



CHAPTER 16

MANAGING THREATS

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TITLE PAGE PHOTO

Visitors viewing Ta Prohm near Angkor Wat, Cambodia, a World Heritage property: the sheer numbers of people and frequency of visits to cultural (and natural) destinations may be a threat to the values of such destinations and such visitor use needs active management

Source: Graeme L. Worboys

Introduction

Protected areas *inter alia* aim to support the persistence of biodiversity and the conservation of natural and cultural heritage. While the definition of protected areas (see Chapter 2) may be interpreted in more than one way, the concept of protected areas has been adopted by countries across the world and adapted according to their specific national or local contexts. Protected areas do perform important conservation functions and protect biodiversity, especially from indiscriminate destruction; however, even when protected areas appear to be maintaining their values, they may be undergoing imperceptible changes and declines, leading to ‘half-empty forests’ with loss of biodiversity (Peres and Palacios 2007). Protected areas all over the world are beset by a host of threats that undermine the aims of conservation. Protected area management needs to develop the capacity and apply innovative and adaptive approaches for handling a range of complex and often interrelated threats that not only stem from issues specific to an individual protected area but also are driven by factors well beyond protected area boundaries and control.

This chapter provides, first, a description of threats to protected areas and offers a classification of the nature and characteristics of threats based on the protected area threat classification given by Worboys et al. (2006). Next, the chapter discusses generic approaches to responding to threats like encroachments on protected areas, human consumption of ecological assets, poaching of wildlife, fertiliser use (nitrogen deposition), overharvesting of fish stocks and climate change. As a concrete example, it focuses on the process of managing invasive species threats, giving examples from Africa and Asia, as this threat to biodiversity has been identified as being among the major pressures globally (Butchart et al. 2010). Human–wildlife conflicts are also used as an example of how to address a threat. Finally, the chapter discusses the importance and the application of principles of good governance in managing for threats.

Classification of threats

The Convention on Biological Diversity (CBD) has defined a threat to a protected area as ‘any human activity or related process that has a negative impact on key biodiversity features, ecological processes or cultural assets within a protected area’ (CBD 2014a). Threats to protected areas may also arise from natural causes and events such as natural fires, earthquakes, floods, and so on. Threats jeopardise the protected area’s values

(see Chapter 6) and are closely linked to them. Thus, they are very diverse in nature and what may be a threat somewhere may not be seen as such in another protected area or may evolve through time and go on to become a threat. It is difficult to establish a comprehensive global list of threats to protected areas, although various threat assessment frameworks have classified and assessed threats to protected areas, biodiversity and ecosystems.

They have done this in different ways (Carey et al. 2000; MEA 2005; Salafsky et al. 2008; WWF 2012). The International Union for Conservation of Nature (IUCN) Conservation Measures Partnership (CMP), for example, developed a classification of threats to biodiversity in order to provide a unified scheme for classifying threats globally (Salafsky et al. 2008). This Unified Classification for Threats and Actions is constructed in a tiered manner, with direct threats classified at three levels (analogous to families, genera and species in the Linnaean system of biological classification). What this means is that a threat to biodiversity identified at the first level is subdivided into several second-level entries that in turn are subdivided at a third level (Figure 16.1).

With specific regard to protected areas, Worboys et al. (2006) developed a classification of threats and underlying causes that drive threats, both direct and indirect, to protected areas. This classification, while not organised in a hierarchical or tiered fashion as in the classification by Salafsky et al. (2008), shares a similar conceptual approach to analysing threats to protected areas as direct and indirect, identifying the underlying causes and managing protected areas for conservation actions that address such threats. Worboys et al. (2006), in particular, distinguished direct and indirect threats by their spatial characteristics, as explained in the next section.

Understanding threats through such a framework is intended to help protected areas managers and frontline staff to identify threats in their protected areas, learn about other protected areas and the kinds of threats faced, and how these can be tackled. Threats have also been classified into external and internal threats in the context of Indigenous Peoples’ and Community Conserved Territories and Areas (ICCAs), which are often vulnerable to the negative impacts of threats in a way that is different from other types of protected areas (Box 16.1).

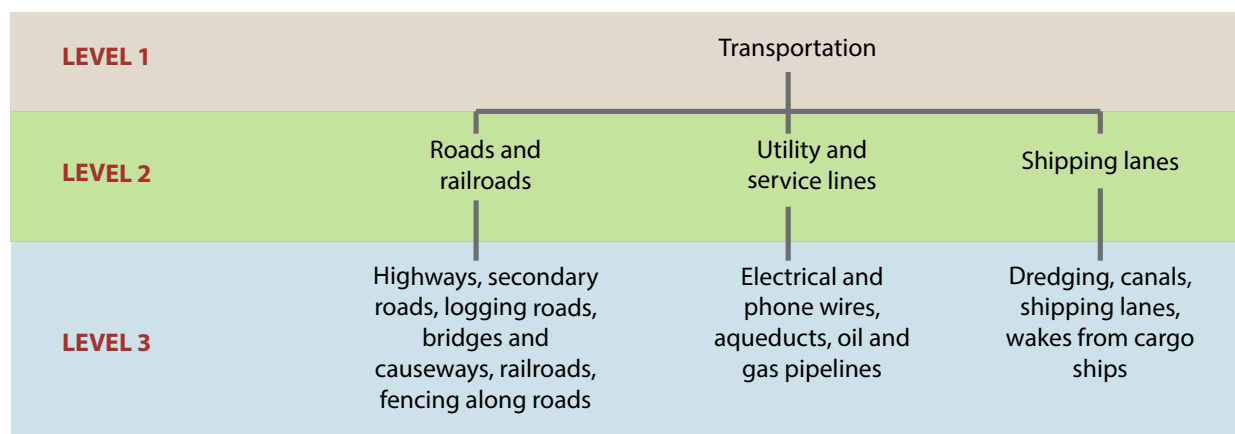


Figure 16.1 Example of a three-level threat classification

Source: Adapted from Salafsky et al. (2008)



Despite the best efforts of protected area managers, dumped garbage (such as in this protected area in Asia) is a constant source of frustration and part of the real cost of actively managing protected areas

Source: Graeme L. Worboys

Direct threats

Direct threats result from proximate (in general, within the protected area) human activities or processes that cause the degradation of protected area values and hinder progress towards meeting its conservation goals. Direct threats can often be—but are not always—caused by human activities that may be tackled by appropriate management interventions. Direct threats also result from natural events such as fires and tsunamis, among other extreme natural events or cataclysms. Direct threats range from on-site pollution, water withdrawal and tourism infrastructure development within the protected areas to illegal activities, invasive species and war and civil conflict.

A description of direct threats and their consequences for protected areas is given in Table 16.1, and Case Study 16.1 provides an example of a direct threat (poaching) in Ghana's national system of protected areas.

