NATURE-BASED SOLUTIONS AND PROTECTED AND CONSERVED AREAS

An introduction for protected and conserved area practitioners

Incorporating material from the Second Asia Parks Congress, Kota Kinabalu, Sabah, Malaysia, May 2022

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This publication has been made possible by funding from the Ministry of the Environment, Government of Japan.

Published by: IUCN, Gland, Switzerland in collaboration with the Ministry of the Environment, Government of Japan (MOEJ)

Produced by: IUCN Japan Liaison Office, Institute for Global Environmental Strategies (IGES) and Equilibrium Research

Recommended citation: Dudley, N., Furuta, N., Natori, Y. and Okano, N. (2022). *Nature-based Solutions and protected and conserved areas: An introduction for protected and conserved area practitioners*. Gland, Switerland, IUCN and Tokyo, Japan, Ministry of the Environment, Government of Japan

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PREFACE

A growing focus on Nature-based Solutions (NbS) as a response to many societal challenges, and a radical increase in global ambition for protected and conserved areas, have emerged as two critical development themes for the third decade of the 21st century – critical and closely linked. It is becoming increasingly obvious that protected and conserved areas (PCAs) are a major vehicle for Nature-based Solutions and essential to their success in many situations.

Neither of these "tools" is without its critics. People fear both will result in land grabbing, loss of rights for Indigenous peoples and local communities, and further marginalisation of vulnerable groups. But, properly used with appropriate and implemented safeguarding policies, they are also some of the best routes we have for providing a decent future for people and the planet, combining many important elements of sustainable development. It is therefore vital that we make sure that they develop in ways everyone is comfortable with.

Two events closely linked to Asia – the Second Asia Parks Congress in Sabah, Malaysia and the 15th Conference of Parties to the Convention on Biological Diversity chaired by China, are instrumental in setting conservation strategies for the next decade and beyond. Given the current state of the environment, which is already perilously close to a tipping point in several parts of the world, the stakes have never been higher. Understanding how Nature-based Solutions and protected and conserved areas can work most effectively together is a critical part of the puzzle.

Hence this publication is particularly important. All these issues are in flux. The emergence of Other Effective Area-based Conservation Measures[1] as an additional tool of area-based conservation is exciting but is also creating some concerns; it is still too early to see whether governments really get behind the concepts or whether they are used as a convenient excuse for avoiding taking more definitive action. Ambitious new conservation targets are focusing attention on a whole range of approaches to the way in which we manage the natural world: over a hundred governments have already signed a pledge to increase the global coverage of protected and conserved areas to 30 per cent of land and ocean by 2030 (30x30).

Commitments on this scale will not work if based solely on biodiversity conservation; governments and civil society need to be convinced that such areas provide other concrete benefits, particularly ecosystem services. This means that Nature-based Solutions need to move from niche to mainstream and be embraced by more stakeholders outside the usual suspects: companies, ministries of finance, local authorities, religious bodies and more. Many people – governments, non-governmental organisations, Indigenous peoples and local communities – are still struggling to understand how NbS will be applied and what the proposed new targets for PCAs will mean in practice. We hope that this publication will help.

THE BACKGROUND

EVOLUTION OF THE IDEAS BEHIND NATURE-BASED SOLUTIONS

The fact that natural ecosystems provide benefits to humanity has been recognised for millennia, and conscious management decisions aimed at preserving these ecosystems also stretch way back, thousands of years in some cases.[2] The *hima* set aside in the Arabian Peninsula to protect grazing lands,[3] forests preserved in Japan to protect against landslides and flooding, and thousands of traditional management systems of Indigenous people and local communities (IPLCs)[4] were in place centuries before the emergence of the modern environmental movement.

More formal recognition of these benefits emerged much more slowly. Our understanding took a great step forward at the turn of the century with the publication of the Millennium Ecosystem Assessment,[5] and identification of a range of different "*ecosystem services*" (see box 1).

Box 1: The Millennium Ecosystem Assessment

The MEA defined ecosystem services and divided them into four main types:

- **Provisioning services** – like food from the wild, increased water flow from tropical cloud forests, etc.
- **Regulating services** – such as the water purification role of forested watersheds, mangroves protecting coastal communities from tsunamis and storms
- **Cultural services** – the recreational roles and spiritual importance of many natural ecosystems to particular faith groups
- **Supporting services** – basic life support like photosynthesis, soil formation and nutrient cycling

All are important. The distinctions are not precise, some values spread across several of the categories above, but they provide a convenient way of understanding and describing the range of services.

With recognition came attempts to value ecosystem services in economic terms, ranging from early attempts to work out the total value of an ecosystem to studies of the immediate values in terms of financial benefits. Researchers like Robert Costanza and colleagues looked at all values,[6,7] including quite theoretical values such as the potential value of genetic resources in a rainforest for medicinal research or other uses. These are important and have continued to be developed and refined.[8] They give a taste of exactly what we are wasting when we destroy these ecosystems but have to date proved too abstract to appeal to many governments, with ministers often looking for immediate benefits that they can report to civil society before the next election.

The Economics of Ecosystems and Biodiversity (TEEB) process attempted to give the subject wider appeal,[9] as did the Natural Capital approach,[10] the latter providing a framework for companies to measure and value their impacts and dependencies on nature, and also analytical tools that have been developed to calculate economic returns from ecosystems throughout the world. Many other methods of measuring ecosystem services exist.[11]
Disclosure of environmental risks and benefits is becoming increasingly important for the private sector, although currently experience is stronger on issues like resources and climate change than for biodiversity.[12] The International Organization for Standardisation (ISO) is developing a standard (ISO/TC 331) on biodiversity.[13] Additionally, the Taskforce on Nature-related Financial Disclosures (TFND) has been set up with an explicit objective of developing a risk management and disclosure framework to report and act on nature-related risks and help shift global financial flows towards more positive outcomes.[14] The concept of biodiversity footprints is gaining acceptance as an analytical tool, with many methodologies already available.[15]

None of these methodologies are without their detractors; some people think that putting an economic value on nature is unethical, others that it risks seriously undervaluing ecosystems and implies that if exploitation could be shown to be more "economically valuable" than maintaining natural ecosystems this would undermine efforts at conservation.[16] These criticisms are valid, but on the other hand, being able to show governments and industry that nature "pays for itself" has in many cases persuaded otherwise reluctant parties to take positive action for conservation. Monetary evaluation makes the invisible visible in many cases. Valuation is a complicated tool that needs to be used strategically and with care.

At the same time, the role of protected areas as suppliers of ecosystem services has been ever more recognised. The *Arguments for Protection* series from WWF and the World Bank drew attention to a variety of services, ranging from crop wild relatives[17] to spiritual values for faith groups,[18] and gained particular traction in respect to the mitigation of and adaptation to climate change.[19] The term "*natural solutions*" gained currency for the role of protected areas in supplying ecosystem services. There were also important attempts to develop methodologies directly for valuing the benefits from protected areas.[20] While all natural and almost all managed ecosystems have some ecosystem services, protected areas have special advantages. In countries where conversion of land and water ecosystems has been profound, they may be some of the only natural ecosystems remaining. And protected areas have management plans, trained staff and resources to maintain natural ecosystems, providing additional security for the services they provide.[21]

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), despite "ecosystem services" being part of its name, suggested a new term, "nature's contributions to people",[22] in part due to opposition to the term "ecosystem services" as being too linked to valuation and exploitation. There have been numerous attempts to explain the differences between the two although these centre more on framing than on the processes themselves.[23] IPBES also provided important analyses of services that have often been forgotten or downplayed, such as pollination[24] and FAO has increasingly focused on the wider issues of biodiversity, particularly through the long-running assessments of biodiversity for food and agriculture.[25]

These changes reflect rapidly developing attitudes towards conservation and our relationship to the rest of nature.[26] Up to the 1960s, the main focus was on protecting intact and wilderness areas, often for scenic values as much as for biodiversity conservation. In the 1970s and 1980s, the emphasis shifted to strategies to address threats to species and ecosystems. By the 1990s, new thinking about ecosystem services prompted another change, towards a focus on "nature for people". But this perspective was always controversial, because of its implication that nature *only* had value with regard to its usefulness to us. A more rounded concept of "people and nature" has since emerged, which hints at a two-way relationship between humanity and the rest of nature, where we draw many benefits but also recognise the independent values of other lifeforms.

Box 2: Definitions of Nature-based Solutions

As with most new concepts, ideas have developed gradually and sometimes in parallel:

- **IUCN** defines NbS as: "*actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*".[31]
- The **European Commission** has a simpler definition: "*Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience*".[32]
- More recently, **UNEA** adopted a definition of NbS, at the fifth session of the United Nations Assembly, drawing largely on the IUCN definition: "*actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits*".[33]

Box 3: Eight criteria for Nature-based Solutions

In 2020, IUCN published a global standard[34] to help define NbS more thoroughly and lay out a series of expected best practices. These clustered around eight main themes.

- Criterion 1: NbS effectively address societal challenges
- Criterion 2: Design of NbS is informed by scale
- Criterion 3: NbS result in net gain to biodiversity and ecosystem integrity
- Criterion 4: NbS are economically viable
- Criterion 5: NbS are based on inclusive, transparent and empowering governance processes
- Criterion 6: NbS effectively balance the trade-offs between achievement of their primary goal(s) and the continued provision of multiple benefits
- Criterion 7: NbS are managed adaptively, based on evidence
- Criterion 8: NbS are sustainable and mainstreamed within an appropriate jurisdictional context

More recently, the concept of *Nature-based Solutions* (NbS) has developed within IUCN and, independently, the European Union, reflecting in part this inter-relationship. There are now at least three definitions of NbS (see box 2 below).

Nature-based Solutions therefore contain important elements of conservation but also other priorities and aims. Protected areas, as their name suggests, are defined largely around "areas" and have nature conservation as a primary aim. Nature-based Solutions, on the other hand, are based conceptually around actions and have a wider range of aims, which include nature conservation but also ecosystem services and human benefits at an equal level. While the objective of NbS is always to find "win-win" solutions, whereby people, ecosystem services and nature all benefit equally, this is not always possible and NbS often implies some level of trade-off.

In practice, ecosystem services from protected areas are recognised by both IUCN and the EU as "Nature-based Solutions". In the years since the ideas were first developed, IUCN has continued to work on the theory of Nature-based Solutions, developing some operating principles and, in 2020, global operational standards (see box 3).

Despite these efforts at standardisation, the term NbS is still often applied quite loosely with respect to the role of ecosystem services in addressing a range of human needs. The term has also sometimes attracted criticism due to its implied commodification of nature and fears that it will lead to greenwashing and dispossession of people from their land.[27]

While NbS can and will be an important part of the solution to environmental degradation, poverty and inequity, these criticisms need to be taken seriously and safeguarding processes put in place and implemented. The agreed principles for application of NbS state clearly that developments should only take place with the full support of people living in or using the area, so responses that include any form of land grabbing should not be recognised as NbS. The concept of NbS is becoming increasingly important in light of decisions such as the move towards placing 30 per cent of land and water in protected and conserved areas by 2030 (30x30) and the development of "other effective area-based conservation measures" (OECMs, see page 14). One important priority is to ensure that the issues critics are concerned about – land-grabbing, the promotion of monoculture plantations and greenwashing – have no place in developments that are labelled as NbS, and to challenge any incidents that do occur.

NATURE-BASED SOLUTIONS

The NbS concept, as used in environmental sciences and nature conservation contexts, has emerged over the last twenty years as institutions seek to work with natural ecosystems to address a range of societal challenges. IUCN to a large extent led the way in defining and promoting NbS and, from 2013, made the achievement of Nature-based Solutions a key part of its global programme, bringing important new levels of political attention to the issue.

