A response from the British Ecological Society to the Glover Review on Designated Landscapes

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Founded in 1913, we are the world's oldest ecological society, with over 6,000 members worldwide. As the voice of the UK's ecological community, we communicate the value of ecological knowledge to policymakers and promote evidence-informed solutions.

Question 9.

The role National Parks and AONBs play in nature conservation and biodiversity? a) Could they do more to enhance our wildlife and support the recovery of our natural habitats?

9.1 Environmental context

England has multiple environmental commitments, both nationally (e.g. the 25 Year Environmental Plan) and internationally, with the Aichi targets requiring zero extinction, 17% coverage of terrestrial protected areas, and restoration of ecosystems that provide essential services, amongst other things[1]. The UK is considered to be a country with significantly degraded levels of biodiversity, compared to the rest of the world. Between 1970 and 2013, 56% species for which we have sufficient data were shown to have declined; of 8000 species assessed, 15% are extinct or threatened with extinction from Great Britain[2].

Well-managed protected areas should be a cornerstone of conservation efforts, acting as a bulwark against anthropogenic pressures[3,4,5,6,7]. Yet England's largest 'protected areas', National Parks (from this point NPs) and Areas of Outstanding Natural Beauty (from this point AONBs) are not even considered to be protected areas for nature by the International Union for the Conservation of Nature (IUCN) because of their management focus on preserving historic, cultural landscapes, rather than a dominant focus of wildlife conservation[8]. Furthermore, SSSIs – which are designated specifically for nature conservation, are in poorer condition within NPs and AONBs than they are outside of them, with only 25% of in favourable condition in NPs, and only 33% are in favourable condition in AONBs.

To combat biodiversity decline and improve future resilience, in the face of environmental and manmade perturbations, the Lawton principles of Bigger, Better, More, and Joined protected areas should be followed to create a Nature Recovery Network[9,10]. The recently published 25 Year Environment Plan suggests restoring 75% of our protected areas to favourable condition and creating or restoring a further 500,000 hectares of wildlife-rich habitat[11]. If these actions are implemented,

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[1] Aichi Biodiversity Targets from the Convention on Biological Diversity Strategic Plan 2011-2020.

[2] RSPB et al, (2016) State of Nature Report.

[3] Watson et al, (2014). The performance and potential of protected areas. *Nature*.

[4] Jenkins and Joppa, (2010). Considering protected area category in conservation analyses. *Biological Conservation*.

[5] Coad et al, (2015). Measuring impact of protected area management interventions: current and future use of the Global Database of Protected Area Management Effectiveness. *Phil. Trans. R. Soc. B*370, 20140281.

[6] Pringle, R (2018). Upgrading protected areas to conserve wild biodiversity. *Nature*.

[7] Shwartz et al, (2017). Scaling up from protected areas in England: The value of establishing large conservation areas. *Biological Conservation*, 212(Part A): pp.279-287.

[8] Dudley, Nigel (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN WCPA Best Practice Guidance on Recognising Protected Areas and Assigning Management Categories and Governance Types, Best Practice Protected Area Guidelines Series No. 21, Gland, Switzerland.

[9] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

[10] Lawton, Sir John (2010). Making space for nature: A review of England's Wildlife Sites and Ecological Network.

[11] Defra (2018). A Green Future: Our 25 Year Plan to Improve the Environment. [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

with a spatially targeted approach, then the dramatic biodiversity loss seen in England[12] could be reversed. Compared to smaller, more fragmented designations, such as SSSIs, designated landscapes have the potential to deliver the ambitions of the Lawton Review by restoring ecological connectivity and ecosystem function to large swathes of the country. Moreover, the governance mechanisms and statutory remit of NPs, lend themselves to a co-ordinated approach that would be more difficult to achieve across multiple authorities in the 'wider countryside'[13]. Appropriate management and focus would allow these areas to become exemplars of conservation, benefitting people and nature and enabling the Government to fulfil its national and international objections for safeguarding nature.

9.2 Current management practices are failing in National Parks and AONBs

Despite having an aim to "conserve and enhance the natural beauty, wildlife and cultural heritage" of their landscapes, NPs and AONB's most important sites for wildlife (the SSSIs within) do not do not appear to be properly managed. Inside NPs, only 25% of SSSIs meet the "favourable" criteria, compared to 43.5% of other SSSIs not in NPs. Similarly, only 33% of SSSIs in AONBs meet the "favourable" criteria, compared to 40% of other SSSIs not in AONBs[14].

National Park	**Percentage of SSSI in favourable condition**
Dartmoor	19%
Exmoor	15%
Lake District	22%
New Forest	53%
North York Moors	12%
Northumberland	33%
Peak District	16%
South Downs	52%
The Broads	63%
Yorkshire Dales	30%

AONB	**Percentage of SSSI in favourable condition**
Arnside & Silverdale	65%
Blackdown Hills	19%
Cannock Chase	5%
Chichester Harbour	14%
Chilterns	68%
Cornwall	52%

[12] RSPB et al, (2016). State of Nature Report.

[13] The Environment Act 1995 revised the original legislation and set out two statutory purposes for national parks in England and Wales:

- Conserve and enhance the natural beauty, wildlife and cultural heritage
- Promote opportunities for the understanding and enjoyment of the special qualities of national parks by the public

Where these two aims conflict, the Sandford principle is applied, which gives more weight to conservation of the environment.

[14] Data obtained from Natural England's website.

Cotswolds	63%
Cranbourne Chase & West Wiltshire Downs	45%
Dedham Vale	47%
Dorset	46%
East Devon	35%
Forest of Bowland	7%
High Weald	31%
Howardian Hills	36%
Isle of Wight	47%
Isles of Scilly	60%
Kent Downs	64%
Lincolnshire Wolds	50%
Malvern Hills	46%
Mendip Hills	59%
Nidderdale	12%
Norfolk Coast	95%
North Devon	42%
North Pennines	16%
North Wessex Downs	38%
Northumberland Coast	47%
Quantock Hills	16%
Shropshire Hills	32%
Solway Coast	61%
South Devon	55%
Suffolk Coast & Heaths	41%
Surrey Hills	72%
Tamar Valley	95%
Wye Valley	55%

9.3 Management in upland landscapes threatens their biodiverse landscapes

When investigated on an individual basis, it is clear that the NPs failing to meet favourable SSSI conditions tend to be in upland areas. This is despite the fact that some of the UK's most important habitats for wildlife, such as blanket bogs and calcareous grasslands, are found in upland areas, concentrated in NPs and AONBs. Blanket bogs form important carbon stores, provide clean water, prevent flooding, and hold a variety of threatened or rare species[15]. Semi-natural grasslands, including calcareous grasslands, are also extremely biodiverse[16], supporting a wide variety of birds, invertebrates and plants. Both habitats are protected under the UK Habitats and Species Regulation 2010[17], however both are consistently threatened by poor management[18], diminishing the services they provide and the biodiversity they hold.

