The ninety-ninth meeting of the Joint Nature Conservation Committee to be held at 0900 hours on 12 June 2014, at Monkstone House, Peterborough, PE1 1JY

This is a revised version of a paper provided to the Joint Committee for decision/discussion or information. Please refer to the minutes of the meeting for Committee's position on the paper.

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Joint Nature Conservation Committee

Advancing conservation science thinking on protected areas for biodiversity in the UK

Editorial note

The main intention of this paper is to stimulate debate on an important subject for nature conservation where there are potentially different views, but where discussion, consideration and a strategic approach can bring much needed benefits. The Joint Nature Conservation Committee (JNCC) felt it was timely to discuss this subject and in a way that demonstrates JNCC's science leadership role. JNCC support company has taken a lead coordinating role in compiling the paper with contributions from all the country nature conservation bodies (CNCB).

The subject is topical because it fits well with the various reviews into the role of protected areas that are currently underway in the CNCBs. The refresh and implementation of the country Biodiversity Strategies is also giving consideration to the effectiveness of protected areas, their public value in terms of ecosystem services, and the relative value of protected areas as a tool, compared with other tools, in delivering healthy biodiversity.

 There is no intention in the paper to suggest we can do without protected areas, rather to consider how they function in the wider landscape and wider socio-ecological contexts. Much of the content of the paper is applicable to a range of strategic questions that need to be asked at high level, e.g. is protected area management actually achieving its aims? Are we using protected areas in an effective way? The paper reflects on how approaches have worked, how they might work better in the future and how to respond better to increasing pressures and threats.

The paper has evolved over time in an open way, with two previous publicly available versions, in November 2013 and March 2014, so it is possible to see how discussion and consideration have produced the current version of the paper. As a result the paper reflects a robust discussion about how to assess the role of protected areas in the short, medium and longer terms

That said, there is still further work to be done. More evidence is required to support the content and statements in the paper, while recognising that gathering such evidence is time consuming and expensive. There is a need to illustrate points made using exemplars of management practices and other factors that are working well, and those that are not working so well. Further work could be done to provide resolution into different temporal and spatial scales.

The paper refers to reallocation of resources, which implies shifting resources to other measures rather than considering more resources overall. There is a need to look at the potential of other resources being available i.e. if we devote more resources 'upstream' of a problem then resources may be saved 'downstream'.

Moving on to the next stage, due consideration is being given to further consultation and taking an evidence based perspective. Protected areas are a societal choice, so there is a need for a greater linkage with a broader community. Audiences that have not yet been fully engaged in the discussion are the academic community and NGOs. Engaging a wider group of more expert individuals through a workshop convened in the second half of 2014 will provide opportunity for useful input to such a debate.

Joint Nature Conservation Committee

Advancing conservation science thinking on protected areas for biodiversity in the UK

Executive summary

Sponsor director: Paul Rose

1.   Action required

1.1   The Joint Committee is asked to:

i.   **discuss** the paper and identify any further changes they wish to make;

ii.   **advise** on the style of presentation best suited to the work and **agree** the audiences for the work including the timing and scope of any wider consultations;

iii.   **consider** ideas for further work presented in section 6 and identify if anything ought to be a priority for either JNCC or others to undertake.

2.   Key issues

2.1   This paper is a contribution to thinking on conservation issues that have wider resonance across the UK, its territories and internationally. It explores the role protected areas play in halting biodiversity loss, and aims to stimulate debate about the other measures that could build on that role.

2.2   The paper follows on from consideration by the Joint Committee in March 2013 of the role of protected areas in the context of a wider land and seascape-scale vision for nature conservation and is a contribution to thinking on conservation issues that have wider resonance across the UK, its territories and internationally. Joint Committee considered how the approach to designating protected areas had evolved in the UK and looked at the future for such areas in a changing, even volatile, policy landscape. A previous draft of the paper was discussed by the Committee in March 2014.

2.3   Three questions are explored:

i.   Is the contribution of protected areas to halting biodiversity loss as effective as it could be? To address this question consideration has been given to the underpinning scientific principles for protected areas and the assessment of benefits they provide.

ii.   What factors influence the effectiveness of protected areas in relation to halting biodiversity loss? Strategic issues are considered, specifically: legal requirements for protected areas, how they affect design principles and the possible restrictions they pose to a more flexible, forward looking approach; and, the impact of a protected areas approach on the wider social psyche and attitudes to biodiversity.

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iii. Are there other approaches to nature conservation that contribute to wider objectives of sustainable communities? Consideration is given to: the ecosystem approach, and the extent to which protected areas and other approaches are considered in country strategies.

2.3 Some more specific and even more scientifically challenging questions are posed as a means of identifying possibilities for follow on work by Committee or others.

Joint Nature Conservation Committee

Advancing conservation science thinking on protected areas for biodiversity in the UK

Paper by Jessa Battersby, Clive Mitchell, Pete Brotherton, Hazel Drewett, Michel Kaiser and Diana Mortimer

1.   Introduction

1.1.   Protected areas are widely recognised as being an essential component of biodiversity conservation strategies around the world. It is also recognised, however, that their effectiveness could be improved if they were integrated better into a wider suite of measures. This paper considers how this might occur.

1.2.   The paper explores the role protected areas play in halting biodiversity loss, and aims to stimulate debate about the other measures that could build on that role and how we might achieve the most effective deployment of resources across the suite of measures. It considers the main threats to biodiversity and the complexity of halting biodiversity loss, and the history and current extent of protected areas in the UK. It then considers some key questions concerning protected area effectiveness and suggests future work that could be done to help further understanding of the issues raised. It is important to note that as a 'think piece' this paper does not attempt to find solutions or draw conclusions. Its main aim is to raise awareness of the issues and facilitate further debate.

