' hidden costs of environmental degradation add up to a large cost to society as a whole. Similarly, a valuation that only looks, for instance, at the profits from ecotourism but ignores the benefits forgone by local communities will not produce a complete picture. It is therefore important that an assessment takes account as far as possible of the views and values of all stakeholders (see Box 6.4). In addition, valuation should not look at a single snapshot in time, but should consider long-term implications as well: some values are short term while others exist for years, decades or even centuries. This makes valuation inherently complex; our understanding of benefits and their value changes over time. Ten years ago the role of protected areas in carbon sequestration was hardly discussed; today it is at the top of the list for many valuation studies.

It is also important to acknowledge that benefits provided by protected areas come with costs related to the implementation of management activities. Like benefits, costs can be experienced by different stakeholders at different levels ranging from global to local, from international donors to local communities. Therefore, when assessing the overall value of benefits provided by protected areas it is also necessary to think about the associated costs. This allows conclusions to be drawn on the actual net benefits (for further information, see Kettunen and ten Brink 2013). Importantly, complementing the assessment of benefits with information on related costs guides the appropriate uptake of valuation results in practice (as elaborated in the next section).

Fishermen, Rio Platano Biosphere Reserve, Honduras
Source: Eduard Müller

Building on different indicators of value

The value of benefits can be assessed at three levels: qualitative, quantitative and monetary (Kettunen and ten Brink 2013). Qualitative valuation focuses on non-numerical indications of value—for example, by describing the role of a protected area in supporting local culture and identity. Quantitative indicators of value focus on numerical data including, for example, visitors to or the quantity of carbon stored in a protected area. Monetary valuation focuses on capturing or reflecting the different values in monetary terms—for example, by calculating the revenue generated by visitors or defining the value of carbon storage. Only a limited number of benefits can be captured through monetary indicators. Therefore, a comprehensive assessment of protected area benefits is likely to build on a combination of qualitative, quantitative and monetary indications of value.

A range of methods is available and is currently used to estimate the value of protected area benefits. Kettunen and ten Brink (2013) provide a more comprehensive overview of the available methods and their appropriate application. As a rule of thumb, market values and prices are generally useful when assessing the value of benefits related to the access to biodiversity resources, and opportunities for recreation and tourism. There are also several benefits that are not currently captured by the markets but can be valued in monetary terms. For example, the value of protected areas in purifying water can be captured as the avoided costs of pre-treatment by water companies. Similarly, several survey-based methods are available, designed to assess indicative or 'hypothetical' market values for different benefits. The wider welfare (non-economic) values are difficult to capture in monetary terms. For example, it is difficult to find monetary indicators that would sensibly reflect the role protected areas play in supporting mental health and cultural identity. In these cases, qualitative and quantitative methods are often the most feasible approaches for valuation.

The purpose of assessments

Identifying the purpose of an activity is a key to its success: in order to guide practical decision-making, the benefit assessment and related valuation need to be fit for purpose (Kettunen and ten Brink 2013; TEEB 2013). For example, socioeconomic assessment of benefits, building mainly on qualitative and quantitative information (see above), is often very suitable for raising initial awareness of the benefits among stakeholders. These assessments can be carried out in the context of a scoping study designed to both collect information and engage relevant stakeholders (for example, Stolton and Dudley 2009; Kettunen and ten Brink 2013). Such assessments also form a useful starting point for further valuation: they help to avoid creating an imbalanced overview of benefits by focusing on benefits for which monetary evidence is available while ignoring benefits with less readily available information.

Detailed economic valuation, including monetary assessment, can usefully complement and further specify the overview of total benefits (see Box 6.5). For example, economic valuation can be required when there is a need to demonstrate protected area benefits in relation to alternative land-use practices. Similarly, the development of concrete management mechanisms, such as Payment for Ecosystem Services or new markets for sustainably produced goods, requires detailed economic valuation.