At its simplest, an NbS approach would choose to invest in – for instance – restoration of protective mangrove forests along a storm-affected coast rather than relying on conventional engineering solutions such as a seawall. Particularly well-known in the context of providing disaster risk reduction – often called Eco-DRR – NbS also offers important opportunities to improve food and water security, provide energy solutions, reduce pollution, improve health and provide materials for society. While some NbS will require outside support, including financial support, others will generate their own finance and therefore provide additional benefits in terms of poverty reduction and improvement of livelihoods.

NbS applies conservation principles to solving a range of social and economic challenges and can be implemented alone or in an integrated manner with other approaches such as technological or engineering solutions. By their nature, NbS are determined by site-specific natural and cultural factors that include traditional, local and scientific knowledge. In other words, NbS need to be tailored to particular situations and will be influenced by a range of factors; there is no "one size fits all". Most NbS explicitly rely on support from people living in the area and therefore social factors may be as significant as the physical and ecological conditions that are present.

IUCN has always been clear that Nature-based Solutions need to produce societal benefits in a fair and equitable way, and in a manner that promotes transparency and broad participation. Furthermore, they should maintain biological and cultural diversity and the ability of ecosystems to evolve over time. They need to recognise and reconcile the trade-offs between the production of a few immediate economic benefits for development, and future options for the production of a full range of ecosystems services.[28]

Nature-based Solutions should not be stand-alone projects but an integral part of landscape and seascape-scale approaches to ensuring sustainable development and human well-being.

NbS might best be considered as an umbrella concept that covers a range of different approaches, relating broadly to protection, management and restoration, but also relating to natural infrastructure, and ecosystem-based management. A variety of approaches that commonly fall within the concept of Nature-based Solutions is described below. These have emerged variously from scientific research, traditional ecological knowledge and from policy developments, but all share a common focus on ecosystem services that aim to address societal challenges.

For a concept that was only defined less than a decade ago, the idea of Nature-based Solutions has taken hold remarkably quickly, with widespread recognition in policy, the development of organisations and university departments based around NbS and its rapid emergence in international policy. A key factor is the new understanding amongst policymakers and politicians that the climate and biodiversity crises are so intertwined that it is important to tackle them together. Furthermore, ideas are emerging about the scale at which nature-based responses could help to address these issues, such as research suggesting that NbS have the potential to provide up to 37 per cent of the climate change mitigation needed by 2030 to stabilise warming to below 2°C.[29]

Some important elements of Nature-based Solutions are illustrated in Figure 1:[30]

COMPONENTS OF NATURE-BASED SOLUTIONS

Figure 1: **Summary of Nature-based Solutions**
Source: Cohen-Shacham, 2016[28]

The diagram summarises a complex set of interactions. Nature-based Solutions are used to address a series of seven societal challenges: (1) climate change mitigation and adaptation, (2) disaster risk reduction, (3) economic and social development, (4) human health, (5) food security, (6) water security and (7) environmental degradation and biodiversity loss. They achieve this through a variety of ecosystem-based approaches, including protection, sustainable management and ecological restoration, along with hybrid solutions that include built infrastructure and some issue-specific solutions. The results need simultaneously to address human well-being and biodiversity benefits.

Nature-based Solutions embrace a very broad range of management approaches. In the following section, some of the concepts often included amongst NbS are summarised, noting that there is a certain amount of overlap, and that the links between Nature-based Solutions and more general ecosystem services are sometimes confusing.

- **Ecological restoration:** the Society for Ecological Restoration (SER) defines ecological restoration as "*the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed*".[35] In the current context, this would mean restoring an ecosystem in a way that provides tangible benefits to humanity, such as aiding regeneration of coastal mangroves to help protect nearby communities.[36] While restoration is certainly needed in many protected areas, it is likely to be particularly important in OECMs and could be the means by which "new" OECMs are created. Note that SER is clear that "recovery" may not mean returning an ecosystem to its "original" state; this is often difficult to be sure of in many situations and more significantly it may no longer be possible under conditions of climate change when the underlying ecological conditions may have changed. Nevertheless, SER assumes that ecological restoration means returning to a relatively natural state and not, for instance, to a monoculture tree plantation or a pasture planted with non-native grass species. To some extent the term "ecological

restoration" is being replaced by ecosystem restoration,[37] which seems to be used in much the same way but is gaining increasing visibility due to the publicity surrounding the UN Decade on Ecosystem Restoration.

- **Ecological engineering**: uses knowledge of both ecology and engineering to predict, design, construct or restore, and manage ecosystems that integrate "*human society with its natural environment for the benefit of both*".[38] This implies a fairly conscious and sometimes major form of management intervention and can involve use of ecology in quite non-natural situations (such as use of reedbeds to treat waste products or use of biological controls) or various forms of food production (agroforestry, multi-species aquaculture). Whilst a key component of NbS, ecological engineering is less likely to be important in protected and conserved areas. Its true role is in developing more sustainable ways of human activities such as food production and waste treatment and is likely to be commonest in urban and peri-urban areas or in agricultural lands.

- **Forest landscape restoration** (or **forest *and* landscape restoration**): two closely related terms. Forest landscape restoration (FLR) is defined as "a *planned process that aims to regain ecological integrity and enhance human wellbeing in deforested or degraded landscapes*".[39] FLR could be a major tool in the creation and establishment of OECMs, in places where for instance native forest is restored as part of steps to stabilise degraded land or as a mixed forest-pasture system with significant associated biodiversity. FAO has a slightly different definition of forest landscape restoration, which broadens the definition to include other ecosystems such as grassland and savannah.[40] The FAO definition is useful in that it emphasises a landscape approach and the importance of all ecosystems, and for example might make it less likely that natural grassland is planted with trees in the name of "restoration".

- **Green infrastructure** and **blue infrastructure**: are terms often applied to the use of ecological principles to provide people in urban or suburban situations with benefits, such as green stormwater systems, model prairies, green walls and the use of green spaces, rivers, ponds and lakes in urban environments, tree planting to reduce air pollution and temperature, and other deliberate interventions.[41] This has similarities with ecological engineering but is likely to be less artificial in approach, although the two approaches merge into each other to some extent. Because it is closely linked to towns and cities, this kind of green infrastructure is likely to be relatively little used in protected areas although can certainly provide services to buildings such as tourist lodges, park headquarters and similar. However other institutions, including the European Union[42] and the Japanese government, use the term "green infrastructure" in a much looser way, to include protected areas, so the term needs to be understood to mean different things in different places.

- **Natural infrastructure**: refers to "*naturally occurring landscape features and/or Nature-based Solutions that promote, use, restore or emulate natural ecological processes*" according to the US-based Environmental Defense Fund.[43] It is generally associated with active management of ecosystems for particular societal benefits. But it is most commonly used in ecosystems with a higher level of naturalness than the engineered use of ecological processes often associated with green or blue infrastructure. Natural infrastructure fits well with integration into protected and conserved areas, which could be employed explicitly to protect particular ecosystem services, like protecting a tropical cloud forest to maintain a constant flow of water to a city further down the watershed.

- **Ecosystem approach**: a general framework that seeks to bring a holistic, participatory approach into ecosystem management. The CBD defines the ecosystem approach as "*a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way*".[44] The ecosystem approach is embedded in a framework with 12 principles, including two particularly relevant here: principle 1, "*The objectives of management of land, water and living resources are a matter of societal choice*" and principle 5, "*Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach*."[45] The approach is more in the nature of a philosophical underpinning for management rather than a specific methodology that can be followed. Many applications are linked closely with the delivery of ecosystem services.[46]

- **Ecosystem-based management**: generally considered to be "*An integrated approach that incorporates the entire ecosystem, including humans, into resource management decisions, and is guided by an adaptive management approach*." It is said to have emerged first in management approaches to the Great Lakes in North America in the 1970s.[47] Ecosystem-based management has been widely used in US National Parks to move from species to ecosystem protection. It does not necessarily refer to ecosystem services as such but is an approach to management that allows such services to be integrated with other management aims, such as biodiversity conservation or recreation.

- **Satoyama / Socio-ecological Production Landscapes and Seascapes**: a Japanese term that literally means the borderland between foothills and flat agricultural land, but over time has developed into a broader term for a mixed landscape of forests, rice paddies, grasslands, streams and ponds, with people present, providing ideal conditions for NbS. The Satoyama concept has been known in Japan for centuries, using techniques that were present before the revolution in fossil fuel use in the 1950s.[48] Satoyama areas support a wide range of native plants and animals that have adapted to these cultural landscapes, and they can also act as important ecological corridors, linking natural ecosystems, and provide a wide range of ecosystem services. The Satoyama Initiative aims to apply these management concepts more widely around the world,[49] and promotes "*socio-ecological production landscapes and seascapes*" (SEPLS).[50] It is recognised as an important

contributor to biodiversity conservation by the CBD. Many but not all Satoyama sites qualify as protected areas or, more commonly, as OECMs.

- **Ecosystem-based mitigation**: a term referring to management that makes use of ecosystems and biodiversity to reduce emissions of greenhouse gases.[51] This includes both preserving ecosystems that store carbon and other greenhouse gases and maintaining or restoring ecosystems to facilitate additional sequestration of greenhouse gases. The approach therefore has close links to restoration. Examples would be the protection of peat forests and mires, or of kelp beds in coastal regions, to prevent loss of the carbon they store, and natural regeneration of forests as a way of sequestering additional carbon. Ecosystem-based mitigation can bring strong co-benefits for biodiversity.[52] The UN Framework Convention on Climate Change (UNFCCC) has developed an approach for monitoring and reporting on forest conservation activities which reduce greenhouse gas emissions. REDD+ stands for "*reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries*"[53] and is the most developed tool for ecosystem-based mitigation. However, although there are some voluntary REDD+ schemes supported by governments, the private sector and philanthropic individuals, there is still a debate about how a global REDD+ scheme will work and be financed within the current Paris Agreement.

The emphasis of Nature-based Solutions to date has been more on management and restoration than it has on protection policies and protected and conserved areas. The emergence of the CBD Global Biodiversity Framework and, particularly, OECMs is likely to change this.

- **Ecosystem-based adaptation**: defined by the Convention on Biological Diversity as "*the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change*".[54] IUCN promotes EbA as a key component of NbS and protected and conserved areas fall neatly into this approach, for the wider ecosystem services they provide to facilitate adaptation to existing climate change. EbA is often assumed to include ecosystem-based mitigation, mentioned above, although the two are quite distinct and sometimes require different management prescriptions.

- **Ecosystem-based disaster risk reduction** or **Eco-DRR**: the use of natural ecosystems to protect against a variety of disasters caused by extreme weather events, earth movements and volcanoes, including coastal protection against storms and tsunamis, protection of steep slopes against snow and earth movement, prevention of desertification and dust storms and various forms of flood control.[55] Eco-DRR has been officially recognized in some global environmental fora such as CBD and Ramsar and a few countries have started to establish protected areas partly or mainly for their functions as ecosystem buffers against disaster, although governments often still instinctively reach for engineering solutions. The Convention on Biological Diversity has issued voluntary guidance on the use of Eco-DRR.[56] There are important areas of overlap, but also some differences, between EbA and Eco-DRR.

- **Area-based conservation**: generally referring to places with a defined boundary that deliver conservation benefits (as opposed to species conservation, which may take place across an entire landscape or seascape but focuses on a single species or group). Area-based conservation includes protected areas, which have conservation as their primary aim, OECMs, where conservation is often a more-or-less accidental side-effect of their management, and a range of other area-based approaches including ecological corridors. Some types of area-based conservation are already clearly defined and recognised by governments and the international community. In other cases, such as ecological corridors, definitions are slightly looser and still under development. By maintaining natural ecosystems in a healthy condition, many protected and conserved areas also provide a range of Nature-based Solutions.

