Appendices

Appendix 1: RCP 4.5 and RCP8.5

The tables below show the headline figures for these scenarios in the PDNP through the remainder of this century. Source: UKCP18

	Hotter, drier summers in the Peak District			
	Increase in average summer temperature, degrees Celcius (compared to 1981-2000 average)	Increase in maximum summer temperature, degrees Celcius (compared to 1981-2000 average)	Increase in minimum summer temperature, degrees Celcius (compared to 1981-2000 average)	% Change in average summer rainfall (compared to 1981-2000 average)
Time slice	Central estimate range (RCP 4.5 - 8.5)	Central estimate range (RCP 4.5 - 8.5)	Central estimate range (RCP 4.5 - 8.5)	Central estimate range (RCP 4.5 - 8.5)
2020-39	1 to 1.2	1.2 to 1.3	0.9 to 1.1	-7 to -8
2040-59	1.7 to 2.2	1.9 to 2.6	1.6 to 2	-18 to -21
2060-79	2.3 to 3.4	2.6 to 3.8	2.1 to 3.1	-21 to -28
2080-99	3.2 to 5.1	3.7 to 5.8	3 to 4.8	-25 to -36

	Warmer, wetter winters in the Peak District			
	Increase in average winter temperature, degrees Celcius (compared to 1981-2000 average)	Increase in maximum winter temperature, degrees Celcius (compared to 1981-2000 average)	Increase in minimum winter temperature, degrees Celcius (compared to 1981-2000 average)	% Change in average winter rainfall (compared to 1981-2000 average)
Time slice	Central estimate range (RCP 4.5 - 8.5)	Central estimate range (RCP 4.5 - 8.5)	Central estimate range (RCP 4.5 - 8.5)	Central estimate range (RCP 4.5 - 8.5)
2020-39	0.8 to 0.9	0.9 to 1	0.8 to 0.9	4 to 5
2040-59	1.2 to 1.6	1.3 to 1.6	1.6 to 2	6 to 8
2060-79	1.6 to 2.4	1.6 to 2.4	1.6 to 2.4	11 to 15
2080-99	2.1 to 3.5	2.1 to 3.4	21. to 3.4	13 to 20

Appendix 2: The IPCC's vulnerability definition

1. The current condition of the feature

   It is important to try to capture the status of the feature if known whether it is in good or bad condition and the trajectory of improvement or decline to date. In addition to considering the impact of climate change to date, this information factors in the impact of non-climate related stressors and to what extent they have influenced the feature. A feature in poor current condition is more likely to be vulnerable to future climate change.

2. The sensitivity of the feature to climate change
   The sensitivity of a feature is a measure of the degree to which it will respond to climate changes. For example, a biological feature such as an animal may be directly sensitive to a change in temperature – unable to survive beyond a certain threshold. In addition, features can be indirectly sensitive to climate change through a wide range of other mechanisms. For example, a living or a non-living feature may respond to human behaviour change that occurs because of climate change. Features with higher sensitivity are more likely to be vulnerable to future climate change.

3. The exposure of the feature to climate change

   Exposure reflects the degree, and way, in which a feature is exposed to climate change. Exposure is independent from sensitivity. For example, a feature found all year round in the PDNP might be very sensitive to a rise in sea level if it was located near to the sea, but in practice, it will not be exposed directly to this change. The location in which features occur within the PDNP could also affect the exposure experienced. For example, a plant found at high altitude on north-facing slopes may be exposed to a smaller temperature rise than one occurring on low altitude south-facing slopes. Again, exposure encompasses not only direct changes, but also indirect changes occurring because of climate change. A feature that is exposed to a high level of change is more likely to be vulnerable to future climate change.

   The categories of exposure used in this assessment are temperature change, precipitation change, extreme events, sea level change and atmospheric pollution. While the last category of atmospheric pollution is not necessarily a result of climate change, increasing CO_2 and nitrogen, for example are closely tied in with predicted changes.

4. The adaptive capacity of the feature

   Finally, the capacity that a feature has to adapt to changes also affects its overall vulnerability. The higher the adaptive capacity rating, the less vulnerable to change a feature is likely to be. In this assessment, this capacity relates both to the inherent properties of a feature, and the potential for human adaptation to take place. Examples of inherent adaptive capacity could be the plasticity of animal behaviour – is an animal capable of adapting its behaviour to meet new conditions? Human adaptation potential includes factors such as the availability of economic resources, the existence of institutions and the management practices they could put into place.

The exposure and sensitivity when viewed together create a picture of the potential impacts of climate change upon a given feature. These potential impacts are theoretical scenarios that do not take into account the adaptive capacity, and so should be viewed as distinct from overall

vulnerability ratings. When considered together, these four components can be used to produce an overall estimation of vulnerability.

Appendix 3: Category and scoring system explanations.

To measure overall vulnerability we took a semi-quantitative approach, scoring for each feature the current condition, sensitivity-exposure (i.e. potential impact), adaptive capacity and certainty. These sub-categories were scored individually using the scoring levels below, ensuring that all features assessed are treated in a consistent and comparable way.

This approach is based on the Climate Change Vulnerability Assessment Tool for Coastal Habitats system developed by Plunket et al in 2015.

Summary Explanations of Categories

EXPOSURE GROUPS	**Current**	The current condition group is intended to capture the relative condition of a feature prior to the influence of additional stress from a changing climate at some future date.
	Atmospheric pollution	This group captures possible changes in exposure to any atmospheric pollutants including but not limited to: particulates, CO^2, ozone, nitrogen compounds, VOCs, sulphur compounds etc.
	Temperature	This group captures any possible changes relates to the predicted increase in summer and winter temperatures.
	Precipitation	This group captures any possible changes related to the predicted increase in winter precipitation and decrease in summer precipitation, and changing patterns more generally.
	Extreme Events	This group captures any possible changes related to the predicted increase in extreme event frequency and intensity e.g. summer droughts, winter storms.
	Sea Level	This group captures any possible changes related to the predicted increase in sea level.
SENSITIVITY GROUPS	**Direct**	Direct climate effects are the physical or physiological responses of features to changes of CO_2, temperature, precipitation, sea level and extreme climate events in the absence of pre-existing stressors. For the 'current condition' group this can include changes which have already been observed as well as general condition.
	Invasive / nuisance species	Is the feature being assessed sensitive to changes in the abundance and/or distribution of invasive or nuisance species?
	Nutrients / environmental contamination	Is the feature being assessed sensitive to changes in nutrient levels (e.g. flushing or nutrient concentration

		increases) and/or environmental contamination by pollutants?
	Sedimentation / erosion	Is the feature being assessed sensitive to changes in sediment quantity, transport and location and processes such as soil decay rate? Is the feature sensitive to increased or decreased erosion?
	Anthropogenic	Is the feature being assessed sensitive to changes in human behaviour which result from climate change?
	Other indirect	Is the feature being assessed sensitive to changes in any other processes which are an indirect result of climate change. E.g. an increase in wildfires?
ADAPTIVE CAPACITY GROUPS	**Fragmentation/barriers**	E.g. habitat fragmentation, isolation of individuals, barriers to movement and dispersal, reduced genetic variation. Usually applies to living features.
	Recovery/regeneration	Innate ability to recover from change – plasticity of behaviour, dispersal ability and evolutionary potential. This category can also apply to non-living features and their ability to recover from or resist changes.
	Diversity groups/infrastructure	Greater variety of infrastructure/functional groups can enhance adaptive capacity, since it provides more options. The characteristics and location of infrastructure or groups also affect adaptive capacity.
	Economic/technological	Greater economic resources increase adaptive capacity, while a lack of financial resources limits adaptation options. A lack of technology limits the range of potential adaptation options.
	Management, info, skills	Implementation of various management strategies could affect the ability of a feature to adapt to climate change, in both positive and negative ways. A 'lack of informed, skilled and trained personnel reduces adaptive capacity,' while 'greater access to information increases likelihood of timely and appropriate adaptation'.
	Institutional and human	The ability of an organization/agency to respond. Well-developed institutions help to reduce impacts, and therefore increase adaptive capacity. Policies and regulations can constrain or enhance adaptive capacity. Human response refers to the mechanisms by which private landowners would take advantage of current policy/regulations to respond.

Climate Change Vulnerability Assessment Scoring Levels

CURRENT CONDITION	**0**	Feature is not impacted by non-climate stressor
	2	Feature is currently impacted by non-climate stressor but to a limited degree (i.e. over a modest portion of its extent or no significant influence on feature structure / function)
	5	Feature is currently moderately impacted by non-climate stressor (i.e. evidence of stressor impact over a majority portion of its extent or clear degradation of feature structure / function)
	10	Feature is severely impacted by non-climate stressor
SENSITIVITY-EXPOSURE	**-2**	Feature may benefit; non-climate stressor impact is alleviated by a change in climate condition
	0	No anticipated change in feature structure, function or extent
	2	Feature will likely be impaired to a limited degree (i.e. over a modest portion of its extent or clear degradation of feature structure/function)
	5	Feature persistence will be limited (i.e. degradation of feature structure/function sufficient to modify survival/reproductive potential, reduced feature extent)
	10	Feature will be lost
ADAPTIVE CAPACITY	**0**	Severe impediments to feature persistence or for ecological features dispersal (e.g. barriers, fragmentation) exist *or* innate characteristics of the feature are not sufficient to compensate for CC stressors *or* policy or management actions to offset CC stressors are not possible or are not likely to be implemented
	2	Modest impediments to feature persistence or for ecological features dispersal (e.g. barriers, fragmentation) exist *or* innate characteristics of the feature are sufficient to partially overcome CC stressors *or* appropriate policy or management actions may be taken to partially offset CC stressors
	5	No impediment to feature persistence or for ecological features dispersal (e.g. barriers, fragmentation) exists *or* innate characteristics of the feature are sufficient to overcome CC stressors *or* appropriate policy or management actions may be taken to fully offset CC stressors
CERTAINTY	**0**	No direct or anecdotal evidence is available to support the score, topic needs further investigation
	1	Low: Inconclusive evidence (limited sources, extrapolations, inconsistent findings, poor documentation and/or methods not tested, etc.), disagreement or lack of opinions among experts, score based on anecdotal observations
	2	Medium: Suggestive evidence (a few sources, limited consistency, models incomplete, methods emerging, etc.) competing schools of thought, score based mostly on expert opinion

	3	High: Moderate evidence (several sources, some consistency, methods vary and/or documentation limited, etc.), medium consensus, general information can be applied to local features
	4	Very High: Strong evidence (established theory, multiple sources, consistent results, well documented and acceptable methods, etc.), high consensus, information for local features available

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Appendix 5: Feature recommendations organised by Special Quality

This appendix includes all of the feature recommendations organised by Special Quality. Each Special Quality has its own contents page listing all the features found within it. These are listed alphabetically within the themes: Built environment; Communities; Cultural landscapes; Geology, geomorphology and soils; Habitats; Watercourses, ponds and reservoirs; and Wildlife.