Managing for multiple benefits in protected areas

Identifying and assessing the value of benefits and understanding the stakeholder dynamics involved in maintaining and using the benefits are key steps towards their management (see Box 6.6). Once we have this information, we have the tools needed to reach some kind of consensus about how the various benefits from a protected area can be divided up, managed and maintained in a sustainable and equitable manner.

Box 6.4 The PA-BAT in the Balkans and Turkey

Sue Stolton, Başak Avcıoğlu Çokçalışkan and Kasandra-Zorica Ivanić

The Protected Area Benefit Assessment Tool (PA-BAT) provides a standardised format for documenting and assessing multiple benefits of protected areas amongst different stakeholders (Stolton and Dudley 2009). The PA-BAT is essentially a set of datasheets that collects basic information about the types of benefits (that is, permissible activities in relation to resource use and ecosystem services), to whom they are important, qualitative information about their level of importance, their relationship to the protected area and the times of year in which they are important. Twenty-four sheets cover assessments of biodiversity values, protected area management (jobs), benefits related to food, benefits related to water (provisioning and regulating services), cultural and spiritual benefits and values, health and recreation values, knowledge, materials, and environmental services.

The Küre Mountains National Park (Küre Dağları Milli Parkı, KDMP) in Turkey was declared in July 2000. There are almost no settlements in the core area of KDMP, but there are some 20 000 villagers in 123 villages in the buffer zone. The PA-BAT was implemented in KDMP in March 2009. At the time KDMP had no management plan, but management had a strong focus on involving local people in planning initiatives related to the national park and buffer zone.

Three meetings were held around KDMP to assess the values and benefits of the protected area in two provinces (Bartın and Kastamonu). The first public meeting was attended mainly by local *Muhtars* (leaders of the village). The meeting concentrated on using a simplified version of the PA-BAT based around a PowerPoint presentation and assessed the values (subsistence, economic and potential) for local people living inside and near the protected area. The second meeting was for representatives of park management (national parks and forestry) and local university departments. The group was divided into two working groups, who between them completed all the PA-BAT datasheets relevant to the park. The third meeting was also a public meeting of mainly local officials from the forest, water and parks sectors.

The assessment and discussion around each of the values highlighted significant differences in the perceptions of local people, managers and service providers. For example, the local community noted the major importance of sacred springs in the area, while managers, researchers and service providers assessed these as being of minor importance. The importance of permitted traditional agriculture, wild food plants and medicinal herbs in the buffer zone was also assessed differently between the groups, with managers thinking traditional agriculture was more important than the local people, whilst managers thought collection of medicinal herbs was of no importance whereas local people assessed this as being of major importance.

As the PA-BAT was one of the first examples in Turkey of assessing ecosystem services and their benefits in protected areas, it served as a basis for the development of a business plan for KDMP during the management planning process. The tool also increased the awareness and technical capacity of park managers and experts on how to integrate benefits in protected area planning and management.

In the Dinaric Arc region of Europe the PA-BAT was being implemented in 2013 and 2014 in all the national parks in the eight countries of the region—the first time such a tool has been used on a regional basis. For many protected areas in the region, the PA-BAT workshops have been the first time that stakeholders have been asked to participate actively in, and comment on, park management. For managers and stakeholders engaged in the process, the workshops have provided a fascinating insight into local cultures and traditions and have raised awareness of the range of benefits provided by the park (for example, ecosystem services are generally a new concept introduced during the workshops). Across the region some clear patterns are emerging of how protected areas can better promote conservation, protect local culture and develop sustainable funding strategies. For instance, there is clearly potential in developing branding for local/regional products from protected areas (for example, honey, mushrooms, medicinal plants, cheese) that highlights that these products come from 'healthy and sustainable' sources. The role of protected areas in the mountainous regions of the Dinaric Arc (a karst region) in providing clean water to the population of the whole region is known scientifically. In theory, the development of Payment for Ecosystem Services (PES) schemes could help support the conservation of these areas; however, these resources have been taken for granted for so long that there is a vast task of educating policymakers and citizens of the role protected areas play in providing water before any such scheme could be developed.

