Biodiversity 2020: Climate change evaluation process report

Report produced by

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Provide an overview of progress made towards delivery of outputs related to climate change adaptation and resilience within the Biodiversity 2020 Strategy between 2011 and 2018.

Background:
In 2011, the government published Biodiversity 2020: *A strategy for England's wildlife and ecosystem services* [1]. This strategy for England builds on the 2011 Natural Environment White Paper - NEWP [2] and provides a comprehensive picture of how we are implementing our international and EU commitments. It sets out the strategic direction for biodiversity policy between 2011-2020 on land (including rivers and lakes) and at sea, and forms part of the UK's commitments under the 'the Aichi targets' agreed in 2010 under the United Nations Convention of Biological Diversity's Strategic Plan for Biodiversity 2011-2020 [3].
Defra is committed to evaluating the Biodiversity 2020 strategy and has a public commitment to assess climate change adaptation measures. This document sets out the information on assessing how action under Biodiversity 2020 has helped our wildlife and ecosystems to adapt to climate change. Biodiversity 2020 aims to halt the loss of biodiversity and restore functioning ecosystems for wildlife and for people. The outcomes and actions in Biodiversity 2020, although wider in scope, aimed to increase resilience of our wildlife and ecosystems in the face of a changing climate. In order to inform the assessment, we have defined which of the measurable outputs under Biodiversity 2020 contribute to resilience.

Biodiversity 2020 included plans to develop and publish a dedicated set of indicators to assess progress towards the delivery of the strategy. The latest list (at the time of writing), published in 2017, contains 24 biodiversity indicators [4] that would help inform progress towards achieving specific outcomes, they are also highly relevant to the outputs (detailed below) that form the basis for this evaluation.

The Adaptation Sub-Committee's 2017 UK Climate Change Risk Assessment Evidence Report [5] sets out the priority climate change risks and opportunities for the UK. The ASC also produced a review of progress in the National Adaptation Programme - "Progress in preparing for climate change" [6], which highlights adaptation priorities and progress being made towards achieving them. The UK Government's response to the ASC [7] review includes a set of recommendations, of which Recommendation 6 states that *"Action should be taken to enhance the condition of priority habitats and the abundance and range of priority species". The recommendation further iterated that "This action should maintain or extend the level of ambition that was included in Biodiversity 2020"* and that *"An evaluation should be undertaken of Biodiversity 2020 including the extent to which goals have been met and of the implications for resilience to climate change."* To this, end an evaluation process has been put in place to define:

  a. What worked and why? Which actions or activities have had the greatest benefit in terms of delivering the desired outcomes? And, conversely, what prevented progress?

  b. Where are the opportunities? What are the financial, political, scientific and social opportunities for furthering the desired outcomes in the future?

These objectives underpin the evaluation process for actions to date, and will also inform future actions and the iteration of a new nature strategy for England.

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Evaluation process:

A logic model (Appendix 1) was developed to trace the pathways from inputs into the Biodiversity 2020 strategy, through to the activities (i.e. schemes/programmes) that may have contributed to achieving the initial outputs (related to priority habitats and species) and specific outcomes (1A-1D & 3 as outlined in the strategy, as well as the CBD Aichi targets), leading to the long-term improvements in the resilience of biodiversity to climate change.

The specific outcomes as outlined in the Biodiversity 2020 strategy and incorporated into the logic model used for this evaluation include the following:

Outcome 1A: *Better wildlife habitats with 90% of priority habitats in favourable or recovering condition and at least 50% of SSSIs in favourable condition, while maintaining at least 95% in favourable or recovering condition.*

Outcome 1B: *More, bigger and less fragmented areas for wildlife, with no net loss of priority habitat and an increase in the overall extent of priority habitats by at least 200,000 ha.*

Outcome 1C: *By 2020, at least 17% of land and inland water, especially areas of particular importance for biodiversity and ecosystem services, conserved through effective, integrated and joined up approaches to safeguard biodiversity and ecosystem services including through management of our existing systems of protected areas and the establishment of nature improvement areas.*

Outcome 1D: *Restoring at least 15% of degraded ecosystems as a contribution to climate change mitigation and adaptation,* and

Outcome 3: *By 2020, we will see an overall improvement in the status of our wildlife and will have prevented further human-induced extinctions of known threatened species.*

These specific outcomes also link to the CBD Aichi targets, in particular targets 5, 11 and 15.

The logic model identifies a range of metrics that could be used to define resilience, but for ease and feasibility of this evaluation, these have been combined into six broad output categories[*]:

- Condition of priority habitats
- Habitat extent
- Habitat connectivity
- Restoration of degraded ecosystems
- Status of priority species / species conservation (which include)
  - Range and habitat of vulnerable species
  - Species translocations.

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[*] Genetic diversity was not included in this evaluation

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Based on the logic model and the specific output categories mentioned above, an evaluation framework was developed to enable an expert panel assessment to answer the following questions:

- (i) What level of progress has been made towards achieving specific outcomes?
- (ii) Are there 'areas' where more or less progress has been achieved?
- (iii) Which activities/ schemes/ programmes have contributed towards achieving the specified outputs?
- (iv) What specific factors in these schemes have contributed to progress towards the specific outcomes?
- (v) What factors (if any) have hindered progress towards the achieving the specific outcomes?
- (vi) What could be improved in the future strategy going forward?

A panel comprising experts from academia, delivery agencies, non-government organisations and individuals with policy experience, was invited to complete an online survey based on the above questions. The survey was designed to collect basic information that allowed the structuring of a more in-depth discussion at a subsequent workshop, with a view to identifying recommendations that can be contribute towards a future iteration of a nature strategy for England. A total of 24 experts were invited to participate in this process: Four individuals could not participate in either the survey or the workshop; 15 experts in total completed the online survey; 18 attended the workshop of whom 13 had completed the survey; two completed the survey but could not attend the workshop.

<u>Progress towards resilience of habitats and species:</u>

In order to determine the level of progress made towards improving the resilience of habitats, species and ecosystems, six questions were posed to the panel, in which they were invited to select measure of progress and a level of confidence in their response. The responses from the survey were discussed during the workshop and the panel invited to re-score their responses. The results from the workshop and the associated points raised during the discussions are provided for each question below.