[15] Littlewood et al, (2010). Peatland Biodiversity: Scientific Review.

[16] Meelis et al, (2005). Biodiversity in temperate European grasslands: origin and conservation. *Grassland Science in Europe,* 10: pp.1-14.

[17] National Archives (2010). The Conservation of Habitats and Species Regulations 2010. No. 490.

[18] Littlewood et al, (2010). Peatland Biodiversity: Scientific Review.

Designated landscapes must value their areas of high-quality habitat. They are resource-rich, and so support larger populations of species, buffering against environmental change[19]. Designated landscapes must focus on improving the condition of their most important habitats, and, by doing so, also restoring ecosystem functioning. Compared to the 25 YEP goal of 75% of SSSIs in "favourable" condition[20] and even the Biodiversity 2020 goal for 50% of SSSIs[21], the current NP and AONB figures are far off.

9.4 Blanket Bogs and Heathlands

9.4.1 Grouse moor management

A large proportion of uplands in some of the northern NPs are managed by land owners for the rearing of grouse on 'grouse moors' to support the rural gun sports industry. Intensive management practices associated with 'driven' grouse moors, requiring a greater number of grouse to be reared to be economically viable compared to 'walked up' shooting[22], can have damaging effects on natural habitats and ecosystems and negative effects on bird species of high conservation concern such as the hen harrier[23,24,25,26]. As such, management activities on driven grouse moors may in some instances, be at odds with the role of NPs and AONBs in recovering nature conservation and biodiversity. Evidence of negative environmental impact is described below:

9.4.2 Heather burning on deep peat

Rotational burning (5 to 20 years) of patches of heather on 'grouse moors' has been a common practice over the past 150 years[27] to produce heather age mosaics to support red grouse habitats as desired by the rural gun sports industry[28]. Douglas et al (2015) has found that there has been an increase in the frequency of fires on moorlands managed for grouse covering England, Scotland and

[19] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

[20] Defra (2018). A Green Future: Our 25 Year Plan to Improve the Environment. [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

[21] Defra (2011). Biodiversity 2020: A strategy for England's wildlife and ecosystem services. [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69446/pb13583-biodiversity-strategy-2020-111111.pdf

[22] Sotherton et al, (2009). Hen harriers and red grouse: economic aspects of red grouse shooting and the implications for moorland conservation. *Journal of Applied Ecology*, 46: pp.955–96.

[23] Natural England 2008. A future for the hen harrier in England? Natural England, Sheffield. [Online]. Available at: http://www.naturalengland.org.uk/Images/hen_harrier_report221208_tcm6-9451.pdf

[24] Sotherton et al, (2009). Hen harriers and red grouse: economic aspects of red grouse shooting and the implications for moorland conservation. *Journal of Applied Ecology*. 46: pp.955–96.

[25] Fielding et al, (2011). A Conservation Framework for Hen Harriers in the United Kingdom. JNCC Report, no. 441.

[26] Brown et al, (2014). Effects of Moorland Burning on the Ecohydrology of River basins. Key findings from the EMBER project. University of Leeds.

[27] Simmons et al, (2003). The Moorlands of England and Wales: An Environmental History 8000 BC - AD 2000. Edinburgh University Press, Edinburgh, UK.

[28] Holden et al, (2012). The impacts of prescribed moorland burning on water colour and dissolved organic carbon: A critical synthesis. *Journal of Environmental Management*, 101: pp 92-103.

Wales[29]. The number of burning events on moorlands managed for grouse had increased significantly from 2001 to 2011 at a rate of c 11% per annum across the UK. They found that nearly a third of burning in England was on peat ≥ 0.5 m in depth (i.e. deep peat).

Certain burning regimes on peatlands have been shown to have a number of negative environmental impacts such as:

- A reduction in aquatic macroinvertebrate diversity in the associated catchment (e.g. lower abundance of some species of mayfly, stonefly, and caddis-fly), due to water chemistry changes[30,31].
- Changes in blanket peat hydrology[32] - burned peatlands have been found to have a deeper water table that could lead to peat degradation and loss of carbon to the atmosphere[33].
- Changes in vegetation composition – with lower overall Sphagnum spp. cover, which are important peat forming mosses[34,35]. As yet unpublished research has also found that even the 'coolest' heather burning temperatures kill moss cells[36], with such changes potentially reducing both carbon and water storage[37].

The extent to which burning has a negative impact varies according to the intensity of burning regime. In some circumstances, low intensity burning regimes have been shown to increase species diversity and reduce the risk of unmanageable wildfires, compared to no burning regimes. In light of a changing climate, greater consideration will need to be given to the potential of carefully managed burning that reduces the fuel load[38].

[29] Douglas et al, (2015). Vegetation burning for game management in the UK uplands is increasing and overlaps spatially with soil carbon and protected areas. *Biological Conservation*, 191: pp.243-250.
[30] Brown et al, (2014). Effects of Moorland Burning on the Ecohydrology of River basins. Key findings from the EMBER project. University of Leeds.
[31] Ramchunder et al, (2013). Rotational vegetation burning effects on peatland stream ecosystems. *Journal of Applied Ecology*, 50(3): pp. 636-648
[32] Holden et al, (2012). The impacts of prescribed moorland burning on water colour and dissolved organic carbon: A critical synthesis. *Journal of Environmental Management*, 101: pp 92-103.
[33] Brown, L.E., Holden, J. Palmer, S.M. (2014). Effects of Moorland Burning on the Ecohydrology of River basins. Key findings from the EMBER project. University of Leeds.
[34] Lunt et al, (2010). Peatland Restoration Review - commissioned by the IUCN UK Peatland Programme's Commission of Inquiry on Peatlands. (Ed. Martin Evans).
[Online]. Available at: www.iucn-uk-peatlandprogramme.org/sites/www.iucn-uk-peatlandprogramme.org/files/images/Review%20Peatland%20Restoration%2C%20June%202011%20Final.pdf
[35] Noble et al, (2018). Prescribed burning, atmospheric pollution and grazing effects on peatland vegetation composition. *Journal of Applied Ecology*. 55: pp.559-569.
[36] Pers. comm. Professor Joseph Holden, Pro-Dean of Research, Faculty of Environment, University of Leeds.
[37] Brown, L.E., Holden, J. Palmer, S.M. (2014). Effects of Moorland Burning on the Ecohydrology of River basins. Key findings from the EMBER project. University of Leeds.
[38] Marrs et al, (2018). Experimental evidence for sustained carbon sequestration in fire-managed, peat moorlands. *Nature Geoscience*.