Note that many of these definitions overlap with each other or describe situations that are very similar. Some are defined by *approach* and others by *process*. They can be divided approximately into those that aim to preserve existing ecosystem services, improve management of these services or restore services that have previously been degraded or destroyed: the classic combination of protect, manage, restore. The emphasis of Nature-based Solutions to date has been more on management and restoration than it has on protection policies and protected and conserved areas. The emergence of the CBD Global Biodiversity Framework and, particularly, OECMs is likely to change this.

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PROTECTED AREAS

Back in history and perhaps even prehistory, many of the management approaches that we now consider to be prototype "protected areas" were established for what we would now call Nature-based Solutions, mainly protection against flooding, landslide, soil erosion[57] and to maintain valuable ecosystems such as forests and grassland for grazing.[58] Other areas were set aside as hunting reserves for the rich and powerful[59] (and often deeply resented by everyone else). There have also, from far back in prehistory, been areas set aside from cultivation and use because they were deemed to be particularly sacred, and many of these sacred natural sites hold high levels of biodiversity.[60]

The modern protected area movement began in the United States in the nineteenth century, with the creation of Yellowstone National Park in 1872, followed soon afterwards by the Blue Mountains National Park in Australia.[61] Early wildlife preserves started to emerge, like Kaziranga National Park in Assam, India, set up to protect the rhinoceros.[62] All these early "modern" protected areas were established in a top-down manner with little if any local consultation.

During the twentieth century, albeit with long breaks during two world wars, the concept of protected areas developed slowly but steadily, in terms of understanding about what a protected area should provide, and how such areas might be managed. The initial impetus was mainly about protection of iconic landscapes or, in fewer cases, preventing the extinction of particularly valued animal species.[63] Some of these were highly successful; the Asia rhino and the American bison could well have been lost to extinction without the establishment of a few strategic preserves. More recently, interest expanded from species to ecosystems, driven by concern about the rapid loss of tropical moist forests, by an ever-growing recreational industry and recently by concerns about ecosystem services and – barely mentioned but sometimes very important – protection of vulnerable human communities. Managers of state protected areas are often expected to deliver a wide range of societal benefits, many far removed from their areas of expertise.

At the same time, the ambition on how much land and water should be protected has also steadily increased. When IUCN first floated the idea that 10 per cent might be protected, around 1990, the idea was widely derided as fanciful and utopian, yet that target was exceeded on land by 1995.[64] By 2010, at the CBD meeting in Nagoya, Japan, the Aichi targets aimed for 17 per cent of land and 10 per cent of ocean; the land target was virtually attained in 2020, with substantial progress made on the marine target as well. (Other aspects of the Aichi target, such as effective management and ensuring equity and human rights, were less successful.) During this period the "half Earth" concept emerged, with proponents arguing that at least half the planet should remain as more or less natural ecosystems, ideally in some form of protected area.[65] The current draft Target 3 of the Global Biodiversity Framework, for 30 per cent of land and ocean to be protected by 2030 (the 30x30 target), reflects that thinking.

Along with changing perspectives, the definition of a protected area has also changed over time. The **CBD** currently defines a protected area as: "*a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives*".[66] **IUCN** has a slightly different definition, agreed in 2008, which the CBD recognises as being equivalent: "*A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values*",[67,1] with additional guidance on marine protected areas.[68] These definitions are guidelines: the details of what does and does not "count" as a protected area are determined by national policies and laws. For example, there are differences in the way that countries view the relationship between Indigenous territories and protected areas.

[1] This differs from the 1994 definition: "*An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means*". Two big changes: "*biological diversity*" is changed to "*nature conservation*", which was chosen to indicate a more holistic approach to the issue and the definition and associated principles make it clear the nature conservation is the primary aim, whereas the earlier definition could be interpreted to mean that "*natural and associated cultural resources*" were considered of equivalent importance.

Various types of protected areas

Both IUCN and the CBD recognise a range of management approaches and governance types as being acceptable within protected areas, as long as the areas *also* meet the definition of a protected area.[69]

The rapid growth of protected areas is an extraordinary political and social development, almost certainly the largest and fastest conscious change of land management in history – rapid but far from uncontroversial. There has been significant pushback from people worried about losing access to land and resources,[70, 71] along with backsliding in many places as governments step back from previously agreed protection policies, a phenomenon that has become significant enough to earn its own name: Protected Area Downgrading, Downsizing and Degazettement (PADDD).[72] Expansion has focused predominantly on increasing the area under protection, with less attention paid to how well the areas are performing or what side effects they might have for people living inside or nearby. Site selection has also sometimes been driven by political rather than conservation priorities, leading to ineffective[73, 74] and inefficient[75 , 76] outcomes for biodiversity, by selecting sites that are convenient[77] rather than most appropriate. Nonetheless, repeated surveys find that support for protected areas remains high, which helps to explain the success of current initiatives to radically increase the area under protection, such as that spearheaded by the High Ambition Coalition.[78]

Table 1: **IUCN and the CBD recognise several different management categories:**

Ia	Strictly protected areas set aside to protect biodiversity and also possibly geological/ geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such areas can serve as indispensable reference areas for scientific research and monitoring
Ib	Usually large unmodified or slightly modified protected areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition
II	Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities
III	Set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value
IV	Aim to protect particular species or habitats and management reflects this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category
V	An area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values
VI	Conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area

Table 2: **Governance types: IUCN and the CBD recognise four governance types of protected areas:[79]**

A	A government body (such as a Ministry or Park Agency reporting directly to the government) manages the protected area and determines its management aims and objectives.
B	Complex institutional mechanisms and processes are employed to share management authority and responsibility among a plurality of (formally and informally) entitled governmental and non-governmental actors.
C	Protected areas under individual, cooperative, NGO or corporate control and/or ownership set up and managed under not-for-profit or for-profit schemes.
D	Includes two main subsets: (1) Indigenous peoples' areas and territories established and run by Indigenous peoples and (2) community conserved areas established and run by local communities.

Sources: Dudley, 2008[67]; Borrini-Feyerabend et al., 2012[79]

OTHER EFFECTIVE AREA-BASED CONSERVATION MEASURES

Nonetheless, there is no cause for triumphalism. At the same time that protected areas have expanded, biodiversity has continued to decline [80] (including sometimes *inside* protected areas, many of which have management deficiencies).[81] Critics argue that this shows protected areas have little value. But this takes no account of how much faster the decline might have been without the presence of protected areas. A growing number of species *only* survive inside the boundaries of one or more protected areas and even some iconic species like the tiger are virtually dependent on such conservation. Protected areas remain the cornerstone of most national conservation strategies, albeit the approach to protection differs significantly around the world.

There is an increasing recognition that protected areas alone cannot save all biodiversity. It is socially and politically impossible to set aside large enough areas of land and water. There is also effective conservation being conducted outside protected areas, which needs to be recognised within overall conservation management plans. Additionally, actions outside protected areas are increasingly undermining conservation within the boundaries, such as the pervasive impacts of pesticides in many parts of Europe, or changes to river systems through upstream dams, or the pervasive and global effects of climate change. A large "conservation estate" is needed but one that employs a wider range of tools than hitherto.

In 2010, Aichi Biodiversity Target 11 from the Convention on Biological Diversity invented a new phrase and started a decade of debate about its implications: "*By 2020, at least 17% of terrestrial and inland water areas and 10% of coastal and marine areas … are conserved through … systems of protected areas* ***and other effective area-based conservation measures***…" (our emphasis).

IUCN and the CBD Secretariat initially argued that this was virtually the same as a protected area and should be treated as such,[82] but this was rejected and IUCN tasked with the job of defining an OECM. A task force produced draft guidance for the CBD. CBD Signatories agreed a definition in November 2018 at the 14th Conference of the Parties in Egypt:[83] "*A geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic, and other locally relevant values*." This covers three main cases:

1. **Ancillary conservation** – areas delivering *in-situ* conservation as a by-product of management, even though biodiversity conservation is *not* an objective (e.g., some military training grounds).
2. **Secondary conservation** – active conservation of an area where biodiversity outcomes are only a *secondary* management objective (e.g., some conservation corridors).
3. **Primary conservation** – areas meeting the IUCN definition of a protected area, but where the governance authority (i.e., community, Indigenous peoples' group, religious group, private landowner or company) does not wish the area to be reported as a protected area.[84]

The OECM is still a new concept and governments are scrambling to understand how OECMs will be applied in practice and what falls "inside" and "outside" the definition. This is particularly true in the case of marine areas [85] and for instance the extent to which fishery set asides could "count" as OECMs. There are still considerable differences of opinion and international norms are under development. Meanwhile, governments are already starting to establish OECMs, adding urgency to the need for stronger definitions and guidance.

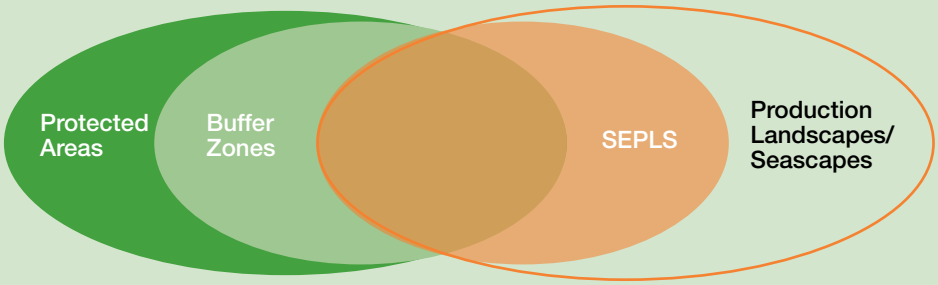
On the one hand, there is a risk that OECMs become an easy option for governments, rather than setting up protected areas, and that OECMs are established on areas that offer few benefits to biodiversity. Human rights groups also fear that OECMs will – like some protected areas – result in people losing possession of land, waters or the resources they contain in the name of conservation. More positively, OECMs could bring new or existing areas that are important for biodiversity conservation into overall conservation planning and thus help prevent them from being lost or degraded.

OECMs also change the debate about big new conservation targets. When the "half Earth" concept was first floated it proposed half of the planet in IUCN I–VI protected areas; now the debate is more about half being maintained as natural ecosystems, using a mixture of protected areas, OECMs and maybe other designations as well, which makes a bold conservation target far more attainable.[86]

Key issues that still need to be addressed include exactly what the differences are between OECMs and some of the protected area categories, particularly category V protected landscapes and seascapes. To date, governments have not agreed about the extent to which sustainable management areas could "count" as OECMs, although IUCN is clear that in most cases they would not. The question of monitoring is critical; OECMs are based around the concept of effectiveness, which implies that the OECM is monitored to ensure that it really *is* effective, but in many cases OECM managers (or groups of managers) will not be in a position to do such monitoring themselves. How such monitoring would be carried out or financed remains unclear, as does the question of what happens if an OECM loses effectiveness. Is it no longer an OECM? How much leeway do sites have and how long before they are "delisted"? And who decides? In practice it seems likely that governments will be reluctant to "de-list" areas and then slip further behind in meeting their international obligations, but for a management approach based around effectiveness, the presence of ineffective OECMs undermines the whole concept. These and other questions remain to be answered.

Box 4: The emerging global role of Satoyama

At a broader scale, the Satoyama Initiative promotes "socio-ecological production landscapes and seascapes" (SEPLS), production landscapes and seascapes that support or facilitate biodiversity. SEPLS may serve ancillary, secondary or primary conservation cases, in the same way as OECMs, depending on where they occur and how they are managed. Most SEPLS already exist as results of traditional land-use practices and help maintain the level of biodiversity as it is now. By improving the practices, however, new SEPLS may also be created. SEPLS are not area-designation, but some of them may be within protected areas and many may qualify as OECMs. Figure 2 below shows these relationships in diagrammatic form and Figure 3 presents a first mapping of SEPLs around the world.