Habitat condition: This measure is related to outcome **1A** in the Biodiversity 2020 strategy that states "*Better wildlife habitats with 90% of priority habitats in favourable or recovering condition and at least 50% of SSSIs in favourable condition, while maintaining at least 95% in favourable or recovering condition*". The panel were invited to respond to the following question:

Q1. What category of progress has been made towards improving the condition of priority habitats?
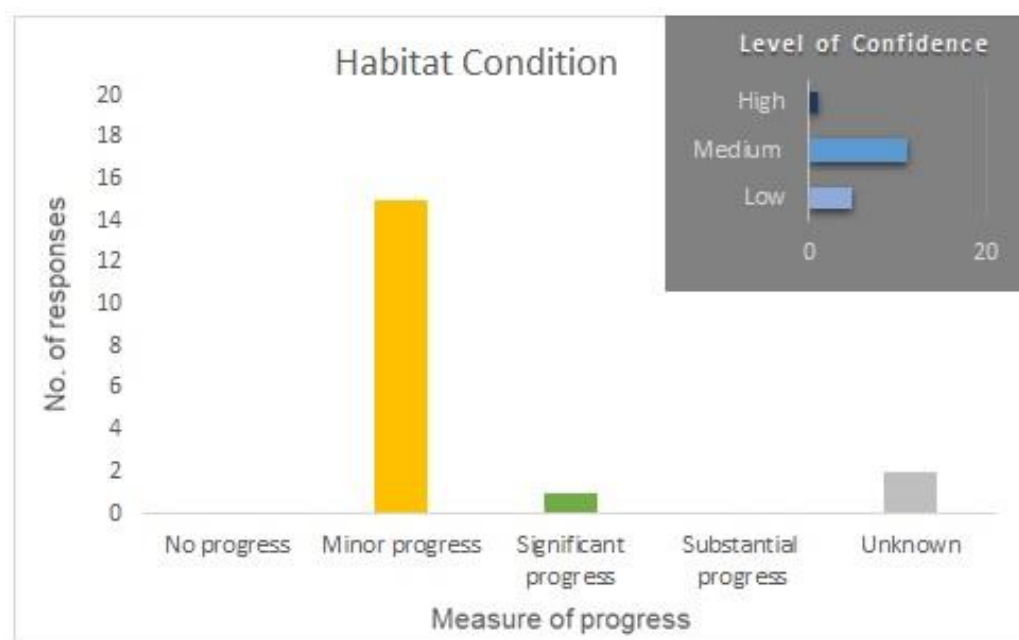

Figure 1: The results of the expert panel workshop re-scoring for Q1 with confidence levels as insert

The panel agreed that, whilst good progress has been achieved in some areas, deteriorations in habitat condition have yet to be reversed more widely. There was consensus that minor progress has been made in marine and coastal habitats and in certain peatland areas. There has been more progress where resources have been imputed, for example through LIFE [8] and Interreg [9] funding. Agri-Environment schemes (AES), notably HLS (the only AES designed to improve habitat condition), have also contributed to progress, but evidence is lacking as to whether the changes will be sustainable in the long-term. There was consensus however that significant progress has been made towards reducing pressures that impact habitat condition.

Areas where less progress has been observed include freshwater habitats, where only 16% of surface water bodies assessed in England were of high or good status in 2016, compared

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with 26% in 2011 [10]. In terms of woodland targets, the Forestry Commission reported in June 2016 on woodland and tree planting across the UK. This report showed the lowest level of tree planting in the UK for more than five years, and some organisations have raised concerns that the Government is not on track to achieve its commitment to plant 11 million trees by 2020 [11, 12].

The panel discussed the uncertainty that exists in the terminology used. For example, 'recovering condition' is not explicit as to the changes on a site or explain why some areas show more progress than others. There may be spatial/geographical differences in the level of progress achieved, which may also lead to differences of opinion. There is a possibility that the timescale for improvement (i.e. by 2020) is not be long enough for interventions to result in measurable progress. However, the panel felt that time lags are a reality and collecting evidence is still imperative.

Habitat extent and Habitat connectivity: The panel decided to have a joint discussion on the two questions pertaining to the extent and connectivity of habitats, which relate to outcomes **1B** – "*More, bigger and less fragmented areas for wildlife, with no net loss of priority habitat and an increase in the overall extent of priority habitats by at least 200,000 ha*"; and **1C** – "*By 2020, at least 17% of land and inland water, especially areas of particular importance for biodiversity and ecosystem services, conserved through effective, integrated and joined up approaches to safeguard biodiversity and ecosystem services including through management of our existing systems of protected areas and the establishment of nature improvement areas*". The specific questions and responses and provided below:

Q2. What category of progress has been made towards increasing the extent of priority habitats?
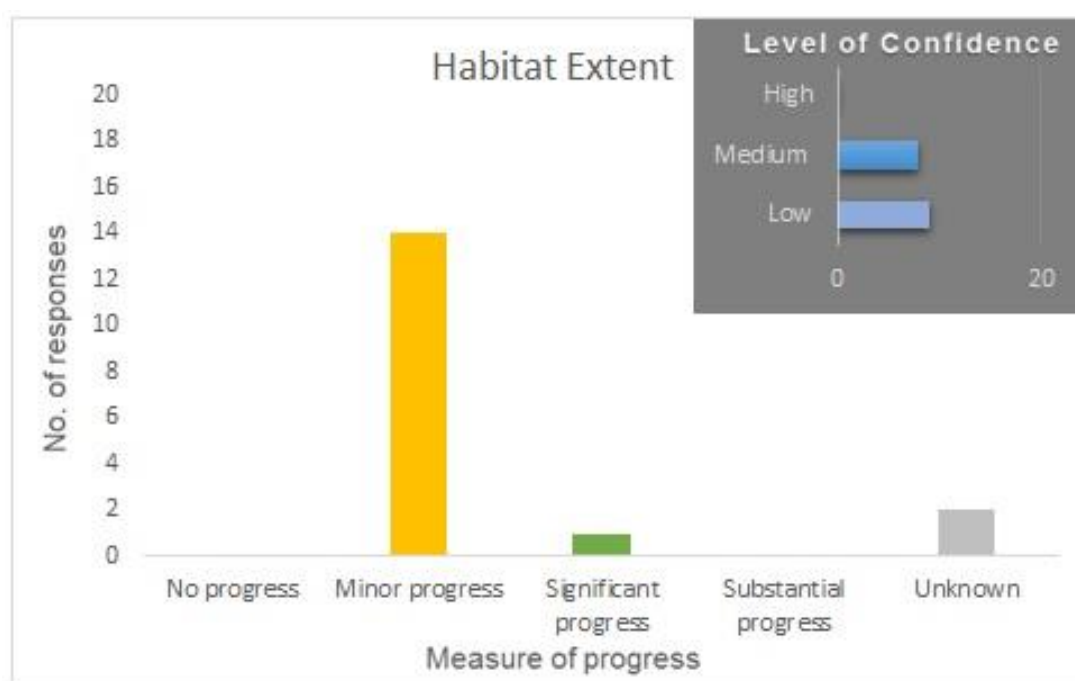