9.4.3 Illegal persecution of hen harriers associated with intensively managed grouse moors.

The aim of 'driven' grouse moor management is to maximize the number of grouse available for shooting in autumn. Hen harriers can reduce grouse harvests, and even though hen harriers are protected by law, they may be illegally killed or disturbed as a consequence[39].

Several scientific studies[40,41,42,43] have found that breeding hen harrier numbers in the UK are lower in areas associated with the management of grouse moors (e.g. north of England, southern and eastern Scotland) and these studies infer that this is due to illegal killing of hen harriers. Some gamekeepers kill harriers because of the real or perceived impact of harrier predation on red grouse populations and shooting bags[44].

Redpath et al (2010) have commented for UK grouse moors: "The absence of breeding hen harriers from many grouse moors suggests that some, possibly many, grouse moor managers will not tolerate even one pair of hen harriers on their land"[45]. According to their modelling analysis they estimated that driven grouse moors across the UK (in the absence of persecution), should support about 500 successful hen harrier pairs in total each year. However, in 2008 there were just five successful pairs of hen harrier on driven grouse moors in the whole of the UK[46]. The latest estimates of the hen harrier population in England recorded four territorial pairs and there had been a notable decrease in England since 2010[47]. However, it has been calculated that there is sufficient upland habitat in northern England to support 323–340 pairs of hen harriers[48]. Hen harriers will only return to a viable population with the cessation of unsustainable grouse moor management and illegal persecution, and are in serious danger of extirpation without such action[49].

[39] Redpath et al, (2010). People and nature in conflict: can we reconcile hen harrier conservation and game management. Species Management: Challenges and Solutions for the 21st Century. pp. 335-350.
[40] Sim et al, (2007). Status of the Hen Harrier Circus cyaneus in the UK and Isle of Man in 2004, and a comparison with the 1988/89 and 1998 surveys. *Bird Study*. 54 pp. 256-267.
[41] Natural England 2008. A future for the hen harrier in England? Natural England, Sheffield. [Online]. Available at: http://www.naturalengland.org.uk/Images/hen_harrier_report221208_tcm6-9451.pdf
[42] Fielding et al, (2011). A Conservation Framework for Hen Harriers in the United Kingdom. JNCC Report, no. 441.
[43] Hayhow et al, (2013). The status of the Hen Harrier, Circus cyaneus, in the UK and Isle of Man in 2010. *Bird Study*. 60 pp. 446-458.
[44] Redpath et al, (2010). People and nature in conflict: can we reconcile hen harrier conservation and game management. Species Management: Challenges and Solutions for the 21st Century. pp. 335-350.
[45] Redpath et al, (2010). People and nature in conflict: can we reconcile hen harrier conservation and game management. Species Management: Challenges and Solutions for the 21st Century. pp. 335-350.
[46] Redpath et al, (2010). People and nature in conflict: can we reconcile hen harrier conservation and game management. Species Management: Challenges and Solutions for the 21st Century. pp. 335-350.
[47] Wotton et al, (2016). Status of the Hen Harrier Circus cyaneus in the UK and Isle of Man in 2016. *Bird Study*. 65: pp. 145-160.
[48] Fielding et al, (2011). A Conservation Framework for Hen Harriers in the United Kingdom. JNCC Report, no. 441.
[49] Wotton et al (2018). Status of the Hen Harrier Circus cyaneus in the UK and Isle of Man in 2016.

9.5 Biodiverse upland grasslands are threatened by agricultural intensification

Upland grassland habitats are also threatened by human modification, having undergone extensive decline and degradation during agriculture intensification in the second half of the 20th century[50]. These grasslands were originally created by low-intensity, traditional land management, still requiring low-intensity grazing and cutting to avoid transition into scrub and woodland[51]. These so called "semi-natural" grasslands are especially altered by the use of inorganic fertilisers to "improve" their productivity. Whilst unimproved grasslands are extremely biodiverse, improved grasslands tend to hold plant communities with limited diversity, mainly dominated by a few competitive species[52]. A long-term study in Upper Teesdale by Natural England highlighted the negative impacts of agricultural improvement on biodiversity in upland meadows, suggesting a more precautionary approach should be taken[53]. Often grasslands are treated by fertilisers to accommodate increased stocking density, which in itself leads to environmental damage through overgrazing[54]. Overgrazing is one of the largest threats to grassland habitats, and on SSSIs in general – it is the second most common explanation for adverse SSSI conditions in England[55]. With 97% of semi-natural grasslands lost[56], preservation and restoration are increasingly important. NPs and AONBs provide an opportunity to creating and maintain "core" areas of priority habitats within NPs and AONBs, from which species can disperse outwards.

9.6 Innovative management options, such as rewilding, offer cost-effective solutions to conservation issues

As much of our current biodiversity depends on the preservation and restoration of semi-natural habitats[57], it is important they are maintained as core areas of biodiversity in a patchwork landscape of diverse habitats. However, in other areas of designated landscapes, different options may be more appropriate for increasing biodiversity and delivering of ecosystem services. Rewilding could represent a cost-effective solution to enhance biodiversity and ecological resilience in designated landscapes, due to rewilding's goal of "self-sustaining provision of ecosystem services with minimal ongoing management"[58].

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[50] Robinson and Sutherland, (2002). Post-war changes in arable farming and biodiversity in Great Britain. *Journal of Applied Ecology*, 39(1): pp.157-176.

[51] Ridding et al, (2015). Fate of semi-natural grassland in England between 1960 and 2013: A test of national conservation policy. *Global Ecology and Conservation*, 4: pp.516-525.

[52] Ridding et al, (2015). Fate of semi-natural grassland in England between 1960 and 2013: A test of national conservation policy. *Global Ecology and Conservation*, 4: pp.516-525.

[53] Natural England (2014). Upper Teesdale: changes in upland hay meadow vegetation over the past twenty to thirty years - results presented from botanical surveys (NECR139). [Online]. Available at: http://publications.naturalengland.org.uk/publication/6301646967537664

[54] Natural England (2006). The importance of livestock grazing for wildlife conservation (IN170). [Online]. Available at: http://publications.naturalengland.org.uk/publication/68026

[55] Natural England (2018). Designated Sites View: Adverse condition summary. [Online]. Available at: https://designatedsites.naturalengland.org.uk/ReportUnitAdverseCondition.aspx?ReportTitle=All%20of%20England%20adverse%20conditions

[56] Hooftman and Bullock, (2012). Mapping to inform conservation: A case study of changes in semi-natural habitats and their connectivity over 70 years. *Biological Conservation,* 145(1): pp.30-38.