1.3.   While recognising the many types of land use that are regarded as protected areas under UK legislation, international designation and through the work of the IUCN, this paper focuses on sites that are statutory designations for biodiversity protection in the UK, that is, Sites of Special Scientific Interest (SSSIs) in Great Britain and Areas of Special Scientific Interest (ASSIs) in Northern Ireland, nationally designated Marine Protected Areas (MPAs) and the protected areas designated under the European wildlife directives, Special Areas of Conservation (SAC) for the Habitats Directive and Special Protection Areas (SPAs) for the Birds Directive.

2.   Context of the protected areas discussion

2.1.   There are many initiatives that form the context for the need for broader thinking on protected areas in the UK, including the Convention on Biological Diversity (specifically Aichi Target 11 and the Programme of Work on Protected Areas), the upcoming EU Regulatory Fitness and Performance Programme (REFIT) review of the EU nature directives, and the upcoming World Parks Congress in November 2014.The publication of the Intergovernmental Panel on Climate Change fifth assessment report (IPCC, 2013) gives a broader context of likely environmental change in which protected areas must be set.

2.2.   Protected areas are one of the cornerstones of conservation policy. As noted by Susan Braatz (Braatz, 1992) "setting up comprehensive and well managed protected area systems is likely to be the most practical way to preserve the greatest amount of the world's biodiversity ...". The percentage of protected areas has increased over time, globally and in the UK, and the new Convention on Biological Diversity targets call for further increases, yet although rates of biodiversity decline have slowed since the 1980s, the downward trend for

biodiversity continues (Burns et al., 2013). This suggests that protected areas are unlikely to be sufficient on their own to achieve the new targets for biodiversity. This is particularly the case in a country such as the UK where, terrestrially, there are relatively low levels of land under strict protection and management for biodiversity but where human pressures and patterns of land ownership make it unlikely that there will be a significant increase in this area. In contrast, there is a much stronger tradition of managing activities in the marine environment in the UK. Innovative thinking is needed to investigate how protected areas can be complemented by other measures to ensure biodiversity loss is halted and ultimately reversed, especially when facing restricted or declining financial support.

3. **The main threats to biodiversity and why 'halting the loss of biodiversity' is complex**

3.1. The suite of measures deployed to halt the loss of biodiversity (the 'solution') must, collectively, address the main threats to the loss of biodiversity (the 'problem'). The main proximate threats to biodiversity are habitat change (such as land use changes, physical modification of rivers or water withdrawal from rivers, loss of coral reefs, and damage to sea floors due to trawling), climate change, invasive alien species, over-exploitation, and pollution (MEA, 2005). These interact in complex, often non-linear, ways. However, it is also important to consider the underlying drivers, which include population growth, rising incomes and changing consumption patterns (Palmer & Di Falco, 2014). Halting the loss of biodiversity by 2020 will require attention to both the proximate and underlying drivers (e.g. Secretariat of the CBD, 2010; Palmer & Di Falco, 2014).

3.2. Halting biodiversity loss is complex for several reasons. Biodiversity is difficult to define and to measure. Definitions at different levels (genes, species, habitats and ecosystems) interact and are interdependent. Species are a pragmatic focus for the purpose of measuring status, but biodiversity is more than the sum of species. As a result, designing rigorous frameworks with which to evaluate the impact of policy interventions is very challenging.

3.3. Biodiversity is also context-specific. Loss of a particular species or habitat in one location does not necessarily have the same impact if lost in another location, and the state of nature in any one place is on a trajectory of change that results from environmental factors, influenced by the integrated effects of social, cultural, historical, economic and political contexts.

3.4. People have differing motivations to protect biodiversity, varying from utility and the ecosystem services it provides to appreciating its intrinsic value and recognising a moral obligation for conservation (Smout 2000; 2009). In some cases measures to conserve biodiversity benefit ecosystem services and vice versa (Polasky *et al* 2014).

3.5. Policy interventions to address the underlying causes of the loss of biodiversity are complicated by asymmetries including:

    i.   time, where the costs of action now may achieve benefits which will not be seen or appreciated for decades;

    ii. space, where the costs of biodiversity conservation in one place may not be associated with the benefits which may be witnessed in another place (e.g. biodiversity action upstream to alleviate floods downstream).

1.6. Because biodiversity is context-specific and the proximate and underlying causes of loss difficult to address, protected areas are often seen as the default solution and nature conservation is generally framed as a natural sciences problem. However, loss of biodiversity is clearly both a 'people' and 'nature' problem. Presenting it as one or the other misses at least half of the problem and therefore at least half of the potential solutions. (For further discussion on the complexity of the biodiversity problem see Helm & Hepburn, 2014).

2. History and extent of the UK protected area resource

2.1. Protected areas are one of the three pillars of conservation, along with protected species and the wider countryside, recognised in the nature conservation strategy which emerged from the Command papers in the 1940s. The National Parks and Access to the Countryside Act 1949 enshrined the philosophy of habitat conservation through site designation and established the Nature Conservancy (which in 1973 became the Nature Conservancy Council) with the principal function of identifying and establishing by agreement, lease or purchase a series of National Nature Reserves. In Northern Ireland, Nature Reserves were designated under the Amenity Lands Act 1965. These reserves served the dual function of protecting the most important habitats and of providing an opportunity for detailed scientific research.

2.2. In addition, a national network of Sites of Special Scientific Interest (SSSIs) was designated. The SSSI series was further developed under the 1981 Wildlife and Countryside Act, and protection and management provisions improved by the Countryside and Rights of Way Act 2000 (in England and Wales) and the Nature Conservation (Scotland) Act 2004. In Northern Ireland the suite of Areas of Special Scientific Interest (ASSIs) were notified under the Nature Conservation and Amenity Lands (Northern Ireland) 1985, and improved in the Environment (Northern Ireland) Order 2002. This national suite of sites provides statutory protection for the best examples of the UK's flora, fauna, geological or physiographical features. They are also used to underpin other national and international nature conservation designations. Most SSSIs and ASSIs are privately-owned or managed; others are owned or managed by public bodies or non-government organisations.