Figure 2: The results of the expert panel workshop re-scoring for Q2 with confidence levels as insert

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A [2017 report](#) [13] submitted to the Committee on Climate Change indicated that, as of 31 March 2016, a total of 114,798 ha of new priority habitat had been created through a number of mechanisms as a contribution to Biodiversity 2020 Outcome 1B. This represents 57% of the 200,000 ha target by 2020 and is slightly ahead of target - if a linear increase to 2020 is assumed. The report indicated that Environmental Stewardship was responsible for 55% of the habitat created or restored, the majority being arable field margins. Whilst this was seen to be useful and positive, the question was raised as to the permanence of these features and their contributions towards wider conservation objectives. Much of the remainder created is woodland and some wetland/open water. The panel reflected that the goal to increase habitat extent required cooperation from multiple land owners and this was seen as a significant factor limiting progress towards this target.

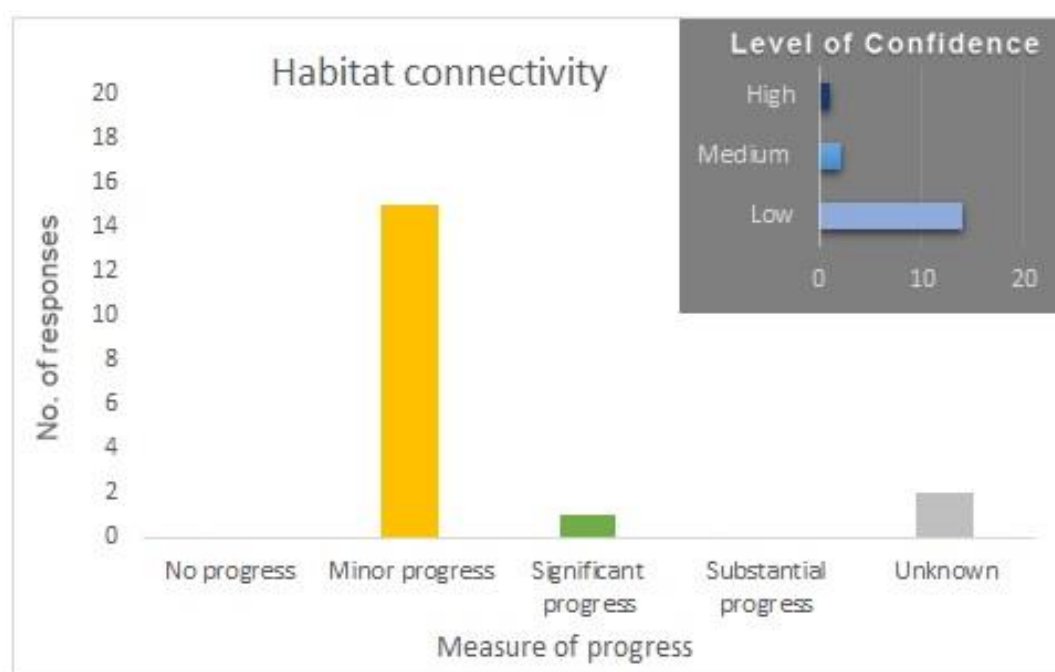Q3. What category of progress has been made towards increasing towards increasing habitat connectivity?

Figure 3: The results of the expert panel workshop re-scoring for Q3 with confidence levels as insert

The panel agreed that, if habitat extent has increased, it must have improved habitat connectivity to some extent: For example, removing obstructions to fish passage (or using fish passes to reduce the obstruction) has greatly increased habitat availability for salmon and eels (ref). There has also been some increase in functional connectivity of reedbeds, not as a result of increasing physical connectivity, but by virtue of the size of the sites created, providing more effective spring-boards and landing pads for dispersing individuals [14]. However, the panel indicated that definition of 'connectivity' needs greater clarity and defined metrics are required for its measurement. [The UK biodiversity indicators 2018 report](#) [15] defines connectivity as "*a measure of the size and distribution of patches of habitat and the relative ease with which typical species can move through the landscape between the patches.*" However, limited data are available on patch size and distribution (except for woodland), limiting the extent to which functional connectivity can be reliably measured.

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Restoring degraded ecosystems: This measure is related to outcome **1D** –"*Restoring at least 15% of degraded ecosystems as a contribution to climate change mitigation and adaptation*". The panel were asked to score the category of progress made based on the following question:

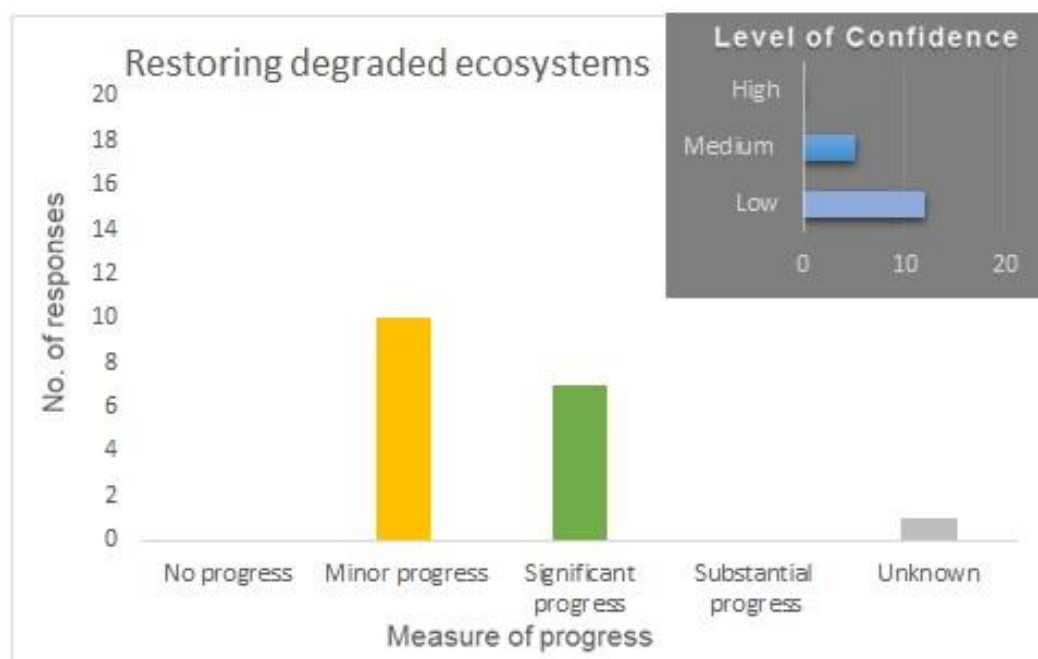Q4. What category of progress has been made towards restoring degraded ecosystems?