[57] Duelli and Obrist, (2003). Regional biodiversity in an agricultural landscape: the contribution of semi-natural habitat islands. *Basic and Applied Ecology*, 4(2): pp.129-138.

[58] Pettorelli et al, (2018). Making rewilding fit for policy. *Journal of Applied Ecology*, 55(3).

Rewilding is another option for the management of certain designated landscapes and could represent a transformative approach to conserving biodiversity in England. This is because current practices are shaped by a 'compositionalist' paradigm, predicated on the preservation of particular species assemblages and habitat types. However, environmental change is increasingly undermining the function of ecosystems under a compositionalist approach. Given the recent declines in biodiversity, continuing restoration to historical benchmarks or modern likely equivalents may no longer be an option. Thus, to ensure ecosystems can maintain biodiversity and function, allowing delivery of ecosystem services over the long term, rewilding may be the most appropriate option for damaged ecosystems[59]. The uptake of function-focused management in the form of large-scale restoration projects, such as Cairngorms Connect[60], is promising and should set an example for England's NPs and AONBs. It is important that decisions follow careful consideration of whether or not to work towards baselines. A conscious decision to adopt a more passive approach to managing land in certain areas may be helpful, but a laissez faire approach to decision-making would be problematic.

9.7 The potential of designated landscapes to deliver nature conservation

There are clear and immediate goals for NPs and AONBs to improve the condition of current areas for wildlife, in the form of SSSIs and NNRs[61]. However, as these only cover 6.37% of England's land[62], other support systems are needed to build a Nature Recovery Network that is resilient to future environmental change[63]. Improving site conditions of SSSIs and NNRs would fulfil the "Better" principle of the Lawton report, by creating core areas of biodiversity from which high concentrations of species could disperse to other areas of the network. However, NPs and AONBs would need to go further to fulfil the "Bigger", "More" and "Joined" principles of the Lawton report[64].

9.8 National Parks and AONBs have the ability to deliver larger spaces for nature

Covering 24% of England's total land, NPs and AONBs have the size needed to fulfil the "Bigger" part of the Lawton Principles. SSSIs, the strongest designation with a nature conservation focus, have a median size of only 0.2km^2 in England[65]. **On the other hand, NPs have a median size of 1241km^2 and AONBs have a median size of 370km^2**. Larger areas of natural or semi-natural habitat support larger populations of species, because the impacts of variable conditions on the population are buffered[66]. Therefore, overall extinction threat is reduced. Currently, only 30% of AONBs and NPs is high-quality

[59] Pettorelli et al, (2018). Making rewilding fit for policy. *Journal of Applied Ecology*, 55(3).

[60] Endangered Landscapes Programme (2018). Cairngorms Connect: Scotland. [Online]. Available at: https://www.endangeredlandscapes.org/projects/cairngorms-connect-scotland/

[61] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

[62] Shwartz et al, (2017). Scaling up from protected areas in England: The value of establishing large conservation areas. *Biological Conservation*, 212(Part A): pp.279-287.

[63] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

[64] Lawton, Sir John (2010). Making space for nature: A review of England's Wildlife Sites and Ecological Network.

[65] Shwartz et al, (2017). Scaling up from protected areas in England: The value of establishing large conservation areas. *Biological Conservation*, 212(Part A): pp.279-287.

[66] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

semi-natural habitat, often captured in other designations of SSSI or NNR[67]. While these form the core areas for biodiversity within designated landscapes, there is certainly potential to create and restore habitat within, making larger spaces for biodiversity. Isaac et al (2018) suggest expanding the area of high quality semi-natural habitat to cover 40% of these landscapes[68]. It will be important to optimise the location of this habitat creation and restoration, primarily focusing on network extension to recover species and ecological function[69]. In time, these areas have the potential to form part of the core habitat for biodiversity within the network.

9.9 More National Parks and AONBs means more opportunity for nature conservation

England's SSSIs and NNRs fall overwhelmingly within upland areas, meaning many ecoregions are poorly represented[70]. 78% of England's 159 National Character Areas have <10% representation within SSSIs and NNRs[71]. Designated landscapes, especially NPs, also tend to be upland areas and cover only a few of the National Character Areas[72]. If biodiversity is to be properly protected, with no net loss of species, then all species and their habitats should be represented, at least in part, by protected areas[73]. New NPs outside of upland areas, if effectively managed for biodiversity (unlike many current NPs and AONBs), could therefore play a crucial role in both reversing biodiversity declines and increasing public access to nature.

9.10 National Parks and AONBs could reduce the negative impacts of climate change

Climate change is likely to surpass land-use change (e.g. agricultural intensification) as the leading driver of biodiversity decline worldwide[74]. In the UK, changes in climate have had both negative and positive effects[75]. Generally, changes in climate have been linked to species' known preferred climate envelopes shifting towards the poles and to higher elevations[76]. Positive impacts of climate change are realised in the UK, because many species have seen expansions to their northern range limit, whilst reductions in their southern range limit are experienced outside of the UK[77].

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[67] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

[68] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

[69] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

[70] Shwartz et al, (2017). Scaling up from protected areas in England: The value of establishing large conservation areas. *Biological Conservation*, 212(Part A): pp.279-287.

[71] Shwartz et al, (2017). Scaling up from protected areas in England: The value of establishing large conservation areas. *Biological Conservation*, 212(Part A): pp.279-287.

[72]Natural England (2013). National Character Areas with National Parks and Areas of Outstanding Natural Beauty. [Online]. Available at:https://webarchive.nationalarchives.gov.uk/20140712093344/http://www.naturalengland.org.uk/Images/nca-np-aonb_tcm6-36961.pdf

[73] Rodrigues et al, (2018). Global Gap Analysis: Priority Regions for Expanding the Global Protected-Area Network. *BioScience*, 54(12): pp.1092-1100.

[74] Newbold, Tim, (2018). Future effects of climate and land-use change on terrestrial vertebrate community diversity under different scenarios. *Proceedings of the Royal Society B: Biological Sciences*, 285(1881).

[75] Burns et al, (2016). Agricultural Management and Climatic Change Are the Major Drivers of Biodiversity Change in the UK. *PLoS ONE*, 11(3).

[76] Parmesan and Rohe, (2003). A globally coherent fingerprint of climate change impacts across natural systems

[77] Burns et al, (2016). Agricultural Management and Climatic Change Are the Major Drivers of Biodiversity Change in the UK. *PLoS ONE*, 11(3).