Contents

SQ1 - Beautiful views created by contrasting landscapes and dramatic geology

CULTURAL LANDSCAPES

Boundaries and patterns of enclosure

Key adaptation recommendations for boundaries and patterns of enclosure:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor boundary changes at a landscape scale, for example quantify the loss of walls and hedges. Ensure that management mitigates piecemeal changes to enclosure patterns that may seem insignificant on their own, but that can have cumulative and large impact upon landscape character over time.
- Encourage the use of agricultural buffer strips to protect hedges from human behaviour changes (e.g. intensification of agriculture) which may occur because of climate change.
- Ensure management practices allow for the maintenance of walls and historic field patterns. Explore opportunities in future environmental land management schemes.
- Undertake research to understand the significance of different boundary types and patterns. Appreciate that boundaries may have different components, including natural features. Also appreciate the time-depth in enclosure, for example prehistoric boundary patterns may underly the dominant, later enclosure patterns, and be visible only as earthworks. This will help inform future adaptation planning.
- Help land managers within the PDNP to enter into environmental stewardship type agreements or secure funding for capital works by providing assistance with advice and logistics - see Moors for the Future Partnership's Private Land Project as a possible model.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Focus efforts on restoring and reconnecting fragmented hedges and walls in priority areas. It is important to avoid further loss and restore boundaries. This will improve their function as wildlife corridors and improve their overall resilience to change. Ensure targeted conservation efforts are informed by historic character and relative significance.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Diversify the landscape and increase the proportion of tree cover to reduce the impact of flooding from rivers and overland flow.
- Restore and connect fragmented hedges with native species sourced from further south in the UK. Increase species diversity of hedges to buffer against single species losses.

Estate lands and designed landscapes

Key adaptation recommendations for estate lands and designed landscapes:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Carry out research and survey into designed landscapes, especially those at a smaller scale that might not previously have been recognised as significant. This will help inform future adaptation planning.
- Increase the resilience of the surrounding landscape to help create a buffer for estate lands and designed landscapes. Form estate level plans for improved climate resilience, such as improving moorland condition to reduce flood risk.
- Nurture partnerships with big estates and landowners.
- When planning any future adaptations ensure existing archaeological complexity is taken into consideration.
- Consider the cumulative impact on estate lands by visitor pressure and events.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify field boundaries that are at risk and work to restore or improve them.
- Manage and replace veteran trees (scattered trees in historic parklands and in field boundaries are a key characteristic of the Derwent Valley).
- Harvest and store rain water at drought sensitive sites (already in place at some properties).

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase woodland establishment and enhancement of habitats where appropriate, while maintaining the significance of key views and designed elements. This will strengthen existing landscape character, whilst in the future lower lying landscapes adjacent to the river could provide useful floodwater storage services.
- Increase the diversity of planting in parklands to make them more resilient.

Lowland pastoral landscapes

Key adaptation recommendations for lowland pastoral landscapes:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor the risk and spread of disease in both plants and animals.
- Reduce visitor pressure by encouraging use of the area at times outside of the high season.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Explore opportunities for storing high levels of winter rainfall for use during the summer; these should be sensitive to the landscape.
- Encourage better connectivity in these landscapes. (CHECK IT FITS, NOT A SQ2 FEATURE)
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- See the recommendations under 'boundaries, and walls/hedgerows'.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Enable more species rich hay cropping through meadow creation and restoration on a wide scale.
- Enable the diversification of plant species in permanent pasture; this will increase adaptive capacity to future change.
- Establish more trees and hedges in the landscape where appropriate to assist with surface water management, soil condition, and livestock summer shading. Help farmers to select the most appropriate and resilient species.
- Work to change perceptions about the value of 'abandoned' pastureland. More scrub and tree development on improved pasture would create a more sheltered and resilient overall landscape with microclimates that are more diverse, and improve future soil condition.

GEOLOGY, GEOMORPHOLOGY AND SOILS

High open moorland and edges

Key adaptation recommendations for high open moorland and edges:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Native trees and scrub should be encouraged around the plateau edges to increase resilience of upland habitats and protect blanket peat, but archaeological sensitivities need to be taken into account in the management of tree cover. More trees across the currently open upland landscape may assist with climate adaptation and mitigation, along with ecosystem service provision.
- Pilot a 'rewilding' or 'wilding' trial scheme with no fixed conservation aims and monitor the impact on this feature.
- Reduce fragmentation via restoring and improving corridors between moorland habitats to strengthen the ecological network.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Encourage flexible land management to facilitate the development of a more diverse habitat composition and structure.
- Enable habitats to respond to climate change - do not view the landscape as fixed but allow room for change.

Limestone dales

Key adaptation recommendations for limestone dales:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Protect geological features and maintain their visibility by removing or managing vegetation.
- Improve water use efficiency and rainwater harvesting, especially in remote locations which are dependent on springs and susceptible to drought.
- Provide advice, information and support to farmers on increasing organic matter in soils and other measures to increase carbon storage and improve drought tolerance of farmland.
- Maintain historic environment records to enable historic environment advice to be integrated with other land management advice.
- Encourage sympathetic management, restoration and creation of riparian habitats, particularly grassland, woodland and wetland, to stabilise river banks and reduce erosion and diffuse pollution.
- Install settlement ponds and silt traps to intercept run-off and sediment before it reaches watercourses.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Undertake stream revetment schemes to slow flow, reducing rock face undercutting, stream bank erosion and minimise downstream flooding.
- More research is required to better understand the hydrology and role of artificial drainage on low flow river systems.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Monitor the spread of tree diseases, in particular ash dieback, and ensure appropriate mitigation measures. However, deadwood is a very valuable habitat and should be left standing unless it is a public safety hazard.
- Manage visitor access to popular locations to minimise traffic, disturbance, footpath erosion and other negative environmental impacts.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- In areas where it does not have a negative impact on the landscape character, establish trees to provide shade for wildlife, livestock and people and to regulate the temperature of watercourses.

River valleys

Key adaptation recommendations for river valleys:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Accept that landscape character and habitat types cannot remain static in PDNP river valleys, and that management changes will need to happen to enable resilience to climate change.
- Improve the management of riverside grasslands, and create more wet meadows. They can be used to temporarily store floodwater and reduce the effects of large rainfall events.
- Remove manmade impoundments where appropriate, especially those in small watercourses to help increase habitat quality, decrease downstream flooding and landscape aesthetics.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Regular monitoring of key sensitive heritage features (such a listed bridges).
- More research is required to better understand the hydrology and role of artificial drainage on low flow river systems.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Management of river valleys should allow space for natural processes to occur. Allow rivers to meander, and exclude livestock to allow space for riverside woodland and scrub to develop in appropriate locations. This should help to control nutrient input and may reduce water temperature increases.
- Manage the whole catchment including the upper slopes to reduce run-off and increase lag-times. Create more clough woodland to reduce flood risk and erosion of valley sides.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

- The potential for new reservoirs should be raised as an issue in the review of the Local Plan for the PDNP where this supports climate change adaptation, nature recovery and effective visitor management.

Slopes and valleys with woodland

Key adaptation recommendations for slopes and valleys with woodland:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Reduce grazing pressure where possible, for example reducing deer and sheep numbers to allow for more flowering and seed setting of ground flora, increasing the potential for populations to survive drought years.
- Encourage and protect regeneration where appropriate. Natural regeneration including a scrub phase will benefit biodiversity and ecosystem services. Establish significantly more tree cover in the upland valleys of the Dark and South West Peak, where appropriate.
- Consider blocking artificial drainage channels within woodland in areas predicted to become drier.
- Undertake contingency planning for outbreaks of new tree diseases.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk. Include surveys for heritage significance to enable protection of the historic environment to be built into woodland management practices.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Continue improving woodland condition through the careful management of plantations and more native plantings. Replace non-native conifer plantations with native broadleaved woodland.
- Encourage a greater mix of native trees through active management.
- Replace unused small plantation woodland with native broadleaf woodland.
- Increase the age structure and structural heterogeneity of woodland, for example by reducing coupe size i.e. the area harvested in one operation and encouraging continuous cover forestry rather than large scale clear felling.
- Take positive steps to increase the proportion and diversity of decaying wood throughout sites to ensure both, resilience of dependant species, and the replenishment of woodland soils' organic content.
- Allow natural woodland processes and/or woodland management to promote a diversity of age structure within woodlands. This may include retaining some undisturbed old growth stands, encouraging natural regeneration, allowing pockets of wind throw trees and deadwood, and creating a 'graduated' woodland edge as opposed to a sharp boundary with neighbouring land uses.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Link woodland patches together - to provide wildlife corridors.
- Increase woodland cover and the shade/shelter for other species as temperatures rise.
- When determining the optimal management of sites, consider the requirements of key species such as woodland birds to ensure minimum patch size is retained.

HABITATS

Blanket bog

Key adaptation recommendations for blanket bog:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Increase effort to restore hydrology and raise the water table.
- Increase effort to revegetate any remaining bare peat areas.
- Increase *Sphagnum* re-introduction, including as diverse a mix of appropriate species as possible.
- Research is needed to look into promoting the growth of bog edge woodland or scrub where appropriate, through tree establishment and natural regeneration, to reduce wind effects, provide shade and stabilise peat blanket edges.
- Cease the use of burning for heather management on blanket bog sites – but consider alternative techniques such as cutting if there is a high fuel load (e.g. bog is or has become dry heath on peat) as an interim measure until the bog is wet enough.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity.
- More research into peat pipes is needed.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify key areas to focus work on; especially those, which are likely to remain hydrologically suitable. Further study required.
- Develop visitor management plans to influence public behaviour in areas of high wildfire risk.

Heather moorland and mixed heath

Key adaptation recommendations for heather moorland and mixed heath:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Continue program of moorland rewetting.
- Identify sites within the uplands that can act as climate change refugia due to complex micro-topography, robust hydrology, and high species diversity, and manage these accordingly.
- Minimise erosion through management of access, appropriate grazing levels, and reduction of burning.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity.
- Bracken may need to be controlled through grazing and other management.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase the diversity of heather dominated areas - adapt to mixed heath.
- Maintain and enhance structural diversity within heathland vegetation, including wet heath patches, diverse age classes of dwarf shrubs, and scattered trees and scrub.
- Continue clough woodland creation/restoration to increase scrub and woodland cover within upland mosaic which will help improve habitat heterogeneity and provide refugia for sensitive plants and invertebrates.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Develop visitor management plans to reduce fire risk on areas of high wildfire risk.
- Cease the use of burning for heather management on vulnerable sites – but consider alternative techniques such as cutting.
- Strengthen footpaths and manage increased visitor access to minimise disturbance in key areas.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Adapt management intensity to changing characteristics of heather moorland – alter grazing pressure, types/breeds of livestock, and burning/cutting cycles to suit future climatic conditions.
- Consider that designated natural and cultural site features of interest may change.