Figure 4: The results of the expert panel workshop re-scoring for Q4 with confidence levels as insert

There was general consensus that good progress has been achieved within the Site of Special Scientific Interest (SSSI) network. Good progress was also deemed to have made in river basins through River Basin management plans [16]. Woodland PAWS [17], while not strictly fitting the definition of degraded ecosystems, were provided as a good example of where restoration has taken place. Areas of real progress also include reed beds, heathlands and wetlands, lowland bogs, upland peatlands, and coastal habitats [14]. Restoration has also been achieved in some priority habitats, such as limestone pavements. The IUCN peatland program was seen as a significant contributor to progress in peatland ecosystems, particularly upland blanket bog and lowland raised bog, where over £10 million of government grants have been awarded for restoration work [18]. It was suggested that the 'good ecological status' condition of the Water Framework Directive (WFD) [19], which has been useful in restoring degraded water systems/water quality, could be extended to restoration of other terrestrial habitats and ecosystems.

The panel highlighted that there were a lot of options available for outcome 1D that could have been included in schemes such as Countryside Stewardship [20], but that some of these may have been picked up through other means (e.g. WFD and Shoreline Management Plans (SMPs) [21] for coastline realignment).

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The panel felt that limited progress had been achieved in areas outside designated sites and there has been a significant loss of early successional habitat. It was also felt that is difficult to define a 'degraded ecosystem' and the ambiguity concerning the term 'restoration' was also raised. For example, if a habitat is created in an area of a historic ecosystem, should this be defined as restoration or creation of habitat? The issue of how to measure restoration was also raised; whilst creation can be measured, no metrics are as yet available to determine whether the created system is delivering the desired (restored) processes or outcomes.

Specific points were raised about some sites being included as priority habitat before they start functioning as such and also some habitats (such as woodland) losing-out when restoration practices are focussed on other land use types (e.g. grassland restoration). An additional point was raised about working at the ecosystem level, as a focus on habitats may not provide information on ecosystem function. The panel agreed that more importance needs to be placed on ecosystem processes and function, as these are the most important factors in terms of climate change adaptation. Some processes may happen quickly, while others can take longer (e.g. re-wetting of peatland blocks of oxygen and time taken for water channels to build up). As such, in many cases, restoration is unlikely to be achieved within a 10 year timescale, although significant progress may be evident.

Status of priority species / species conservation: These measures pertain to outcome **3,** which states, "*By 2020, we will see an overall improvement in the status of our wildlife and will have prevented further human-induced extinctions of known threatened species*", and includes questions on improving the range and habitat of priority species, as well as translocation of species known to be vulnerable to climate change.

Q5. What category of progress has been made towards improving habitat and range of species vulnerable to climate change?
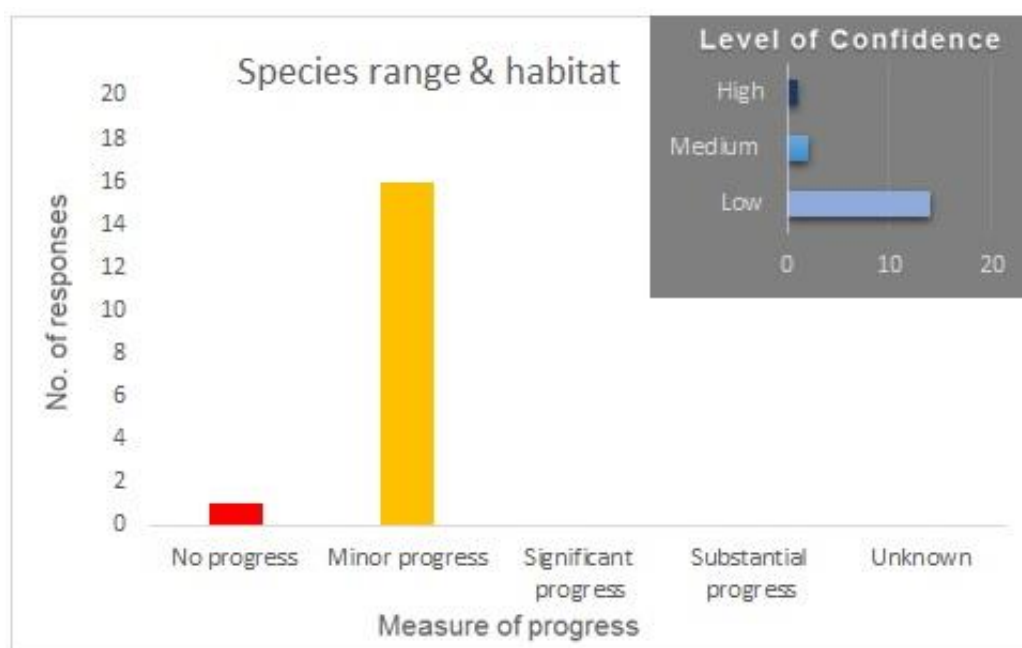

Figure 5: The results of the expert panel workshop re-scoring for Q5 with confidence levels as insert

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In terms of improving habitat and range of species vulnerable to climate change, progress has been made in reducing vulnerability by improving habitat condition, with evidence for protected areas facilitating species range expansions [22, 23]. While there is significant evidence of species moving northwards in response to climate change [24, 25], some members of the panel expressed the opinion there may be more conservation focus on species that are still vulnerable within the UK, whilst species that have moved north beyond UK geographical borders are less likely to be a priority; however, there is still focus on species on the southern edges of their ranges. There is evidence that the range of some species may have improved, but this may be a short-term gain masking longer term vulnerability to changing environmental conditions. Evidence is available on range expansion, whilst less information is available on contractions.