Designation	Protected areas	Protected Landscapes and Seascapes
Management orientation	• Minimising impacts • Conservation, an objective	• Enhanced use and livelihood • Conservation, one of the means to an end
Management entity	Well defined, designed	Diffused, *de facto*

Figure 2: **Relationship between different types of area-based conservation.** *Source: Natori and Hino, 2021*[147]

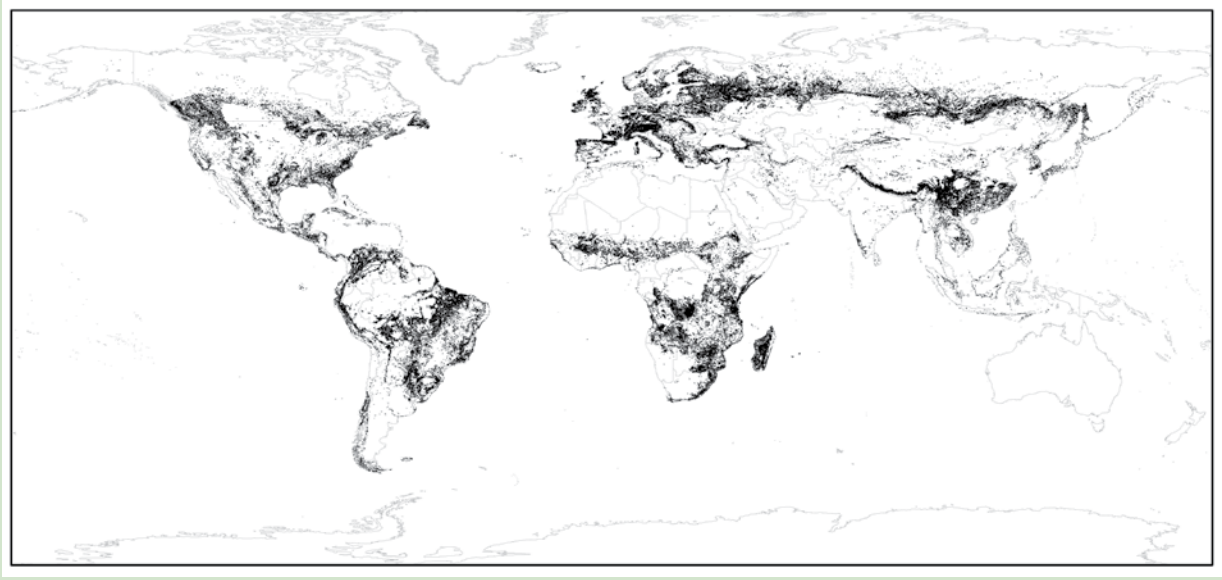


Figure 3: **SEPLS around the world.** *Source: Natori and Hino, 2021*[147]

NbS IN PROTECTED AND CONSERVED AREAS

Nature-based Solutions can take place inside or outside protected areas. If designed correctly, NbS and protected and conserved areas are in most cases fully compatible and mutually reinforcing. Indeed, protected and conserved areas are ideal vehicles for that proportion of NbS that comes from natural ecosystems. So there is an ideal match for values like ecosystem adaptation, ecosystem-based mitigation and Eco-DRR, and for natural infrastructure. All the restoration options (ecological restoration, forest landscape restoration, etc.) will be important in some protected areas and in many OECMs. The parts of NbS that are using ecological principles to modify highly managed systems, such as green and blue infrastructure and ecological engineering, are less likely to be a regular feature of protected and conserved areas. These issues will be discussed in detail in the Practitioner's Guide and are summarised below.

Protected areas can assist with each of the seven societal challenges addressed by Nature-based Solutions, many of which have an important economic component as well:

- **Food security**: conservation of wild species harvested for food, including particularly marine and freshwater fish, protection of crop and livestock wild relatives to assist in crop and livestock breeding, supporting critical agricultural services such as pollination and more fundamentally supplying soil formation, photosynthesis and nutrient cycling services.

- **Water security**: providing a range of water services including water purification by filtering through pristine forest ecosystems and some freshwaters, increasing water flow in certain circumstances such as from tropical cloud forest and paramos vegetation, and stabilising water flow to reduce both flooding and the impacts of drought.

- **Climate change mitigation and adaptation**: helping to mitigate climate change through storing carbon in the biomass (in foliage and the soil) and sequestering carbon dioxide through photosynthesis, preventing the emission of some other greenhouse gases (such as methane) and assisting adaptation to existing and future climate change.

- **Disaster risk reduction**: through ecosystem-based disaster risk reduction.

- **Economic and social development**: by providing direct jobs, indirect jobs and a secure source of resources that can be transformed into cash income. The role of sustainable production systems will likely increase with the further recognition of OECMs, although the extent to which agriculture matches OECMs is still a matter for debate.

- **Human health**: from local medicines and Western-based pharmaceuticals sourced from plant and animal material maintained in healthy conditions in protected and conserved areas, use for exercise and relaxation with an increasing recognition by doctors and mental health professions, control of zoonotic diseases by helping to separate pathogens from the human population, and regulation of several other vector-based diseases.

- **Environmental degradation and biodiversity loss**: which remains the primary role of such areas, underpinning the other values.

There are also still questions about when a value becomes an "ecosystem service" and in turn when this ecosystem service can be recognised as a Nature-based Solution. Are spiritual benefits amongst the "*social, economic and environmental challenges*" that NbS address? This probably depends on who you ask. All these issues will be examined in greater detail in the Practitioner's Guide, when the particular role that protected areas and OECMs can play in their delivery will be discussed and compared.

THE ISSUES IN CONTEXT

The meeting of and interaction between Nature-based Solutions and protected and conserved areas has implications for a wide range of international goals and commitments. In the following two pages, some of the main links are explained.

The Convention on Biological Diversity's planned (and delayed) action plan to 2030, the Global Biodiversity Framework (GBF), includes a draft target relating directly to protected and conserved areas: "*Ensure that at least 30 per cent globally of land areas and of sea areas, especially areas of particular importance for biodiversity and its* ***contributions to people****, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures and integrated into the wider landscapes and seascapes*" (our emphasis). The target, whilst aimed principally at addressing the global biodiversity crisis, deliberately references the role of these areas in meeting various human needs, including NbS. Many other of the draft targets (8, 9, 11–13) refer in one way or another to ecosystem services, although the phrase "Nature-based Solutions" is still in square brackets in the text.

Ecosystem services of various kinds are also fundamental to many of the 17 UN Sustainable Development Goals (SDGs) and the links with protected areas and OECMs have been carefully investigated; at least ten of the SDGs draw benefit from area-based conservation and many of these link directly to Nature-based Solutions.[87,]

Links are also clearly identifiable within the aims of the remaining two "Rio Conventions". The UN Convention to Combat Desertification has a target of Land Degradation Neutrality by 2030,[88] which relies in many cases on the introduction or reintroduction of management systems that help ecosystems such as grasslands and forests to recover from past mismanagement or adapt to changing climatic conditions. Strategic use of area-based conservation can protect much larger areas outside the boundaries against soil erosion and desertification, and the kinds of low-level grazing

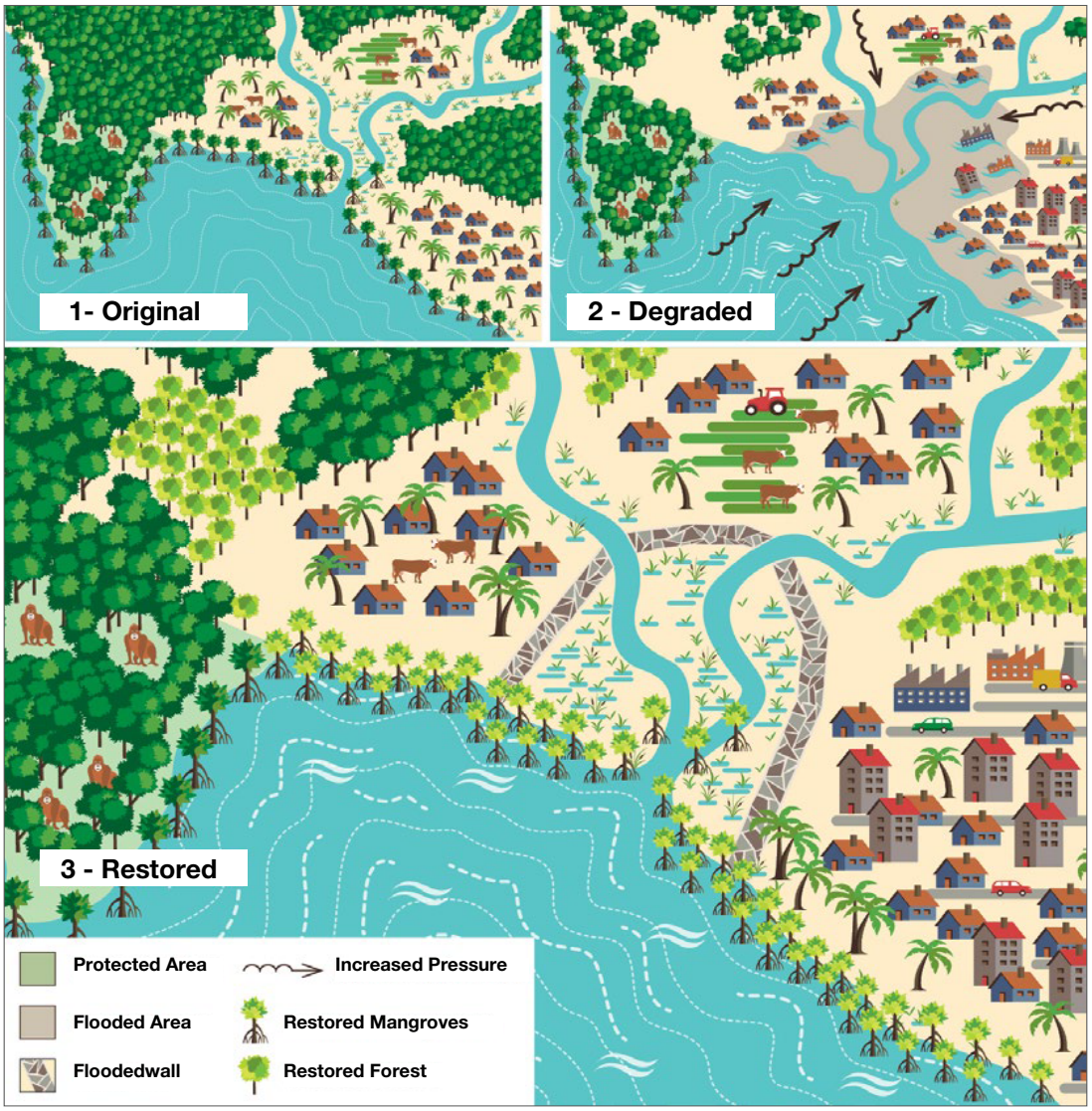


Figure 4: **Hypothetical scenario of Nature-based Solutions being used in conjunction with infrastructure development and protected area conservation.** *Source: Cohen-Shacham et al., 2016*[28]

that may well meet standards for OECMs could be used to help recover degraded drylands.[89]

Within the UN Framework Convention on Climate Change, a growing number of Nationally Determined Contributions[90] draw on protected areas as a means of storing carbon and sequestering carbon dioxide from the atmosphere, and this use is likely to grow through development of OECMs.

Commitments to reducing deforestation and to forest restoration, present in the UN Strategic Plan for Forests, the New York Declaration on Forests and (for restoration) the Bonn Challenge all draw on concepts of forests as Nature-based Solutions as one of their major incentives for governments to adopt serious conservation and restoration policies.

And these links do not relate solely to dry land. The GBF and the SDGs both apply equally to land, freshwater and marine environments, with for example very clear links to food security and Eco-DRR in the case of coastal ecosystems. The Strategic Plan of the Ramsar Convention on Wetlands puts heavy emphasis on protection and recovery of wetlands for human use as well as biodiversity with for instance peatland restoration for climate change mitigation being a key strategic aim.