Visitor access by horse to remote protected areas in the Altai-Sayan Mountains, Russia
Source: Graeme L. Worboys

Understanding conflicts between different benefits, beneficiaries and uses

A key aspect of protected area management is to understand the synergies and conflicts between the wants and needs of different users and to manage the trade-offs and build on the opportunities that result. One important aspect of this is managing different, and sometimes conflicting, demands on ecosystem services, in turn keeping in mind their various implications for biodiversity conservation. Human–wildlife conflict is a classic example of conflict and trade-off. An expanding population of elephants, large cats or monkeys may be a success for the protected area, in terms of both achieving conservation goals and increasing potential for tourism, but a problem for local villagers whose crops are damaged or children endangered. Similarly, a new tourist complex may bring visitors and money into the protected area but also generate significant waste streams that may pollute nearby seawater, negatively impact marine ecosystem's natural nursery functions and imperil the livelihoods of local fishing communities. Preventing local people from riding horses inside protected areas may create a more pristine environment for biodiversity and visitors alike and help to maintain the soil's natural regeneration capacity but loses support among key constituencies. Managing these conflicts is a key aspect of the lives of most protected area managers, and ensuring that one person's benefit does not substantially undermine other people is an important priority. At the same time, the primary role of nature conservation should not be overshadowed in the rush to develop other protected area values. Good assessment and, where necessary, valuation of ecosystem services can help to address these conflicts. Here synergies and opportunities can play a role. For example, understanding the links between protected areas and the surrounding landscape can ensure support from local beekeepers to help conserve flowering plants, which make high-quality honey, or local farmers who rely on the pollinators who thrive on flora in a protected area to pollinate crops or orchards.

Access and benefit sharing

The need for equitable distribution of costs and benefits has gained important backing through the development of 'access and benefit sharing' (ABS) agreements within several international treaties and instruments, including the Convention on Biological Diversity (see Chapter 26). In particular, the 'Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization' was adopted by the Conference of the Parties to the Convention on Biological Diversity at its tenth meeting on 29 October 2010 in Nagoya, Japan. It is an international agreement aimed at sharing the benefits arising from the utilisation of genetic resources in a fair and equitable way. This includes appropriate access to genetic resources and transfer of relevant technologies.

The ways in which the ABS protocol will be implemented are still subject to much discussion: from the perspective of protected areas it has important considerations relating to the rights of traditional owners, local communities and the managers of the parks themselves, depending on the area's history. While the ABS protocol does not address all protected area benefits, the need to ensure that protected area benefits and costs are balanced out equitably between those who benefit and those who manage or experience the costs remains critical.

Communicating benefits to a range of audiences

One key aspect of successful management is to make sure that people understand and appreciate the wide range of benefits from protected areas. Many, particularly indirect, values have long been treated as 'free goods' and the problems that have arisen only when they disappear, such as water pollution, soil erosion and coastal damage, are what have focused attention on their good management.

Box 6.5 Parks Canada: Thousand Islands National Park ecosystem services

Dan Mulrooney and Karen Keenleyside

The Thousand Islands National Park (TINP) is named after the larger Thousand Islands ecosystem of Eastern Ontario, Canada. The park was established in 1904 and is one of the smallest national parks in Canada. The total area is 22.3 sq km while the entire ecosystem covers an area of 3000 sq km that is bisected by the international border between Canada and the United States.

Thousand Islands has historically been a rich area that has provided a host of ecosystem services (food, water, recreation) to First Nations, early settlers and modern-day residents and visitors. The park itself was primarily created as a place for recreational activities such as picnicking, camping and boating. More recently, the park has become better known for protecting a unique Canada–United States trans-boundary ecosystem that is part of an extension of the Canadian Shield, connecting the Appalachian forest of the south-eastern United States to the northern boreal forest. The park provides critical habitat for a great diversity of plant and animal life, including more than 30 species at risk.