When species have the dispersal ability and habitat availability, they can potentially shift or expand their distributions to track their preferred climate. This has been particularly well evidenced through butterfly distributions in the UK[78]. However, with increasing habitat fragmentation and loss, some species are unable to do this, and could be at risk of being trapped in increasingly climatically unsuitable areas. This is particularly the case for species with narrow requirements; for example, a study of 46 butterfly species reported distribution size declines in 89% of habitat specialists between 1970 and 2000[79,80].

This could mean that under a climate change scenario, species in fragmented landscapes are vulnerable to not just a higher risk of stochastic extinction events, but to increasingly unsuitable climates, and exposure to novel species that are successfully expanding their range, with unpredictable outcomes; e.g. brown argus range expanding northward to coincide with the range of northern brown argus, potentially resulting in hybridisation and threatening the population of the northern brown argus[81,82].

In order to help species, track their changing climate envelope, it is important to maintain a range of well managed habitat patches through the landscape. This is particularly the case at higher altitudes and latitudes, such as in the Peak District, the northern limit of many UK species. Protected areas, if well managed (which currently many NPs and AONBs are not), have been proven to support species' persistence during climatic change: butterflies and other invertebrates consistently show larger populations within SSSIs compared to outside, even in areas that were recently colonised after warming had begun[83]. Thus, NPs and AONBs must deliver areas of high-quality habitat to protect biodiversity against environmental change.

Most importantly, these climate refugia should be well connected – fulfilling the "Joined" principle from the Lawton report[84]. Given their scale, NPs and AONBs have great potential to act as climate refugia, if management efforts within them focus on creating:

- Ecological "corridors" and "stepping stones" of high-quality habitat between larger areas of high-quality habitat[85].
- A softer "matrix", whereby areas surrounding patches of high-quality habitat are more wildlife friendly[86].

In designated landscapes, this would mean improving connectivity between habitats, especially high-quality areas, such as SSSIs and NNRs within, through high-quality, linear landscape features such as

[78] Parmesan et al, (1999). Poleward shifts in geographical ranges of butterfly species associated with regional warming

[79] Warren et al, (2001). Rapid responses of British butterflies to opposing forces of climate and habitat change

[80] Fox et al, (2001). Butterflies for the new millennium: mapping butterfly distributions in Britain (Lepidoptera)

[81] Pateman et al, (2012). Temperature-Dependent Alterations in Host Use Drive Rapid Range Expansion in a Butterfly. *Science*, 336(6084): pp.1028-1030.

[82] Mallet et al, (2010). Hybridisation and climate change: brown argus butterflies in Britain (Polyommatus subgenus Aricia). *Insect Conservation and Diversity*, 4(3): pp.192-199.

[83] Gillingham et al, (2014). High Abundances of Species in Protected Areas in Parts of their Geographic Distributions Colonized during a Recent Period of Climatic Change. *Conservation Letters*, 8(2): pp.97-106.

[84] Lawton, Sir John (2010). Making space for nature: A review of England's Wildlife Sites and Ecological Network.

[85] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

[86] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).

along roads, footpaths, hedgerows, rivers and coasts[87]. It would also require more sustainable, nature-friendly development and agriculture within areas not designated for conservation, as discussed in question 11. Furthermore, connectivity should be considered when developing areas between current designated landscapes, as well as when designating any landscapes in the future. We can increase the resilience of our ecosystems through NPs and AONBs by taking steps to create a dynamic mosaic of habitat patches under appropriate, sustainable management, with minimal barriers to species movement between them.

9.11 Marine National Parks and AONBs

The UK's marine biodiversity is also highly threatened, with 38% of species found to be decreasing[88]. Despite England's 4,422 km of coastline, it has no marine NPs. New marine NPs, if properly managed with strict protections for biodiversity, could therefore make a significant contribution to reversing declines in marine biodiversity. Currently, the strongest protection of English seas are the no take zones, only around Lundy Island in the Bristol Channel and Flamborough Head in Yorkshire. These ban fishing of any kind, removal of matter, dredging, dumping, construction, and any other activity that would disturb natural processes[89]. The benefits of such reserves have been realised in New Zealand, a pioneer in marine conservation, where marine reserves directly led to improvements in conservation, education, recreation and management, and indirectly to fisheries, tourism and coastal planning[90]. Recent research has supported the 2014 World Parks Congress call for ≥30% of seas as no take zones, a value very different to the current coverage[91]. No take zones could therefore form an important part of new marine designated landscapes, perhaps surrounded by areas of sustainable resource management, similar to our vision for terrestrial NPs and AONBs. If these were implemented, a spatially targeted approach would be important, applying ecological network theory to ensure recovery of wildlife within.

[87] Isaac et al, (2018). Defining and delivering resilient ecological networks: Nature conservation in England. *Journal of Applied Ecology*, 55(6).
[88] RSPB et al, (2016). State of Nature Report.
[89] Ballantine, Bill (2014). Fifty years on: Lessons from marine reserves in New Zealand and principles for a worldwide network. *Biological Conservation*, 176: pp.297-307.
[90] Ballantine, Bill (2014). Fifty years on: Lessons from marine reserves in New Zealand and principles for a worldwide network. *Biological Conservation*, 176: pp.297-307.
[91] O'Leary et al, (2016). Effective Coverage Targets for Ocean Protection. *Conservation Letters*, 9: pp. 398-404.

Question 11.

The role National Parks and AONBs play in working with farmers and land managers and how might this change as the current system of farm payments is reformed?

11.1 Introduction

By virtue of their scale, National Parks and Areas of Outstanding National Beauty are uniquely positioned to restore ecosystem function and deliver ecosystem services. Ecosystem functions are a product of the communities of species that reside within the system, with greater biodiversity improving ecosystem productivity and stability[92]. A functioning ecosystem will in turn provide services to humans, including pollination and soil formation, which have tangible value[93]. Given the extent of agricultural land within designated landscapes[94], the delivery of ecological public goods will depend on farmers and land managers being incentivised to promote biodiversity conservation and maintenance of ecosystem function[95,96].

11.2 Public money for public goods scheme

As the UK leaves the EU, AES will be reformed to focus on supporting and maintaining ecosystem services for the delivery of public goods, as described in the 25-Year Environment Plan[97]. We define a public good as: *"Something which is a benefit to humans and provided by the environment, such as nutrient cycling, pollination, soil formation and climate regulation. All provisioning and regulating ecosystem services are public goods"*[98]. Patchy conservation measures and intensive land use has caused habitat loss and fragmentation in the farmed landscape. As such, it is important that a future public goods scheme creates more and better-connected habitats, protects and enhances biodiversity, builds healthy soils, and improves air and water quality. The delivery of these public goods would benefit farmers and the natural environment by providing services such as nutrient cycling and pest regulation.