Table 16.1 Threats to protected areas: Examples of direct threats

Direct threat	Potential consequences	Related chapter(s) in this book
On-site pollution, impacts of chemicals	Damage to natural ecosystems and species, tourism and recreation values, human health	19, 20, 23, 24
On-site impoundment/diversion of streams and rivers, groundwater withdrawal	Damage to natural ecosystems and species, blocking of migration passages	19
Excessive livestock grazing	Damage to natural ecosystems and species, tourism and recreation values	25
Mining	Damage to natural ecosystems and species, tourism and recreation values, cultural heritage	25
Infrastructure and industrial development within the protected area	Damage to natural ecosystems and species, cultural heritage	24
Unsustainable tourism	Damage to natural ecosystems and species, social and cultural heritage	23
Excessive resource extraction; overharvesting including poaching, hunting, fishing, fodder and fuel-wood extraction, logging (legal and illegal)	Damage to natural ecosystems and species, cultural heritage, tourism and recreation values	25
War and civil strife	Damage to natural ecosystems and species, social and cultural heritage, infrastructure, human life	26
Inadequate or incompetent technical and protected area management actions, processes and resources	Damage to natural ecosystems and species, social and cultural heritage, infrastructure, human life	8, 12, 13, 24
Invasive species of plants and animals	Damage to natural ecosystems and species	21
On-site cataclysmic natural events (such as fire, flood, earthquakes, volcanic activity)	Damage to natural ecosystems and species, infrastructure, property, human life	24, 26

Source: Adapted from Worboys et al. (2006)



A wrecked and looted car dumped in protected area bushland in southern New South Wales, Australia: the urban–protected area interface in particular is affected by such illegal acts and rangers constantly need to clean up such garbage

Source: Graeme L. Worboys

Case Study 16.1 Assessing threats to protected areas in Ghana: The case of poaching

The three main threats identified in the protected area system of Ghana through the Rapid Assessment and Prioritisation of Protected Area Management (RAPAM) methodology, conducted in December 2009, are: poaching, bushfire and land conversion mainly due to agriculture around the protected areas (Figure 16.2). Other threats mentioned are illegal fishing, invasive species (plants) and pollution, but they affect the protected areas to a lesser extent. Poaching is the most widely distributed threat and its intensity varies from one park to another.

Indeed, poaching exists in all protected areas of Ghana at different degrees of severity (Figure 16.3). It is particularly high in Kakum National Park, despite the good law enforcement strategy in place, and also present in Ankasa, Shai Hills and Mole national parks. There is a high demand for bushmeat all over the country. Rattan is poached

for craft, elephant is poached for tusks and leopard for skin. In Bia, the killing of animals is mostly as a result of human–wildlife conflict. In Kyabobo, this pressure is very low, despite the high demand for bushmeat. This is because of the enhanced law enforcement leading to highly reduced poaching activities. Furthermore, the park has encouraged the creation of community resource management committees that regulate the harvesting of non-timber forest products, which contributes to decreasing effects from poaching. Regarding Bia, there are small local markets near its international borders that are seriously involved in the bushmeat trade; the wildlife population outside the parks is limited, so protected areas are the major source of bushmeat—mainly to meet the protein requirements of the local population.

Source: IUCN PAPACO (2010)

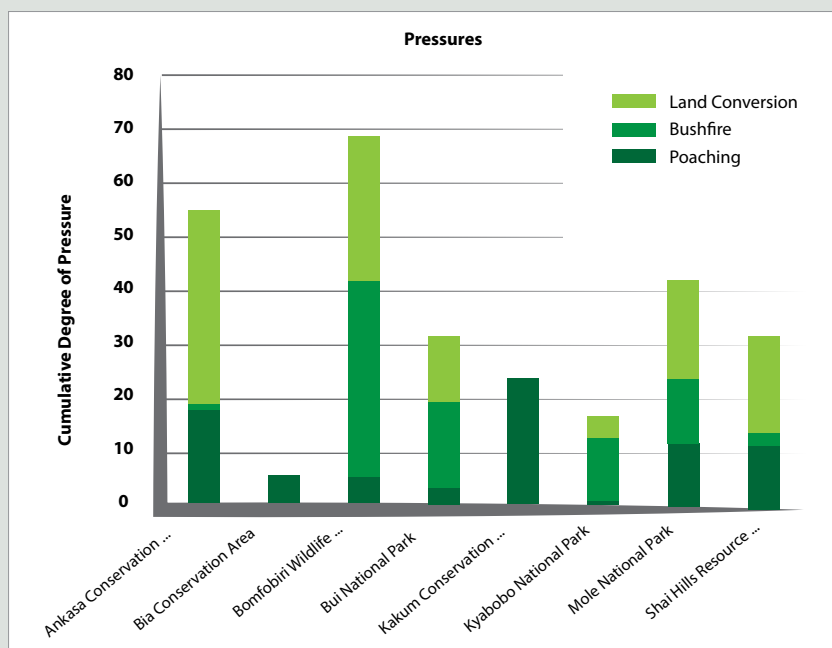


Figure 16.2 The main threats to the protected area system of Ghana

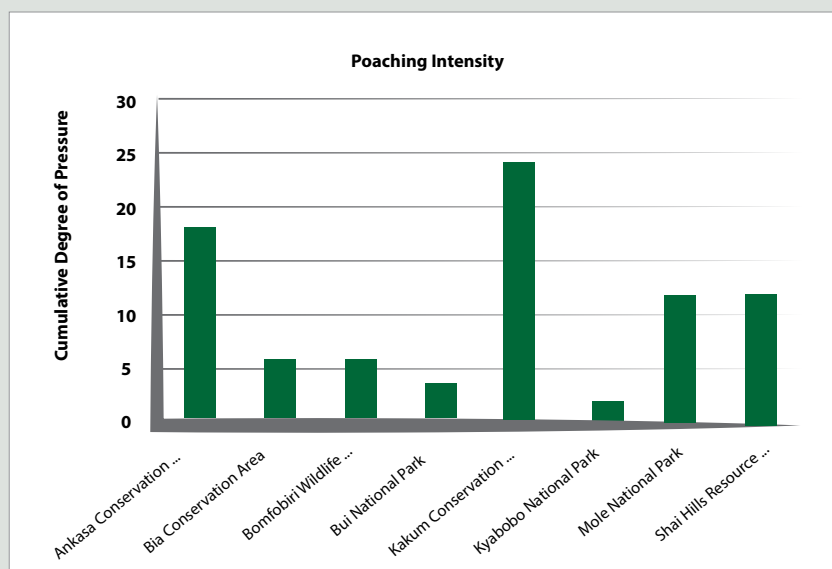


Figure 16.3 Poaching intensity in the protected areas of Ghana



Bushfire in eastern Australia: frequent unplanned bushfires can impact on the natural heritage values of protected areas

Source Graeme L. Worboys



Acidic mine water flowing from an abandoned mine: polluted water such as this flowing into any catchment—and protected area catchments in particular—needs to be thoroughly and adequately treated

Source: Graeme L. Worboys

Indirect threats

Indirect threats are those that arise from outside protected areas, but which affect values within protected areas and jeopardise their conservation goals (Table 16.2). Indirect threats include climate change (see Chapter 17) and off-site activities such as pollution, damming of

ivers, diversion of water, application of pesticides to crops and land-use changes around the protected area that are incompatible with protected areas and also reduce landscape connectivity.

Table 16.2 Threats to protected areas: Examples of indirect threats

Indirect threat	Potential consequences	Related chapter(s) in this book
Off-site pollution	Polluted water affecting marine or terrestrial ecosystems and species in protected areas, polluted air affecting ecosystems and species	19, 20, 24
Off-site damming of streams and rivers, diversion of water, groundwater withdrawals	Inadequate water resources or disrupted hydrological and soil and nutrient deposition patterns for wildlife in protected areas, blocking of migration passages, damage to natural ecosystems	19
Inappropriate land use and sea use	Land-use change, habitat loss and fragmentation due to human settlement, urban development, agriculture, resource extraction	27
Climate change	Changes to habitat and species distribution and abundance, increased risk of species extinctions Changes to rainfall, stream-flow regimes, flood patterns, ice distribution, frequency and severity of storms/other extreme weather, frequency and severity of fires Inundation of low-lying areas through rising sea-levels Impacts on corals, coral bleaching	17

Source: Adapted from Worboys et al. (2006)

Underlying causes

Underlying causes are the factors that ultimately drive threats to protected areas. These are usually economic, social, political, institutional or cultural factors that contribute in an interrelated way to create one or several direct and indirect threats. Among the many underlying causes of threats are human population growth, growth in consumption, economic development aspirations and activities, weak or inadequate legal systems, powerful

vested interests, imbalance of power, poor decision-making, lack of political will, absent or weak tenure and rights regimes, policy failures, and contradictory or opposing values. An example of opposition between conservation and extractive industries, in Guinea, is provided (Case Study 16.2). A lack of information, awareness and education, and inadequate funding for conservation are also issues (Table 16.3).