Q6. What category of progress has been made towards translocations of species vulnerable to climate change?

Figure 6: The results of the expert panel workshop re-scoring for Q6 with confidence levels as insert

There remains high uncertainty about the effectiveness of adaptation to help species and habitats cope with climate change. The panel also raised questions on whether the aim was to try and preserve vulnerable species, or whether to try and maintain habitat that will facilitate movement of species (that is inevitable) under climate change. It was agreed that maintaining habitat in good condition was important to ensure the latter.

In terms of translocations, the panel indicated that the focus needs to be primarily on keystone species that ensure ecosystem functioning and not all species. A study by Willis et al. in 2009 [26] provided evidence of assisted colonisation of two UK butterfly species in response to changing climate, but there is as yet a lack of evidence exploring the impacts of

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species translocations. There exist opportunities for translocations at a local scale (i.e. finding microclimates within habitats- moving uphill, moving to shady spots, river shading etc.) [27] . However, focus needs to be on species that are currently vulnerable rather than potential future colonisers, and species-related actions need to consider decision making frameworks that account for timescales and factors beyond climate change that may impact populations [28, 29].

Programmes contributing towards achieving specific outputs:

In the online survey, the expert panel was asked to choose up to five schemes or programmes that had contributed to progress towards the six measurable outputs. The tables in this section highlight the top five schemes or programmes as indicated by the survey results (along with the count and % of respondents who chose that scheme). Any other programmes indicated are provided in the text below the tables.

Table 1: The top five schemes as ranked by experts that have contributed to progress toward improving habitat condition

Rank	Scheme	Count[†]
1	Environmental Stewardship – Higher Level Scheme	13
2	EU Life Natura 2000 sites	9
3	NE National Nature Reserve Management	8
4	Countryside Stewardship	6
5	NE Species Recovery Programmes	5

Other schemes highlighted in the survey as contributors towards progress by more than one expert include: Environmental Stewardship – entry level schemes, Nature improvement areas, FC Woodland restoration activity on public estates, FC open habitats policy, UK sustainable forestry standard, Shoreline management planning, Catchment sensitive farming, and Species protection legislation.

[†] Count indicates the number of experts who indicated a specific scheme amongst their choices for that question

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Table 2: The top five schemes as ranked by experts that have contributed to progress toward increasing habitat extent

Rank	Scheme	Count‡
1	Environmental Stewardship – Higher Level Scheme	11
2	Countryside Stewardship	7
2	Nature Improvement Areas	7
4	EU Life Natura 2000 Sites	5
5	Heritage Lottery - Back from the Brink & NE National Nature Reserve Management	4

Other schemes highlighted in the survey as contributors towards progress by more than one expert include: Woodland carbon fund, FC Woodland restoration activity on public estates, FC open habitats policy, UK sustainable forestry standard, Peatland fund, Peatland code, Catchment sensitive farming, and Site protection legislation.

Table 3: The top five schemes as ranked by experts that have contributed to progress toward increasing habitat connectivity

Rank	Scheme	Count
1	Environmental Stewardship – Higher Level Scheme	12
2	Nature Improvement Areas	11
3	Countryside Stewardship	9
4	EU Life Natura 2000 Sites	6
5	FC Woodland Restoration Activity on the public estate	5

Other schemes highlighted in the survey as contributors towards progress by more than one expert include: Shoreline management planning, River basin management planning,

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‡ Count indicates the number of experts who indicated a specific scheme amongst their choices for that question

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Catchment sensitive farming, Peatland fund, Heritage lottery – Back from the brink, UK sustainable forestry standard, and Site protection legislation.

Table 4: The top five schemes as ranked by experts that have contributed to progress toward restoring degraded ecosystems

Rank	Scheme	Count[§]
1	Environmental Stewardship – Higher Level Scheme	11
2	Countryside Stewardship	7
3	Nature Improvement Areas	7
4	Peatland Fund	6
5	Catchment Sensitive Farming; Peatland Code; NE National Nature Reserve Management ; FC Woodland restoration activity on the public estate; River basin management planning & Shoreline Management planning	4

Other schemes highlighted in the survey as contributors towards progress by more than one expert include: EU LIFE Natura sites, Heritage lottery – Back from the brink, Environmental Stewardship – entry level schemes, Site protection and Species protection legislation.

Table 5: The top five schemes as ranked by experts that have contributed to progress toward improving habitat and range of vulnerable species

Rank	Scheme	Count
1	Environmental Stewardship – Higher Level Scheme	7
2	Nature Improvement Areas	6
3	NE National Nature Reserve Management & Countryside Stewardship	5
5	Peatland Fund; EU Life Natura 2000 Sites; NE Species Recovery Programmes; Site protection & Species Protection	4

[§] Count indicates the number of experts who indicated a specific scheme amongst their choices for that question

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Other schemes highlighted in the survey as contributors towards progress by more than one expert include: JNCC species surveillance programmes, Shoreline management planning, Catchment sensitive farming, Peatland code, Woodland carbon fund, FC Woodland restoration activity on public estates and UK sustainable forestry standard.

Table 6: The top five schemes as ranked by experts that have contributed to progress toward translocations of species vulnerable to climate change

Rank	Scheme	Count*
1	NE Species Recovery Programmes	7
2	Nature Improvement Areas	3
2	NE National Nature Reserve Management	3
2	JNCC Species Surveillance Programmes	3

Other schemes highlighted in the survey as contributors towards progress by more than one expert include: Countryside stewardship, EU LIFE Natura 2000 sites, Heritage lottery – Back from the brink, UK sustainable forestry standard, and GB non-invasive species strategy.