The population of Eastern Ontario has grown significantly in recent years. In 2011, for example, approximately 2 million people lived within 100 km of the Thousand Islands ecosystem—an increase in population of 47 per cent since 1981. Today, the TINP ecosystem is influenced by habitat fragmentation, pollution and other activities on the landscape that are associated with rapid population growth in the region. While population growth and other pressures have created challenges for the park, they have also highlighted the importance and value of the ecosystem services it protects. Parks Canada is working broadly with First Nations, adjacent communities, organisations and volunteers to protect and connect visitors with this special place while assessing and ensuring a lasting flow of ecosystem services.

A land-cover analysis using satellite imagery formed the base data from which estimates of the value of ecosystem services were produced. Within the Thousand Islands ecosystem, the three primary land covers were forest (31 per cent), cropland (24 per cent) and water (22 per cent), while wetlands and urban areas covered 7 per cent and 6 per cent of the area respectively. TINP has higher forest cover (82 per cent) and wetlands (10 per cent) and lower cropland/field (2 per cent) and built-up areas (2 per cent) compared with the entire ecosystem.

Estimating monetary values from ecosystem services protected by and flowing from the TINP supports park management, policy development and public education purposes. Two methods were used to estimate the monetary values for ecosystem services. The first method reproduced the results of the study *Estimating Ecosystem Services in Southern Ontario* by Troy and Bagstad (2009) for the case study area. The second method involved making estimates of selected ecosystem services by land-cover type, drawing from published valuation studies and transferring monetary values found in similar areas within the park. Using the first approach, estimates of the annual value of ecosystem services for the TINP were produced, ranging from C$12.5 million to $14.7 million (2012 dollars). Using the second method, the value of the park's recreation services as well as option, bequest and existence values associated with the park's wetlands were produced. The annual recreational services for all land-cover types in the park were valued at C$3.9 million (2012 dollars). Finally, the annual option, bequest and existence values of the park's wetlands ranged from C$434 000 to $531 000 (2012 dollars).

The monetary values identified for the TINP are conservative estimates and represent an experimental effort by Canadian Government departments and agencies. Depending on the approach taken and the data sets used to support the analysis, a range of value estimates can be generated. Much consideration needs to be given to the valuation methods, the supporting data and the selection of the ecosystem service or suite of services measured and reported. As demonstrated by the TINP case study, even with the selection of a small data-rich area, the analysis does not represent the total value of the national park area.

For further information concerning the case study and the production of the experimental monetary valuations for TINP, see Statistics Canada (2013).

Box 6.6 Managing for crop wild relatives

Nigel Maxted and Danny Hunter

Most genetic reserves (areas where the specific goal is to conserve the genetic diversity of CWR species) will be established in existing protected areas to avoid the cost of establishing new sites (Maxted 2003). Their implementation may be divided into five steps.

1. 'Ground truth' potential in *in situ* conservation sites. Having established the *in situ* conservation goals, an ordered list of potential *in situ* conservation sites should be established. The list of potential sites is likely to have been achieved remotely from the actual sites using eco-geographic or geographical information systems (GIS) techniques and the potential sites must be visited to check if the prediction matches the reality at the site and the CWR population is viable.
2. Reformulate protected area management goals. The first step in formulating the revised management plan is to observe the biotic and abiotic dynamics of the site for both CWR and non-CWR species. A survey of the species present in the site should be performed to help understand the ecological interactions within the reserve. A clear conservation goal should be decided, the management interventions recommended for the site and how the CWR are to be monitored to ensure the management is promoting CWR population health.
3. Ensure the *in situ* conservation sites comply with (at least) the minimum quality standards. The quality standards are related to enable the genetic reserve to function and fulfil its conservation objectives (Iriondo et al. 2012) and include such factors as: sites being identified through a rigorous scientific process; the site is of sufficient size to conserve the populations of the target taxon, its natural habitat and to maintain natural processes; a management plan using participatory and evidence-based criteria has been developed; and the site has a legal foundation that underpins long-term site stability.
4. Integrate *in situ* conservation priorities with national/international agro-environmental schemes. The selected protected areas that contain genetic reserves constitute a national network of genetic reserves and should be integrated with agro-environmental schemes.
5. Ensure local communities value and use their local CWR diversity. Promoting the involvement of local communities in *in situ* conservation and management of CWR is often crucial for conservation to be effective. Awareness of the value of CWR may need to be raised among the different stakeholders.