Table 16.3 Threats to protected areas: Examples of underlying causes

Underlying causes	Potential consequences	Related chapter(s) in this book
Human population growth	Unsustainable consumption of natural resources, waste generation	5
Higher consumption, material aspirations	Unsustainable consumption of natural resources, waste generation	5
Inadequate economic systems, inequitable economic growth, inappropriate socioeconomic, political and governance mechanisms	Failure to account fully for environmental costs and benefits Poverty and lack of choices, lack of options to adopt sustainable practices Ability by rich to extract resources without feeling negative feedback Harmful subsidies, lack of incentives for environmentally positive activities Lack of resources for protected area management and conservation Inequitable management, ownership and costs and benefit sharing Profit motives prioritised above all else	5
Inadequate legal and political systems	Policies that fail to secure environmental protection Lack of political will and commitment Prevalence of corruption leading to enforcement, management and governance failure Weak, absent or inappropriate legal tenure and rights over land and resources Absent, weak or inappropriate recognition of conservation practices of non-governmental actors, including indigenous peoples and local communities Excessively centralised control, lack of public participation in governance	5
Breakdown or dysfunction of social, cultural or political relations	War, conflicts and civil strife that hinder protected area management or destroy protected areas	5
Values and attitudes incompatible with conservation goals	Impairment of protected area management, conservation failure	5
Inappropriate governance and management	Damaging management policies and actions, poor planning, improper implementation, incompetent execution, iniquitous or poor governance	7, 8, 12, 13
Lack of information, knowledge and education, inadequate recognition of relevant knowledge systems	Lack of awareness of threats to protected area values and benefits of protected areas	5, 6, 11
Lack of technical and human capacity, low levels of human resources for protected area management	Improper or inadequate identification of problems and solutions to environmental problems, inadequate management response, inability to implement	8, 9, 10, 12, 13

Source: Adapted from Worboys et al. (2006)

Case Study 16.2 Mount Nimba: A World Heritage site under great pressure

The strict nature reserve of Mount Nimba has been classified as a biosphere reserve and UN Educational, Scientific and Cultural Organisation (UNESCO) World Heritage property since 1981. It is located between Ivory Coast, Guinea and Liberia. Mount Nimba is both a very rich and specific ecosystem and a very large iron ore reserve. In theory, Mount Nimba is totally protected, however, iron ore deposits are mined both in Liberia, with a railway linking Mount Nimba to the Buchanan mining port, and in Guinea, where an area with high mineralisation was declassified as World Heritage to enable prospecting to be carried out. Given Liberia's economic and political instability, Guinea plans to construct more than 1000 kilometres of railway line between Mount Nimba and Kamsar mining port. The planned line would pass along the boundary of the strict natural reserve of the Ziama mountain range.

For more than 20 years, the mining of Mount Nimba iron ore in Guinea has been an issue of contention between

environmental activists and mining supporters. There is a unique mountainous ecosystem harbouring endemic species and in particular the western Nimba toad (*Nimbaphrynoides occidentalis*) and the Nimba otter shrew (*Micropotamogale lamottei*). The altitude of Mount Nimba influences the climate of the region. Then there is a project worth several billion dollars (the railway line and deep-water port of Conakry were estimated in 2008 to be worth US\$4 billion, to which can be added several hundred million dollars to develop the mine itself) with tens of thousands of jobs and royalties guaranteed for about 20 years.

To date, the project is restrained by the high investment cost. If, however, metals maintain their current prices, the project could soon begin. On the Ivorian side, preliminary prospecting has also been noted.

Source: IUCN PAPACO (2014)

Although threats identified in Tables 16.1, 16.2 and 16.3 have been presented as individual issues, for managers they are often interacting and interrelated. For example, threats to protected areas associated with recreation and tourism can include development of infrastructure, fragmentation through roads and powerlines, pollution, increased risk of wildfire, hunting and fishing, and increased human populations in adjacent areas.

Both evaluation and planning for improved management need to take into account the interrelationships between the threats and to identify their root causes, if effective and sustainable management solutions are to be devised and implemented. Moreover, many threats relate to the interface between conservation and human welfare and therefore are very challenging to resolve. This is even more so in regions with rapidly growing populations and developing economies. Many other threats relate to deeply set patterns of development and consumption that are hard to change, which is especially so in industrialised countries and among rich populations of all countries. Some of the threats facing ICCAs are described in Box 16.1.

Threat assessment and management

According to the CBD's Programme of Work on Protected Areas (PoWPA), a protected area threat assessment should include an analysis of the type, extent and impact of a range of threats on the health and integrity of biodiversity within a protected area (CBD 2014a). The typical steps involved in assessing threats to protected area biodiversity are described in Figure 16.4.

A number of management tools are available for assessing threats and some of these may be found on the CBD website (CBD 2014b), including an e-course on threat management. Other tools are included in protected area management effectiveness assessments (see Chapter 28) such as the Management Effectiveness Tracking Tool and the Rapid Assessment and Prioritisation of Protected Area Management (RAPPAM) methodology. With these tools, threats are usually linked to the values that the protected area is trying to conserve, as exemplified by Kakum National Park in Ghana (Case Study 16.3).

Planning conservation actions to address threats

General management actions include setting priorities, developing a situation analysis, designing and implementing a strategic plan, developing and implementing a monitoring plan, and analysing and communicating results (CMP 2013). They also include fundraising, reporting, administrative work, and developing and managing the institutions associated with a protected area. At times they may involve the creation or strengthening of institutional structures for the purpose. Specific conservation actions, in contrast, are specific interventions to counter specific threats to biodiversity or restore degraded biodiversity targets. Strategies and action plans for managing threats must be guided by desired conservation outcomes that should be identified as clearly as possible early in management planning.

Box 16.1 Threats to Indigenous Peoples' and Community Conserved Territories and Areas

The IUCN defines ICCAs as 'natural and modified ecosystems with significant biodiversity, ecological and related cultural values, voluntarily conserved by indigenous peoples and local communities through customary laws or other effective means' (Kothari et al. 2012:16). They are increasingly recognised as areas of significant biodiversity and cultural diversity that need not only appropriate recognition but also support in order to combat threats to their continued existence. Key threats affecting ICCAs have been broadly classified into indirect (or external—that is, those threats originating from outside actors or phenomena) and direct (or internal—that is, arising from within the community or people).

Direct threats

- **Inequalities between economic and social classes and gender groups** within the community, leading to conflicts about the management of natural resources and benefits arising from their use.
- **Changing values**, integration into the dominant society and economy, loss of interest in traditional knowledge and practices, and loss of the group's original language, particularly among young people.
- **Population growth** or, conversely, depopulation leading to increased pressure on the natural resources of ICCAs or loss of traditional knowledge and institutional arrangements, respectively.