Finally, the UN Decade on Ecosystem Restoration, launched in June 2021, has the recovery of ecosystem services as a critical part of its mandate and will be important for protected areas[91] and OECMs. For OECMs, the Decade offers a stimulus to "create" new OECMs on degraded land or water. "Identifying" and "recognising" OECMs in places that are already providing biodiversity conservation is important, as it should bring more security to the areas conserved but does not add to the total area supporting biodiversity. Bringing restoration into the picture will mean that OECMs start adding additional areas to the global coverage of area-based conservation.
These links are easy to spell out in an analysis like this but it is more complicated to persuade governments to notice

and act upon them in practice. Often different elements of the various targets will be under the mandate of different arms of government, where people may not realise what is happening elsewhere, or indeed may be in competition. Better explanation of and capacity building around the overlaps and potential room for collaboration in joint achievement of targets relating to protected and conserved areas and Nature-based Solutions is urgently required.

ROLE AND LIMITATIONS OF PROTECTED AND CONSERVED AREAS AS TOOLS FOR NATURE-BASED SOLUTIONS

It has already been noted that protected and conserved areas are a good match for many, but not all, the components of Nature-based Solutions. Not every NbS fits into a protected and conserved area. Furthermore, the wider NbS benefits may be only partially understood by those responsible for the management and governance of these areas, particularly if the benefits accrue outside the immediate area. A community managing a forest is likely to know its immediate benefits in terms of food, materials and storm protection but might have less understanding about how important it is in terms of water provisions for people living further down the catchment, or its role in contributing to climate stabilisation. A manager of a national park may be an expert in wildlife management but have little knowledge about the importance of crop wild relatives.

Bringing NbS into area-based conservation and the management strategies of protected and conserved areas requires a detailed understanding of what such sites can and cannot do. Very important, and likely to become even more significant in OECMs, is the question of trade-offs, whether management can or should be altered in protected and conserved areas to increase the ecosystem services, and if so how much and the extent to which this might impact biodiversity values.[92] One concern often stated about the promotion of NbS is the risk that it leads to the further spread of intensive monoculture tree plantations.[93,94] Within protected areas, will managers come under pressure to "restore" forests on natural grasslands to help boost a country's carbon balance, whilst undermining grassland conservation aims? Altering ecosystems alters the overall stock of biodiversity and therefore the range of ecosystem services produced; gains in one area might lead to losses in others.

The NbS standards set out what is and is not good practice, and Criterion 3 notes the need for a net gain to biodiversity and ecosystem integrity. A consortium of 20 NGOs in the UK issued a statement that was more explicit still, outlining just four main standards but noting the need to "*prevent inappropriate tree planting on naturally open ecosystems such as native grasslands, savannahs and peatlands, or replacement of native forests with plantations*".[95] Evidence that such principles are being adhered to in practice should do much to allay civil society concerns.

Box 5: Some examples of Nature-based Solutions that do not fit well into protected and conserved areas [97]

Some NbS practices that are important and beneficial in the wider landscape and seascape may not fit so easily into the aims of protected areas or (to a lesser extent in some cases) OECMs. The list below is by no means complete but gives an initial idea about what might fall outside:

- City parks, with flowerbeds and mown lawns, gardens on traffic islands and trees planted along city streets can help air quality, provide recreational benefits and help to prevent flash flooding but are not protected areas or OECMs.
- Plantations of non-native trees may sequester carbon but they have few biodiversity values. If the timber is used for short-life products they have little medium-term impact on carbon storage, and in fact may create a net increase in greenhouse gases, particularly if it is established by replacing natural forests or grasslands.
- Fishery closures, temporary set asides, gear restriction areas with a single species, and other temporary fisheries closures may help rebuild fish stocks, but offer little to other marine species or to the general marine ecosystem.
- Intensively grazed pastures, or grasslands where native species have been replaced with monocultures of non-native grasses. Non-native grasslands of this type can help reduce erosion but result in a net loss of native species.
- Temporary agricultural set asides, summer fallow and grant-maintained changes to agricultural practice may benefit biodiversity in the short term but lack the commitment to permanence needed to qualify as a protected or conserved area.
- Reedbeds established as water purification systems in an otherwise non-natural landscape and other similar forms of green or blue infrastructure.

Given that OECMs will often be in places where those managing the areas have little history in or understanding of conservation, and are based on effectiveness, the ability to monitor and report on trends in biodiversity will be critical. But it is unreasonable to expect the skills to do this to be available on site, which means that someone else will have to help. This could be expert consultants although this has cost implications, or government scientists bringing OECMs into the monitoring they already carry out in protected areas (although this also carries costs) or in some countries it might be possible to use volunteers. All these issues are still largely waiting to be resolved.

All these factors have implications for the ways in which governments, local rightsholders and stakeholders plan and manage their land. There are many other NbS where the links are less certain and where decisions need to be made on a case-by-case basis.

SAFEGUARDING: MAKING SURE THAT NbS WORKS FOR ALL STAKEHOLDERS AND FOR THE WIDER ENVIRONMENT

Nature-based Solutions in protected and conserved areas offer a potential win-win; safeguarding biodiversity whilst providing immediate benefits for society and attracting support from people who do not normally think too much about nature and the environment. The opportunities presented for climate change mitigation have further increased the incentive to draw on natural solutions.[96] But as noted, there are concerns that a rush to apply Nature-based Solutions will result in inequitable forms of management: as a form of greenwashing and a cover for land grabbing.

These are real fears and there are plenty of examples of such things happening in practice. Unfortunately, whenever money is available people will find ways to exploit it, and these criticisms omit the situations where NbS has been applied carefully, with the full participation of (and often at the instigation of) local communities or Indigenous peoples living in the area. The NbS approach can provide an important source of support for many people who have few if any alternatives.

Nature-based Solutions need to be applied in a responsible way that respects the rights of people living in the area, or near the area, or regularly making use of the area (including transhumant communities). When working in protected and conserved areas, there is an additional prerogative to ensure that the NbS contributes to, or at the very least does not undermine, the aim of biodiversity conservation. Furthermore, civil society, NGOs and governments all need to be aware of the potential for abuse of the NbS label and be ready to call out bad practices wherever these occur. IUCN provides a set of principles for application of NbS, which includes principle 5 (see box 6) that focuses explicitly on human rights.

Box 6: Details of IUCN Global Standard for Nature-based Solutions Criterion 5: "NbS are based on inclusive, transparent and empowering governance processes"

IUCN has attempted to provide a set of standards to provide some guidance on maintaining human rights in NbS. These are summarised below.

- A defined and fully agreed upon feedback and grievance resolution mechanism is available to all stakeholders before an NbS intervention is initiated
- Participation is based on mutual respect and equality, regardless of gender, age or social status, and upholds the right of Indigenous peoples to Free, Prior and Informed Consent (FPIC)
- Stakeholders who are directly and indirectly affected by the NbS have been identified and involved in all processes of the NbS intervention
- Decision-making processes document and respond to the rights and interests of all participating and affected stakeholders
- Where the scale of the NbS extends beyond jurisdictional boundaries, mechanisms are established to enable joint decision making of the stakeholders in the affected jurisdictions

The opportunities presented for climate change mitigation have further increased the incentive to draw on natural solutions.But as noted, there are concerns that a rush to apply Nature-based Solutions will result in inequitable forms of management: as a form of greenwashing and a cover for land grabbing.

THE PRACTITIONER'S GUIDE

INTRODUCTION TO THE PRACTITIONER'S GUIDE

Half the world's protected areas have been set up in the last 30–40 years, which means that we are still very much learning how they should be managed, even more so when it comes to managing for Nature-based Solutions. OECMs are much newer still as a recognised category of area-based conservation, although as with protected areas many of the techniques and approaches proposed for OECMs have existed for a very long time. We are likely to see a sudden burst of designations rolling out around the world. There is also a certain amount of overlap between the two concepts; areas that have long been designated as protected areas might, if they were being considered today, be more likely to be classified as OECMs. This means that inevitably there is a certain amount of confusion as to where one starts and another stops, despite the apparent clarity in the definitions. In the following section we provide a user's guide to identifying and managing both protected areas and OECMs for their Nature-based Solutions.

This section follows a standard format as follows, with a particular societal challenge tackled in turn (water security, food security, disaster risk reduction, etc.):

- The range of Nature-based Solutions that protected and conserved areas can address under the topic in question
- The role of protected areas
- The role of OECMs
- Real-life thumbnail examples throughout to illustrate uses in action
- Some notes distinguishing between the two approaches
- General policy guidance

We can only introduce general concepts at this stage, references and where necessary hotlinks guide the reader to further information wherever necessary.

FOOD SECURITY

Background: A combination of a rapidly growing world population, massive levels of food waste and dietary change towards steadily less efficient foodstuffs mean that food production is critical and may reach genuine shortages in the next few decades.[98] Climate change increases the problems by driving up the likelihood and the severity of events such as droughts and floods, leading to local catastrophes and wider food insecurity. The war in Ukraine is providing immediate evidence of how political issues can quickly escalate into food issues, with shortages of grains and oils already becoming apparent. Part of the role of many protected areas and OECMs is to keep land *out* of significant food production so that its other benefits are not compromised, including support for food security such as the maintenance of beneficial biodiversity. Other types of area-based conservation accommodate or are even based around traditional food production systems.

Nature based solutions to food security: amongst the most important are:

- **Biodiversity for food and agriculture** – ranging from pollinators needed in crops and orchards, other beneficial insects (such as predators of pests), useful soil organisms and others.[99] Small reserves in mixed landscapes are particularly beneficial for their spillover effects into cropland, although their own survival depends on farming systems managed sympathetically enough so that the beneficial biodiversity is not destroyed.
- **Crop and livestock wild relatives** – often essential as sources of genetic material for crop breeding, to resist disease and adverse environmental conditions, or bring in other desirable attributes.[100] A vast industry is based around such genetic material, which is increasingly preserved within protected areas, albeit with some dangerous gaps in coverage.[101]
- **Maintaining fish stocks in coastal and inland waters** – marine and freshwater protected areas provide safe places for fish to breed, and to survive and grow to a large size (which boosts breeding rate in many species). Spillover into the wider environment maintains stocks for livelihood and commercial fishing; it is now well established that marine protected areas (MPAs) provide a net benefit in terms of food security as compared with open access to fish an entire area.[102]
- **Access to wild foods** – including both food directly eaten by humans and fodder for livestock. Many protected areas and most likely an even larger proportion of OECMs are open to sustainable collection and provide important and sometimes irreplaceable components of local and more distant diets.
- **Maintaining water security** – reducing the likelihood of either catastrophic floods or of drought by securing a more constant water flow.
- **Emergency food supplies in times of crisis** – for example during drought conditions when other options are no longer available. Such emergency use is often a trade-off between a conservation ideal – which would probably be no collection – and a humanitarian need; in practice many protected and conserved areas supply emergency foods.
- **Traditional farming and grazing** – probably the most controversial of all the uses. All kinds of farming takes place in protected areas, for example in most national parks in Europe and Japan, but some protected area professionals reject these uses. Similar debates are occurring about OECMs. Some traditional agricultural practices are well matched with protected and conserved areas (and with Satoyama), especially when they are so long-established that they have developed important associated biodiversity, and in many areas livestock grazing has replaced wild deer and antelope grazing as a way of maintaining grassland and savannah. But it is also clearly the case that many forms of sustainable agriculture are *not* suitable in such areas.

Some traditional agricultural practices are well matched with protected and conserved areas (and with Satoyama), especially when they are so long-established that they have developed important associated biodiversity.