Limestone grassland

Key adaptation recommendations for limestone grassland:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- There is scope for expansion of limestone grasslands onto some parts of the plateaux where limestone is close to the surface or exists as outcrops. Where expansion is limited by underlying geology, grading into continuous neutral grassland, heathland or scrub should be encouraged.
- Adapt management to avoid fertilizer inputs.
- Reduce non-climate sources of harm.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Grassland in greatest need of considering conservation options further is perhaps MG2 Jacob's-ladder grasslands.
- Restore priority areas where scrub has encroached, but maintain some scrub in the landscape.
- Work to identify the best refugia sites and ensure these are managed appropriately.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase size and connectivity of existing patches, including connectivity with other habitat types in a mosaic.
- Increase connectivity by restoring species rich grassland. This should also increase resistance to drought and increase carbon capture.
- Increase wood pasture on the plateau. Increase trees in fields and along margins to help with summer drought and forage for stock.
- Have an integrated management plan for each of the Dales in the PDNP for the different habitats within them.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Adapt grazing regimes to allow for more flexibility of timing and stocking density.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

- Loss of some currently valued northern species but gain of more southern species may need to be accepted. Liaise with other protected landscapes (such as those further north) to share knowledge and management techniques.

Meadows

Key adaptation recommendations for meadows:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Many more restored meadows are needed in the PDNP if effective nature recovery networks are to be developed. These would increase carbon storage and capture, increase resilience to climate change and drought especially, provide transitional sites between existing habitats, plus better habitat for invertebrates and other animals. Species rich meadows are much better for a healthy stock animal as well – though less productive than heavily fertilised pastures, they provide a more diverse, healthy diet, better ways of managing health – many old ones were called hospital fields, and are essential for a low input low output system.
- Opportunities to extend and enhance the management of existing unimproved grasslands should be sought, for example in "Riverside Meadows" where grasslands could enhance their role for flood water storage, helping to reduce flood impacts further downstream.
- Encourage the creation and enhancement of wildflower meadow in non- agricultural settings e.g. recreational areas, churchyards, verges and residential gardens. A scheme to help with conversion or management may be required.
- Non-climate sources of harm (for example conversion to silage or permanent pasture; application of high fertilizer levels, early cutting) should be minimised to ensure maximum possible resilience.
- Identify and preserve refugia for species at their southern range limit - look at aspect and topography and ensure sites are sensitively managed.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Species rich meadow should be one of the key habitats to be considered when other habitat types are no longer viable due to climate change. Rush-pastures which have become too dry could be converted.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Greater flexibility in site management will be needed - e.g. Timing of hay cut and grazing.

Wet grassland and rush pasture

Key adaptation recommendations for wet grassland and rush pasture:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Ensure appropriate levels of grazing are maintained.
- Increase connectedness, size and condition of rush pasture through habitat creation and restoration of adjoining semi-improved grasslands.
- Retain wetness by blocking artificial drainage.
- Re-introduce Sphagnum to sites where purple-moor grass has invaded blanket bog.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- On sites of importance for breeding waders where it is not viable to maintain water levels across the whole site, consider minor channelling of the water resource to retain some wet flushes.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase the variation in vegetation structure across site to maximize biodiversity. Rush management should be planned with the needs of different species in mind.
- If it is not possible to maintain wetness of rush pasture accept that it will change and facilitate conversion to other priority habitats such as species rich meadow.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Flexibility in grazing is key – changing timings and providing alternative land for years where areas are flooded could be important to limit land abandonment on economically marginal land.
- Altering livestock may have benefits for the pasture habitats. Native grazer analogues such as appropriate cattle breeds that are less selective than sheep are more likely to facilitate a diverse sward.

Woodlands

Key adaptation recommendations for woodlands:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Reduce grazing pressures where possible. Recognise the importance of an integrated deer management plan for the park.
- Encourage more continuous cover forestry – to maintain higher levels of carbon storage and decrease soil losses.
- Improve protection, management and recruitment of veteran trees.
- Consider water management in woodlands predicted to experience drought.
- Further study is required to explore appropriate opportunities for woodlands to be used in local wood fuel schemes.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase diversity of tree species; especially in single species woodlands. Accept change in composition of woodlands, such as accepting species not previously native to the PDNP.
- Continue improving woodland condition – more native woodland creation, encourage regeneration to increase structural diversity, increase patch size (>2ha) to meet habitat requirements for birds and other species, increase decaying wood for replenishing soils.
- Natural woodland regeneration by excluding stock should be seen as preferable to tree establishment, with the latter principally to increase diversity - importance of scrub is underestimated.
- Convert small or unused conifer plantations to broadleaf/mixed woodlands.
- Increase establishment of field and boundary trees, particularly across the White Peak, to increase habitat diversity and connectivity, replace trees lost to Ash Dieback, enhance the landscape and provide shade and better grazing for livestock in hotter summer conditions.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Increase connectivity between woodlands to provide wildlife corridors.
- Increase woodland cover – to keep waterways cool, provide shelter for other species as temperatures increase, increase carbon storage, and improve water quality.

WATERCOURSES, PONDS AND RESERVOIRS

Riverside meadows associated with meandering river channels

Key adaptation recommendations for riverside meadows associated with meandering river channels:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Look to improve the quality and species diversity of these grasslands through sensitive and flexible grazing and by limiting inputs of fertilizers and pesticides.
- Put protections in place to ensure hydroelectric generators are not installed in inappropriate locations where they would be detrimental to the function of the river system and the aesthetics of the landscape.
- Ensure tree strips along riversides are protected as much as possible in order to minimise the effects of erosion due to higher flows.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Investigate the flood storage capacity of riverside meadows. Identify areas that could benefit from becoming temporary flood storage areas during times of high flow.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Allow natural river processes such as the formation of oxbow lakes to occur as much as possible and avoid channel modifications.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

- The potential for new reservoirs should be raised as an issue in the review of the Local Plan for the PDNP where this supports climate change adaptation, nature recovery and effective visitor management.

Vanishing rivers

Key adaptation recommendations for vanishing rivers:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- More research is required to better understand the hydrology of low flow river systems and their interaction with surface and underground workings associated with mining.
- Consider restoration measures to reduce the impact of human activity, such as features in mining (soughs) diverting water to different catchments. Especially where impacts are known.

- Restoration of natural processes across the catchment will improve watercourse health and therefore resilience to change.
- Consider removal of impoundments and weirs to restore natural river flow and improve species dispersal.
- Minimise agricultural inputs, especially fertilisers and pesticides. Give consideration to good management of waste to improve catchment quality, including effective slurry store management.
- Restoration of healthy soils in river catchments will increase infiltration of water and reduce runoff, thereby reducing sedimentation. Tree establishment is a known method to improve infiltration and reduce pollutant spread from runoff.
- Restoration of semi-natural vegetation on critical runoff pathways will slow the flow and reduce erosion.
- Use of low nutrient livestock feeds will reduce contamination of the watercourse.
- Manage invasive species, including botanical species and crayfish.
- Consider the impact on key views when planning adaptations.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Creation of riparian shade through tree and scrub establishment will be beneficial to freshwater habitats, and may offset some of the effects of temperature rises.

SQ2 - Internationally important and locally distinctive wildlife and habitats

CULTURAL LANDSCAPES

Lead mining features

Key adaptation recommendations for lead mining features:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Ensure surveyed features are included in Historic Environment Records and Selected Heritage Inventory for Natural England (SHINE) datasets.
- Nurture collaborative networks to build capacity for monitoring (e.g. PDMHS, caving groups, other local interest groups).
- More research is required to better understand the hydrology of low flow river systems and their interaction with surface and underground workings.
- Liaise with other protected landscapes to share knowledge and management techniques.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Use existing records (e.g. Lead Legacy High Priority lead mining sites and landscapes) to target resources.
- Undertake regular monitoring, including at landscape scale, of selected sites to identify those sites likely to be most vulnerable in terms of archaeology and ecology.
- Put forward key sites for scheduling.

HABITATS

Acid grassland

Key adaptation recommendations for acid grassland:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Identify areas of refugia such as north facing slopes to target conservation efforts.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Ensure key sites are in appropriate management to maximize resilience.
- Where long established grasslands can be identified, these should be a conservation priority.
- Monitor extent of bracken on important sites and ensure appropriate management to prevent spread.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Restoring the less valuable areas of upland acid grassland to heath; or scrub/woodland along edges of watercourses e.g. in upland cloughs. More trees and scrub could also reduce landslips.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

- Accept that some of this habitat may be lost or the structure of the habitat changed. It could become more diverse and create a mosaic of habitats, benefitting biodiversity.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Adapt grazing regimes to allow for more flexibility of timing and stocking density, to ensure they are responsive to new conditions.

Blanket bog

Key adaptation recommendations for blanket bog:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Increase effort to restore hydrology and raise the water table.
- Increase effort to revegetate any remaining bare peat areas.
- Increase *Sphagnum* re-introduction, including as diverse a mix of appropriate species as possible.
- Research is needed to look into promoting the growth of bog edge woodland or scrub where appropriate, through tree establishment and natural regeneration, to reduce wind effects, provide shade and stabilise peat blanket edges.
- Cease the use of burning for heather management on blanket bog sites – but consider alternative techniques such as cutting if there is a high fuel load (e.g. bog is or has become dry heath on peat) as an interim measure until the bog is wet enough.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity.
- More research into peat pipes is needed.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify key areas to focus work on; especially those, which are likely to remain hydrologically suitable. Further study required.
- Develop visitor management plans to influence public behaviour in areas of high wildfire risk.

Heather moorland and mixed heath

Key adaptation recommendations for heather moorland and mixed heath:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Continue program of moorland rewetting.
- Identify sites within the uplands that can act as climate change refugia due to complex micro-topography, robust hydrology, and high species diversity, and manage these accordingly.
- Minimise erosion through management of access, appropriate grazing levels, and reduction of burning.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity.
- Bracken may need to be controlled through grazing and other management.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

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- Increase the diversity of heather dominated areas - adapt to mixed heath.
- Maintain and enhance structural diversity within heathland vegetation, including wet heath patches, diverse age classes of dwarf shrubs, and scattered trees and scrub.
- Continue clough woodland creation/restoration to increase scrub and woodland cover within upland mosaic which will help improve habitat heterogeneity and provide refugia for sensitive plants and invertebrates.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Develop visitor management plans to reduce fire risk on areas of high wildfire risk.
- Cease the use of burning for heather management on vulnerable sites – but consider alternative techniques such as cutting.
- Strengthen footpaths and manage increased visitor access to minimise disturbance in key areas.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Adapt management intensity to changing characteristics of heather moorland – alter grazing pressure, types/breeds of livestock, and burning/cutting cycles to suit future climatic conditions.
- Consider that designated natural and cultural site features of interest may change.