Indirect threats

- **Lack of or inappropriate recognition** of the ICCA by the state or civil society, which makes it vulnerable to other threats such as those from land-use change. For example, in Iran, there is mostly no official recognition of ICCAs and natural resource management controls remain with the state despite the nomadic peoples having conserved grazing lands for long periods.

- **Weak or inadequate legal tenure or rights** over ICCAs and their resources. For example, in sub-Saharan Africa, customary land rights and common property natural resource governance regimes are widely unrecognised, and communities are effectively tenants of the state.
- **Development and resource exploitation processes**, such as mining and fossil fuel extraction, logging, industrial fishing, dredging, conversion to monocultures (including agro-fuel crops), dams, urbanisation, roads, ports, airports and tourism). For example, in many countries dams have resulted in loss of biodiversity, displacement of local communities or indigenous peoples and loss of cultural heritage.
- **Increasing pressure on resources** from demands of the larger external market economy. For example, in Australia, employment and other benefits offered by mining companies often win over traditional landowners' resistance despite veto rights against mining on their lands.
- **Encroachment on the ICCA** by state-sponsored policies or by unauthorised but more powerful interests.
- **Inappropriate forms of recognition** that create a conflict between the traditional governance systems of the ICCAs and systems imposed by top-down arrangements or legislation. For example, in England, traditional governance systems of the commons can be in conflict with systems imposed under relevant legislation or in relation to protected areas.
- **Inappropriate and active acculturation of communities**—for example, through education programs that are disrespectful of local cultures, livelihoods and values, or evangelisation programs of different faiths.

Source: Adapted from Kothari et al. (2012)

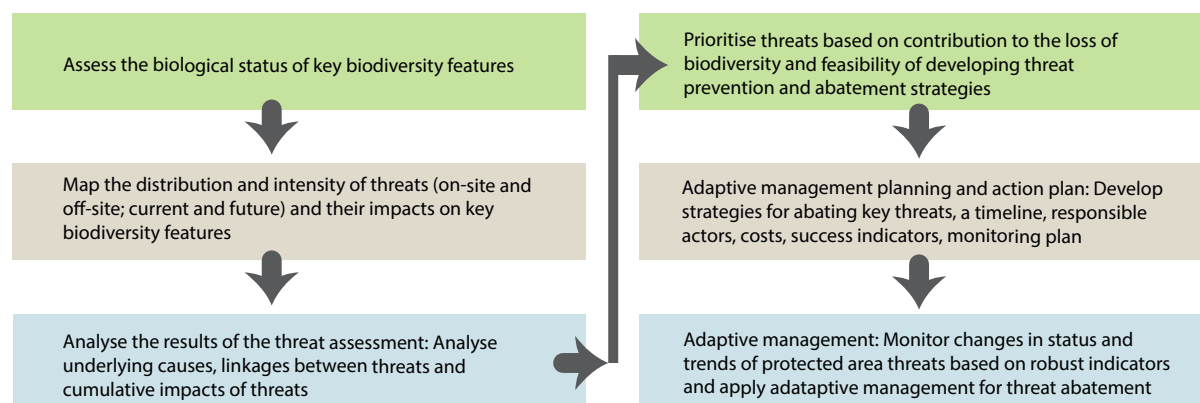


Figure 16.4 Key steps in assessing threats to biodiversity in protected areas

Source: Adapted from CBD (2014a)

Case Study 16.3 Kakum National Park, Ghana

Threats can be quite easily identified through a rapid consultative assessment of management effectiveness. The 36 000-hectare Kakum National Park (IUCN Category II) in southern Ghana was assessed using the Management Effectiveness Tracking Tool in 2011, to help with the revision of its management plan and with developing an adaptive management response to help protect its main values.

The natural, cultural and social values identified for Kakum National Park were:

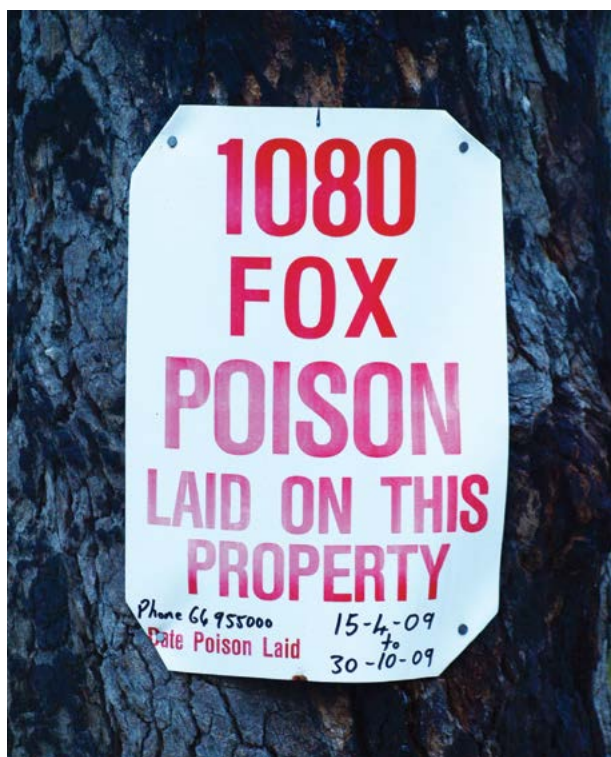
- a network of rivers
- highlands, swampy and muddy area landscapes
- a sample of a pristine rainforest ecosystem
- a typical reforestation model of the upper Guinean rainforest
- endangered species such as the bongo (*Tragelaphus euryceros*), forest elephant (*Loxodonta cyclotis*), black-and-white colobus monkey (*Colobus* sp.), yellow-backed duiker (*Cephalophus silvicultor*) and Diana monkey (*Cercopithecus diana*)
- charismatic species such as leopard (*Panthera pardus*), giant forest pangolin (*Manis pangolin*) and various birds and butterflies

- cultural values including sacred sites and traditional rites closely related to the rainforest such as the use of drums
- economic values including climate change mitigation and control at local, regional and global levels; the protection of the sources of the main rivers bringing water to surrounding populations; the conservation of plants of economic value; and tourism.

The main threats related to these values were identified as:

- poaching
- overuse by tourists in certain areas
- invasive species (plants)
- pollution of rivers with chemicals used for fishing purposes or coming from the surrounding croplands
- harvesting of vegetation products (such as raffia for roof making, medicinal plants and wood for fuel).

Source: IUCN-PAPACO (2011a)



In Australia, the introduced red fox (*Vulpes vulpes*) is a serious threat to small mammals and birds and active control programs are planned and implemented for protected areas, including the use of carefully designed and distributed poison baits that target foxes

Source: Graeme L. Worboys

Any entity (government, non-governmental, community or co-management) responsible for managing a protected area would ideally have a management plan (formal or informal) that is designed to take into account actual and potential threats to the protected area, the consequences of such threats and ways in which to avoid or mitigate them (see Chapter 13). Although managing threats to protected areas is based on the precautionary principle, particularly for threats with severe and potentially irreversible consequences, often management responses may be driven by situational factors specific to the local history and prevalent economic and political climates. The importance of applying adaptive management based on the evaluation of results and lessons learnt so that it can evolve according to the dynamic requirements of protected area conservation is also well recognised (CMP 2013). At the same time, a focus is needed on specific conservation activities that address threats and the management and monitoring of these actions are important (Box 16.2).