Factors contributing towards progress:

Questions were posed in the survey about the factors that had contributed to achieving progress for the six outputs related to ecosystems, habitats and species. The responses from the survey were then used to enable the discussions for two breakout groups during the workshop – one focusing on habitats and ecosystems and the other on species. Since there were several overlapping elements in the discussions between the two groups, this section summarises the discussions and focuses on factors that have contributed to progress that can be broadly divided into the following categories:

Policy/ legislation/ designations: The panel agreed that strong international and EU environmental and climate objectives and policies have underpinned progress towards Bio2020 habitat targets. In particular, panel members highlighted international drivers such as Sustainable Development Goals (Goal 13 'climate action') [30], UNFCCC – CC reporting obligations [31], CBD Aichi targets [3] direct translation into England's Biodiversity 2020 strategy; EU level policy and directives such as EU Climate Policy/funding (25% funding to CC action), EU Birds and Habitats Directive [32], EU Water Framework Directive [19] and the associated landscape scale responses; and National policy including the 2008 Climate change act [33], the periodic climate change risk assessments [5], the National Adaptation Programme -NAP's reporting power requirement [34], and the NEWP [2].

There has been some good progress towards the priority actions aligned behind the GB Invasive Non-Native Species (INNS) strategy [35]; however, it is still relatively early in the

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strategy roll-out and the pressure from INNS is increasing. The implementation of the EU regulation on Invasive Alien species [36] should help reinforce the GB strategy. Designation of Natura 2000 [37] sites, which encompass several SSSIs, has enabled larger-scale approaches to conservation. The UK government Nature Improvement Areas [38] have also contributed to this effort albeit, but with limited funding.

Protected Areas and the FSC targets represent a key driver for delivering habitat condition, but are less effective in delivering (and can constrain) ecosystem restoration and rarely contribute to increasing habitat extent. The ambition in the National Planning Policy Framework [39] for Local Authorities to consider Ecological Networks was also deemed very useful. While it is as yet too early to see what these initiatives might deliver, further strengthening of the need to map out and deliver targets towards enhanced ecological networks would be very helpful, possibly through the Natural Capital Plans in the 25 year environment plan [40].

Funding: Funding, primarily through AES (ES), has been instrumental in the progress made towards the Bio2020 habitat targets. Further information is available in a study conducted by Atkins has explored the benefits for CCA delivered by AES [41].

While discussing the cost of various funding streams compared to their effectiveness, the panel concluded that 'targeted funding' was more efficient in providing answers and generating relevant evidence. Examples include LWEC / LIFE / INTEREGG / Specific CC funding within NE. Additional funding through NGOs and business was also deemed to be highly effective, but the scale on which these operate would be much smaller.

Partnerships/Collaboration: Delivery of the targets often requires large-scale responses and, therefore, frequently depends upon partnerships amongst multiple stakeholders to underpin progress. Examples of such partnerships that have aided climate change adaptation include Coastal realignment within the SMPs [21], Nature Improvement Areas – NIA [38], NGO led land purchases and co-ordination of activities amongst multiple actors for projects such as the Wildlife Trusts' "Living Landscapes" [42] and RSPB's "Futurescapes" [43] projects, "Moors for the Future" partnerships [44], "Keeping Rivers Cool" project [45] partnerships, as well as knowledge exchange through projects such as the WrEN [46].

The success of such partnerships may also depend upon the availability and provision of high-quality advice key at local and national scales. This requires continuity (long-term) and expertise (right skills) – both of which are dependent on organisational capacity. Examples of appropriate guidance/knowledge exchange tools include the NE/RSPB climate change adaptation manual [43] and the UK Forestry Standard [47]. There are also effective voluntary standards, such as the UK Woodland Carbon Code [48], and these can be used to provide expert advice to land owners.

Scientific Evidence: Clear and well-presented scientific evidence of climate change, the impacts, threats and vulnerability posed by changing climate, and evidence of the benefits that the natural environment can deliver through nature-based solutions can help progress towards targets. Climate change projections are available (e.g. the UKCP09 Climate Change projections [49]) and evidence of impacts on species and adaptations have been collated, including through the NE/RSPB climate change adaptation manual [43], as well as research on range shifts, climate change refugia and species translocations (e.g. marbled white butterflies, fish species). In terms of habitats, there is good evidence, for example, that work to restore peatland habitats will increase their resilience to climate change [50].

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Evidence on the benefits of different approaches to adaptation has been provided by the Making Space for Nature review [51], effectiveness of habitat creation and ecological networks by the WrEN [46], and on effective monitoring and evaluation through NE's Long-Term Monitoring Networks – LTMN [52] as well as citizen science schemes such as Breeding Bird Survey [53] and UK Butterfly Monitoring Scheme [54].

LWEC climate change report cards [55] have made science accessible to industry and provide synthesised information with confidence levels. However, these have better information on impact rather than on adaptation. There also exist vulnerability assessments such as those developed by Natural England [56], amongst several others [28, 29, 57], which can help identify species at risk. Integrating such vulnerability assessments into landscape-level planning may help adaptation measures. Long-term monitoring provides data for assessing impacts (e.g. colonisation of protected sites) [22]. The UK has access to more long-term data (collected by both professionals and amateurs) than many other countries. Collating and utilising standardised long-term data information can add to and enhance the evidence base.

Practical Demonstration: While the CC adaptation manual has been published and progress has been made in gathering evidence, this does not necessarily translate into practice. Understanding which adaptation and mitigation actions work is often improved through practical demonstrations. Examples of where this has been achieved include: climate change embedding into NE NNR management, NGO reserve management [14], Cluster farms approach (although limited to CSF gain to water and wetland habitats), Large forestry estates (integration of sustainability, productivity and biodiversity), implementation of river basin planning and shoreline management plans, and roll-out of maps, guidance and demonstration events for Keeping Rivers Cool projects.

Advocacy/Societal change: A step change in the perception of the role of the natural environment in supporting adaptation and reducing the vulnerability of other sectors through nature-based solutions/ecosystem-based adaptation has occurred, with an increasing realisation of shared/cross-sectoral benefits. Climate driven extreme events, in the UK primarily around flooding, has also led to greater public awareness of the need for adaptation and mitigation strategies. The progress against the 2010 Public Service Agreement to get SSSIs into at "Least Unfavourable Recovering status" [58], and the commitment of the 'major landowners group' to achieve this [59] have all contributed towards progress.