Limestone grassland

Key adaptation recommendations for limestone grassland:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- There is scope for expansion of limestone grasslands onto some parts of the plateaux where limestone is close to the surface or exists as outcrops. Where expansion is limited by underlying geology, grading into continuous neutral grassland, heathland or scrub should be encouraged.
- Adapt management to avoid fertilizer inputs.
- Reduce non-climate sources of harm.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Grassland in greatest need of considering conservation options further is perhaps MG2 Jacob's-ladder grasslands.
- Restore priority areas where scrub has encroached, but maintain some scrub in the landscape.
- Work to identify the best refugia sites and ensure these are managed appropriately.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase size and connectivity of existing patches, including connectivity with other habitat types in a mosaic.
- Increase connectivity by restoring species rich grassland. This should also increase resistance to drought and increase carbon capture.
- Increase wood pasture on the plateau. Increase trees in fields and along margins to help with summer drought and forage for stock.
- Have an integrated management plan for each of the Dales in the PDNP for the different habitats within them.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Adapt grazing regimes to allow for more flexibility of timing and stocking density.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

Meadows

Key adaptation recommendations for meadows:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Many more restored meadows are needed in the PDNP if effective nature recovery networks are to be developed. These would increase carbon storage and capture, increase resilience to climate change and drought especially, provide transitional sites between existing habitats, plus better habitat for invertebrates and other animals. Species rich meadows are much better for a healthy stock animal as well – though less productive than heavily fertilised pastures, they provide a more diverse, healthy diet, better ways of managing health – many old ones were called hospital fields, and are essential for a low input low output system.
- Opportunities to extend and enhance the management of existing unimproved grasslands should be sought, for example in "Riverside Meadows" where grasslands could enhance their role for flood water storage, helping to reduce flood impacts further downstream.
- Encourage the creation and enhancement of wildflower meadow in non- agricultural settings e.g. recreational areas, churchyards, verges and residential gardens. A scheme to help with conversion or management may be required.
- Non-climate sources of harm (for example conversion to silage or permanent pasture; application of high fertilizer levels, early cutting) should be minimised to ensure maximum possible resilience.
- Identify and preserve refugia for species at their southern range limit - look at aspect and topography and ensure sites are sensitively managed.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Species rich meadow should be one of the key habitats to be considered when other habitat types are no longer viable due to climate change. Rush-pastures which have become too dry could be converted.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Greater flexibility in site management will be needed - e.g. Timing of hay cut and grazing.

Wet grassland and rush pasture

Key adaptation recommendations for wet grassland and rush pasture:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Ensure appropriate levels of grazing are maintained.
- Increase connectedness, size and condition of rush pasture through habitat creation and restoration of adjoining semi-improved grasslands.
- Retain wetness by blocking artificial drainage.
- Re-introduce Sphagnum to sites where purple-moor grass has invaded blanket bog.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- On sites of importance for breeding waders where it is not viable to maintain water levels across the whole site, consider minor channelling of the water resource to retain some wet flushes.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase the variation in vegetation structure across site to maximize biodiversity. Rush management should be planned with the needs of different species in mind.
- If it is not possible to maintain wetness of rush pasture accept that it will change and facilitate conversion to other priority habitats such as species rich meadow.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Flexibility in grazing is key – changing timings and providing alternative land for years where areas are flooded could be important to limit land abandonment on economically marginal land.
- Altering livestock may have benefits for the pasture habitats. Native grazer analogues such as appropriate cattle breeds that are less selective than sheep are more likely to facilitate a diverse sward.

Wet heath

Key adaptation recommendations for wet heath:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Updated habitat mapping taking into account peat depth is needed to determine exact size and extent of current wet heath resource.
- Moorland rewetting work should be continued as a top priority.
- Identify sites that can act as climate change refugia due to their favourable topography, aspect, hydrology, or good species diversity, and manage these sensitively.
- Minimise erosion through management of access, appropriate grazing levels, and reduction of burning.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change

- Strengthen footpaths and manage increased visitor access to minimise disturbance in key areas.
- Careful livestock management at high risk sites.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Structural diversity within heathland vegetation should be increased - including wet heath patches, diverse age classes of dwarf shrubs, and scattered trees and scrub to provide refugia for sensitive plants and invertebrates.

Accept that habitats need to be dynamic and not fixed. Consider that designated site boundaries may need to change as habitats move/change to create larger functional sites, and features of interest may change. Liaise with other protected landscapes to share knowledge and management techniques, and contribute to the national picture.**Adapt land use for future conditions**

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Create future conservation objectives in the knowledge that wet heath and other habitat types will move along a continuum, and so the ideal location to target actions for particular species will change with the climate.

Wet woodland

Key adaptation recommendations for wet woodland:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Map existing wet woodland habitat to assess value and content.
- Continue with sensitive woodland management.
- Continue with work on managing invasive species such as Himalayan balsam.
- Continue management of woodland along watercourses to reduce flood risk.
- Evaluate whether the introduction of beavers would be a feasible and appropriate method of delivering ecosystem service benefits such as flood mitigation, water quality and wet woodland creation.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify sites for wet woodland restoration, expansion and/or creation. Care should be taken to ensure this is not at the expense of other wetland habitats that are of value. Some sites could just be scattered trees, others more dense woodland and wet scrub – smaller willows of various locally native types.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Establish trees and encourage natural regeneration to increase species diversity, structural diversity, and patch size.
- Evaluate whether there are benefits in establishing scrub to stabilise eroding edges of blanket peat, and implement if appropriate.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Increase woodland cover – to keep waterways cool and to provide shelter for other species as temperatures increase.
- Increase connectivity between woodlands to provide wildlife corridors.

Woodlands

Key adaptation recommendations for woodlands:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Reduce grazing pressures where possible. Recognise the importance of an integrated deer management plan for the park.
- Encourage more continuous cover forestry – to maintain higher levels of carbon storage and decrease soil losses.
- Improve protection, management and recruitment of veteran trees.
- Consider water management in woodlands predicted to experience drought.
- Further study is required to explore appropriate opportunities for woodlands to be used in local wood fuel schemes.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase diversity of tree species; especially in single species woodlands. Accept change in composition of woodlands, such as accepting species not previously native to the PDNP.
- Continue improving woodland condition – more native woodland creation, encourage regeneration to increase structural diversity, increase patch size (>2ha) to meet habitat requirements for birds and other species, increase decaying wood for replenishing soils.
- Natural woodland regeneration by excluding stock should be seen as preferable to tree establishment, with the latter principally to increase diversity - importance of scrub is underestimated.
- Convert small or unused conifer plantations to broadleaf/mixed woodlands.
- Increase establishment of field and boundary trees, particularly across the White Peak, to increase habitat diversity and connectivity, replace trees lost to Ash Dieback, enhance the landscape and provide shade and better grazing for livestock in hotter summer conditions.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Increase connectivity between woodlands to provide wildlife corridors.
- Increase woodland cover – to keep waterways cool, provide shelter for other species as temperatures increase, increase carbon storage, and improve water quality.

WATERCOURSES, PONDS AND RESERVOIRS

Dew ponds and other ponds

Key adaptation recommendations for dew ponds and other ponds:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Maintain and enhance existing sites, where possible, consider re-lining failing ponds with materials that reflect their historic character.
- Reduce non-climatic sources of harm such as non-native species and nutrient sources.
- Minimise agricultural inputs, especially slurry, fertilisers and pesticides. Give consideration to good management of waste to improve catchment quality, including effective slurry store management.

- Manage biosecurity to limit spread of invasive and non-native species.
- Investigate external funding sources for a major pond project using citizen science.
- Create semi-natural vegetation such as woodland along run-off pathways to reduce evaporation and maintain water quality.
- Keep a strategy for dewpond restoration under review, due to their high vulnerability and extensive cost input required.
- Liaise with other protected landscapes to share knowledge and management techniques.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Restore key sites to link clusters and improve pond connectivity for species such as great crested newt.

Reservoirs

Key adaptation recommendations for reservoirs:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Continue reservoir management of water levels with strict usage policies in place for drought periods.
- Continue catchment management to improve vegetation cover to reduce erosion and nutrient run-off entering reservoirs.
- Continue monitoring and control of non-native species in reservoirs and in neighbouring habitats.
- Improve access and recreation infrastructure to minimise habitat damage and wildlife disturbance.
- Increase riparian tree cover at reservoirs lacking in riparian vegetation, shade can help regulate reservoir water temperatures.
- Minimise agricultural inputs, especially slurry, fertilisers and pesticides. Give consideration to good management of waste to improve catchment quality, including effective slurry store management.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Strengthen biosecurity measures by raising awareness: install signs at busy recreation sites, particularly where fishing and boating are common.
- Manage disturbance levels during bird breeding season, for example have access restrictions to vulnerable sandpiper territory.

Rivers and streams

Key adaptation recommendations for rivers and streams:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Restoration of natural processes across the catchment will improve watercourse health and therefore resilience to change.
- Consider removal of impoundments and weirs to restore natural river flow and improve species dispersal.
- Minimise agricultural inputs, especially fertilisers and pesticides. Give consideration to good management of waste to improve catchment quality, including effective slurry store management.
- Restoration of healthy soils in river catchments will increase infiltration of water and reduce runoff, thereby reducing sedimentation. Tree establishment is a known method to improve infiltration and reduce pollutant spread from runoff.
- Restoration of semi-natural vegetation on critical runoff pathways will slow the flow and reduce erosion.
- New hydroelectric power developments should not be allowed to prevent restoration of natural processes in river systems.
- Use of low nutrient livestock feeds will reduce contamination of the watercourse.
- Block artificial drainage where possible.
- Manage invasive species, including botanical species and signal crayfish.
- Evaluate whether the introduction of beavers would be a feasible and appropriate method of delivering ecosystem service benefits such as flood mitigation, water quality and wet woodland creation.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Creation of riparian shade through tree and scrub establishment will be beneficial to freshwater habitats, and may offset some of the effects of temperature rises.