2.3. The Birds Directive, requiring the designation of Special Protection Areas (SPA) for birds, and the Habitats Directive requiring the designation of Special Areas of Conservation (SAC) for a range of other species and habitats, date from 1979 and 1992, respectively. SPAs are areas of the most important habitat for rare (listed on Annex I to the Directive) and migratory birds within the European Union. SACs are areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive, and should make a contribution to the favourable conservation status of those species and habitats. Together they form the Natura 2000 network.

2.4. The comparative lack of access to, and understanding of, the marine environment compared to the terrestrial environment has meant that until relatively recently there has not been an equivalent effort to create marine protected areas. The powers under existing legislation, for example the Conservation of Habitats and Species Regulations 2010, to deliver protected areas to fulfil national European and international commitments were increased through Royal Ascent of the Marine and Coastal Access Act (2009), the Marine

Scotland Act (2010) and the Marine Act (Northern Ireland) (2013). They allow for the designation of Marine Conservation Zones (MCZs) in Secretary of State waters, and Nature Conservation Marine Protected Areas (NC MPAs) in Scottish waters.

Box 1. Number and area of relevant protected areas in the UK, as at 24th July 2014

The table shows the total area of, SSSIs, ASSIs, SPAs,SACs (including candidate SACs and Sites of Community Interest (SCI), MCZs (Tranche 1 sites) and NC MPAs. It includes SSSIs and ASSIs that are designated for geological features. It should be noted that there is overlap across the designations. Annex 2 to this paper provides an overview of all protected area designations across the UK and indicates where ASSIs, SSSIs, SACs,SPAs, MCZs and NC MPAs fit in the wider framework.

Type of protected area	Number	Area (ha)	Feature protected
Sites of Special Scientific Interest	6,616	2,367,094	Species, habitats, geology
Areas of Special Scientific Interest	360	104,587	Species, habitats, geology
Special Protection Areas	269	2,748,257	Birds Directive Annex I and migratory birds and the habitat used by birds
Special Areas of Conservation	649	8,001,016	Habitats Directive Annex I habitats and Annex II species
Tranche 1 Marine Conservation Zones	27	966,400	Species, habitats, geology (listed Features of Conservation Importance [FOCI] in the Ecological Network Guidance[1]
Nature Conservation Marine Protected Areas	30	6,134,700	Species, habitats, geology (listed MPA search features in the Scottish MPA Selection Guidelines[2]

The total extent of land and sea protected in the UK through national and international protected areas has increased from just over 1.1 million hectares in 1980 to just over 20 million hectares in July 2014. A large contribution to this has been from the marine environment, following the designation of inshore and offshore marine sites under the Habitats Directive and National marine protected sites. Further 'marine' SPAs and MCZs are also being considered by Governments.

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[1] Available from: http://jncc.defra.gov.uk/pdf/100705_ENG_v10.pdf
[2] Available from: http://www.scotland.gov.uk/Topics/marine/marine-environment/mpanetwork/mpaguidelines/

3. **Raising questions around protected areas**

   3.1. A review of England's wildlife sites and ecological network (Lawton et al., 2010) made a series of recommendations on how protected areas and the wider environment could be better managed to achieve coherent, resilient ecological networks. It clearly demonstrated the value of protected areas, and emphasised that they needed to be managed to maximise their contribution to biodiversity and ecosystem service provision. It has proved influential in shaping the government's revised England Biodiversity Strategy, Biodiversity 2020, and in developing the new agri-environment programme for England and the Nature Improvement Areas programme. The report had a short epigrammatic summary – more, bigger, better, joined – a telling and effective communication tool. However, the report also stressed that protected areas are not sufficient to conserve biodiversity on their own, which leaves some key questions to be answered.

   i. How can more, better and bigger wildlife areas be most effectively achieved, and how should these fit with other elements in the landscape matrix?

   ii. What priorities should be given to different parts of the Lawton framework in different places?

   5.2. Considering the context to this paper, even more challenging questions could be posed.

   i. Do we fully understand the need for protected areas and the extent to which they meet that need, including preventing biodiversity loss and enhancing ecosystem function and services?

   ii. Do we have the right balance between care for protected areas and action across the whole environment – recognising that protected areas are part of an incomplete strategy?

   iii. Are there better ways to deploy scarce resources to achieve environmental goals?

   5.3. Given that protected areas are not the whole solution to biodiversity conservation, we need to consider how we get the balance right between conservation action within and outside protected areas. The range of issues and questions already identified concerning protected areas can be captured in three key questions.

   i. Is the contribution of protected areas to halting biodiversity loss as effective as it could be?

   ii. What factors influence the effectiveness of protected areas in relation to halting biodiversity loss?

   iii. Are there other approaches to nature conservation that contribute to wider objectives of sustainable communities?

   5.4. These three questions are dealt with in sections 6 to 8 of this paper.

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6. Is the contribution of protected areas to halting biodiversity loss as effective as it could be?

6.1. To address this question consideration has been given to the underpinning scientific principles for protected areas and the assessment of benefits they provide.

6.2. Scientific principles underpinning protected areas in the UK

6.2.1. Traditionally, in order to fulfil the role of maintaining a sample of biodiversity into the future, protected areas should achieve two things: i) capture that biodiversity within their boundaries, and ii) buffer it from processes that threaten its persistence, while allowing evolution to continue (Margules & Pressey, 2000). In terrestrial UK the principles underpinning protected areas come from the guidelines for setting up the series of SSSIs and ASSIs. This series was intended to "form a national network of areas containing the most important features for nature conservation, of highest quality and concentration and should be large enough to guarantee the survival of a necessary minimum of Britain's wildlife and physical features" (JNCC, 2013). The series has not yet lived up to this expectation, as it does not yet function as a coherent, resilient ecological network (e.g. Lawton et al., 2010). Ervin et al. (2010) developed these ideas in more detail at global level.