Barriers to progress:

Similar breakout groups to the above were used during the workshop to discuss the barriers to progress. The discussions followed on from the responses provided during the survey and are summarised into the following categories:

Policy/Governance/Legislation: The panel felt that climate change adaptation is often seen as a separate issue and, therefore, not properly and fully integrated into policies, programmes and projects within and across sectors. This lack of effective integration has, conceivably, been to the detriment of the delivery of certain goals related to the 2020 Strategy and inhibited progress towards targets. The uncertainties whilst EU exit is being

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finalised and loss of resources to adaptation progress were also considered a significant barrier to progress. The current designation framework was seen as failing to support improvement in condition/extent of habitat in the wider countryside. Consideration of change and adjustment of conservation objectives are rarely undertaken (but see [60]), and there also remains conflict across economic, development and environmental policy sectors. The panel felt that the economic consequences of not addressing climate change adaptation for the environment need to be highlighted and lessons learned from other sectors that do so successfully.

Funding: AES incentives/funding (notably HLS) currently represent the primary driver for habitat and ecosystem restoration. These incentive schemes and delivery mechanisms are too short-term in relation to the time-frames required to deliver the desired outcomes. There is also a lack of continuity in the design, operation, focus and prioritisation of AES – such as the options from Environmental Stewardship being carried through to Countryside Stewardship - leading to high levels of turnover and poor renewals. AES are not good at delivering ecosystem restoration at the landscape scale, which often requires multiple landowner agreement (e.g. restoration of hydrological systems).

There is a lack of resource/targeting on the high-quality often complex interventions that are required. There is also a lack of direct focus of many incentives on climate change, with adaptation to changing climate often a subsidiary/supporting objective/target in many funding schemes. There is also competition for resources for work associated with mitigation. There needs to be integrated design and assessment of adaptation and mitigation policies and funding, which are often developed by distinct communities.

Evidence: There is a lack of conclusive evidence to determine whether we are focusing resources and interventions are focused in the right places. There is also continued uncertainty within the CP09 projections in relation to "key weather" events. Insufficient/inaccessible data on climate impacts and poorly-resourced monitoring of impacts hinder progress towards targets. Evidence also needs to be published in accessible locations (for e.g. British Wildlife, ECOS) and in formats that meet practitioner needs.

Partnerships/Collaboration: Many partnerships are relatively small and often underpinned by short-term funding and/or policy. Frequently, partnerships are made between the same organisations, with fewer new partnerships being formed.

Advocacy/Communications: Uncertainty and complexity remain a reason for low confidence and an excuse for inaction. There are problems associated with the lack of a Bio2020 website to highlight and promote targets and interventions, shifting baselines and clear definitions of success, and poor articulation of potential solutions that deliver environmental gain.

Options for future nature strategies:

The survey asked the panel to list any suggestions for improvements to climate change adaptation measures in a future nature strategy. The responses fell into four broad categories: 1. Implementing Lawton principles; 2. improving the evidence base; 3. setting clearer targets; and 4. increasing resources. Based on these broad responses, specific

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questions were posed to the panel at the workshop, and the responses are summarised below.

1. Which of the ecological principles highlighted by Lawton would be most important in delivering CC resilience and why: Bigger / more (extent); better (condition) or more joined up (connectivity)?

The majority opinion was that focus should to be on condition (i.e. achieving better quality habitat). The reasons included better quality habitat being a pre-requisite to delivering the benefits associated with the other aspects. Concern was raised that the definition of 'better' should not be related to 'outdated' condition criteria.

Some of the panel felt that extent and condition need to be jointly considered, as together they would provide more ecosystem services, greater redundancy and increased functional connectivity. It was felt that emphasis on physical connectivity was often misplaced, as there is limited evidence for range retraction and, moreover, species tend to arrive preferentially at high quality sites and are less likely to go extinct.

Some panel members also felt that immediate focus on increasing extent (bigger/ more) could help improve future condition (better). A point was raised on how areas of little spatial heterogeneity (e.g. Somerset levels) could benefit from focus on better condition, while areas of greater spatial heterogeneity (e.g. the Lake District) might benefit from increasing extent, particularly if edge-effects have detrimental impacts.

2. Are there key habitats/ species (indicators) where evidence gathering should be focussed? Focus on risk? Adaptation? Resilience?

The panel felt that focus needs to be on montane habitats, peatland sites, and wetland and coastal areas that are highly sensitive to climate change. Habitats that have the potential to deliver most in a changing climate and to increase natural capital, and habitats with potential for mitigation would also be good sources of evidence. Better evidence needs to better is needed to evaluate the effectiveness of adaptation management more robustly.

In terms of species, more evidence is required on keystone species important for ecosystem functioning. Species case studies that inform on climate change impacts and adaptations are also needed. Existing evidence needs to be utilised better and combined with predictions/projections and simulations to inform future strategies.

3. What makes for clearer targets for ecological resilience?

The panel felt that is was important to have intermediate targets, as well as final outcomes, which could be measured at regular intervals. SMART (Specific, measurable, attainable, realistic and timely) principles incorporated into targets may help make them clearer. There needs to be a better understanding of the concept of 'resilience' and clearer steps to achieving it. Also, understanding process and testing effectiveness of adaptation to quantify what is likely to be feasible given particular levels of investment and climate change is important. Clearer target areas, such as spaces managed as ecological restoration units, could also help. Targets that could be deemed 'disempowering' by stakeholder communities need to be avoided.

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4. Where should resources be concentrated – species / communities/ habitats/ ecosystems/ landscapes?

The majority consensus was that resources need to be concentrated at the ecosystem-level, particularly on ecosystem processes as this, in turn, will help habitats and species within those ecosystems. Areas where known climate vulnerabilities exist should be priorities for immediate resources, while some resources focussed at the species level could help protect existing biodiversity assets and help set clear measurable objectives. As change is inevitable under climate change, distributing resources across different levels such as species, habitats and ecosystems is needed to deal with the uncertainties.