WILDLIFE

Adder

Key adaptation recommendations for adders:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Continue improving habitat condition: ensuring there are suitable sites for basking, hibernation, and breeding. This will help to make existing populations more resilient.
- Continue gathering sightings and creating photo database of individuals.
- Increase habitat connectivity: to aid dispersal and breeding.
- Investigate translocation to new sites. Further research is required.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Limit disturbance at known sites (particularly at hibernaculum during winter).
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

Aquatic invertebrates

Key adaptation recommendations for aquatic invertebrates:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Contamination of watercourses must be taken seriously, and efforts made to reduce the entry of fertilisers, slurry, pesticides, pharmaceuticals, road runoff, and wastewater pollutants.
- Changes or modifications made to river channels (for example for renewable energy sources) must be made with aquatic invertebrates in mind.
- Floating dead wood and woody debris is invaluable invertebrate habitat. Allow natural processes to occur in river systems, and allow for a less 'tidy' looking environment.
- Conduct surveys of invertebrate communities across the PDNP. Dewponds may be of particular interest.
- Remove impoundments and allow natural meandering where feasible and retro-fit artificial berms or meanders to improve natural sediment transport.
- Buffer strips to trap sediment before it reaches a watercourse should be established wherever possible.
- Combatting the spread of invasive non-native species will be key to the recovery of many invertebrate populations, especially the white-clawed crayfish.
- Continue dewpond restoration work.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Establishment of more native trees around riverbanks will assist not only with flood management and water quality but also shade the river and cool the water, although too much shade may be detrimental to aquatic plant life. Increased tree and scrub cover in upland catchments would also be beneficial.
- A greater diversity of habitat surrounding rivers will be beneficial to the invertebrate populations. Variability in shading, as well as wetness of the surrounding habitat is desirable.

Bilberry bumblebee

Key adaptation recommendations for bilberry bumblebees:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Continue and build on bumblebee surveys within the PDNP to improve knowledge of local populations.
- Improve habitat management: encourage establishment of bilberry and legumes; limit grazing/mowing during nest-building season; limit pesticide/herbicide use particularly during hot summers.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Assess foraging habitat and identify areas that need improving such as those with a low diversity of food sources and areas where food is unavailable during nest-building season in spring.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

Curlew

Key adaptation recommendations for curlew:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Create or back experiments to test the effectiveness of current and potential management techniques.
- Improve curlew habitat and increase connectivity through management.
- Ensure silage cutting is delayed until after chicks have left the nest.
- Cease the ploughing of fields and reduce chemical inputs to improve soil invertebrate populations.
- Maintaining sward lengths above minimum can reduce predation risk and can mean less predator control is needed.
- Rush management should be planned with the needs of different species in mind, some suitable areas of long rushes should be left intact.
- Predator control could be a useful tool in high predator density areas, but may inadvertently increase predator populations and disrupt other species interactions. Research is needed to determine if a more natural system would be a better option for the future.
- Further study is needed to track how productivity and breeding success are changing with climate. Recording of clutch sizes at nest can help.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Wetland restoration should be a priority. This is both through upland rewetting and lowland drain blocking.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Reduction of soil compaction will reduce surface drying and increase habitat suitability for curlew.
- Reduce high grazing levels and avoid intensification of farming methods.

Dipper

Key adaptation recommendations for dippers:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Minimise agricultural inputs, especially slurry, fertilisers and pesticides. Give consideration to good management of waste to improve catchment quality, including effective slurry store management.
- Increased natural flood management measures will benefit dipper. This includes upland woody damming, broadleaf woodland establishment, and natural scrub regeneration.
- Hydroelectric power schemes have the potential to be very harmful to dipper and other riparian species. Natural processes within river systems are key to the adaptive capacity of the system. Developments should only be approved if they interfere minimally with the natural course of the river.
- Dipper should be considered when building structures to regulate flow. Construction should be limited during dipper breeding season.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Conifer plantations beside rivers are detrimental to dipper populations. Streamside conifers should be phased out and replaced with native broadleaf wherever possible.
- Improve variation in streams: riffles, rocks, and boulders can create variable flow and deeper sections. This creates better foraging habitat.

Dunlin

Key adaptation recommendations for dunlin:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Rewetting of moorland and blanket bog restoration is the most beneficial intervention for dunlin. Implementation of this management will benefit other waders and have associated benefits of carbon storage and water storage.
- Moorland gully and grip blocking for creation of bog pools creates good feeding habitat for dunlin.
- Upland conifer plantations remove dunlin habitat and should be phased out from areas where they are thought to be limiting populations.
- Partnership with coastal conservation organisations will be the best way to create an integrated management plan, as dunlin may winter in other areas.
- Reducing the number of sheep and therefore lambs may also reduce pressure from generalist predators. Predator control could be a useful tool in high predator density areas, but may inadvertently increase predator populations and disrupt other species interactions. The increase in Dunlin at RSPB Dove Stone has not included predator control, so good quality habitat can counterbalance the effects of predation. Research is needed to determine if a more natural system would be a better option for the future.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Ensure dunlin habitat has well marked and maintained footpaths to prevent encroachment of visitors onto breeding areas.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

Golden plover

Key adaptation recommendations for golden plover:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Blocking of drainage and rewetting of bogs and moors will increase the resilience of golden plover habitat to climate change.
- In-bye land can be good habitat for golden plover. Good management will allow golden plover and other waders to make use of these resources without sacrificing productivity.
- Predator control could be a useful tool in high predator density areas, but may inadvertently increase predator populations and disrupt other species interactions. Research is needed to determine if a more natural system would be a better option for the future.
- Well maintained footpaths across the moors will reduce disturbance of golden plover and other ground nesting birds.
- Conifer plantations have historically reduced golden plover habitat. Establishment of new plantations should be discouraged and existing plantations removed where they have an impact on golden plovers.
- Partnership with coastal conservation organisations and other organisations who manage winter feeding grounds to provide integrated management is a better strategy than breeding ground only methods.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

Great crested newt

Key adaptation recommendations for great crested newts:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Minimise agricultural inputs to ponds, especially slurry, fertilisers and pesticides. Give consideration to good management of waste to improve catchment quality, including effective slurry store management.
- Systematically monitor invasive species in ponds, and control them where needed.
- Increase the use of sustainable drainage schemes for new developments.
- Translocate to new sites if needed. Undertake further research into translocation feasibility and sustainability.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Continue restoring and creating ponds across the PDNP: make it a priority especially near existing populations such as in the White Peak.
- Improve habitat between ponds to help connect them. Focus on terrestrial habitat vegetation and inter-pond distances.
- Monitor existing populations. Records of population size and habitat quality will be important to inform adaptation planning.
- Protect potential new habitat as well as existing habitat that is impacted through development proposals, particularly where it is near existing populations.

Lapwing

Key adaptation recommendations for lapwing:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Reduce chemical inputs to fields to allow soil invertebrate populations to recover.
- Stronger grazing pressure in autumn and delayed lower pressure grazing in spring can generate the correct sward conditions, while minimising trampling and disturbance.
- Rush management should be planned with the needs of different species in mind, some suitable areas of long rushes should be left intact.
- Predator control could be a useful tool in high predator density areas, but may inadvertently increase predator populations and disrupt other species interactions. Research is needed to determine if a more natural system would be a better option for the future.
- Future increases in PDNP arable land use may become a resource for PDNP lapwing populations. In this scenario, management of this land should be sensitive to this species
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Wetland restoration should be a priority; both upland rewetting and lowland drain blocking will help.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Heterogeneity in surface water conditions is beneficial for lapwing chick survival. Some shallow wet features should be maintained throughout the breeding season. Generally wetter conditions are also beneficial.

Merlin

Key adaptation recommendations for merlin:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Greater focus on preventing bird of prey persecution in the PDNP is needed, as well as prosecution of offenders.
- Lower grazing intensity is beneficial to both merlin and their avian prey.
- Further research is required to understand drivers of population changes. Breeding success has been relatively good so it is important to uncover the reasons why Merlin are not doing well in the PDNP.
- Undertake research or collaboration with organisations linked to wintering grounds.
- Predator control could be a useful tool in high predator density areas, but may inadvertently increase predator populations and disrupt other species interactions. Research is needed to determine if a more natural system would be a better option for the future.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increasing the heterogeneity of moorland vegetation has been suggested to be beneficial to merlin.
- Woodland creation on moorland edges may provide nesting habitat and allow merlin to be more adaptable.

Mountain hare

Key adaptation recommendations for mountain hares:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Work with partners to reduce or end culling of hares in PDNP.
- Continue moorland restoration work to reduce bare peat and improve mountain hare habitat.
- Continue to gather mountain hare sightings data and encourage the public to report sightings. This will help inform future adaptation planning.
- Set up a mountain hare monitoring plan: to better understand local population dynamics and to identify risks, opportunities and key areas. Further research is required.
- Predator control could be a useful tool in high predator density areas, but may inadvertently increase predator populations and disrupt other species interactions. Research is needed to determine if a more natural system would be a better option for the future.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Limit disturbance at known sites: particularly in areas with high visitor numbers.
- Install wildlife corridors, such as underpasses, to increase connectivity between populations and decrease road casualties.

Pied flycatcher

Key adaptation recommendations for pied flycatchers:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Suitable broadleaf woodland and new broadleaf woodland in the Dark and South West Peak should be fitted with nest boxes as soon as possible, including increasing nest box numbers within existing sites. This is the best way to increase pied flycatcher habitat and would help to improve resilience.
- Implement known best management practices on nest boxes such as corking and orienting away from south-west. Ensure continuity of management. More sustainable long term strategies may need to be considered.
- Increased upland woodland establishment, especially oak woodland, will increase habitat for pied flycatchers.
- Manage for increased Lepidopteran (caterpillar) populations to increase nesting food supply for pied flycatchers.
- PDNP based management can only do so much for pied flycatchers and other migratory birds. Partnership with West African conservation groups and others along the migration route would be the best way to increase winter survival.
- Investigate natural dynamic land management for pied flycatcher and other species. Pilot a 'rewilding' or 'wilding' trial scheme with no fixed conservation aims and monitor the impact on this feature.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Ring ouzel

Key adaptation recommendations for ring ouzel:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Non-native upland forestry plantations remove good ring ouzel habitat and should be phased out where they are impacting ring ouzel populations.
- Predator control could be a useful tool in high predator density areas, but may inadvertently increase predator populations and disrupt other species interactions. Research is needed to determine if a more natural system would be a better option for the future.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Manage visitor access and disturbance during sensitive breeding season will increase ring ouzel breeding success, and thus help reduce non-climate related pressures.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Move towards a habitat mosaic for ring ouzel. This includes open areas and heterogeneous vegetation structure, with some scrub in appropriate areas.
- Appropriate cutting or grazing to create varied vegetation structure would be beneficial to ring ouzel and reduce wildfire risk.