Management zoning and sustainable-use limits

Management planning for protected areas typically employs planning tools, zone management schemes, models and techniques that address threats and seek to minimise their negative effects. Some protected areas

Box 16.2 Monitoring Information System Tool: Software for monitoring the application of law and addressing poaching in protected areas

The fight against poaching—one of the main threats in African protected areas—is subject to the application of current legislation. This requires not only initial knowledge of the law but also the subsequent capacity to use limited human and material resources effectively and efficiently. To do so, access to pertinent, regular and timely spatial-temporal data regarding threats to the protected area is essential to enable protected area managers to take enlightened surveillance decisions (planning, patrols and activity assessment). These data can only be gathered by rangers. ‘Ranger-based monitoring’ is a system to organise data collection by rangers in such a way that they can be used for both managerial and strategic needs. The data provided by rangers are used to monitor conservation efforts, discourage illegal activities, identify the most endangered areas and assess future or potential threats.

The Monitoring Information System Tool (MIST) software has proved to be an effective application for ranger-based monitoring. It facilitates planning and monitoring while avoiding the problems encountered with geographical information systems (GIS) software, which require too much specialised assistance and equipment. MIST works on normal computers and, once set up, it can be managed by a non-specialist and the information can be easily and rapidly shared or backed up between sites by email. As well as its user-friendliness, MIST can be used to rapidly produce patrol maps and make a simple or sophisticated analysis of aggregated data.

Finally, MIST can store data on legal monitoring when infringements are registered. For example, the national parks network in Gabon has used MIST since 2011. The information gathered by rangers during their rounds is summarised in monthly, quarterly and annual reports. This information is used by park managers in their decisions regarding surveillance strategies and one can now see the efforts made to cover national parks and the results. The new version of MIST, baptised SMART, is in 2014 being tested in five African countries (including Gabon) and in five Asian countries.

Source: IUCN PAPACO (2011c)

are spatially differentiated into zones with specific management objectives that will address the potential threats—for example:

- a core zone where human activities are disallowed other than for necessary management or occasional sociocultural uses
- a buffer zone, which is intended to act as a buffer for the protected area nested in the larger landscape; a buffer zone is often a multiple-use zone where management allows for different levels of resource use and extraction, which may be carried out based on rights-based approaches for local communities or for government revenue collection
- a recreation or tourism zone where visitor management is key.

Limits on resource use or visitor numbers are applied by protected area management to ensure sustainable use—for example, the amount of small timber that may be extracted by forest-dependent communities, the number of grazing permits for livestock or the number of tourists allowed to visit a protected area each day. Defining limits on resource use is increasingly sought through a consultative process by or with communities, researchers and protected area managers using a rights-based approach that respects traditional and customary rights (Chapter 25).

Prescriptions for visitor-use limits need to be clearly worked out if threats to the natural and cultural heritage values of protected areas from excessive tourist numbers or inappropriate tourism are to be avoided. Recreational planning frameworks such as the recreation opportunity spectrum and other recreational opportunity management systems as well as visitor impact management frameworks can help identify threats and minimise social and environmental impacts (see Chapter 23). Moreover, community-based and community-run tourism offers opportunities for equitable management of protected areas and promotes sharing of tourism revenue and other benefits with local communities.

Using environmental impact assessment to address threats

Environmental impact assessment is a process that many countries around the world follow to help harmonise development proposals with conservation needs (Byron 2000; UNEP 2002). Sometimes, however, the nature of developmental activity is such that addressing threats effectively lies beyond the scope of a conventional environmental impact assessment process.



Visitor safety sign for bison (*Bison bison*), which are wild, free-roaming animals in Yellowstone National Park, USA

Source: Graeme L. Worboys

This is particularly true for mining and other extractive industries, and each sector has its specific processes and rules (Case Study 16.4). Another example, hydropower development, may involve the construction of a series of dams (big, medium and small) whose impact potential cannot be gauged by the case-by-case approach as practised in environmental impact appraisal. Mitigation of threats in such situations may be better addressed by a cumulative environmental impact assessment (Rajvanshi et al. 2012) or strategic environmental assessment. Global experience suggests that environmental impact and cumulative environmental impact assessment processes are relevant to address threats arising from specific development processes. To meet the larger challenge of effectively addressing the upstream and downstream impacts of development projects in a holistic manner, there is, however, a need to conduct environmental assessments at a strategic level.

Strategic (or sectorial) environmental assessment is a participatory approach for upstreaming environmental and social issues to influence development planning, decision-making and implementation processes at the strategic level (Mercier 2004). It is a systematic process for evaluating the environmental impacts of a proposed policy, plan or program (or sector) in order to ensure that environmental consequences of development are addressed at the earliest appropriate stage of decision-making (Sadler and Verheem 1996). Although very few countries have enacted strategic environmental assessment as a legal instrument, there is an urgency to mainstream such assessment in environmental planning



Enthusiastic but potentially unsafe visitor behaviour near wild bison, Yellowstone National Park, USA

Source: Graeme L. Worboys

through other enabling mechanisms of governance processes, policy initiatives and voluntary practices. Guidelines for strategic environmental assessment have been prepared (Slootweg et al. 2006; Partidário 2012). This approach is also relevant in the context of protected areas being embedded in connectivity conservation areas as well as being integrated into wider landscapes and seascapes (Chapter 27; Ervin et al. 2010).

Managing direct threats

Most management effectiveness assessments of protected areas evaluate, to a certain extent, the types and level of threats to protected area values and management. In a comprehensive study of management effectiveness evaluation in protected areas, Leverington et al. (2010) provided a global picture of threats from 227 protected area management effectiveness reports covering 125 countries and 6125 individual protected area assessments. Adapting the threat classification developed by the IUCN and the CMP (IUCN-CMP 2006; Salafsky et al. 2008; Leverington et al. 2010), the research identified the most common threats. In most regions, the most commonly reported threats included: hunting, killing and collecting animals; logging and wood harvesting; gathering non-timber forest products; recreational activities; invasive alien species; and the management of adjacent lands. In some regions such as Australia, invasive species and fire management were reported more often, while residential or commercial development emerged as the most frequent threat in Latin America. Overall, biological resource use, including

Case Study 16.4 Oil and gas environmental impact appraisals in West Africa

For any protected area, oil and gas exploration and/or extraction is a serious threat. It is the same for the development of a mine. Generally, however, oil laws differ significantly from mining laws. A survey conducted in West Africa showed that oil exploration blocks are delineated by the government and granted through a call-for-tender process or by direct negotiation with oil companies. Oil exploration and production licences are entirely covered by oil agreements or contracts that govern the holders' rights and obligations more specifically than do mining laws. While standard oil agreements are in the public domain, the agreements themselves are not, and it is impossible to know their specific content.

By way of example, the standard oil agreement in Guinea-Bissau contains the following clauses:

- The (oil) company recognises and accepts that oil operations can cause environmental damage. Therefore, during execution of this contract, it must ensure that the environment and natural resources are conserved. To this end, the company must:

- a. use techniques compliant with good oil industry practices to prevent damage
- b. when environmental damage is inevitable, limit the effects on people and goods in compliance with legislation and good oil industry practices.

An environmental impact appraisal is compulsory, but the relationship between mining licences and protected areas is rarely specified and a good number of oil exploration blocks contain protected areas (for instance, in Mauritania, Senegal, Mali and Guinea-Bissau), including national parks and areas inscribed or proposed for inscription as World Heritage properties such as Banc d'Arguin (Mauritania), the Archipelago of Bijagos (Guinea-Bissau), Djoudj National Park (Senegal) and the Saloum Delta (Senegal).