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[92] Seddon et al (2016). Biodiversity in the Anthropocene: prospects and policy. Proceedings of the Royal Society B: Biological Sciences, 283(1844).

[93] Seddon et al (2016). Biodiversity in the Anthropocene: prospects and policy. Proceedings of the Royal Society B: Biological Sciences, 283(1844).

[94] 75% of the Chilterns AONB is farmland, and in the Cranborne Chase AONB, farmland represents 80% of the total site (https://chilternsaonb.org/about-chilterns/farming-land-use.html); In National Parks, farmland makes up between 50% to 80% of the total landscape (http://www.nationalparksengland.org.uk/__data/assets/pdf_file/0009/967905/Farming-in-the-English-National-Parks.pdf)

[95] Shwartz et al. (2017). Scaling up from protected areas in England: The value of establishing large conservation areas. *Biological Conservation*, 212.

[96] Robinson and Sutherland (2002). Post-war changes in arable farming and biodiversity in Great Britain. *Journal of Applied Ecology*, 39(1): pp.157–176.

[97] UK Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment. [Online]. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/673203/25-year-environment-plan.pdf

[98] Uitto et al (2016) Evaluating the environment as a global public good. *Evaluation*, 22(1): pp. 108–115.

11.3 Maximising the potential of designated landscapes to restore ecosystem function

Biodiversity underpins ecosystem function (and therefore service)[99]. As such, biodiversity conservation through habitat restoration should be a key focus of future incentive schemes for landowners within designated landscapes. Designated landscapes are often dominated by monocultures – such as sheep grazing – that limit habitat variability and result in low levels of biodiversity; future incentives should focus on increasing habitat heterogeneity and the connectivity between habitats.

Unlocking the ecological potential of designated landscapes, will require strategic incentives that bring together multiple landowners across landscapes[100,101], moving beyond single-farm schemes operating at insufficient spatial scales that characterise the current agri-environment (AES) model[102]. Most important ecological processes and ecosystem services, for example pollination, water retention and filtration, nutrient cycling, seed dispersal, natural pest control etc. operate at a scale much larger than single farms. Farm-level uptake of AES is only effective for less mobile species, whereas a joined-up approach delivers biodiversity gains irrespective of species' mobility[103].

11.4 Encouraging take-up and enabling landowners to work together

Widespread adoption of environmental stewardship schemes, and partnerships between farmers and land managers will be crucial in reversing biodiversity and habitat loss and restoring natural ecosystem function.

As detailed below, some Designated Area authorities have already shown leadership in collaborating with stakeholders to deliver a conservation initiative. However, these have been patchy and issue-specific, lacking the scale and resources required to establish a resilient ecological network.

Lack of uptake has been highlighted as a reason for the lack of efficacy of AES in other countries, due to insufficient area in the landscape being under conservation management[104,105]. Delegated authorities within NPs and AONBs can help to promote take-up and facilitate conservation partnerships between farmers and landowners[106].

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[99] Truchy et al (2015). Linking Biodiversity, Ecosystem Functioning and Services, and Ecological Resilience: Towards an Integrative Framework for Improved Management. *Advances in Ecological Research*, 53: pp.55-93.

[100] Westerink et al (2017). Collaborative governance arrangements to deliver spatially coordinated agri-environmental management. Land Use Policy, 69: pp.176-192;

[101] Whittingham (2006). Will agri-environment schemes deliver substantial biodiversity gain, and if not why not? *Journal of Applied Ecology*, 44(1).

[103] Merckx et al (2009). Effect of field margins on moths depends on species mobility: Field-based evidence for landscape-scale conservation. *Agriculture, ecosystems and environment*, 129 (1-3): pp.302-309.

[104] Macdonald et al (2018). Have Welsh agri-environment schemes delivered for focal species? Results from a comprehensive monitoring programme. *Journal of Applied Ecology*.

[105] Hammes et al (2016). The attitude of grassland farmers towards nature conservation and agri-environment measures-A survey-based analysis. *Land Use Policy,* 59: pp.528-535.

[106] Landscapes for Life & NAAONB (2018). Farming for the Nation: AONBs as test beds for a new Environmental Land Management Scheme.

For instance, Cranborne Chase AONB facilitated the South Wiltshire Farmland Conservation Project (SWFCP) covering 52,000ha of mostly farms, primarily under the HLS AES scheme. The Cranborne Chase AONB worked with partners to create an evidence-based package of simple measures to deliver and monitor the minimum amount of habitat needed for specialist farmland bird species including; bunting, tree sparrow, turtle dove, grey partridge, lapwing, linnet, skylark, starling, stock dove, goldfinch, whitethroat and yellowhammer[107].

Farmers and land managers who participated in the project were given detailed guidance on how to implement the project on their land and given support in their AES applications. Feedback from land managers and farmers indicated that the technical advice and support from Cranborne Chase AONB was the determining factor for their continued participation in the project[108]. The SWFCP package has since been replicated across England and has now been extended to woodland birds and farmland butterflies[109].

11.5 The importance of providing technical advisory services

Given the potential of designated landscapes to contribute towards national targets, for instance, within the 25 Year Plan, it is particularly important that landowners within designated landscapes have access to sufficient technical advice on how to deliver incentivised land management. This is because the effectiveness of agri-environment schemes has been highly variable, and often depends on the level of engagement, experience and skills of the farmer[110]. AES delivery has been shown to improve in terms of biodiversity outcomes when farmers and landowners received training[111,112,113].

AONBs supporting farming clusters have been successful in facilitating knowledge exchange. For instance, the High Weald AONB set up the Upper Rother and Dudwell Farm Cluster which facilitates knowledge exchange between land owners on topics such as soil health and wildflower meadow creation. Support from High Weald AONB has resulted in a 20% increase in AES application success for farmers in the area, increasing the overall amount of land under conservation management[114].

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[107] Southwest Farmland Bird Initiative (unknown). The South Wiltshire Farmland Bird Project - Final Report. [Online]. Available at: http://www.ccwwdaonb.org.uk/uploads/docs/Our_Work/SouthWiltsFarmlandBirdFINAL

[108] Southwest Farmland Bird Initiative (unknown). The South Wiltshire Farmland Bird Project - Final Report. [Online]. Available at: http://www.ccwwdaonb.org.uk/uploads/docs/Our_Work/SouthWiltsFarmlandBirdFINAL

[109] Southwest Farmland Bird Initiative (unknown). The South Wiltshire Farmland Bird Project - Final Report. [Online]. Available at: http://www.ccwwdaonb.org.uk/uploads/docs/Our_Work/SouthWiltsFarmlandBirdFINAL

[110] De Snoo et al, (2013). Toward effective nature conservation on farmland: making farmers matter. *Conservation Letters*, 6: pp.66-72.