6.2.2. The delayed focus on marine protected areas in the UK has contributed, partly through necessity and partly through developments in thinking, to a more strategic approach at sea with the objective of coherent, representative, well-managed networks identified through consideration of regionally agreed guidelines. The UK has signed up to international agreements that aim to establish an 'ecologically coherent network of Marine Protected Areas (MPAs)' that is well-managed by 2016. The sites in the network will work together to provide more benefits than an individual area could on its own. MPAs established under international, European and national legislation will all contribute to the network. Marine protected areas are recognised as one of many tools needed to support a healthy environment – an example is reflected in the Scottish Government's marine nature conservation strategy (2011).

6.2.3. However, to date, our consideration of coherence and networks remains compartmentalised into a separate consideration of terrestrial and marine environments. This compartmentalised approach is entirely at odds with the reality that terrestrial catchments influence directly the coastal marine environment through riverine discharge. The same is true when we take into consideration migratory species of conservation importance that have both marine and freshwater life stages.

6.3. Assessing the benefits of protected areas in the UK

6.3.1. Assessing the benefits of protected areas is not easy because there are so many biases involved in any analysis (Joppa & Pfaff, 2010; Pfaff, 2012). Biases include location of area, responsibility for designation, whether designation is for multiple or single features, and future likelihood of pressures increasing or decreasing. There is a body of evidence that protected areas provide a range of benefits in addition to their designation purpose, some of which include facilitating range

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expansion of species (Thomas et al., 2012); reducing extinction risk (Butchart et al., 2012); providing ecosystem services (GHK, 2011; McInnes, 2013); and acting as establishment centres for colonising species (Hiley et al., 2013). There are questions, though, around the ecological effectiveness of protected areas (Gaston et al., 2006) and the value of the protectionist paradigm in the long-term protection of biodiversity (Wilshusen et al., 2002). In the marine environment there is evidence that displacement of existing fishing activities from protected areas can result in net negative effects on biodiversity in adjacent areas of the sea in the absence of additional management measures (Hiddink et al., 2006).

6.3.2.   A rather complicated and time-consuming evaluation process may be the only truly reliable solution (see also Miteva et al., 2014), but such an exercise would be costly in terms of time and resources. Considering the readily available information carefully, and in light of the obvious biases, may be the best alternative option. The most recent assessments of species and habitats protected under the Habitats and Birds Directives (Article 17 and Article 12 reports respectively) can give some indication of how effective protected areas are in fulfilling their designation objectives and making an important contribution to wider biodiversity protection. Data collected for the UK SPA review and the Birds Directive Article 12 report will enable a breakdown of trends for features on designated sites by onsite versus offsite components. The Habitats Directive Article 17 report, for the first time in 2013, included an estimation of the percentage of each habitat and species reported on within the UK protected area network, thereby providing the potential for future comparison of the conservation status of those with a high proportion of the feature on protected areas with those that have a low proportion. There is also potential to analyse trends for onsite and offsite components of some features.

6.3.3.   It might also be useful to identify conservation priorities and then consider the best mechanisms for delivering them. Species or habitats with characteristics such as being highly localised, dependent on a very high degree of ecosystem functionality or being very susceptible to disturbance (or other location-specific threats), species that are poor dispersers and those whose habitat is naturally very scarce and fragmented (such as base-rich springs), might be examples where protected sites would be most effective. Further work could then start to categorise conservation priorities by these characteristics and assess the provision made by the current protected area network.

6.3.4.   For terrestrial and freshwater birds, a Site Provision Index has been developed and calculated for each species as part of the ongoing UK terrestrial SPA review. This index takes account of the distribution, population size (national and biogeographic) and ecology of each species. The degree of protection provided by the SPA network can then be calculated for each species and compared across species with similar Site Provision Index values to help the country nature conservation bodies and others decide whether any species are under-represented.

6.3.5.   Protected areas mainly address the symptoms and, on their own, they are not well positioned to tackle the causes of the loss of biodiversity

and need to work alongside other measures. For example, protected areas are sometimes designated on politically uncontroversial land of little or no commercial interest, at least at the time of designation, while the main pressures and underlying causes continue unabated on areas of land of commercial interest (e.g. Margules & Pressey, 2000).

7. What factors influence the effectiveness of protected areas in relation to halting biodiversity loss?

7.1. Proximate factors that influence the effectiveness of protected areas include their size, location, quality, the pressures upon them and their degree of isolation (e.g. Lawton et al., 2010). Here, we consider more strategic issues, specifically: legal requirements for protected areas, how they affect design principles and the possible restrictions they pose to a more flexible, forward looking approach; and the impact of a protected areas approach on the wider social psyche and attitudes to biodiversity.

7.2. Legislation, design principles and protected areas

7.2.1. Legislation pertaining to protected areas largely reflects the scientific principles previously referred to. The SSSI series, set up under the National Parks and Access to the Countryside Act 1949 and then further protected under the Wildlife and Countryside Act 1981 (as amended), provides the underpinning statutory protection for almost all terrestrial sites, including those which are of European and international importance. These sites are designated following a process of detailed survey, interpretation, notification and formal consultation. There is some flexibility, in that the list of features for which an SSSI is notified may be amended at any time, and the scientific case for an SSSI can be reconsidered every 10 years. Management statements exist for all sites and, originally intended to be quite simple, have evolved into quite complex/cumbersome documents. Certain operations require consent from the country nature conservation bodies.

7.2.2. A study assessing the benefits of SSSIs in England and Wales found they provided good conservation and economic benefits and delivery of some ecosystem services, but noted that they did not provide an effective ecological network (Defra, 2011). This is partly because the current network of designated sites in the UK has evolved over time. The process adopted for SSSI/ASSI designation has led to the selection of generally small sites (especially in areas of more productive land use such as large parts of England and the central belt and east coast of Scotland) each focusing on one or a few features with carefully defined boundaries. This doesn't facilitate the creation of a modern, coherent, ecological network that is flexible and able to adapt to changes resulting from climate impacts, and other factors, such as the spread of non-native species.