Source: IUCN PAPACO (2011b)



Forest guards and the entrance station to the Great Himalayan National Park, India: providing protection to the park from illegal use such as native herb extraction. The park staff have facilitated the cultivation of herbs in the adjacent buffer area as an alternative source.

Source: Graeme L. Worboys

illicit resource extraction, hunting and poaching, was the most common threat discussed. Wildlife crime also poses serious challenges to protected areas (Dudley et al. 2013). Other frequently mentioned threats included mining, quarrying and oil drilling, pollution of various kinds, fragmentation caused by roads and other utility lines, severe weather and climate change.

Invasive alien species

While invasive alien species are not the only threat to protected areas, they are a serious existing and emerging threat that is often not recognised due to gaps in information on these species. While the potential threat from invasive alien species is appreciated, 'the state of knowledge and level of management of invasive alien plants in protected areas differs considerably across the world' (Foxcroft et al. 2014:621). Moreover, 'many invasive plants have, or have the potential to, greatly lessen the potential of protected areas to achieve the things they were proclaimed to do—provide refugia for species, habitats and the ecosystem services that they sustain' (Foxcroft et al. 2014:621–2).

Invasive species constitute an increasingly serious threat to biodiversity in marine ecosystems also but remain inadequately understood (Molnar et al. 2008; IPBES 2013). Threats from these species need to be addressed to preserve the values and functions of protected areas and the support they provide to the livelihoods of millions of people. Economic losses from invasive species are very high and it has been estimated worldwide that the cost of damage from invasive alien species exceeds US\$1.4 trillion, amounting to 5 per cent of the global economy (IPBES 2013).

The CBD guidance on assessing and managing invasive species within protected areas (Tu 2009) provides a comprehensive overview of the strategies, methods, techniques and development of management plans for use by protected area practitioners. In addressing threats

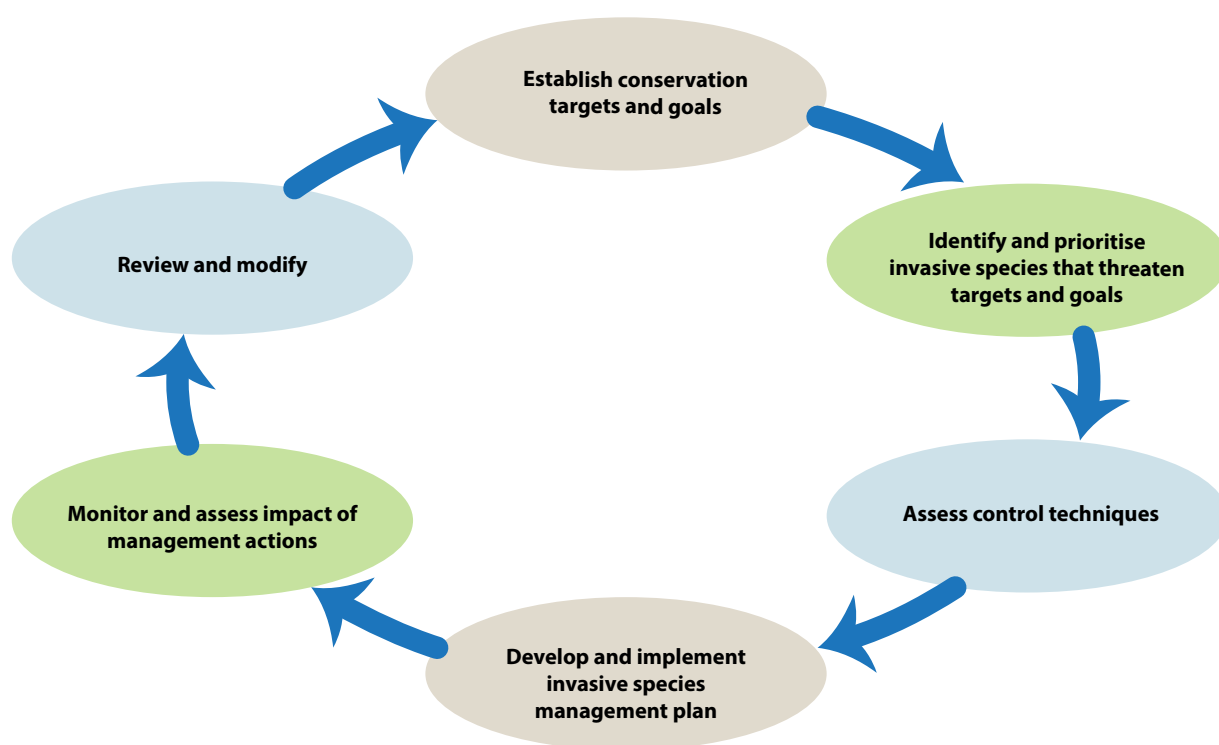


Figure 16.5 Adaptive management approach for invasive species

Source: Adapted from Tu (2009)



Invasive weed for Australia: Cape ivy (*Delairea odorata*) invading and overwhelming native flora, NSW South Coast coastal reserve area

Source: Graeme L. Worboys

from invasive species, the guide describes prevention, early detection and rapid response, management, control and restoration as key steps. These steps could be adapted to deal with most threats that concern protected areas (Figure 16.5). Examples of assessing and managing invasive species threats in protected areas have been provided (Case Studies 16.5 and 16.6).

Human–wildlife cohabitation

Human–wildlife conflict is a major challenge in many protected areas. This is particularly true in human-dominated landscapes. With a growing population in most countries and the loss of space and connectivity for wildlife, conflicts between humans or human activities and ‘nature’ are becoming more and more frequent and less and less acceptable to people. This represents an increasing problem for which new responses need to be identified (Case Study 16.7). While conflicts between humans and wildlife are often quite difficult to handle, they are sometimes the basis for developing a people (community) protected area collaboration that may not only solve the issue but also enhance conservation on the ground (Case Study 16.8).

Case Study 16.5 Assessing invasive plant species occurrence and distribution in India

Identification, monitoring and management of invasive alien species are a major global challenge. India has made a start in identifying and assessing the extent of coverage of invasive plant species as part of a nationwide study of the 'Status of Tiger, Co-predators and Prey Species, 2010', carried out by the National Tiger Conservation Authority and the Wildlife Institute of India. A protocol was developed for habitat assessment that included gathering data on invasive plants from 17 tiger range States in India in 2009–10. While the assessment exercise focused on tiger, co-predator and prey species and included an unprecedented effort of about 477 000 person-days by forest staff and

37 000 person-days by professional biologists, valuable datasets were created on various habitat parameters in a spatial domain. Data analysis revealed the presence of 15 invasive species in the States that were surveyed, of which maps for four representative species are shown in Figure 16.6. Work is in progress to plan and implement appropriate management interventions to deal with these four species to mitigate threats to protected areas in the 17 States and in a prioritised manner.