Short-eared owl

Key adaptation recommendations for short-eared owls:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- A greater focus on bird of prey persecution is needed.
- Lower sheep grazing densities in short-eared owl habitat could benefit owl populations by increasing the populations of their small mammal prey.
- Study into migration habits of short-eared owl could clarify the resident status of PDNP birds, informing management.
- Partnership approach with coastal wintering grounds would be beneficial to short-eared owl conservation.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Monitoring of known breeding pairs could increase the information resource available.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

Snipe

Key adaptation recommendations for snipe:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Remove drains in pastureland to promote wet flushes and rush areas – by creating better habitat for snipe their current status can be improved and so they are likely to be more resilient to change.
- Rush management should be planned with the needs of different species in mind, some suitable areas of long rushes should be left intact.
- Cease the ploughing of fields and reduce chemical inputs to improve soil invertebrate populations and diversity – giving snipe a more abundant and wider choice of food.
- Predator control could be a useful tool in high predator density areas, but may inadvertently increase predator populations and disrupt other species interactions. Research is needed to determine if a more natural system would be a better option for the future.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Stocking levels should be kept low to reduce nest trampling and disturbance.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Ditches and other varied surface topography can provide damp areas for snipe to feed in dry periods, so these should be considered in management and development plans.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Prolonging high soil moisture into summer will extend the nesting season and increase snipe breeding success. Landscape scale management plans should look at interventions which can reduce the drying effect of hotter, drier summers.

Swallow

Key adaptation recommendations for swallows:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Reduced pesticide input to livestock on pastureland. This would increase populations of swallows and other birds, as well as associated soil health benefits.
- Transition lowland pasture in the White Peak from sheep to suckler cattle, to improve insect populations.
- Ensure planning decisions leave some swallow nesting space in buildings by allowing access. Platforms with bags to catch droppings can be built. Only a small access hole is required.
- Increase potential for swallow nests in new and restored buildings, with particular consideration for agricultural buildings.
- A whole range approach, with partnership with organisations in their African wintering grounds would be needed to maximise swallow adaptive capacity.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Better knowledge and monitoring of PDNP swallow populations would help understand whether they are declining, and where action is needed.
- A review of planning applications where swallows have been a considering factor would increase understanding of where action has been done or is needed.

Twite

Key adaptation recommendations for twite:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Restoration of quarries where appropriate will provide habitat for the larger White Peak population to expand into.
- Integrated management of twite nesting and feeding habitat is essential to their preservation. Co-ordinated management of upland moorland and lowland meadows will give the best chance for twite survival.
- Lowering livestock densities on pastoral land can improve its suitability as feeding habitat.
- Twite are migratory birds, so management interventions in the PDNP will have a limited effect if not part of wider efforts in wintering grounds. Partnership with coastal conservation organisations in Norfolk and the south-east coast will be the most beneficial to PDNP twite.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

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- Loss of feeding resources is likely the biggest contributing factor to the current decline. Meadow creation will therefore be very beneficial to twite populations. Expansion of existing meadows and conversion of some improved grassland near twite nesting areas may prevent or slow the loss of twite from the PDNP.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Allow some stands of mature heather to persist within a varied vegetation structure, to allow nesting habitat while minimising wildfire risk. Rotational burning is unlikely to create this structure and so should be phased out.
- Bracken can provide nesting habitat for twite. Consider preserving bracken on steep slopes within 2km of feeding habitat where vegetation is otherwise unsuitable for nesting.

Waxcap fungi

Key adaptation recommendations for waxcap fungi:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Survey greater areas of PDNP grassland to assess true extent of waxcap grassland.
- Alter management of pastureland to increase waxcap populations. Cease ploughing and ensure appropriate grazing levels, and lower inputs of fertiliser and lime. Introduce measures to reduce compaction and waterlogging. Concurrent benefits of improved soil health and ecological condition mean this is desirable even disregarding waxcaps.
- Management of large lawns such as those on estate land should have a greater focus on waxcap assemblage.
- Promote PDNP waxcap grasslands, as they are already some of the finest internationally. An increase in awareness and knowledge may lead to wider benefits for waxcap grassland resilience and soil health.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Training on identification of CHEGD fungi (**C**lavaroids (club and coral fungi)*,* ***H****ygrocybe spp.* (waxcaps)*,* ***E****ntoloma spp.* (pinkgills*),* ***G****eoglossum* and related genera (earthtongues)*,* and ***D****ermoloma spp.* (as well as *Porpoloma* and *Camarophyllopsis spp.*) will increase the pool of surveyors to identify and designate sites of importance.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Focus of future assessments and management should be broadened from just waxcaps to include the wider grassland fungi assemblage that associates with waxcap grassland. This is often known as the CHEGD group.

SQ3 - Undeveloped places of tranquillity and dark night skies within reach of millions

COMMUNITIES

Open access land and public access

Key adaptation recommendations for open access land and public access:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor condition of paths, tracks and trails and reassess vulnerability on an ongoing basis.
- Provide funding for resilience planning. Take a proactive approach to improve path structure in a smaller way rather than waiting for a damaging event before acting.
- Invest in and encourage natural flood management across the PDNP including the restoration of upland habitats and the regeneration of large areas of woodland and scrub.
- Invest time in developing further crowd-sourced funding for adaptation of paths, tracks and trails, fostering a sense of ownership among user groups.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Maintain and upgrade those areas subject to heavy usage or those likely to be most vulnerable.
- Create visitor management plans for peak times and honeypot areas. Identify areas that are vulnerable to crowding and influence behavioural changes to spread out visitor impact
- Continue to foster partnerships to help manage the impacts affecting open access land.

Transport links into the PDNP

Key adaptation recommendations for transport links into the PDNP:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Review and adapt vegetation management to keep routes open.
- Incentivise reduced demand for services through behaviour change and the use of more efficient technologies.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Support changes such as enlarging drainage capacity for roads, railways and other routes to enable them to cope with increases in rainfall, and the implementation of speed limitations during times of extreme temperature.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Identify alternative and creative ways of delivering services, for example using green spaces to aid flood management.
- Natural Flood Management in the uplands of the PDNP through habitat restoration and woodland establishment is a key adaptation to reduce the impacts of flooding on transport infrastructure.

CULTURAL LANDSCAPES

Abandoned places of industry

Key adaptation recommendations for abandoned places of industry:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Ensure that the industrial heritage of the PDNP is properly embedded into all areas of PDNPA's activities (policy development, interpretation, visitor development etc.).
- Ensure that any climate adaptations can be reversed to prevent long term impacts on features.
- Nurture collaborative networks to build capacity for monitoring (e.g. P*eak District Mines Historical Society*, local interest groups).
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Increase knowledge about what assets exist to help determine which specific sites in the PDNP are most in need of protection.
- Undertake regular monitoring (including at landscape scale) of selected sites to identify those sites likely to be most vulnerable in terms of archaeology and ecology.
- Monitor outcomes of any change to sites. Select representative samples to monitor on sites where management actions are being implemented and sites where they are not.
- Put forward key sites for scheduling.
- Implement suitable natural flood management techniques in valley bottom sites, such as mills.

Estate lands and designed landscapes

Key adaptation recommendations for estate lands and designed landscapes:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Carry out research and survey into designed landscapes, especially those at a smaller scale that might not previously have been recognised as significant. This will help inform future adaptation planning.
- Increase the resilience of the surrounding landscape to help create a buffer for estate lands and designed landscapes. Form estate level plans for improved climate resilience, such as improving moorland condition to reduce flood risk.
- Nurture partnerships with big estates and landowners.
- When planning any future adaptations ensure existing archaeological complexity is taken into consideration.
- Consider the cumulative impact on estate lands by visitor pressure and events.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify field boundaries that are at risk and work to restore or improve them.
- Manage and replace veteran trees (scattered trees in historic parklands and in field boundaries are a key characteristic of the Derwent Valley).
- Harvest and store rain water at drought sensitive sites (already in place at some properties).

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase woodland establishment and enhancement of habitats where appropriate, while maintaining the significance of key views and designed elements. This will strengthen existing landscape character, whilst in the future lower lying landscapes adjacent to the river could provide useful floodwater storage services.
- Increase the diversity of planting in parklands to make them more resilient.

Lowland pastoral landscapes

Key adaptation recommendations for lowland pastoral landscapes:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor the risk and spread of disease in both plants and animals.
- Reduce visitor pressure by encouraging use of the area at times outside of the high season.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Explore opportunities for storing high levels of winter rainfall for use during the summer; these should be sensitive to the landscape.
- Encourage better connectivity in these landscapes. (CHECK IT FITS, NOT A SQ2 FEATURE)
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- See the recommendations under 'boundaries, and walls/hedgerows'.
- Encourage further uptake of environmental land management schemes by farmers within the PDNP.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Enable more species rich hay cropping through meadow creation and restoration on a wide scale.
- Enable the diversification of plant species in permanent pasture; this will increase adaptive capacity to future change.
- Establish more trees and hedges in the landscape where appropriate to assist with surface water management, soil condition, and livestock summer shading. Help farmers to select the most appropriate and resilient species.
- Work to change perceptions about the value of 'abandoned' pastureland. More scrub and tree development on improved pasture would create a more sheltered and resilient overall landscape with microclimates that are more diverse, and improve future soil condition.

GEOLOGY, GEOMORPHOLOGY AND SOILS

High open moorland and edges

Key adaptation recommendations for high open moorland and edges:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Native trees and scrub should be encouraged around the plateau edges to increase resilience of upland habitats and protect blanket peat, but archaeological sensitivities need to be taken into account in the management of tree cover. More trees across the currently open upland landscape may assist with climate adaptation and mitigation, along with ecosystem service provision.
- Pilot a 'rewilding' or 'wilding' trial scheme with no fixed conservation aims and monitor the impact on this feature.
- Reduce fragmentation via restoring and improving corridors between moorland habitats to strengthen the ecological network.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Encourage flexible land management to facilitate the development of a more diverse habitat composition and structure.
- Enable habitats to respond to climate change - do not view the landscape as fixed but allow room for change.

Limestone dales

Key adaptation recommendations for limestone dales:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Protect geological features and maintain their visibility by removing or managing vegetation.
- Improve water use efficiency and rainwater harvesting, especially in remote locations which are dependent on springs and susceptible to drought.
- Provide advice, information and support to farmers on increasing organic matter in soils and other measures to increase carbon storage and improve drought tolerance of farmland.
- Maintain historic environment records to enable historic environment advice to be integrated with other land management advice.
- Encourage sympathetic management, restoration and creation of riparian habitats, particularly grassland, woodland and wetland, to stabilise river banks and reduce erosion and diffuse pollution.
- Install settlement ponds and silt traps to intercept run-off and sediment before it reaches watercourses.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Undertake stream revetment schemes to slow flow, reducing rock face undercutting, stream bank erosion and minimise downstream flooding.
- More research is required to better understand the hydrology and role of artificial drainage on low flow river systems.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Monitor the spread of tree diseases, in particular ash dieback, and ensure appropriate mitigation measures. However, deadwood is a very valuable habitat and should be left standing unless it is a public safety hazard.
- Manage visitor access to popular locations to minimise traffic, disturbance, footpath erosion and other negative environmental impacts.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- In areas where it does not have a negative impact on the landscape character, establish trees to provide shade for wildlife, livestock and people and to regulate the temperature of watercourses.