7.2.3. European requirements for terrestrial protected areas derive from the nature directives. Both the Birds Directive and the Habitats Directive focus on the designation of protected sites, SPAs and SACs respectively, for Annex-listed features. SPAs and SACs together form the Natura 2000 network, which is intended to be 'a coherent European ecological network of sites'. Member States are required to improve ecological coherence through landscape management, land-use

planning and development policies (Habitats Directive, Article 10). The Habitats Directive is perhaps the most robust legislation because of decision-making processes required under Article 6 concerning management and protection of Natura 2000 sites. However, the fact that SPA and SAC designations are underpinned with SSSI/ASSI designation means that they have similar restrictions, at least terrestrially. Furthermore, for European designations, the process of submitting sites to the European Commission for adoption is highly formalised and time-consuming and there is very little opportunity to change factors related to designations once they have been adopted.

7.2.4. In the marine environment the Marine Strategy Framework Directive (adopted in 2008) requires spatial protection measures to be established that 'contribute to coherent and representative networks of marine protected areas, and cover the diversity of the constituent ecosystems' and make an important contribution to the achievement of good environmental status under the Directive. There is overlap with the Habitats and Birds Directives, which also require protected areas to be designated in the marine environment. The OSPAR Convention (adopted in 1992), the Ramsar Convention (adopted in 1971), and the Convention on Biological Diversity (adopted in 1992) all make reference to, or have targets for, the establishment of protected areas for important species and habitats.

7.2.5. The Marine Acts in the UK place duties upon the UK and devolved administrations to create a coherent network of marine protected areas (MPAs) for the protection of biodiversity and geodiversity. The process for creating an ecologically coherent network recognises the significant contribution existing area-based conservation measures already make to the protection of the marine environment. Work to complete the network has involved assessing this contribution, and identifying new protected areas to fill gaps in feature protection in the network.

7.2.6. Biodiversity is experiencing increasing pressures, which can lead to conflict between conservation and development needs and rapid change. Climate change and other factors are causing the distribution of species to change and ecosystems to function in different ways. There is evidence that the current SPA network is predicted to remain important for future conservation in a changing climate (Johnston et al., 2013) but the traditional approach to protected areas needs to be considered in relation to a more mobile biodiversity resource in the future; it is not easy to change the features for which a site is designated without potentially undermining the protection afforded by the site. More progress has been made on how sites might be connected to increase their ability to adapt, to create a coherent network, to be more resilient and to allow biodiversity to change its distribution. More analysis could be undertaken to identify what has been tried on the ground and how well it has worked.

7.2.7. Protected areas involve constraining activities on specific areas of land to retain their more natural, or less modified, characteristics. If the land use economy can be regarded as a system comprising all land management activities interacting at a variety of scales then we need to be confident that the intended and unintended consequences of protected areas for nature do not, for example, intensify pressures on

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biodiversity on unprotected land. Some of these issues have been explored, at least indirectly in the 'land sharing' versus 'land sparing' debate over the last few years (e.g. Balmford et al., 2012). Whilst the polarisation of this debate is probably over-emphasised, the impacts of protected areas on the wider land use economy may warrant further study. There are, in addition, similar discussions focused on the dual delivery role of many marine areas where areas of the sea allocated for renewable energy may also fulfil conservation objectives. (Defra Science Advisory Panel, 2011).

7.2.8. Nature is always changing as a result of succession and surrounding social factors. Rates of change are likely to intensify in future as the effects of the enhanced greenhouse effect become more apparent from the 2040s onward (IPCC, 2013; 2014).

7.2.9. What are our guiding principles for dynamic ecology? What do we mean by 'naturalness' and native species? To what extent should conservation be about preserving species and habitats (a snapshot in time; an emergent feature of all of the factors that create 'nature') or 'conserving' the factors that enable nature to thrive and survive (even if the species and habitats come and go)? Some of these issues are touched on in the 12 principles for the ecosystem approach and raise questions for the baselines used to judge the condition of sites and species (e.g. a fixed point or trajectory of change).

7.2.10. For some features of interest the factors that influence their condition are wholly within the protected area and the condition of the feature is then a reasonable guide to the condition of the site. But if the condition of the feature depends on environmental and social factors outwith the protected area then the management of the features of interest could extend far beyond the boundaries of the site. Depending on the type of factors at play, a range of measures may be required to bring about the desired behaviours. This leads to questions about the role of protected areas in wider landscape-scale or ecosystem approaches to halting the loss of biodiversity.

7.3. The impact of a protected areas approach on the wider social psyche and attitudes to biodiversity

7.3.1. It is generally acknowledged that for most protected areas some form of human intervention is necessary to maintain, manage or enhance the features for which they were designated. Most complex open environmental problems (such as loss of biodiversity and climate change) require public engagement and commitment for significant progress to be made on them (e.g. Brechin et al., 2002). Lawton et al. (2010) concluded that protected sites should be valued by, and be accessible to, people. UNESCO Biosphere reserves have encompassed this approach for several decades, now well exemplified in the UK by the North Devon, Dyfi and Galloway Biosphere Reserves, with others in preparation or submitted in England, Northern Ireland and the Isle of Man.

7.3.2. More recent thinking on the management and benefits of protected areas is giving greater focus to including people, particularly at local level. Much work has been done to encourage public engagement in

nature conservation through biodiversity action plans, development of citizen science, embedding biodiversity into school curricula, and a range of other initiatives. However, there remains a risk that if biodiversity loss appears to be a complex, specialised and highly technical problem, seen principally through the lenses of protected areas and priority habitats and species, many people could be alienated from concerns about nature. For example, the perception that nature conservation requires highly skilled professionals in protected places that are physically and metaphorically far away from where most people live could present a barrier to engaging people in addressing the underlying drivers of the loss of biodiversity, especially those connected with consumption and lifestyle (Blackmore et al., 2013).