Source: Mungi et al. (2013)

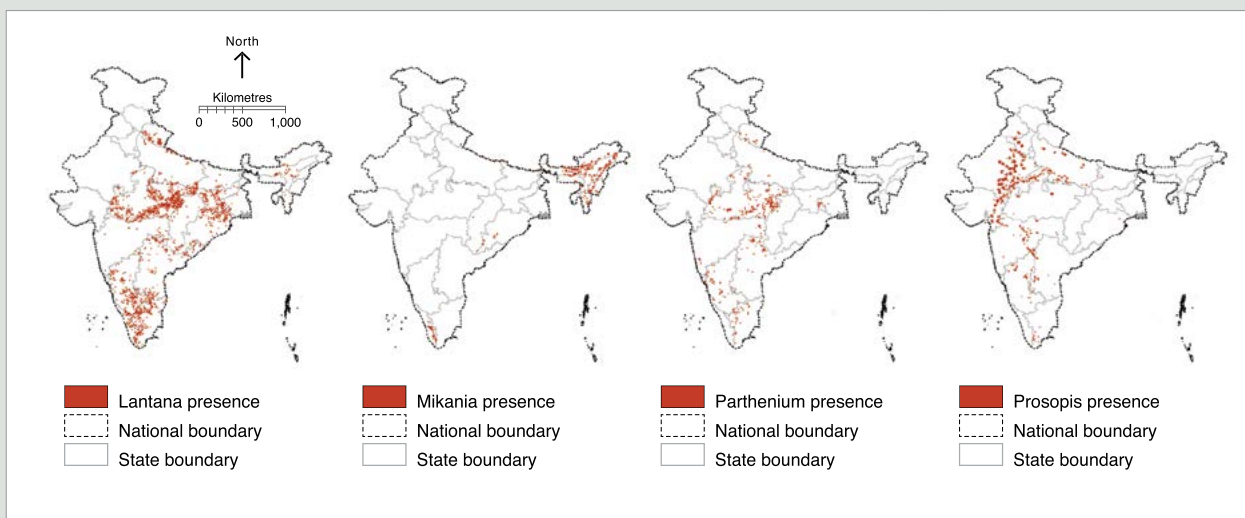


Figure 16.6 Distribution of four representative invasive species, India

Case Study 16.6 Invasive plant species management in Zambia, Africa

The Removing Barriers to Invasive Plant Management in Africa project was implemented in four African countries (Ethiopia, Ghana, Uganda and Zambia) between 2005 and 2010. Under this project in Zambia, 800 hectares of infested floodplain in the Lochinvar National Park were cleared of giant sensitive plant (*Mimosa pigra*). The clearing operation, carried out with assistance from the Government of Zambia, reduced the extent of mimosa infestation within the Chunga Lagoon sector of the park by roughly 30 per cent. After clearing under the project, increases were recorded in the numbers of individual birds and animals and species, as well as in the number of species. Species which returned to the area following clearing included the endangered wattled crane (*Grus carunculatus*) and several other bird species, mainly waders.

In the Mosi-oa-Tunya National Park, Zambia, the project was key in successfully clearing lantana (*Lantana camara*) from an area of about 30 hectares, which was more than 6 per cent of the total affected area of about 524 hectares.

Using a combination of uprooting, cutting back and applying systemic herbicides, entire thickets of lantana were removed from stretches of riverbank. In the cleared areas, seedlings of a variety of indigenous trees and shrubs, grown in nurseries set up in the compounds of local hotels and tourist establishments, were planted to supplement the natural regeneration of germinating seedlings within the soil's existing seed bank. All rehabilitated areas were closely monitored to gauge ecosystem recovery. Biocontrol agents, imported from South Africa under the terms of Zambia's Plant Quarantine and Phytosanitary Act, were also employed. The leaf-mining beetle (*Uroplata girardi*) was used as a biocontrol agent. It feeds on the leaves of *Lantana camara* and retards its growth, thus slowing its spread.

Source: Adapted from Roy and Witt (2013)

Case Study 16.7 Managing threats from human–wildlife conflict in human-dominated landscapes

Protected areas in many regions of the world are now found in human-dominated landscapes. Threats from wild animals (such as tigers, leopards and elephants) to human life and property and threats to these animals in the form of retaliatory killings have become frequent (Lenin 2010). In both cases, the conservation cause suffers. The National Tiger Conservatory Authority (NTCA) in India in 2014 prepared a standard operating procedure to deal with emergencies arising due to tigers straying into human-dominated landscapes (NTCA 2014). The aim of the document is to ensure that straying tigers are handled in the most appropriate manner, to avoid death/injury to human beings, the tiger and cattle and loss of property.

The procedure also includes:

- a protocol on the immobilisation and restraint of tigers
- guidelines for the declaration of big cats as ‘man-eaters’
- preventive/proactive measures to be followed in straying tiger incidents
- monitoring of tigers in the landscape.

There is a need to develop similar procedures for other wild animals in order to reduce or minimise such threats in and around protected areas.

Source: Mungi et al. (2013)

Case Study 16.8 From poaching to protection in Periyar Tiger Reserve, Kerala, India

For years, the Periyar Tiger Reserve in India battled the problem of illicit collection of vayana bark (*Cinnamomum* sp.), but that is no longer the case. The turnaround came more than 15 years ago when the reserve’s managers began working with men who were previously engaged in illegal harvesting of the vayana bark. Now, the poachers have turned protectors of the forest. This all started when a local non-governmental organisation (NGO) helped set up an ecodevelopment committee with former bark collectors through a participatory program that involved local NGOs, hoteliers, Periyar staff and tour operators (Alers et al. 2007). With their intimate and extensive knowledge of the forests, the ecodevelopment committee has put in place a model of ecotourism that encourages protection. Under the program, small groups of tourists are taken to camp in the tourist zones of the forests—areas where previously these bark collectors ‘poached’. Their presence is a deterrent to poachers and smugglers, who stay away from the tourist camps.

More than two-thirds of the earnings go into the ecodevelopment committee’s account to be distributed equally among the members, while the remaining money is

disbursed equally for revenue to government and honoraria to forest field staff, on food expenses and to the community welfare fund. Though committee members may have earned more previously from the sale of the vayana bark than they do now, they have benefited in other ways. Before, they had to give away a large part of their earnings in fines, bribes and as cuts to middlemen. Now, they are free of these impositions. Also, their social status has improved and their relationship with the community has benefited considerably. The forest, too, has improved under this program. Ecological monitoring has shown a reduction in debarking damage and improvement in the regeneration of vayana. Patrolling has increased in these areas and ecodevelopment committee members have caught offenders and brought legal cases against them. All this has resulted in more animal sightings in the tourism zone. This initiative has provided livelihood support on the one hand and has enhanced the natural wilderness experience for tourists on the other.

Sources: Uniyal and Zacharias (2001); Alers et al. (2007); Gubbi et al. (2009)



Advice sign for visitors about resident wild leopards (*Panthera pardus*), Sanjay Gandhi National Park, Mumbai, India

Source: Graeme L. Worboys



A tiger (*Panthera tigris tigris*) resting in Bandhavagarh National Park, India

Source: Ashish Kothari

Box 16.3 Extractive industries around protected areas in West Africa: Management of the exploration phase

A study conducted in 2011 in Burkina Faso, Mali, Niger, Guinea and Senegal identified the main mining threats that could impact on a protected area during the exploration phase (a phase that lasts from one to five years and sometimes slightly longer). This phase needs to be managed closely with the project developer to address the following key issues.