HABITATS

Woodlands

Key adaptation recommendations for woodlands:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Reduce grazing pressures where possible. Recognise the importance of an integrated deer management plan for the park.
- Encourage more continuous cover forestry – to maintain higher levels of carbon storage and decrease soil losses.
- Improve protection, management and recruitment of veteran trees.
- Consider water management in woodlands predicted to experience drought.
- Further study is required to explore appropriate opportunities for woodlands to be used in local wood fuel schemes.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase diversity of tree species; especially in single species woodlands. Accept change in composition of woodlands, such as accepting species not previously native to the PDNP.
- Continue improving woodland condition – more native woodland creation, encourage regeneration to increase structural diversity, increase patch size (>2ha) to meet habitat requirements for birds and other species, increase decaying wood for replenishing soils.
- Natural woodland regeneration by excluding stock should be seen as preferable to tree establishment, with the latter principally to increase diversity - importance of scrub is underestimated.
- Convert small or unused conifer plantations to broadleaf/mixed woodlands.
- Increase establishment of field and boundary trees, particularly across the White Peak, to increase habitat diversity and connectivity, replace trees lost to Ash Dieback, enhance the landscape and provide shade and better grazing for livestock in hotter summer conditions.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Increase connectivity between woodlands to provide wildlife corridors.
- Increase woodland cover – to keep waterways cool, provide shelter for other species as temperatures increase, increase carbon storage, and improve water quality.

SQ4 - Landscapes that tell a story of thousands of years of people, farming and industry

BUILT ENVIRONMENT

Clapper and packhorse bridges

Key adaptation recommendations for clapper and packhorse bridges:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Slow the flow of water into rivers by ensuring landscape scale natural flood management in the uplands through blanket bog restoration, diversification of heather moorland and significantly increased woodland and scrub regeneration.
- Stabilise watercourse banks by encouraging tree and scrub growth adjacent to the channels where appropriate to reduce sedimentation and slow run-off entering.
- Encourage the designation of more structures by increasing knowledge base of these features.
- Engage with landowners and offer advice and funding streams for maintenance and repair of bridges.
- Control invasive species such as Himalayan balsam which can lead to the destabilisation of watercourse banks.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Conduct a survey to collect more detailed information about the current condition of these features and identify those individual structures which are most at risk.
- Select a sample of bridges which can be routinely monitored to track any deterioration in condition over time.

Farmsteads

Key adaptation recommendations for farmsteads:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Use existing PDNPA farmsteads research to understand regional patterns and help inform decisions about change.
- Adapt traditional farm buildings where appropriate so they may still be used beneficially..
- See Peak District Farmsteads: Issues and Responses Report (2017), section 6.2 'Recommendations' for further information.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Consider keeping buildings standing for the benefits of wildlife.

Field barns and outfarms

Key adaptation recommendations for field barns and outfarms:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- In order to halt large-scale dereliction and decay, some change in use is inevitable and work to enable quality conversions to economically viable uses, while maintaining the character as far as possible, should be encouraged where appropriate.
- Investigate alternative funding streams to support adaptation.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Work to identify the most significant landscapes with field barns for enhanced maintenance through future environmental land management schemes.

CULTURAL LANDSCAPES

Abandoned places of industry

Key adaptation recommendations for abandoned places of industry:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Ensure that the industrial heritage of the PDNP is properly embedded into all areas of PDNPA's activities (policy development, interpretation, visitor development etc.).
- Ensure that any climate adaptations can be reversed to prevent long term impacts on features.
- Nurture collaborative networks to build capacity for monitoring (e.g. P*eak District Mines Historical Society*, local interest groups).
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Increase knowledge about what assets exist to help determine which specific sites in the PDNP are most in need of protection.
- Undertake regular monitoring (including at landscape scale) of selected sites to identify those sites likely to be most vulnerable in terms of archaeology and ecology.
- Monitor outcomes of any change to sites. Select representative samples to monitor on sites where management actions are being implemented and sites where they are not.
- Put forward key sites for scheduling.
- Implement suitable natural flood management techniques in valley bottom sites, such as mills.

Boundaries and patterns of enclosure

Key adaptation recommendations for boundaries and patterns of enclosure:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor boundary changes at a landscape scale, for example quantify the loss of walls and hedges. Ensure that management mitigates piecemeal changes to enclosure patterns that may seem insignificant on their own, but that can have cumulative and large impact upon landscape character over time.
- Encourage the use of agricultural buffer strips to protect hedges from human behaviour changes (e.g. intensification of agriculture) which may occur because of climate change.
- Ensure management practices allow for the maintenance of walls and historic field patterns. Explore opportunities in future environmental land management schemes.
- Undertake research to understand the significance of different boundary types and patterns. Appreciate that boundaries may have different components, including natural features. Also appreciate the time-depth in enclosure, for example prehistoric boundary patterns may underly the dominant, later enclosure patterns, and be visible only as earthworks. This will help inform future adaptation planning.
- Help land managers within the PDNP to enter into environmental stewardship type agreements or secure funding for capital works by providing assistance with advice and logistics - see Moors for the Future Partnership's Private Land Project as a possible model.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Focus efforts on restoring and reconnecting fragmented hedges and walls in priority areas. It is important to avoid further loss and restore boundaries. This will improve their function as wildlife corridors and improve their overall resilience to change. Ensure targeted conservation efforts are informed by historic character and relative significance.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Diversify the landscape and increase the proportion of tree cover to reduce the impact of flooding from rivers and overland flow.
- Restore and connect fragmented hedges with native species sourced from further south in the UK. Increase species diversity of hedges to buffer against single species losses.

Estate lands and designed landscapes

Key adaptation recommendations for estate lands and designed landscapes:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Carry out research and survey into designed landscapes, especially those at a smaller scale that might not previously have been recognised as significant. This will help inform future adaptation planning.
- Increase the resilience of the surrounding landscape to help create a buffer for estate lands and designed landscapes. Form estate level plans for improved climate resilience, such as improving moorland condition to reduce flood risk.
- Nurture partnerships with big estates and landowners.
- When planning any future adaptations ensure existing archaeological complexity is taken into consideration.
- Consider the cumulative impact on estate lands by visitor pressure and events.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify field boundaries that are at risk and work to restore or improve them.
- Manage and replace veteran trees (scattered trees in historic parklands and in field boundaries are a key characteristic of the Derwent Valley).
- Harvest and store rain water at drought sensitive sites (already in place at some properties).

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase woodland establishment and enhancement of habitats where appropriate, while maintaining the significance of key views and designed elements. This will strengthen existing landscape character, whilst in the future lower lying landscapes adjacent to the river could provide useful floodwater storage services.
- Increase the diversity of planting in parklands to make them more resilient.

Lead mining features

Key adaptation recommendations for lead mining features:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Ensure surveyed features are included in Historic Environment Records and Selected Heritage Inventory for Natural England (SHINE) datasets.
- Nurture collaborative networks to build capacity for monitoring (e.g. PDMHS, caving groups, other local interest groups).
- More research is required to better understand the hydrology of low flow river systems and their interaction with surface and underground workings.
- Liaise with other protected landscapes to share knowledge and management techniques.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Use existing records (e.g. Lead Legacy High Priority lead mining sites and landscapes) to target resources.
- Undertake regular monitoring, including at landscape scale, of selected sites to identify those sites likely to be most vulnerable in terms of archaeology and ecology.
- Put forward key sites for scheduling.

Managed moorland

Key adaptation recommendations for managed moorland:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Target re-creation and restoration around existing managed moorland areas to reduce edge effects and increase core area, reducing the effects of fragmentation.
- Adapt management intensity to the changing characteristics of the moorland.
- Explore the benefits of 'wilding' in areas where current management is dependent on payment through environmental land management schemes**.**
- Guide management strategies based on the carbon storage potential of peatlands.
- Ensure that cultural heritage is fully embedded in moorland management plans and the cultural complexity of moorlands is understood (See Buried soils, archaeological remains and deposits and Palaeoenvironmental remains and sequences for associated recommendations).

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Improve visitor management in areas of high wildfire risk by developing visitor management plans.
- Improve the knowledge of cultural heritage features to help target conservation efforts.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Diversify single species dominated areas into mixed heath and bog. Encourage a mosaic of habitat types.
- Diversify land management techniques.

Prehistoric ceremonial monuments

Key adaptation recommendations for prehistoric ceremonial monuments:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Create an action plan for recording sites discovered as a result of land use changes and other factors.
- Consider the landscape context of these structures and improve resilience of the surrounding landscape to better protect them.
- Ensure that any climate adaptations can be reversed to prevent long term impacts on features.
- Use sites themselves as valuable assets for example to sustainably generate money for their upkeep. Explore opportunities in future environmental land management schemes.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Further exploration into evaluating site significance and evaluating which known assets require protection and management.
- Implement monitoring of sites, especially where adaptations have been made and their surroundings - this may provide beneficial information for other sites. Carry out regular monitoring of scheduled sites.
- Put forward non-scheduled sites of suitable quality for scheduling.

Prehistoric and Romano-British settlements, field systems and cairnfields

Key adaptation recommendations for prehistoric and Romano-British settlements, field systems and cairnfields:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Continue to stabilise peat and soils to prevent erosion.
- Continue assessing site significance in order to increase knowledge of asset existence to determine which need protecting.
- Facilitate data sharing information between organisations that helps us understand the extent of archaeological features. This will help inform future adaptation planning.
- Use sites themselves as valuable assets for example to sustainably generate money for their upkeep. Explore opportunities in future environmental land management schemes.
- Ensure that any climate adaptations can be reversed to prevent long term impacts on features.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Carry out regular monitoring of scheduled sites.
- Put forward non-scheduled sites of suitable quality for scheduling.
- Consider locations of important prehistoric and Romano-British settlements, field systems and cairnfield sites when planning flood management, tree establishment, or piloting wilding trial schemes.
- Monitor outcomes of any adaptations that are implemented.

GEOLOGY, GEOMORPHOLOGY AND SOILS

Buried soils, archaeological remains and deposits

Key adaptation recommendations for buried soils, archaeological remains and deposits:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Habitat enhancement to stabilise the water table, which will create stable environmental conditions for preserving remains and deposits.
- Integrate heritage protection into moorland restoration schemes.
- Appropriate management of the overlying habitat to prevent/minimise indirect damage from e.g. erosion, wildfire, root disturbance due to scrub growth or increased burrowing animal activity.
- Phase out burning on blanket bog. Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Investigate funding for strategic survey to locate and catalogue sites of archaeological interest and potential (deposit modelling) in order to identify where habitat enhancement or management needs to take place to protect buried archaeology.