Finally, it should be stressed that the implementation of specific CWR *in situ* conservation actions within protected areas will ultimately be pragmatic, dictated by the resources available as well as national and regional-level governmental will, and NGO and local community involvement (Hunter et al. 2012).

Communication is therefore critical. Protected areas have the opportunity to reach a wide variety of visitors, and along with information on wildlife and walking trails, a growing number are telling people about the other values they contain (see Chapter 15). Perhaps even more important is to work with local communities to understand the full range of values—through community evaluations (see Box 6.5), meetings, discussions on community radio and articles in local newspapers. Just as essential from the protected area's perspective, however, is that large downstream users understand and where necessary pay a contribution towards the benefits, through such initiatives as payments for ecosystem services schemes (see Chapter 8).

Learning from best practice

There are an increasing number of case studies from protected areas around the world where local people, rights-holders and stakeholders are working closely together to ensure the full range of socioeconomic benefits is conserved. Three examples are given in Boxes 6.7 to 6.9, and many more can be found in peer-reviewed and published literature (see, for example, Stolton and Dudley 2010b; Kettunen and ten Brink 2013).

Cairngorms landscape, Scotland
Source: Michael Lockwood

Box 6.7 Healthy Parks, Healthy People

John Senior

In the United Kingdom, the Cairngorms Walking to Health project started in 2004 as a community health and learning initiative. Inspired by an initial demonstration health walk organised as part of a health fair, the project has since gone from strength to strength, extending geographically each year into new areas, and involving more people. In 2009, the original project, focused on Deeside and Donside in Scotland, was extended to include the whole of the Cairngorms National Park and surrounding area, and to include walk programs targeting specific health issues.

The project is led by Cairngorms Outdoor Access Trust (COAT), which employs a part-time freelance project manager, and two part-time staff who support volunteer walk leaders. The project has established 37 different walking groups, led by 60 trained and active volunteers, attracting an average of 215 walkers each week, with the number of participants increasing weekly.

Weekly walks, varying in duration from 30 to 60 minutes, aim to encourage outdoor exercise in a safe and socially enjoyable way. The walks are targeted at people who would benefit from increasing their physical activity, ranging from people struggling to lose weight to those suffering from cancer or diabetes. Considerable time and effort have been invested in developing close links with doctors and encouraging direct referral, but participation by service users and their carers is entirely voluntary. Approximately 95 per cent of participants are female, mainly aged over 55, but walks have also been established targeting younger people.

Pedometer challenges have encouraged new mothers and vulnerable adults from Aviemore to increase how far they walk each day, while on Deeside, academic evidence of the benefits of walking in delaying symptoms of early onset Alzheimer's is used to encourage patients diagnosed with the condition to take part in health walks. Group walks are also part of the range of services on offer to support people after quitting smoking.

To demonstrate the benefits of Cairngorms Walking to Health, COAT has collaborated with Paths for All, the Centre for Rural Health (a department of the University of the Highlands and Islands) and the Scottish Agricultural College in a comprehensive evaluation using six different research methods. New walker and follow-up physical activity questionnaires to monitor health improvements were complemented by focus groups, interviews, participant feedback postcards, case studies and longitudinal studies with participants and leaders. The evaluation clearly demonstrated that the project is making a very significant and highly cost-effective contribution to Scottish and local government priorities in relation to health improvement, volunteer development, long-term health condition and self-care strategies, community development and engagement, and in providing high-quality access to the local environment.