7.3.3. The need to address both the underlying drivers as well as the proximate threats to the loss of biodiversity requires us to think much more deeply about framing the loss of biodiversity and associated policy interventions (including protected areas) as a joint social and natural sciences issue – so all solutions must involve people. A counter-argument to this might be that at least some protected areas could be viewed as 'natural havens', but even then they represent a form of land use so are inescapably part of the land use economy.

8. Are there other approaches to nature conservation that contribute to wider objectives of sustainable communities?

8.1. To address this question consideration is given to the ecosystem approach, and the extent to which protected areas and other approaches are considered in country strategies.

8.2. Focusing on the ecosystem approach

8.2.1. Demands on terrestrial, freshwater and marine environments for different uses are constantly growing. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use, including agri-environment schemes, species protection and species recovery, in an equitable way. As such, it is a decision-making framework, which involves the distribution of costs and benefits. It promotes the use of terrestrial, freshwater and marine environments for multiple benefits with less intense (single purpose) management (although the scale at which these multiple benefits and associated ecosystem services are delivered has not yet been discussed). It recognises that humans, with their cultural diversity, are an integral component of ecosystems and is the primary framework for action under the Convention on Biological Diversity.

8.2.2. Ecosystem services are also a major consideration. The relationship between ecosystem function and biodiversity is complex. Ecosystems that have greater diversity are thought to support more resilient and stable ecosystem functions, yet there exist naturally poor but highly resilient systems such as mangroves, saltmarshes and sand dunes (and definitions of biodiversity should allow for a range of naturally species-poor to species-rich habitats and ecosystems). The relationship between greater biodiversity and ecosystem services is even less clear (e.g. in some cases less diverse systems yield greater food production

at least in the short term) (Mace, 2014). Further, the links between protected area management and ecosystem service delivery have yet to be fully explored (Eastwood et al., in prep.). Designation is most likely to affect the quality and quantity of ecosystem service delivery in areas which have high potential productive capacity (e.g. change to intensive agriculture), where alternative land uses are required (e.g. development), or where cultural services such as recreation could be either increased or decreased (i.e. impacting negatively on biodiversity from higher visitor numbers or positively due to exclusion in order to protect species).

8.2.3.   A study in Minnesota (Polansky *et al* 2014) suggests that in broad terms management of land for ecosystem services complements the conservation of biodiversity and vice versa. They regard the result as unsurprising since biodiversity supports ecosystem functions which in turn give rise to ecosystem services. However, the specific ecosystem service that is targeted will determine the location of actions (e.g. towards grasslands or woodlands) whereas when conservation of biodiversity is targeted the actions tend to be more evenly spread. The strength and direction of the relationship between ecosystem services and biodiversity conservation may also depend on the measures used.

8.3.   Country strategies, protected areas and the ecosystem approach

8.3.1.   The UK is not a uniform landscape and the approach to protected areas within an ecosystem approach is likely to reflect the different landscapes and perspectives in the four countries.

8.3.2.   The 2020 strategy for biodiversity in England (Defra, 2011) is centred on halting biodiversity loss, but also aims to achieve wider benefits to biodiversity and people through applying the ecosystem approach. It has committed to building an ecologically coherent network of bigger, better and more connected sites as a means of achieving this mission. The Natural England Designations Strategy (2012) considers how, "collectively, the whole suite of designations can be used to deliver ecological networks and the full range of ecosystem services. Where more than one designation or notification option exists, the solution that addresses the widest range of strategy principles, and so delivers the best spread of public benefits, will be favoured".

8.3.3.   Scotland has produced the 2020 Challenge for Scotland's Biodiversity (Scottish Government, 2013), which together with Scotland's Biodiversity: It's In Your Hands (2004) comprise the Scottish Biodiversity Strategy. The Strategy aims to "protect and restore biodiversity on land and in the seas, and to support healthier ecosystems". While recognising the importance of protected areas, the Strategy also recognises the role of natural capital, the importance of connecting people with the natural world and involving them more in decisions about their environment, and maximising the benefits for Scotland of a diverse natural environment and the services it provides. Scotland also has a Land Use Strategy (Scottish Government, 2011), which aims for sustainable land use through multiple benefits, with land-based businesses working with nature, responsible stewardship of Scotland's natural resources, and urban and rural communities better connected to the land. In the marine environment Scotland's Marine

Nature Conservation Strategy (Scottish Government, 2011) and the marine plan (Scottish Government draft, 2013) both recognise the importance of integrated management, and promote the three-pillar approach for conserving the marine environment by including species measures and the use of wider mechanisms alongside site protection measures to achieve goals.

8.3.4. Northern Ireland lists protected areas as a cornerstone of the Northern Ireland Biodiversity Strategy (2002), which is currently being reviewed and supplemented. In the 2009 report on the delivery of the Strategy (NIBG, 2009), much greater emphasis is placed on the ecosystem approach. The report considers that the suite of protected sites, together with agri-environment measures, protect the most specialised, vulnerable and localised species and habitats, but a landscape-scale approach is needed that integrates farming, rural communities, protected sites and habitat restoration, allowing the landscape and biodiversity to adjust to the pressures of human use and the spatial shifts caused by climate change.

8.3.5. The Environment Strategy for Wales (Welsh Assembly Government, 2006) sets the strategic direction until 2026. The Strategy recognises 'the importance of the environment, both for its own sake and for the ecosystem services it provides". It is a framework and vision for a 'distinctive Welsh environment thriving and contributing to the economic and social wellbeing and health of all the people of Wales". Nowhere, perhaps even globally, is there greater and more obvious commitment to applying the ecosystem approach.