Maintaining fish stocks – Tonle Sap Lake, Cambodia: It is now well established that no-take zones in aquatic systems help to maintain fish stocks, giving fish space to breed and grow, maintaining larger fish (which produce proportionately more eggs) and spilling over into fished areas.[103] Cambodia claims to have the largest inland fishery in the world, supplying three-quarters of the protein eaten by inhabitants. Tonle Sap is the largest lake in southeast Asia and hosts two-thirds of Cambodia's inland fisheries. The lake's fishery ranks first in the world in terms of productivity and fourth in terms of catch. It is also a UNESCO Biosphere Reserve, with a long history of fishery co-management, where conservation (particularly in the core zones) is balanced against sustainable use. Whilst co-management principles could be improved, with much power still invested in the hands of central government,[104] the zoning of the biosphere reserve has helped to maintain a fishery that is critical to the food security of people in Cambodia.

The varying roles of protected areas and OECMs in maintaining food security

Protected areas	Other effective area-based conservation measures ***Assumes areas have or could have high biodiversity value***
Particularly… • Protection of crop and livestock wild relatives • Strict protection of marine and freshwater areas to provide space to maintain healthy populations of fish and other species important for commercial and subsistence harvesting • Some traditional grazing regimes and limited forms of agriculture (cork oak farming, some forms of terrace agriculture) with high levels of associated biodiversity	***Particularly…*** • Territories of Indigenous peoples where low-level and sustainable harvest of plants and animals does not undermine the ecosystem • Common lands used for low-level grazing or harvest, with high nature values but outside the protected area system • Low-level grazing regimes or mixed grazing and wildlife management (e.g., in African conservancies) • Permanent or long-term fisheries closures designed to protect the whole ecosystem
Sometimes also… • Small reserves to provide beneficial species within farming mosaics • Emergency food supplies • Regular supplies of certain wild foods managed in a sustainable manner	***Sometimes also…*** • Maintenance of crop wild relatives that require frequent disturbance (weed species, etc.)

WATER SECURITY

Background: Water supplies are in a critical state in many areas, with climate change increasing levels of insecurity by increasing both droughts and floods, leading to too much or too little water, sometimes a single place can face both crises in the course of the year. Unsustainable levels of groundwater use in some drylands are risking a further crisis when these run low;[105] some recharge quickly while others do not.

Nature-based Solutions to water security: Natural vegetation in watersheds and natural wetlands both play a range of roles; key issues relate to quality, quantity and flow of water.[106] These are increasingly being recognised and brought into various Payment for Ecosystem Service (PES) schemes.

- **Water quality** – ecosystems such as watershed forests purify water sources so the water running off needs less or no further treatment, mainly as a result of such areas having less contaminants than in farmed or urban environments but also due to purifying actions by freshwater bacteria. Protection of a watershed can benefit downstream communities; recognition of water values for 4 million downstream users is an important incentive for protecting the Ulu Muda forest complex in Malaysia.[107] Many municipalities recognise the critical role of natural vegetation in maintaining clean water and invest appropriately, in others water security is at risk through failure to protect source watersheds. Natural vegetation does not purify completely – Giardia is not removed for instance – but dramatically decreases the costs of treatment.[108]
- **Water quantity** – increasing the rate of water flow in particular situations (tropical cloud forest, temperate cloud forest, paramos vegetation, etc.), where specially evolved leaves "scavenge" water from the damp atmosphere and increase the downstream flow. While more limited in geographical extent, cloud forest or paramos-increased flow is recognised in large areas of Latin America, in the Himalayas and elsewhere.[109]
- **Water flow** – smoothing out the rate of flow through retaining additional water in vegetation or physically slowing flood events.
- **Protecting groundwater sources** – particularly recharge areas in drylands to ensure that groundwater supplies are not exhausted.

POTENTIAL OECM

Maintaining water quality – wetlands in Japan: Natural ecosystems such as forests, grasslands and wetlands generally produce cleaner water than managed areas, thus reducing costs of water purification. An increasing number of cities and smaller settlements are consciously managing wetlands for water quality. While benefits are often simply the result of natural ecosystems being less subject to pollution, wetlands can also play a positive role in pollution abatement even in areas of intensive agriculture. Sugadaira village, in Nagano prefecture, Japan, is an upland area at 1300 metres, important for winter sports activities and also agriculture.[110] The latter is practised quite intensively, leading to serious nitrate pollution and there is also some pollution from domestic sewage. Research shows that anaerobic conditions in the Sugadaira wetlands helps to reduce sulphate levels and in denitrification, converting toxic nitrate into less toxic forms.[111]

Unsustainable levels of groundwater use in some drylands are risking a further crisis when these run low, some recharge quickly while others do not.

Maintaining the quantity of water – tropical cloud forest above Quito, Ecuador: Many forests reduce water flow out of the catchment, through the process of transpiration (sucking water up through the roots and releasing back into the atmosphere). But some ecosystems, including cloud forests, some eucalyptus forests and the Andean vegetation known as *paramos*, increase net water flow by condensing water from clouds and mist on specially evolved leaves, with the water later trickling down and percolating through the watershed. In Ecuador, some 80 per cent of the 1.5 million population living in the capital, Quito, receive drinking water from two protected areas; *Antisana* (120,000 ha) and *Cayambe-Coca Ecological Reserve* (403,103 ha). To control threats to the reserves, the government works with a local NGO through the Antisana Fund, to protect the watersheds including stricter enforcement of protection to the upper watersheds and measures to improve or protect hydrological functions, protect waterholes, prevent erosion and stabilise banks and slopes.[112] The water fund has been in place for over 20 years, and continues to evolve as rural communities themselves change,[113] showing that NbS is seldom a static process but needs to co-evolve as environments and societies change over time.

The varying roles of protected areas and OECMs in maintaining water security

Protected areas	Other effective area-based conservation measures
	Assumes areas have or could have high biodiversity value
Particularly… • Protected areas that also protect important surface or groundwater resources • Protected areas with forested slopes that help to prevent rapid run-off of water during flooding • Dryland protected areas with significant groundwater recharge areas	***Particularly…*** • Territories of Indigenous people and local communities *outside* the protected area system, protecting valuable watershed forests and therefore eligible for PES schemes • Areas set aside by water authorities to protect catchments • Farmed floodplains that absorb periodic floodwaters for downstream communities
	Sometimes also… • Reedbeds or similar systems in urban areas developed in part to purify water • Areas being restored to protect watershed values, prevent flooding, etc. • Military training grounds, hunting reserves with high carbon levels in the soil

CLIMATE CHANGE MITIGATION AND ADAPTATION

Background: The primary action against climate change must be to reduce emissions, and many policymakers and activists have been reluctant to mention other options such as increased storage because of fears that these will be used as an excuse for inaction on emissions. Today, the situation is recognised as so critical that all possible steps are being taken, with increased emphasis on the role of ecosystem management within Nationally Determined Contributions, produced in response to the Paris Agreement of the UN Framework Convention on Climate Change (UNFCCC).

The REDD+ mechanism creates a strong framework, with the Cancun Safeguards114 providing a set of actions to ensure that implementation provides positive results for society and the environment. REDD+ is applicable in protected areas and OECMs and is a strategy most suitable for places where other options do not exist, for example with little opportunity for ecotourism, or other sources of finance. Setting up a REDD+ scheme is not particularly easy, but successful examples exist.

Vegetation and soils management are therefore essential steps forward, although such management needs to be done with care and remains controversial. Tree planting schemes on natural grassland, and even more so on peat, can lead to net losses of carbon, particularly if the trees are fast-growing, monoculture crops that are themselves used in short-life products; misuse of carbon mitigation is one of the main concerns with NbS. Climate change itself is undermining some of the most important of these functions, by increasing the frequency and severity of vegetation fires and by general atmospheric warming that is melting permafrost and threatening the security of the huge carbon stores in tundra peat deposits throughout the boreal region.

Nature-based Solutions to climate security: These centre around the storage and further sequestration of greenhouse gases and more generally the multiple ways in which NbS can help humanity adapt to the climate change that is already occurring and will occur in the future.115 The latter cover almost everything in this manual, here we focus on management of greenhouse gases. Protected areas and OECMs offer two, very closely related, services:

- **Storage of greenhouse gases** – particularly carbon, in vegetation and soils, in both terrestrial and marine environments. While mature forests and peat deposits are the largest terrestrial stores, many other ecosystems have important storage functions including grasslands and savannahs,[116,117] seagrass and kelp beds, marine plankton and more. Protected areas provide disproportionate benefits by retaining trees; research by the Korea National Park Service found carbon levels of trees in protected areas twice that of the average value for forests.[118]
- **Sequestration of greenhouses gases** – which continues in mature systems,[119] including old-growth forests, as a function of their maintenance but can be increased through restoration activities. This is one of the main reasons for the UN Decade on Ecosystem Restoration. Restoration activities include planting or encouraging natural regeneration of native vegetation, particularly trees, but also rewetting of peat (which must be done carefully or the resulting methane release – itself a greenhouse gas – can balance out sequestration of carbon), changes in agriculture to increase soil carbon and restoration of coastal seagrass and kelp beds.

The varying roles of protected areas and OECMs in supporting climate change mitigation and adaptation

Protected areas	Other effective area-based conservation measures ***Assumes areas have or could have high biodiversity value***
Particularly… • Protected areas that include old-growth forest, regenerating forest, important peat deposits, coastal vegetation, etc. with high potential to store carbon	***Particularly…*** • Territories of Indigenous people and local communities *outside* the protected area system, protecting valuable carbon stores • Areas of grassland and rangeland that can be managed in such a way that they increase carbon capture in soils and vegetation120 • Restoration areas where forests or peatlands are being restored into a more natural condition
Sometimes also… • Degraded protected areas that are under restoration	***Sometimes also…*** • Military training grounds, hunting reserves

POTENTIAL OECM

Carbon storage – Nepal's community forests:
Forests cover 45 per cent of Nepal and are important for the livelihood security of two-thirds of the population. Population pressure, exploitation and other factors have led to serious deforestation, but also some of the earliest experiments with community-managed forestry, which started experimentally in the 1970s and was given official backing in the Forestry Act of 1993 and the Forestry Regulation of 1995. Today, there are 22,000 community forestry groups responsible for the management of a third of the Nepalese forest estate. Communities benefit through ownership of the forest and access to fodder, fuelwood and a range of non-timber forest products, with local control leading in some areas to a restoration of forest area. More recently, forest services have been included in the country's Nationally Determined Contributions to the Paris Agreement on climate change,[121] REDD+ schemes and to 80 targets identified as being linked to the UN Sustainable Development Goals.[122] Forests store large amounts of carbon in living biomass and soil humus, and continue to sequester carbon over time, even when trees are mature. The community forests are thus a classic Nature-based Solution, although interestingly they are still often not identified as such by the communities managing them, suggesting further education and capacity building is important.

DISASTER RISK REDUCTION

Background: So-called "natural disasters" caused by flood, drought, tidal waves and tornadoes take a huge toll on life, livelihoods and money. These impacts are often increased by human activity, due to climate change, or because urban crowding and poverty force people to move to areas at high risk, and due to removal of natural bulwarks against disaster such as coastal mangroves and dryland forests. Earth movements are independent of human meddling but side effects of an earthquake or volcanic eruption, such as landslip or tsunami, are exacerbated by mismanagement of the ecosystem. Protected areas and OECMs offer a range of preventative services.