Cairngorms Walking to Health costs approximately £30 000 per annum to deliver, funded by Cairngorms National Park Authority, LEADER Programme, Scottish Natural Heritage and Paths for All, with additional in-kind support from NHS Grampian and NHS Highland. Per capita, the cost of running the project works out at approximately £140 per walker per year, which represents excellent value for money in terms of associated health and wider community benefits.

Box 6.8 Ecological restoration in and around national parks in Kenya

John Waithaka, Karen Keenleyside and Erustus Kanga

Kenya is famous for its beautiful national parks, great wildlife diversity and panoramic landscapes and is dependent on biological resources for much of its social and economic development. Agriculture, livestock, forestry, nature-based tourism and fisheries account for nearly all the employment, economic output and export earnings. To safeguard its rich biodiversity resources, Kenya has designated an extensive network of protected areas.

Wildlife tourism, which is based primarily in protected areas, is among the top sources of revenue for Kenya, contributing 21 per cent of the total foreign exchange, 12 per cent of the country's gross domestic product (GDP), and supporting the livelihoods of several million people (WRI 2007).

In addition to tourism, Kenya's protected areas support other sectors of the economy such as energy, water, agriculture, security, forestry and horticulture. In Tsavo West National Park, for example, the Mzima Springs, which are the park's most important natural feature, provide habitat for wildlife, attract thousands of visitors and supply 360 million litres of water daily to about 2.5 million people downstream, including in Kenya's second-largest city, Mombasa (NWCPC 1998). In Tsavo East National Park, the largest national park in the country, the Voi River is a major source of water for wildlife and for communities which border the park. Similarly, swamps that are mainly located in Amboseli National Park sustain wildlife and people in the greater Amboseli ecosystem. In the mountains of central Kenya, Mount Kenya National Park (which is also a UNESCO World Heritage property) and the Aberdare National Park are the sources of rivers that provide water to approximately half of Kenya's population and produce nearly 60 per cent of Kenya's hydroelectric power (UNEP 2009).

Many of the important benefits that Kenya's national parks provide to the Kenyan people and their economy are even more crucial in the context of climate change. Droughts are becoming more frequent, prolonged and severe in the south and unusual weather patterns appear to be contributing to unpredictable river flows and lake water-level fluctuations in the central highlands and Rift Valley. These changes can put increased pressure on natural resources and the benefits derived from them. The conservation of healthy park ecosystems is recognised as an important strategy for helping Kenyan wildlife and human communities adapt to climate change. Additional pressures on park ecosystems, however, such as overgrazing by wildlife and livestock, and the spread of invasive species, which are sometimes also aggravated by climate change, mean that park managers have to actively manage these systems to ensure they remain resilient to climate-related changes and can continue to provide important benefits into the future.

The Kenya Wildlife Service is taking action to reduce pressures on national park ecosystems and restore areas that have already been damaged in order to build the resilience of ecosystems and the communities which depend on them to climate change and other stressors. For example, riparian areas around Mzima Springs in Tsavo West National Park, which were degraded due to overgrazing by wildlife, have been fenced and revegetated to reduce erosion and siltation. At the same time, alternative watering sites for wildlife inside the park have been installed, thus helping to protect clean water for downstream users and reducing the risk of human–wildlife conflicts that could result from wildlife seeking alternative water sources outside the park. Similar work has been conducted to restore terrestrial habitat and swamps in Amboseli National Park. There, community and livestock watering sites outside the park have also been improved to reduce grazing pressure on the park ecosystem while helping to maintain the traditional way of life of the local people.

Reafforestation in Mount Kenya and Aberdare National Parks has been an important part of restoration efforts aimed at helping to retain water in the important watersheds that these parks protect. The work has also resulted in benefits for local people, including training of members of local community forest associations in modern propagation and reafforestation techniques and the modernisation of community tree nurseries. Along with community groups, park visitors have been directly involved in restoration efforts such as tree plantings, which have not only provided memorable experiences for them but have helped to build support for restoration efforts and raise awareness of the important climate change adaptation benefits these protected areas provide.