[111] Guillem and Barnes (2013). Farmer perceptions of bird conservation and farming management at a catchment level. *Land Use Policy*, 31: pp.565– 575.

[112] Sutherland et al. (2018) Farmland Conservation Pages 245-284 in: W.J. Sutherland, L.V. Dicks, N. Ockendon, S.O. Petrovan & R.K. Smith (eds) *What Works in Conservation 2018.* Open Book Publishers, Cambridge, UK

[113] Guillem and Barnes (2013). Farmer perceptions of bird conservation and farming management at a catchment level. *Land Use Policy*, 31: pp.565– 575.

[114] High Weald AONB. (unknown0. Upper Rother and Dudwell Farm Cluster. [Online]. Available at: http://www.highweald.org/look-after/upper-rother-and-dudwell-farm-cluster.html

11.6 Targeting and prioritisation of farmland conservation measures

The one-size-fits-all approach of past AES has yielded mixed results with regards to improving species richness and abundance[115]. However, successful spatial targeting can increase the population of priority species, such as micro moths[116] and wild bumblebees[117], through habitat creation.

Question 12.
The role National Parks and AONBs play in supporting and managing access and recreation?

12.1 The importance of biodiversity in cultural services

Underpinning all ecosystem services, including cultural services, is biodiversity[118,119]. If National Parks and Areas of Outstanding National Beauty became accessible "nature hubs", where people have the chance to experience exceptional biodiversity, their educational, health and economic outcomes would be enhanced. Diversity of species, especially of plants, amphibians, birds and mammals, contribute to our perception of places as "meaningful" and "socially valuable" in the UK[120]. Continued species decline is therefore likely to diminish the cultural value of designated landscapes, whereas increased levels of biodiversity will boost their cultural value[121]. Thus, the BES would recommend prioritising increasing biodiversity in order to realise the cultural benefits of designated landscapes (please see question 9 for recommendations on how to increase biodiversity within designated landscapes).

12.2 Educational benefits of biodiverse designated landscapes

The BES would welcome improved access to NPs and AONBs (although see 12.5), allowing people from a variety of backgrounds to connect with nature. Nature inspires people, gives them a sense of place, and a better understanding of heritage and culture[122,123]. Pedagogy of place allows people to understand complex environmental issues and see how nature is relevant to them, encouraging

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[115] Batary et al (2011). Landscape-moderated biodiversity effects of agri-environmental management: a meta-analysis. *Proceedings of the Royal Society B: Biological Sciences*, 278(1713).
[116] Duffield et al (2016). Spatial targeting of habitat creation has the potential to improve agri-environment scheme outcomes for macro-moths. *Journal of Applied Ecology,* 53(6).
[117] Wood et al (2015). Targeted agri-environment schemes significantly improve the population size of common farmland bumblebee species. *Molecular Ecology*, 24(8).
[118] Seddon et al (2016). Biodiversity in the Anthropocene: prospects and policy. *Proceedings of the Royal Society B: Biological Sciences,* 283(1844).
[119] UK National Ecosystem Assessment (2011).
[120] UK National Ecosystem Assessment (2011), Chapter 4.
[121] UK National Ecosystem Assessment (2011), Chapter 4.
[122] Natural England. (2009). Experiencing Landscapes: capturing the cultural services and experiential qualities of landscape. Natural England Commissioned Report NECR024.
[123] UK National Ecosystem Assessment (2011).

displays of pro-environmental behaviours[124]. It can also provide clarity on what public funds are used for and why protections are in place for many areas[125]. There are concerns people have become disconnected with nature, with only 62% of people visit green spaces weekly, and 8% having never visited a green space[126]. Thus, the cultural ecosystem services that NPs and AONBs can provide are not being fully realised, especially by those from deprived areas and BAME backgrounds[127].

12.3 Health benefits of biodiverse designated landscapes

Recreation is another important cultural ecosystem service that can be realised in NPs and AONBs. "Green exercise" theory suggests that exercising in natural spaces, terrestrial and aquatic, improves both physical and mental well-being, when compared to exercising in manmade spaces[128,129,130]. More specifically, exposure to nature reduces internal stress markers and improves long-term health outcomes, including reduced obesity and morbidity[131]. Overall, this reduces costs to the NHS and general economy[132]. Therefore, by prioritising increased biodiversity within designated landscapes, could increase the health benefits they provide the public[133]. Importantly, across a decade of research, Pretty et al. (2017) found all ages, genders, ethnicities, and social classes respond positively to green exercise[134]. Outcomes from green exercise are improved when the participants are aware that they are being "treated"[135,136], for instance through programmes such as "Moor to Enjoy" in the Exmoor NP and "Naturally Healthy" in Dartmoor NP, which facilitated greater overlap with the Public Health sector.

[124] Vaske and Kobrin (2010). Place Attachment and Environmentally Responsible Behavior. *The Journal of Environmental Education*, 32(4).
[125] Kaplan (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15(3).
[126] Natural England (2018). Monitor of Engagement with the Natural Environment: The national survey on people and the natural environment. Headline report 2018.
[127] Natural England (2018). Monitor of Engagement with the Natural Environment: The national survey on people and the natural environment. Headline report 2018.
[128] Pretty et al (2006). The mental and physical health outcomes of green exercise. *International Journal of Environmental Health Research*, 15(5).
[129] Barton and Pretty (2010). What is the Best Dose of Nature and Green Exercise for Improving Mental Health? A Multi-Study Analysis. *Environmental Science and Technology*, 44(10).
[130] White et al (2010). Blue space: The importance of water for preference, affect, and restorativeness ratings of natural and built scenes. *Journal of Environmental Psychology*, 30(4).
[131] Pretty et al (2017). Green Mind Theory: How Brain-Body-Behaviour Links into Natural and Social Environments for Healthy Habits. *International Journal of Environmental Research and Public Health*, 14(7).
[132] Pretty et al (2017). Green Mind Theory: How Brain-Body-Behaviour Links into Natural and Social Environments for Healthy Habits. *International Journal of Environmental Research and Public Health*, 14(7).
[133] Bragg et al (2018). Wellbeing benefits from natural environments rich in wildlife: A literature review for The Wildlife Trusts by the University of Essex.
[134] Pretty et al (2017). Green Mind Theory: How Brain-Body-Behaviour Links into Natural and Social Environments for Healthy Habits. *International Journal of Environmental Research and Public Health*, 14(7).
[135] Barton and Pretty (2010). What is the Best Dose of Nature and Green Exercise for Improving Mental Health? A Multi-Study Analysis. *Environmental Science and Technology*, 44(10).
[136] Natural England (2017). Good practice in social prescribing for mental health: the role of nature-based interventions. Natural England Commissioned Report NECR228.