Nature-based Solutions approaches to disaster risk reduction: all basically rest around the role of natural vegetation in buffering against sudden climate shifts, earth movements and even lava flow:

- **Floods** – forests, particularly riparian forests, help to baffle and slow floodwater,[123] while floodplains provide space for water to disperse without causing damage (as long as settlement and other activities are controlled). Natural vegetation in urban areas is particularly important, where concrete and tarmac prevent absorption and increase the chances of flash flooding.
- **Droughts** – wetland areas, cloud forests, peatlands and other water-rich natural vegetation store water that is released more gradually into catchments to help communities manage and adapt to floods. Protected areas, particularly in drylands, help to maintain aquifer recharge areas and thus provide extra insurance against drought.
- **Tsunamis and sea-level rise** – mangroves, coral reefs and sand dune complexes protect communities against a sudden or a gradual influx of seawater while coastal wetlands allow space for surges to disperse without causing damage.[124]
- **Typhoons and hurricanes** – coastal and other forests provide protection against high winds and storms, absorbing the first shock of the weather and reducing impacts further inland.
- **Earthquakes** – forests and other healthy vegetation on steep slopes helps to prevent earth, rock and snow movements in the aftermath of an earthquake,[125] the latter often causing as much or more damage as the original earth movement itself.[126]
- **Volcanic eruptions** – healthy forests can also apparently baffle and slow the flow of lava from a volcanic eruption thus helping to protect local communities.[127]

POTENTIAL OECM

Flood prevention – Inba Lake, Japan: Problems of urban flooding had increased due to increased inflow, in part from agricultural wastewater, which also contained high levels of ammonia and nitric acid, causing pollution. Part of the reason was identified as the abandonment of Yatsu wetlands, small branch-like valleys that were uneconomic for rice production and unsuitable for mechanisation.[128] Past efforts at flood control had also concentrated on collecting and dispersing the water as quickly as possible, but this led to urban flooding, and in time a switch to greater attention on retention and gradual release of floodwater. Restoration of the Inbanuma swamp basin as rice paddy has helped reduce flooding of nearby urban areas, with maintenance being carried out by both rural and city dwellers. Microorganisms in the water also help to decompose the nitrate pollutants, and these areas are important for biodiversity conservation.[129]

POTENTIAL OECM

Desertification – holding back the desert with the Great Green Wall of China: Desertification is complex and deserts change in ways that geographers struggle to understand. But overgrazing and unsustainable agriculture play an important role. The Gobi Desert in China has expanded for years, with almost 7 million ha affected in the 1960s and 1970s, influencing twice the area of agricultural land due to wind erosion. Ten million ha of grassland were affected by desertification and salinisation, the latter through unsustainable irrigation practices. Desertification caused a decline in groundwater and an increase in sand storms.[130] The government has tried various strategies, including relocating herders, conserving existing forests and the Three North Shelterbelt Forest Programme, also called the Great Green Wall of China. The programme began in 1978 and is aimed for completion in 2050, to create a vast new forest, increasing forest cover from 5 to 15 per cent. Almost 10 million ha of grassland have been restored and over 5 million tonnes of fuelwood produced every year, thus also reducing loss of native forests.[131]

The varying roles of protected areas and OECMs in helping to survive related disasters

Protected areas	Other effective area-based conservation measures
	Assumes areas have or could have high biodiversity value
Particularly… • Protected areas that contain ecosystems likely to help buffer against disasters including coastal mangroves and reefs, riparian vegetation, forests on steep slopes and vegetation in drylands	***Particularly…*** • Areas of land and coastal habitats outside protected areas that are being restored for their buffering capacities against extreme weather events • Traditional management systems that maintain useful vegetation cover, such as mangroves to maintain fish stocks, natural forests or bamboo maintained as shelterbelts, areas managed for flood control, and wild areas in urban parks that provide space for absorption of floodwater
Sometimes also… • Degraded protected areas under restoration	***Sometimes also…*** • Military training grounds, hunting reserves

POTENTIAL OECM

Tsunami and sea-level rise – Adaptive coastal recovery in Shinhama, Japan: Rising sea levels add to threats from occasional tsunamis in many parts of the world. The first instinct of many coastal authorities is to rely on engineering responses, but seawalls often destroy ecosystems on the landward side, and there is plenty of evidence that natural mangroves, dunes and reefs also provide important levels of protection. Following the 2011 tsunami in Japan, researchers noted that the unique transition ecosystem on the coastal Sendai plain, formed by repeated floods and tidal waves over hundreds of years, recovered much quicker than expected. Initial plans to build a seawall in front of the coastal vegetation would have altered this habitat and lost accompanying ecosystem services. After community consultation, a grey-green combination was agreed, with a seawall on the landward side and maintaining the natural ecotone intact. The latter provides a variety of protective functions against storms, tsunamis and sand drift, along with other ecosystem services including provision of firewood, organic fertilisers and water purification.[132]

HUMAN HEALTH

Background: To some extent this is the most complicated of all the benefits, where natural ecosystems have the opportunity both to provide concrete benefits and also potentially cause some problems, and where the gains range from hard-to-measure issues like mental health through to discovery of new pharmaceuticals. The COVID-19 pandemic has also focused attention on the role of natural areas in providing both a source of zoonotic diseases and a means of preventing their transfer to humans. These issues are complex and open to misinterpretation but are one of the most valuable NbS of all.

Nature-based Solutions to health: A large variety of separate issues are important, in addition to issues of food and water security, themselves essential to health (clean water alone will probably save more lives than any other single element below). These are discussed elsewhere in this document:

- **Control of zoonotic diseases** – there is evidence that zoonotic diseases pass from animals to humans through being in close proximity, particularly through eating wild meat that may be carrying diseases. Anything that reduces this interaction will reduce the risk of disease and protected areas can play a critical role in cutting down bushmeat hunting and controlling the ways in which visitors interact with animals.
- **Contributions to physical exercise** – the risks of many of the so-called diseases of civilisation, such as heart disease and cancer, can be reduced through exercise and a healthy diet. Finding space to exercise for many city dwellers is challenging and walking or running along busy roads also risks being exposed to high levels of air pollution. The use of parks and protected areas as places to exercise in safe and pleasant surroundings is increasingly recognised and has been named the "green gym" concept.
- **Contributions to mental health and well-being** – just as important, and closely linked, is the role that natural ecosystems play in helping people to relax and, for those with mental health or addiction problems, is now known to provide measurable benefits. Pioneering linkups between urban mental health authorities and park managers can provide important pointers for further development.[133]
- **Sources of local and more distant medicines** – the majority of the world's population still rely predominantly on local medicines, often self-collected from natural areas; the efficacy of these varies. In places where natural ecosystems have been severely degraded, protected and conserved areas may be the only places where such plants can still be found and a growing number of protected areas are working with communities to develop a sustainable offtake system. At the other end of the scale, some of the world's largest pharmaceutical companies are investing in protected areas in order to have a rich genetic "larder" from which to hunt for new drugs and medicines.[134]
- **Recreation and tourism** – currently perhaps the world's largest industry, although as COVID-19 has shown, one that is severely at risk through sudden shocks from disease, disaster, terrorism and war. But nature-based tourism is currently the fastest growing sector of the tourism industry and one where protected and conserved areas play a critical role in providing access to some of the world's most beautiful places and most abundant wildlife.
- **Nature-deficit amongst children** – closely related to several other of the values described here, the generational switch from children who played predominantly outdoors to ones who play mainly online has created a number of serious mental and physical health problems, including an obesity crisis amongst the young. Furthermore, children who never experience nature are far less likely to be *interested* in nature. Use of protected areas to overcome nature deficit varies from the simple, like pond-dipping parties on local nature reserves, to adventure holidays in wild national parks.
- **Blocking disease vectors** – there is also a theory that natural vegetation impedes the movement of some disease vectors, including malaria mosquitoes. However, others dispute this claim and some natural ecosystems, particularly wetlands, provide breeding space for malaria, schistosomiasis and other diseases.

The varying roles of protected areas and OECMs in promoting mental and physical health

Protected areas	Other effective area-based conservation measures
	Assumes areas have or could have high biodiversity value
Particularly… • Protected areas large enough to provide sustainable supplies of medicinal herbs if needed by the local community, and also situated to preserve the maximum genetic diversity for future medicinal research • Nature reserves near urban centres and other settlements that provide access to people for exercise and relaxation • Protected areas established largely for recreation and tourism, such as many national parks	***Particularly…*** • Wild areas in urban parks or arboreta • Territories of Indigenous peoples and local communities used for collecting medicinal herbs and potentially suitable for a PES scheme relating to medicinal genetic material
	Sometimes also… • Military training grounds, hunting reserves

PR0TECTED AREA

Area-based conservation and the green gym concept – morning walkers in Keoladeo National Park, India: With lack of exercise helping to precipitate a global obesity crisis, protected and conserved areas near human settlements provide safe places for people to exercise. Keoladeo National Park in India was designated a World Heritage Site in 1985 for protecting a large number of migratory aquatic birds particularly the Siberian Crane (Grus leucogeranus). It covers 28.73 km^2 close to the town of Bharatpur, with a population of 250,000. The park has designated a stretch of 2 km which morning walkers enjoy every day, free of charge, between 5 and 7 am when the temperature is cool enough to make exercise possible, as the daytime temperature in Bharatpu town can reach over 45 °C. Up to a thousand men and women visit the park every morning to walk and enjoy the fresh air, beauty and tranquillity. No motorised vehicles are permitted inside the park and the only wheeled transport allowed are the cycle rickshaw-pullers, who are also trained to act as nature guides.[135] over 20 years, and continues to evolve as rural communities themselves change,[136] showing that NbS is seldom a static process but needs to co-evolve as environments and societies change over time.

PR0TECTED AREA

Promoting mental health – conservation as a therapy for addiction in England: Recognition that peaceful natural landscapes are beneficial for mental health is now widespread in the medical profession. [137,138] The Phoenix Futures conservation therapy programme Recovery through Nature has since 2001 been encouraging active involvement in conservation projects in English protected areas, as a form of rehabilitation for people with substance misuse problems. Groups take part in habitat management, boundary construction and footpath repairs, nest-box construction and tree growing.[139] An assessment of the effectiveness of the project is made by comparing the percentage of drug users who remain in the treatment programme (with treatment defined as being effective when clients stay in it for 12 weeks or more). From mid-2007 to mid-2008, 73 per cent of attendees stayed in treatment for 12 weeks or more, compared to 49 per cent of non-participants.[140]

PR0TECTED AREA

Medicines – National parks in Nepal as a source of local medicines: The majority of the world's population still relies at least partly on locally collected medicines from natural plant and animal products. Ecosystem degradation and loss limits access in many places, with protected areas providing an important source. An increasing number of protected areas are permitting sustainable use of medicinal plants, for local use and in some cases also for sale. Researchers in Nepal recognise about 1,624 plant species as having medicinal and aromatic values.[141] A study from Shey-Phoksundo National Park found 107 and 166 species of ethnomedicinal importance in surveyed areas of Dolpa and Mustang districts respectively, with most people relying on the collection of wild medicinal plants for subsistence,[142] and efforts now being made to understand needs and opportunities.[143] A detailed survey in Langtang National Park, Nepal, over five years, involving interviews with 700 households, found 411 medicinal and aromatic plants being used, with about 90 per cent of people in the protected area relying on traditional medicine.[144]

A night walk tour in Akan Mashu National Park, Hokkaido, Japan

ECONOMIC AND SOCIAL DEVELOPMENT

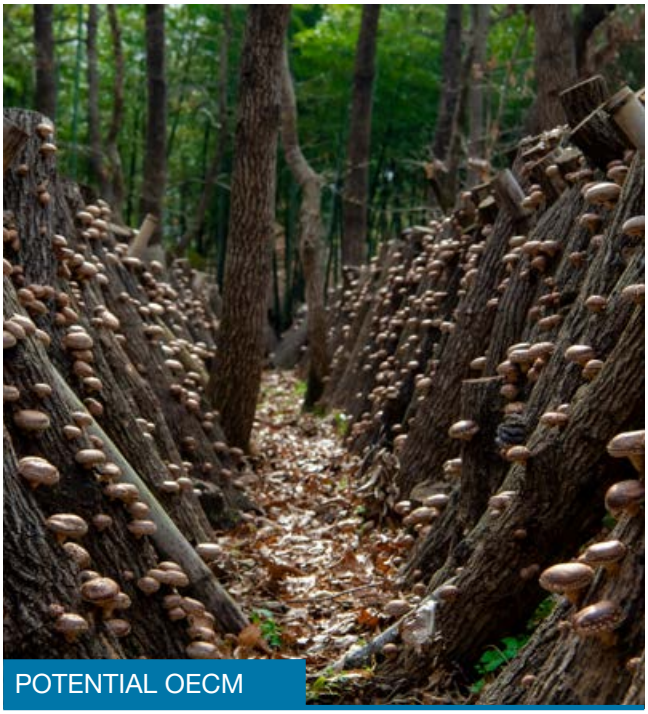
Background: NbS also has an important social and economic function, bringing livelihood opportunities and contributing to overall well-being. People living in rural areas, where NbS are most likely, are often proportionately less well off than people in urban areas, with fewer job and economic opportunities, lower levels of education and frequently often more entrenched attitudes to gender roles, the importance of age in social standing, and strict social barriers.