- Soil sampling: In wooded areas, this stage can require the opening of existing access routes to enable prospectors to pass through. The impact is minimal and does not usually involve tree felling. No specific management is needed except monitoring of workers on site to avoid indirect effects such as bushmeat purchase and increases in poaching.
- Geophysical prospecting: If electric methods are used, lines must be cleared in wooded areas to lay cables. Transects are created just to enable people to pass through on foot. Supervision of workers may be needed.
- Seismic methods (only for oil exploration): In this situation, regularly spaced tracks must be opened up to enable trucks to pass through, hence more land is cleared and the seismic measurements can cause disturbing vibrations. Proper management of ecosystem recovery must be ensured as these tracks can open access to the protected area and increase poaching, grazing and timber exploitation.
- Digging of trenches: This requires tracks to be opened up to let machines (bulldozers and mechanical diggers) through, therefore trees are cut down and small areas are cleared (on average about 1000 to 5000 metres of trenches 1 metre wide are dug, so a maximum of 5000 square metres is cleared). Good-practice guides recommend setting arable land to one side, so it can be used to refill the trenches as soon as the samples have been taken, to limit potential dangers over time (the risk of animals falling in the trenches, for instance). A trench sampling campaign takes several weeks, during which the noise and activities can disturb animals. The restoration of the area has to be monitored with the protected area manager to avoid settlement there (as people access the site easily) and any new impacts.
- Drill sampling: As for trenches, access tracks must be created for drills and drilling platforms must be constructed (an area of about 200 square metres). A drilling campaign can last from a few weeks to a few months. The main impacts are the noise, which can disturb animals, and all other illegal activities that may be related to human presence. In that case also, close monitoring of activities and restoration should be ensured by the protected area managers to reduce short-term impacts and long-lasting effects.

Source: IUCN PAPACO (2011b)



Landmine clearance area at a popular cultural heritage protected area near Angkor Wat, Cambodia. Protected area managers need to deal with such issues in areas of past or even present conflict.

Source: Graeme L. Worboys

Managing indirect threats

Most of the indirect threats to protected areas come from outside the reserve and as such are hardly manageable entirely by managers. These threats are sometimes similar to direct threats—such as invasive species, as they rarely appear only inside the protected area, or human–wildlife conflicts, as they most often happen at the protected area border—and they occur both inside and around the protected area. They are, however, often more global in nature, such as climate change, political instability, security issues, poor land-use planning schemes around the protected area, population growth, infrastructure development, mining or extractive activities close to a protected area (Box 16.3), water diversion and off-site pollution. In that respect, they are usually far beyond a protected area manager's responsibility and control (see, for instance, Chapter 17 on climate change). If they are linked to natural disasters, an incident management system may be instituted (see Chapter 26).

Case Study 16.9 Participatory planning within and beyond protected areas in Bhutan

Bhutan has developed a well-organised system of local government. According to Alers et al. (2007), this system has contributed in large measure to the empowerment and development of local communities, and to solving locally the threats that were identified. In Bhutan, each district (*dzongkhag*) is divided into a number of subdistricts called *geog*. Each *geog* has its own development committee. Both the *dzongkhag* and the *geog* work towards the socioeconomic development of the local communities. Each *geog* prepares a five-year plan and an annual plan based on the needs and requirements of the community as identified by its members. Therefore, these plans reflect the concerns and priorities of the communities and generally cover subjects such as provision of health facilities, education as well as fodder supplementation and livestock improvement, and creating livelihood support and alternative income opportunities.

This is achieved through well-integrated conservation and development plans such that there is not much difference between the administration of local government inside and outside protected areas. Protected area staff are represented on *geog* and *dzongkhag* development committees and are directly involved in local planning processes so they can efficiently address any possible threats. Thus, management planning is not restricted solely to a protected area but entails interaction and participation in decisions that affect the protected area and its surrounding landscape. This allows for identification and management of existing as well as potential threats that arise from decisions and processes beyond protected area boundaries.

Source: Adapted from Alers et al. (2007)

Governance dimensions of addressing threats

Managing threats is not only about what to do to address threats but also about who takes the responsibility. It invariably involves taking decisions that have far-reaching consequences for not only biophysical characteristics of the protected area but also the lives of people associated with the protected area—in particular, local communities and indigenous peoples. It is therefore crucial to analyse the governance issues of threat management. These issues may start very early, from recognising the establishment of a protected area (who plans for and recognises it—a national authority or local community authorities or any other body) to active management of a protected area (how and by whom are the management plan, resource use rules and other permits developed and approved? How and by whom are managers appointed? Who holds authority, responsibility, power and accountability in executing plans and enforcing rules?). In any case, when dealing with threats and threat management, one must determine who or what is impacted by these threats and who is in a position to manage them. The quality of governance of the protected area (or the system of protected areas) is therefore crucial to ensure that all stakeholders will be effectively involved and able to make their contribution (Case Study 16.9).

The importance of key concepts of protected area governance was emphasised by the parties to the CBD in their decision to establish the PoWPA. These concepts (Box 16.4) apply well to managing threats to protected areas (see also Chapter 8, and Chapters 20, 21, 25 and 27 in the context of marine protected areas, biodiversity management, resource use, and managing threats to connectivity conservation corridors, respectively).

Box 16.4 Governance of protected areas: Key concepts for threat management

Participation: Site-based management planning and decision-making must ensure the full and effective participation of relevant rights-holders and stakeholders, including local communities and indigenous peoples, and with due recognition of customary rights, gender considerations and social equity.

Innovation: Protected area and other area-based conservation measures should be effectively managed through new and innovative governance approaches. These may include protected areas managed and governed by government agencies, community conserved areas, indigenous peoples' conserved territories, private protected areas and areas under shared governance.

Respect: Livelihood needs, rights, contributions, local/traditional knowledge, practices and institutions must be respected.

Benefit sharing: Benefits need to be shared equitably with local communities with recognition of the disproportionate burden of costs arising from establishing and managing protected areas that they may bear.

Free, prior and informed consent: Decisions regarding limits or changes in access to protected area resources or relocation and resettlement of local and indigenous communities require their free, prior and informed consent.

Good governance: Decision-making for management should follow general principles of good governance that include fair access to information and promotion of constructive dialogue; accountability in decision-making; respect for rights and the rule of law; and dispute resolution through fair and just institutional procedures.

Source: Adapted from Borrini-Feyerabend et al. (2013)



The Mount Kosciuszko elevated walkway: the walk to the top of the highest mountain on the Australian continent, Mount Kosciuszko (2,228 metres), is very popular, with about 120 000 visitors using the route during the 2014 non-snow months. The visitor walking route was planned at a level of detail to minimise many potential threats to the sensitive alpine flora, endangered wetlands and alpine landscapes. The walkway structure was also carefully designed. It was slightly elevated (encouraging people to stay on the track); made of sheets of black iron mesh placed on a black iron supporting frame and supported by steel pylons (zinc from galvanising was toxic to the alpine plants and rusting is inhibited by the low alpine temperatures); and the mesh was designed to be light transmitting. This permitted native alpine plants to grow through the mesh and to blend it (visually) into the landscape. The structure is strong, long lasting, low in maintenance and safe and comfortable to walk on.

Source: Graeme L. Worboys

Conclusion

Underlying causes of threats are many and most of them are linked to the rapid growth in the human population on Earth. The nature of direct and indirect threats is very diverse, and planned responses and approaches to prioritisation of threat responses are needed. Management frameworks and tools that assist with assessing the scope of threats such as RAPPAM are available to assist protected area systems-level responses to threats, while project planning and adaptive management responses to specific threats may be undertaken using tools such as the CMP planning process. Supportive and effective governance is also paramount to threat management. In this chapter, threat management-focused case studies from Asia and Africa are presented and they provide important cross-referencing to the climate change, freshwater, marine, operations, management and governance chapters of this book to encourage readers to benefit from more specific treatment of these subject areas.

Finally, it is clear from the range and dynamic nature of threats to protected areas discussed in this chapter that the establishment of a reserve is just the start of its investment in conservation. Active and continuous management of protected areas is a fundamental principle for all 21st-century protected area managers. Like running a farm, managing a protected area is a seven-day-a-week, 24-hours-a-day operation that needs to constantly respond to a range of issues and threats—many that are old and recurring and many that are new and potentially insidious. This chapter provides guidance for responding to this formidable responsibility.

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