As is the case in many protected areas, invasive species are a management issue for Kenya's protected areas, as well as for local communities which practise subsistence agriculture. In Amboseli, Tsavo East and Lake Nakuru National Parks, local people have been trained in invasive species identification and have been employed by the Kenya Wildlife Service to help with eradication efforts. Invasive species removal has not only improved wildlife habitat in the parks, but also has improved wildlife viewing opportunities for visitors. Employment opportunities provided by the parks have been important for local communities but, perhaps more importantly, local people have, through participation in this work, gained important knowledge and skills that are transferable to other aspects of their daily lives.

Whether the benefits of protected areas are associated with tourism, provisioning of water, regulation of or adaptation to climate change, knowledge transfer, or support for traditional lifestyles, implementation of active management strategies aimed at maintaining or restoring these benefits is often necessary. The Kenyan work described above is just one example of how multiple benefits can be maintained or restored through actions that simultaneously address ecological issues associated with the structure and function of ecosystems while at the same time considering visitor experience, learning opportunities and the needs and values of local people.

Box 6.9 Kenozersky National Park, Russia: The benefits of joint management

John Senior

Kenozersky National Park, located in the north of the European part of Russia, was established in 1991. The park is one of the most attractive places in Russia, recreating an atmosphere of amazing harmony between humans and nature by initiating the significant involvement of local residents in joint management.

Active local residents within the park were interested in the development of the local economy and wanted to 'take their lives into their own hands'. The establishment and implementation of territorial public self-government, named locally the 'Spark of Hope', has realised this goal.

Over the past decade, a tourism development program has helped the local population become more open to cooperation with park management. The program has a number of elements: food production, activity-based tourism, heritage restoration and education. The first of these relates to the production of organically grown foods, restoring the traditions of Pomorian cuisine (Pomor being one of the ethnic groups of the population in the north of Russia).

A micro-credit fund was established to support local people for the development and maintenance of small nature-friendly businesses to serve visitors. Since 2001, the park has actively developed rural tourism, which is attractive for Russian and foreign tourists. More than 30 local families converted their homes in the park to guesthouses providing activity-based services (boating, fishing, sightseeing, biking and hiking) with relatively inexpensive accommodation for the night, weekend or holiday period in cosy farmhouses. Hosts are always ready to show all the attractions in the vicinity and provide opportunities to try local traditional home cooking, fishing, picking mushrooms and berries, and horseback riding. Visitors can also take part in some simple farm work, such as haymaking, feeding animals and harvesting vegetables.

Kenozersky National Park is now well known in Russia not only for its picturesque natural forests and lakes but also for the numerous examples of restored timber architecture (especially chapels and farm buildings) that blend into the northern landscapes. Once these structures have been restored using traditional skills at state cost, community leaders become permanent employees of the park as the guardians of these heritage buildings. The special spiritual experience that has been created through the presence of 'live' objects of cultural heritage together with the revival of the traditions of the local population is one of the main factors of attractiveness of the area for tourists.

Education, through annual children's environmental camps, has become a major feature of the park. The camps are attended by students from the Arkhangelsk region as well as from Moscow, and even from neighbouring Finland. These camps also accept children from the villages located in the park as well as from orphanages and socially disadvantaged families. The main campsite is in a picturesque setting near the Maselga village. It is a small log-cabin 'town' in a setting vastly different from what the visiting city children are accustomed to. Children actively participate in a range of subjects, including meteorology, geobotany, hydrobiology, as well as studying the history of the village and the cultural heritage of the region. In addition to outdoor exploration, each child takes part in masterclasses in traditional crafts including birch bark weaving, modelling clay toys and learning traditional folk songs. Local elders and artisans provide much of the tuition for these classes.

Together these four elements have enabled a revival in the local economy, provided pride and self-esteem to locals and recreated Kenozero National Park as a vibrant visitor attraction.

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