8.3.6. The Welsh Government White Paper consultation on proposals for a Wales Environment Bill, 'Towards the Sustainable Management of Natural Resources', closed on 15 January 2014. The main purpose of the Bill is to create the statutory basis for a more integrated approach to the management of natural resources in Wales. The focus of 'integration' is to ensure that the planning, management and regulation of the use of natural resources is based on the 'ecosystem approach' (as defined under the Convention on Biological Diversity), and delivers social and economic benefits alongside environmental objectives. The proposal is for a Wales-wide statutory framework for integrated natural resource management, including publication by Welsh Ministers of a national natural resources policy statement, setting out strategic priorities for natural resources. A new duty is proposed for Natural Resources Wales to develop and implement an area-based approach to the sustainable management of natural resources, defining the priorities and opportunities for natural resources on an area basis, aligned with the national policy statement. A Nature Recovery Plan for Wales is currently in preparation, with the aim of it being finished in 2014/15.

9. Future considerations for UK protected areas

9.1. A healthy, wealthy, sustainable society requires many things. Roads, houses, industry, crops, leisure pursuits and biodiversity are all superficially competing for space, yet our future health and prosperity depends upon our natural environment. The ecosystem approach aims to help reconcile these multiple and competing objectives while also effectively conserving biodiversity, thereby

helping to achieve a sustainable future. Determining the role of protected areas within this requires us to:

i.   define the outcomes and impact protected areas should deliver, taking account of land use plans;

ii.   assess how close the current protected area resource is to delivering the required outcomes and impact, and other desired outcomes;

iii. recommend ways for protected areas to be administered and managed so as to be able to 'flex' to factors such as climate change and fit better with wider strategic frameworks in an era of increasing environmental change.

9.2. The following is a list of key questions about protected areas, aimed at problem solving and providing context-specific responses, with potential actions that could be undertaken by JNCC or others over the next triennium:

9.2.1. Has the protected area network (terrestrial and marine) been designed to do what we want it to do? What might be stopping it from achieving its optimal role and what are the gaps?
Possible action: consider the network as part of a system including the task of re-integration and reconciliation of people with nature, conservation and use, multiple values and objectives, and the role of protected areas in the wider land use economy.

9.2.2. Do we need protected areas to do different things? And, if so, how might this be achieved?
Possible action: clarify and expand the principles underpinning the use of protected areas as a conservation tool within an ecosystem approach and consideration of the wider historical, cultural, social, political and economic factors. This could reveal what 'landscape scale' approaches look like, and the role of protected areas within the wider landscape.

9.2.3. Is there anything that protected areas currently do that we can do more simply, or proportionately, or do without? Do we administer protected areas so as to be sensitive and respond to the local context?
Possible action: carry out further work to analyse off-site and on-site trends in biodiversity to assist the identification of characteristics that suit a protected area based conservation approach and those that would suit other approaches.

9.2.4. Is the current and projected cost of protected areas work too much or too little given our nature conservation objectives and all of the other things we need to do?
Possible action: compare and contrast the potential usefulness of protected areas against other conservation tools. This would vary according to landscape types and for different conservation objectives but is absolutely critical to achieving an optimal role for protected areas.

9.2.5. How much are protected areas needed to meet legal obligations or to meet conservation priorities? Are they the same thing?
Possible action: identify where protected area obligations are in danger of standing in the way of protected areas reaching their full potential and recommend solutions. This question relates to issues about change, guiding principles for dynamic ecology, how we foster resilient

ecosystems, and the role of protected areas as a solution to these problems. This would look at the tension between trying to maintain, for example, early successional habitats and their associated species, or re-establishing natural processes, versus allowing things to adapt into a more resilient higher biodiversity value type, and how decisions are made on which approach to adopt.

9.3. Protected areas have – and will continue to have – an important role in nature conservation. We are indebted to Huxley, Tansley, Ratcliffe and others for their pioneering work in the 20th century, but the challenges faced today are not the same as the ones that prevailed when the current protected areas system took shape over 50 years ago. Clarity is required over the roles that protected areas are good at and should continue to play. We need to create space for a discussion and process including the re-allocation of resources for a nature conservation strategy that reflects our understanding of the complex natural and social systems involved, and that is fit for the 21st century.

9.4. The longer term direction of travel for protected areas in the UK may include developing the concepts of their value as natural capital in ever more dynamic systems and recognising the importance of increasing localism, including ownership of key strategic decisions. The number, area, location, purpose, and management type and effectiveness of protected areas will be key considerations in delivering these concepts, which may not be uniform across the UK.

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Annex 2. An overview of the types, numbers and areas of statutorily designated protected areas in the UK. Figures as at 24 July 2014.

Designation	Number of sites	Area (ha)	Features protected	Purpose of designation (for more details see http://jncc.defra.gov.uk/page-1527)
Special Protection Areas	269	2,748,257	birds	SPAs are classified by the UK Government under the EC Birds Directive. The Directive applies to the UK and the Overseas Territory of Gibraltar. SPAs are areas of the most important habitat for rare (listed on Annex I to the Directive) and migratory birds within the European Union.
Special Areas of Conservation*	649	8,001,016	habitats, non-avian species	SACs are designated under the EC Habitats Directive. The Directive applies to the UK and the Overseas Territory of Gibraltar. SACs are areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive.
Ramsar*	148	785,361	wetlands and wetland related species	Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. Originally intended to protect sites of importance especially as waterfowl habitat, the Convention has broadened its scope over the years to cover all aspects of wetland conservation and wise use, recognising wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities.
Sites of Special Scientific Interest	6,616	2,367,094	species, habitats, geology	The SSSI/ASSI series has developed since 1949 as the national suite of sites providing statutory protection for the best examples of the UK's flora, fauna, or geological or physiographical features. These sites are also used to underpin other national and international nature conservation designations. Most SSSIs are privately-owned or managed; others are owned or managed by public bodies or non-government organisations.
Areas of Special Scientific Interest	360	104,587	species, habitats, geology	
SSSI + ASSI	6,976	2,471,681	species, habitats, geology	
Marine Nature Reserves	2	17,824	marine species and habitats	The purpose of MNRs is to conserve marine flora and fauna and geological features of special interest, while providing opportunities for study of marine systems. They are a mechanism for the protection of nationally important marine (including subtidal) areas.
National Nature Reserves	388	253,673	species, habitats, geology	NNRs contain examples of some of the most important natural and semi-natural terrestrial and coastal ecosystems in Great Britain. They are managed to conserve their habitats or to provide special opportunities for scientific study of