Nature-based livelihood options: Many livelihood benefits are associated with other NbS; most of the examples given earlier have livelihood opportunities associated, whether it is tree planting for a shelterbelt or restoring peatland for carbon storage. Indeed, the ability to ensure that Nature-based Solutions also provide livelihood solutions is a key step in their acceptance to many stakeholders. Some key issues include:

- **Tourism and ecotourism** – nature-based tourism is the fastest growing sector in the tourism industry, although it took a major hit during the pandemic. There are plenty of jobs available in and around many protected areas, as guides, trackers and through associated employment such as in tourist accommodation, cafes, food stalls, handicraft sales and transportation. However, major problems of equity remain in many places, with the poorest members of society taking low-paid and unfulfilling jobs while a minority take most of the profits.
- **Traditional farming and livestock** – is an important opportunity although most agriculture falls outside the management aims of protected areas and OECMs. Traditional farming practices and low-level grazing can be associated with and sometimes help create high levels of biodiversity, as exemplified by experience with Satoyama. They thus occur in some protected areas. They are likely to be more important in many OECMs. This remains an important area for debate; some conservationists fear that opening up OECMs in particular to agriculture will result in many areas being listed as “conserved” that offer little to biodiversity conservation or ecosystem services, whilst traditional farmers often seek to be recognised within area-based conservation as it can help to secure financial support for approaches that are now only borderline profitable.
- **Direct employment** – particularly in protected areas for managers and rangers, which can be a major source of income in some remote rural areas.

The varying roles of protected areas and OECMs in promoting livelihood opportunities

Protected areas	Other effective area-based conservation measures
	Assumes areas have or could have high biodiversity value
Particularly…	***Particularly…***
• Employment as managers and rangers • Ecotourism in national parks and in many privately protected areas – as guides and through associated jobs in the hotel and catering trade, etc. • Temporary employment in restoration projects • Specialised forms of agriculture with high levels of associated biodiversity	• Low-level, sustainable grazing • Some forms of traditional agriculture • Work in ecotourism in natural areas outside of protected areas



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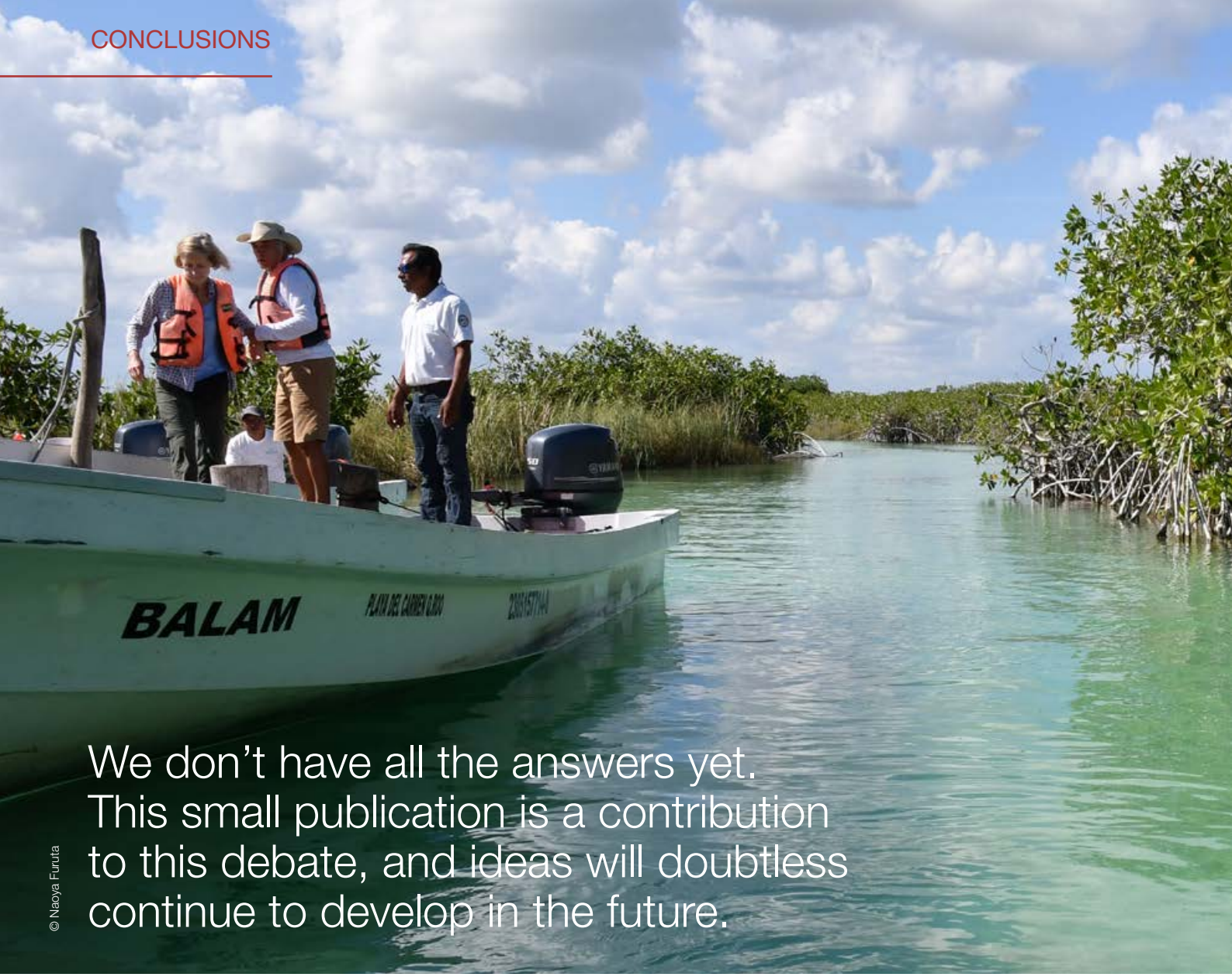
Shiitake mushroom growing in Satoyama, Japan.

Traditional farming as an NbS – Shitake mushroom production in sawtooth oak forest, Japan: Traditional farming techniques often maintain high levels of biodiversity, including species that may have become adapted to cultural management systems over centuries or millennia. Farmers on the Kunisaki Peninsula on Kyushu Island, Japan, face challenges due to low rainfall, volcanic soils that do not retain water and a steep terrain. Maintenance of managed sawtooth oak (*Quercus acutissima*) forests helps to stabilise the water supply, which also reduces risk of flooding, and water is further managed through the construction of interlinked irrigation ponds, some dating back to the 17th century. The oak forests supply timber ideal for growing highly valued shitake mushrooms and the area has been recognised as a Globally Important Agricultural Heritage System by the Food and Agriculture Organization of the United Nations, which means that mushroom producers can apply for regional branding of their products. Rural out-migration and an aging population was decreasing production levels, which have been boosted by an education drive, encouragement of incomers and links to tourism.[145]

© Lake Mashu Tourism Association

Atosanupuri (an active volcano) trekking tour in Akan Mashu National Park, Hokkaido, Japan

Recreation and tourism – Visit! National Park Japan - Project to Fully Enjoy National Parks: National parks were identified as one of the pillars of the "Tourism Vision to Support Tomorrow's Japan" by the Government of Japan in 2016. In 2020, the "Step Up Programme 2020" focused on promotion of the eight leading national parks, with the aim to make these protected areas more attractive to foreign visitors. Visits to national parks by overseas visitors increased from about 4.9 million in 2015 to about 6.67 million in 2019. However, the COVID-19 outbreak led to a decline in 2020 of around 87 per cent, and in addition, the number of domestic overnight visitors in national parks also decreased by approximately 44 per cent, causing serious problems for tourist attractions in national parks. Steps towards recovery from this situation include offering a range of new recreational opportunities in national parks to domestic tourists and renewed efforts to attract foreign visitors. This includes expanding efforts from the original eight to all national parks, and also bringing in policies aiming at carbon neutrality for protected area tourism by 2050.[146]



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We don’t have all the answers yet. This small publication is a contribution to this debate, and ideas will doubtless continue to develop in the future.

CONCLUSIONS

Three major societal developments come together in the issues explored in this report.

In the last five years, the concept of Nature-based Solutions has moved from niche to mainstream and is now increasingly being recognised in international processes, by national governments, industry and civil society. At the same time, the global ambition for protection of natural ecosystems has changed almost by an order of magnitude, with serious consideration being given to the goal of retaining half the world in a more-or-less natural state. And in parallel, the old (and still powerful) concept of a protected area has been joined by the newer idea of other effective area-based conservation measures.

All these developments have their detractors. People who make their living from, for example, engineering approaches to disaster risk reduction don’t like the idea of using natural ecosystems to supplant their industry. Protected areas and OECMs still have plenty of people opposing them. But in all cases, the broad sweep of history seems to be pushing towards acceptance and development.

This also means, given the constraints of money and available space, that NbS, protected areas and OECMs will all overlap, and that NbS will necessarily be drawing on area-based conservation as a major source of land and resources. This has lots of implications, about how and where protected and conserved areas are selected, how they are managed, who decides and who pays, amongst other questions. We don’t have all the answers yet. This small publication is a contribution to this debate, and ideas will doubtless continue to develop in the future.

APPENDIX 1: KEY CONCLUSIONS FROM THE WORKING GROUP ON NATURE-BASED SOLUTIONS AT THE SECOND ASIA PARKS CONGRESS

The following is a lightly edited summary of the key conclusions presented at the end of the working group held at the Second Asia Parks Congress held in Kota Kinabalu, Sabah, Malaysia in May 2022.

- Protected areas, other effective area-based conservation measures (OECMs), ICCAs Territories for Life and Socio-Ecological Production Landscapes and Seascapes (SEPLS) are key delivery mechanisms for Nature-based Solutions (NbS).

- Nature-based Solutions include both traditional and more innovative approaches, and sometimes a mixture of these two, such as using drones and GIS with traditional shifting cultivations and applying modern Western science with local traditional medicine.

- Although the term NbS is widely used at the global level and NbS actions have been implemented widely without naming it as NbS, the relationship between these two is still poorly understood by many governments and by most parts of civil society. This indicates the need for a major capacity-building and outreach effort as well as the need for clear guidance and tools to link globally agreed definitions and standards with actions on the ground.

- Challenges remain in scaling up from individual projects to mainstream application. Blockages include political resistance, concern about the financial implications and more complex reasons of cultural and social resistance. Overcoming these obstructions is a critical need.

- The COVID-19 pandemic was a disaster but it was also an opportunity to highlight the important linkage between human health and nature, both the need for new medicines and the role of natural spaces in supporting mental and physical health. The growing climate crisis has focused attention on NbS and climate mitigation and adaptation as well.

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NATURE-BASED SOLUTIONS AND PROTECTED AND CONSERVED AREAS

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