12.4 Economic benefits of biodiverse designated landscapes

Bringing people to NPs and AONBs would also be beneficial for local economies. Tourism is a notable cultural ecosystem service that NPs and AONBs provide, attracting over 260 million visitors, spending in excess of £6 billion[137]. The success of ecotourism depends on a wide variety of factors, including geographical features, such as accessibility of the NP[138] and feeling of wilderness within[139], as well as biological features, predominantly biodiversity[140] and presence of charismatic species[141].

Charismatic species are species with widespread popular appeal, examples in the England including the osprey and red kite[142]. Such species can have huge economic benefits: 290,000 people visit osprey sites in the UK every year, bringing in an estimated £3.5 million to surrounding areas[143]. Even on the small Isle of Mull, white-tailed eagles bring in an estimated £5 million in tourist spend every year, supporting 110 jobs[144]. There is opportunity to introduce these species in England's designated landscapes; the Lake District has suitable habitat for white-tailed eagles[145] and, importantly, broad public support for their reintroduction[146]. As on the Isle of Mull, any livestock lost to predation could be compensated by government. Other charismatic species, such as beavers, can provide additional benefits. Beavers act as "ecosystem engineers", improving habitat quality and increasing an area's biodiversity value, therefore enhancing public goods in that area[147]. The BES would encourage NPs and AONBs to reintroduce charismatic species, where appropriate, to improve species' conservation status and increase ecotourism, amongst other public benefits, in the area.

12.5 Managing access to avoid harm to nature

Whilst the BES support improved access to NPs and AONBs and recreation within, it is important to recognise, and then avoid or mitigate, any potential conflicts with rare or vulnerable species. Potential issues of increased visitor numbers include: litter, vandalism, trampling, soil erosion, wildfires,

[137] National Association for AONBs and National Parks England (2015). So much more than the view. Available at: http://www.nationalparksengland.org.uk/__data/assets/pdf_file/0011/767477/So-much-more-pdf-with-web-navigation-bar.pdf

[138] Balmford et al (2015). Walk on the Wild Side: Estimating the Global Magnitude of Visits to Protected Areas. *PLoS Biology*, 13(2).

[139] Hausmann et al (2016). Ecotourism marketing alternative to charismatic megafauna can also support biodiversity conservation. *Animal Conservation*, 20(1).

[140] Siikamaki et al (2015). Biodiversity attracts visitors to national parks. *Biodiversity and Conservation*, 24(10).

[141] Skibins et al (2013). Charisma and conservation: charismatic megafauna's influence on safari and zoo tourists' pro-conservation behaviors. *Biodiversity and Conservation*, 22(4).

[142] RSPB (2006). Watched Like Never Before… the local economic benefits of spectacular bird species. Available at: https://www.rspb.org.uk/globalassets/downloads/documents/positions/economics/watchedlikeneverbefore_tcm9-133081.pdf

[143] RSPB (2006). Watched Like Never Before… the local economic benefits of spectacular bird species. Available at: https://www.rspb.org.uk/globalassets/downloads/documents/positions/economics/watchedlikeneverbefore_tcm9-133081.pdf

[144] RSPB Scotland (2011). Widlife at Work: The economic impact of white-tailed eagles on the Isle of Mull. Available at: http://ww2.rspb.org.uk/Images/wildlifeatwork_tcm9-282134.pdf

[145] Scottish Natural Heritage (2016). Population and future range modelling of reintroduced Scottish white-tailed eagles (Haliaeetus albicilla). Scottish Natural Heritage Commissioned Report No. 898.

[146] Mayhew et al (2015). Public perceptions of a white-tailed sea eagle (*Haliaeetus albicilla L.*) restoration program. *Restoration Ecology*, 24(2).

[147] Law et al (2017). Using ecosystem engineers as tools in habitat restoration and rewilding: beaver and wetlands. *Science of The Total Environment*, 605-606.

localised pollution, and direct disturbance of protected species[148]. Research has suggested a range of management options to reduce visitor impact including: setting aside new areas for recreation, physical and natural barriers, provision of track alterations, temporal restrictions, informational and/ or warning signs, trail maintenance, habitat restoration, screening vegetation for wildlife, impact surveys, buffer zones or minimum approach distances[149]. To give an example, new developments around the Thames Basin Heaths SPA threaten rare ground-dwelling birds, due to increased footfall, and increased presence of cats and dogs. Therefore, Suitable Alternative Natural Greenspaces (SANGs) have been created to alleviate pressure on the SPA. These allow the benefits of recreation in greenspaces to continue, without threatening the important wildlife in the area[150].

At a local level, it would be important to monitor these interventions and evaluate their social and ecological success (e.g. visitor compliance and wildlife benefits), to see whether they are appropriate for the wildlife and people in that area. A balance must be struck between the public benefits gained from access to NPs and AONBs and the conservation benefits of reduced human activity. The BES supports continuation of the Sandford Principle, which prioritises conservation if a conflict cannot be resolved through management.

Businesses that support recreation in NPs and AONBs should be encouraged to act sustainably and further encourage visitors to behave sustainably. For example, transport companies operating in NPs and AONBs should be low emission, and be well connected to encourage reduced car use. This is extremely important if designated landscapes are to deliver public benefits; in the USA, NPs suffer from poor air quality due to high vehicle use, as well as industrial emissions from agriculture and power plants[151]. NP and AONB businesses within the hospitality sector should also be encouraged to cut waste, emissions and encourage sustainable behaviours, such as eating locally sourced, organic foods.

[148] Marzano and Dandy. (2012). Recreational use of forests and disturbance of wildlife. Forestry Commission.

[149] Marzano and Dandy. (2012). Recreational use of forests and disturbance of wildlife. Forestry Commission.

[150] Surrey Heath Borough Council (2011). Local Development Framework 2011-2028. Available at: https://www.surreyheath.gov.uk/sites/default/files/documents/residents/planning/planning-policy/TBH/TBHAdoptedSPD.pdf

[151] National Parks Conservation Association (2015). Polluted Parks: How Dirty Air is Harming America's National Parks. Available at: https://www.npca.org/resources/3137-polluted-parks-how-dirty-air-is-harming-america-s-national-parks