Designation	Number of sites	Area (ha)	Features protected	Purpose of designation (for more details see http://jncc.defra.gov.uk/page-1527)
				the habitats communities and species represented within them.
Local Nature Reserves	1,681	55, 998	species, habitats, geology	Under the National Parks and Access to the Countryside Act 1949 LNRs may be declared by local authorities after consultation with the relevant statutory nature conservation agency. LNRs are declared and managed for nature conservation, and provide opportunities for research and education, or simply enjoying and having contact with nature.
Areas of Outstanding Natural Beauty	47	2,238,345	landscape	The primary purpose of the AONB designation is to conserve natural beauty – which by statute includes wildlife, physiographic features and cultural heritage as well as the more conventional concepts of landscape and scenery.
National Scenic Areas	40	1,381,118	landscape	National Scenic Areas (NSAs) are designated by Scottish Ministers as the best of Scotland's landscapes, deserving special protection in the nation's interest. National Scenic Areas are broadly equivalent to AONBs.
National Parks	15	2,265,610	landscape	In England and Wales, the purpose of National Parks is to conserve and enhance landscapes within the countryside whilst promoting public enjoyment of them and having regard for the social and economic well being of those living within them. In addition to the two purposes described above, National Parks in Scotland are designated to promote the sustainable use of the natural resources of the area and the sustainable social and economic development of its communities.
Heritage Coasts	46	2,489 km	landscape	A Heritage Coast is a section of coast exceeding one mile in length that is of exceptionally fine scenic quality, substantially undeveloped and containing features of special significance and interest.
Marine Conservation Zones	27	966,400	marine species, habitats and geology	To protect nationally important marine habitats, species and geological/geomorphological features.
Nature Conservation MPAs	30	6,134,700	marine species, habitats and geology	To protect nationally important marine habitats, species and geological/geomorphological features.

* Figures exclude Ramsar and SAC sites in the UK Overseas Territories and Crown Dependencies.

Many of these site types overlap, so it is at least theoretically possible for an area of land to be simultaneously an SSSI, NNR, SAC, SPA, Ramsar, and within a National Park, AONB or NSA, or Heritage Coast. Some of the site types can be both marine and terrestrial; for this reason it is not straightforward to calculate percentages of land or sea covered by the individual site types.

Many protected areas in the UK are in private rather than public ownership. As an example of the area of land held by NGOs for conservation purposes, the RSPB has 200 nature reserves covering almost 130,000 hectares; collectively The Wildlife Trusts manage more than 2,300 nature reserves; and the National Trust own and manage over 250,000 hectares of land of outstanding natural beauty, and over 700 miles of coastline.

The extent of UK protected areas is published each year by JNCC as part of the set of UK biodiversity indicators http://jncc.defra.gov.uk/page-4241. Figures 1 and 2 are a presentation of the data for ASSIs, SSSIs, SACs and SPAs to December 2013. They do not show the extensive increase in Marine Protected Areas that occurred in 2014.

Figure 1. Extent of UK nationally and internationally important protected areas: (i) on land; (ii) at sea, 1950 to 2013.
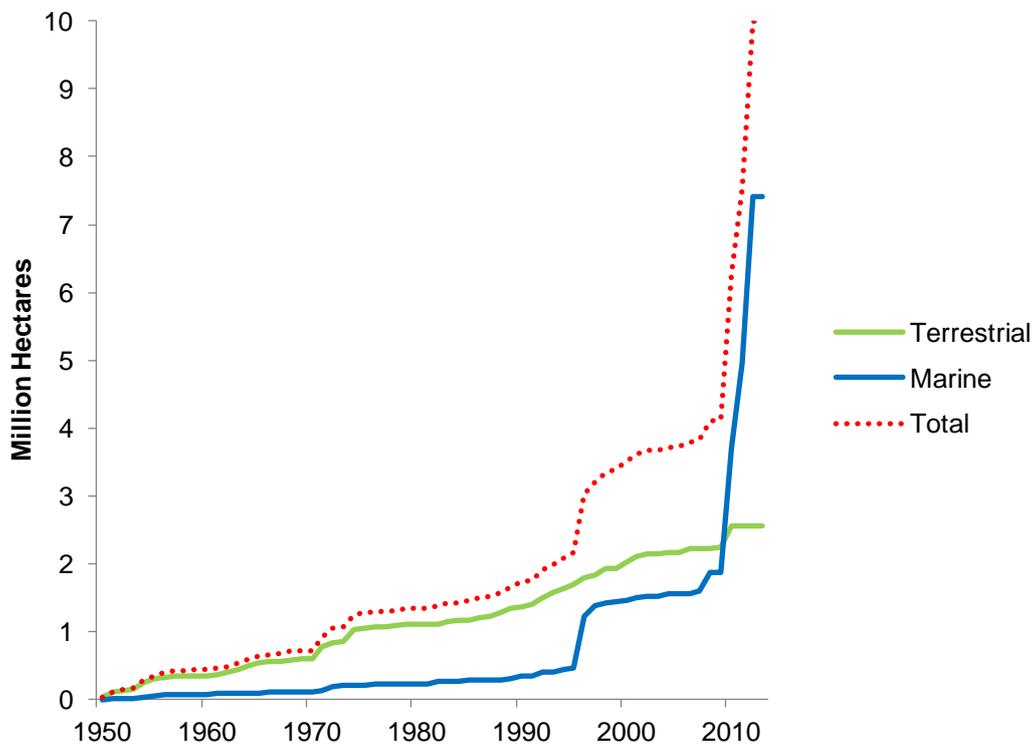

Figure 2. Protected Areas (ASSI/SSSIs SACs and SPAs) in the UK, as at June 2013