Summary of key points:

- Clear progress has been achieved towards the targets in some areas and some habitats, particularly in relation to increasing extent.
- Uncertainty in projections and time lags for natural processes are, however, hindering realisation of targets.
- Current Bio2020 indicators are good, but addition of intermediate measurable targets is desirable. Better use can be made of the 'magenta book' for these purposes.
- An outcome-based framework that accounts for time-lags and climate-driven processes is needed.
- SMART targets may enable better monitoring and evaluation.
- More clarity is required as to the role of the '25 year environmental plan' in relation to climate change adaptation and mitigation and for ecosystem processes.
- Ensuring appropriate climate change adaptation actions are enshrined in the new NAP is also fundamental.
- Role of international and EU environmental legislation/agreements in delivering desired change needs to be reviewed.
- Integrated design of adaptation and mitigation strategies needs to be incorporated into both policy and funding streams.
- Climate change adaptation needs to be incorporated from the start into the design of any new scheme.
- Agri-Environmental schemes need explicit/prioritised objectives related to climate change adaptation and mitigation.
- Schemes such as Countryside Stewardship and AES need to incentivise climate change adaptation and mitigation targets with clear delineation of areas set aside for specific targets.
- Increased incentives and models of payment for practitioners that consider both remuneration for costs incurred as well as payment by results may encourage more up-take of AES or Countryside Stewardship schemes.
- Mechanisms for making best-use of existing data are required.
- Evidence needed on what specific species need targeted interventions in specific places.

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Appendix 1 – Logic Model underpinning the CCA evaluation framework

Inputs	Processes / Activities	Outputs	Intermediate outcomes	Impacts
The resources (financial, time, people, skills, etc) being invested **INFORMATION ON THE TEAMS AND AGENCIES INVOLVED, FINANCIAL RESOURCES AND STAKEHOLDER INPUT RELEVANT TO DELIVERY OF THE STRATEGY:**	The processes being adopted & activities undertaken to deliver the objectives List of the priority actions related to the theme. Underneath list all the actual activities/ initiatives that have been undertaken that contribute to delivery of that priority action. If the activity has a discrete budget associated include the amount.	The initial outputs achieved through the realisation of planned activities The tangible outputs delivered by the processes and activities in column 2. This does not need to be a measure of progress- which will be assessed later.	The short and medium term results of activities & outputs The specific Aichi/ CBD /bio2020 outcomes/targets as listed in Annex C of B2020.	The long term results achieved through the delivery of the outcomes The broad aims of the work delivered by the strategy relevant to your theme:
People resources Defra teams NE and other agency teams Research Councils Stakeholders and NGOs **Stakeholder input:** Details of other stakeholders contributing to delivery of the strategy **Policy input:** National ecosystem assessment Convention on Biological strategy Making space for nature report EU biodiversity strategy **Financial resources** Any details on the financial resources associated with delivery of the strategy eg Defra/ NE staff time not	Establish more coherent and resilient ecological networks on land that safeguard ecosystem services for the benefit of wildlife and people. • Nature Improvement areas- (£7.5M) • Site protection schemes – SSSI • National nature reserve management • Peatland funding and Peatland Fund. (£10.4 M) Take targeted action for the recovery of priority species, whose conservation is not delivered through wider habitat-based and ecosystem measure • Species recovery programmes (£700k- £900k p.a) • Heritage Lottery - Back from the brink (£4.6M) Improve delivery of environmental outcomes from agricultural land management practices, whilst increasing food production. Reform Common Agricultural Policy to achieve greater environmental benefits. • Agri-environment schemes (ELS & Higher Tier) • Countryside Stewardship	**Landscape level measures** • Protected areas conserved • High quality habitats conserved • Improved connectivity • Increased patch size • Range & ecological variability of habitats conserved • Range & ecological variability of species conserved • Existing ecological networks maintained • Buffer zones created around high quality habitats • Habitats restored • Habitats created • Space made for natural development of rivers and coasts **Reducing pressures** • Range and size of priority species populations improved • Spread of invasive species controlled • Improved air quality • Improved water quality • No regret actions implemented • Adaptation & mitigation measures integrated	*Aichi Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.* **Outcome 1A:** Better wildlife habitats with 90% of priority habitats in favourable or recovering condition and at least 50% of SSSIs in favourable condition, while maintaining at least 95% in favourable or recovering condition; **Outcome 1B:** More, bigger and less fragmented areas for wildlife, with no net loss of priority habitat and an increase in the overall extent of priority habitats by at least 200,000 ha; *Aichi Target 11: By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for*	Biodiversity resilience to climate change improved

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| captured within the specific activities in column 2. | Bring a greater proportion of our existing woodlands into sustainable management and expand the area of woodland in England.
• FC woodland restoration activity
• UK sustainable forestry standard
• Open habitats policy
• Woodland Carbon fund?

Take a strategic approach to planning for nature within and across local areas…; encourage greener design; enhance natural networks.
• UN Man & Biosphere reserves
• EU Life Natura 2000 sites

Implement invasive Non-Native Species framework strategy for Great Britain.
• GB NNS strategy (Invasive species)

Align measures to protect the water environment with action for biodiversity, including through the river basin planning approach under the EU Water Framework Directive.
• River basin management plans
• Catchment sensitive farming

Continue to promote approaches to flood and erosion management which conserve the natural environment and improve biodiversity.
• Shoreline management plans
• Coastal re-alignment

Monitoring and surveillance
• JNCC led species surveillance programmes

Reduce air pollution impacts on biodiversity.
• Air quality standards regulation 2010

Research and Development

Establish a new voluntary approach to biodiversity offsets and test our approach in pilot areas

Reform water abstraction regime?
Improving data sharing and communication of evidence | • Policy & practice across relevant sectors integrated
Strengthening evidence
• Role of biodiversity in ecosystems services better understood
• Knowledge gaps researched with stakeholder participation
• New approaches piloted and monitored
• Cross-sector knowledge transfer ensured
People engaged
• Raised awareness of benefits of natural environment to society
• Partnerships built & strengthened | *biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.*

Outcome 1C: By 2020, at least 17% of land and inland water, especially areas of particular importance for biodiversity and ecosystem services, conserved through effective, integrated and joined up approaches to safeguard biodiversity and ecosystem services including through management of our existing systems of protected areas and the establishment of nature improvement areas;

Aichi Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Outcome 1D: Restoring at least 15% of degraded ecosystems as a contribution to climate change mitigation and adaptation.

Outcome 3: By 2020, we will see an overall improvement in the status of our wildlife and will have prevented further human-induced | |

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| | Work with biodiversity partnerships to engage significantly more people in biodiversity issues, increase awareness of the value of biodiversity and increase the number of people taking positive action.

Promote taking better account of the values of biodiversity in public and private sector decision-making, including by providing tools to help consider a wider range of ecosystem services.

Develop new and innovative financing mechanisms to direct more funding towards the achievement of biodiversity outcomes. | | extinctions of known threatened species. | |