High open moorland and edges

Key adaptation recommendations for high open moorland and edges:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Native trees and scrub should be encouraged around the plateau edges to increase resilience of upland habitats and protect blanket peat, but archaeological sensitivities need to be taken into account in the management of tree cover. More trees across the currently open upland landscape may assist with climate adaptation and mitigation, along with ecosystem service provision.
- Pilot a 'rewilding' or 'wilding' trial scheme with no fixed conservation aims and monitor the impact on this feature.
- Reduce fragmentation via restoring and improving corridors between moorland habitats to strengthen the ecological network.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Encourage flexible land management to facilitate the development of a more diverse habitat composition and structure.
- Enable habitats to respond to climate change - do not view the landscape as fixed but allow room for change.

Paleoenvironmental remains and sequences

Key adaptation recommendations for palaeoenvironmental remains and sequences:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Habitat enhancement to stabilise the water table, which will create stable environmental conditions for preserving remains and deposits.
- Integrate heritage protection into moorland restoration schemes.
- Create research partnerships, for example with universities, to provide a better understanding of these deposits across the PDNP, to include scientific dating.
- Phase out burning on blanket bog. Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.
-

Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Investigate funding for strategic survey to locate and catalogue site of archaeological interest and potential (deposit modelling).
- Improve the knowledge of cultural heritage features to help target conservation efforts.

River valleys

Key adaptation recommendations for river valleys:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Accept that landscape character and habitat types cannot remain static in PDNP river valleys, and that management changes will need to happen to enable resilience to climate change.
- Improve the management of riverside grasslands, and create more wet meadows. They can be used to temporarily store floodwater and reduce the effects of large rainfall events.
- Remove manmade impoundments where appropriate, especially those in small watercourses to help increase habitat quality, decrease downstream flooding and landscape aesthetics.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Regular monitoring of key sensitive heritage features (such a listed bridges).
- More research is required to better understand the hydrology and role of artificial drainage on low flow river systems.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Management of river valleys should allow space for natural processes to occur. Allow rivers to meander, and exclude livestock to allow space for riverside woodland and scrub to develop in appropriate locations. This should help to control nutrient input and may reduce water temperature increases.
- Manage the whole catchment including the upper slopes to reduce run-off and increase lag-times. Create more clough woodland to reduce flood risk and erosion of valley sides.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

- The potential for new reservoirs should be raised as an issue in the review of the Local Plan for the PDNP where this supports climate change adaptation, nature recovery and effective visitor management.

Show caves and caverns

Key adaptation recommendations for show caves and caverns:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Ensure cave management plans consider need for increased ventilation, and continue to monitor levels of radon and other gasses such carbon dioxide into the future.
- Ensure planning policies are flexible and open to sympathetic adaptations for caves that do not harm historic significance.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced

- Encourage natural flood management techniques within the catchments feeding the caverns – for example allow some pasture to revert to scrub or woodland in suitable places.
- Reduce farming inputs such as fertilizers, or paper pulp into system, to improve water quality and reduce toxin build-up in caves. Livestock levels should be lowered around streams and rivers as slurry is the main contributor to nutrients in rivers. Give consideration to good management of waste to improve catchment quality, including effective slurry store management. Low nutrient feed should be encouraged. Fertiliser and pesticide inputs should also be reduced to prevent spread into the watercourse.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

- The potential for new reservoirs should be raised as an issue in the review of the Local Plan for the PDNP where this supports climate change adaptation, nature recovery and effective visitor management.

HABITATS

Meadows

Key adaptation recommendations for meadows:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Many more restored meadows are needed in the PDNP if effective nature recovery networks are to be developed. These would increase carbon storage and capture, increase resilience to climate change and drought especially, provide transitional sites between existing habitats, plus better habitat for invertebrates and other animals. Species rich meadows are much better for a healthy stock animal as well – though less productive than heavily fertilised pastures, they provide a more diverse, healthy diet, better ways of managing health – many old ones were called hospital fields, and are essential for a low input low output system.
- Opportunities to extend and enhance the management of existing unimproved grasslands should be sought, for example in "Riverside Meadows" where grasslands could enhance their role for flood water storage, helping to reduce flood impacts further downstream.
- Encourage the creation and enhancement of wildflower meadow in non- agricultural settings e.g. recreational areas, churchyards, verges and residential gardens. A scheme to help with conversion or management may be required.
- Non-climate sources of harm (for example conversion to silage or permanent pasture; application of high fertilizer levels, early cutting) should be minimised to ensure maximum possible resilience.
- Identify and preserve refugia for species at their southern range limit - look at aspect and topography and ensure sites are sensitively managed.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Species rich meadow should be one of the key habitats to be considered when other habitat types are no longer viable due to climate change. Rush-pastures which have become too dry could be converted.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Greater flexibility in site management will be needed - e.g. Timing of hay cut and grazing.

WATERCOURSES, PONDS AND RESERVOIRS

Dew ponds and other ponds

Key adaptation recommendations for dew ponds and other ponds:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Maintain and enhance existing sites, where possible, consider re-lining failing ponds with materials that reflect their historic character.
- Reduce non-climatic sources of harm such as non-native species and nutrient sources.
- Minimise agricultural inputs, especially slurry, fertilisers and pesticides. Give consideration to good management of waste to improve catchment quality, including effective slurry store management.

- Manage biosecurity to limit spread of invasive and non-native species.
- Investigate external funding sources for a major pond project using citizen science.
- Create semi-natural vegetation such as woodland along run-off pathways to reduce evaporation and maintain water quality.
- Keep a strategy for dewpond restoration under review, due to their high vulnerability and extensive cost input required.
- Liaise with other protected landscapes to share knowledge and management techniques.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Restore key sites to link clusters and improve pond connectivity for species such as great crested newt.

Reservoirs and water management features

Key adaptation recommendations for reservoirs and water management features:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Water catchment management practices can be targeted at minimising flood risk and peak water flows. This may include increased woodland cover within the PDNP, restoration of blanket bog and sensitive farming practices, as well as drain blocking in headwater regions.
- Ensure surveyed features are included in Historic Environment Records and Selected Heritage Inventory for Natural England (SHINE) datasets.
- Nurture collaborative networks to build capacity for monitoring (e.g. volunteer groups).

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Research the most suitable adaptations for individual historic sites taking into account their situation and current use. This could include plans or physical barriers to reduce foot traffic, or physical reinforcement for the most valuable features. Care must be taken to avoid maladaptation.
- Undertake regular monitoring (including at landscape scale) of selected sites to identify those likely to be most vulnerable in terms of archaeology and ecology and to document change and help inform interventions where possible.
- Put forward key sites for scheduling.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Plantation woodlands in the uplands and those surrounding reservoirs should be managed to reduce erosion and slow run-off. Structural and species diversification with native broadleaved trees should be investigated. Encourage continuous cover forestry – to maintain higher levels of carbon storage and decrease soil losses.

SQ5 - Characteristic settlements with strong communities and traditions

BUILT ENVIRONMENT

Building materials

Key adaptation recommendations for building materials:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Provide good information on appropriate materials and encourage building owners to carry out timely maintenance and repairs.
- Create/maintain strong partnerships with external organisations to highlight materials sourcing issues, and ensure steady supply of appropriate materials (e.g. Historic England, minerals operators, architects, tradespeople).

Adapt infrastructure for future conditions

These recommendations are adaptations to physical infrastructure that should allow the features to better resist or recover from future climate change.

- Keep abreast of new research into the performance of alternative materials for future climate adaptations.
- Encourage the use and benefits of traditional materials. Review building design with the impacts of climate change in mind.

Farmsteads

Key adaptation recommendations for farmsteads:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Use existing PDNPA farmsteads research to understand regional patterns and help inform decisions about change.
- Adapt traditional farm buildings where appropriate so they may still be used beneficially..
- See Peak District Farmsteads: Issues and Responses Report (2017), section 6.2 'Recommendations' for further information.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Consider keeping buildings standing for the benefits of wildlife.

Field barns and outfarms

Key adaptation recommendations for field barns and outfarms:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- In order to halt large-scale dereliction and decay, some change in use is inevitable and work to enable quality conversions to economically viable uses, while maintaining the character as far as possible, should be encouraged where appropriate.
- Investigate alternative funding streams to support adaptation.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Work to identify the most significant landscapes with field barns for enhanced maintenance through future environmental land management schemes.

Country houses

Key adaptation recommendations for country houses:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Have emergency plans in place for limiting damage during major climate events.
- Include country houses and their parklands in landscape scale flood risk management plans.
- Increase the resilience of the surrounding landscape to help create a buffer for these country houses and parklands. Form estate level plans for improved climate resilience, such as improving moorland condition to reduce flood risk.
- Consider collections and archives that could be at risk, and store those that are potentially vulnerable to damage from water, pests and overheating in places where these impacts will be smaller.
- Remedial work completed after damage has occurred should be appropriate for the specific building. See the Historic England's 2010 (2015 edition) document 'Flooding and Historic Buildings' for examples.

Adapt infrastructure for future conditions

These recommendations are adaptations to physical infrastructure that should allow the features to better resist or recover from future climate change.

- Install rain harvesting and storage facilities at sites which are sensitive to drought. This is already in place at some properties.
- Keep abreast of new research into the performance of alternative materials for future climate adaptations.

Listed buildings

Key adaptation recommendations for listed buildings:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Remedial work completed after damage has occurred should be appropriate for the specific building. See the Historic England 2010 (2015 edition) document 'Flooding and Historic Buildings' for examples.
- Provide good information on appropriate materials, and encourage building owners to carry out timely maintenance and repairs.
- Create/maintain strong partnerships with external organisations to highlight materials sourcing issues, and ensure steady supply of appropriate materials (e.g. Historic England, minerals operators, architects, tradespeople).
- Nurture collaborative networks to build capacity for monitoring (e.g. local interest groups).

Adapt infrastructure for future conditions

These recommendations are adaptations to physical infrastructure that should allow the features to better resist or recover from future climate change.

- Installation of appropriate adaptive measures should be encouraged and regular condition inspections should be carried out.
- Keep abreast of new research into the performance of alternative materials for future climate adaptations.
- Encourage the use and benefits of traditional materials. Review building design with the impacts of climate change in mind.

COMMUNITIES

Local events

Key adaptation recommendations for local events:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Provide advice and support to help event organisers of locally run, volunteer led and traditional events to adapt to climate change and implement more robust processes.
- Assess the value of events and traditions to the PDNP economy and consider whether financial support and grants would be feasible to support the most vulnerable traditions.
- Adapt to increased visitor numbers as a result of hotter, drier summers. Encourage public transport usage for larger events and encourage the provision of extra buses and trains, and low carbon transport, to reduce congestion and improve air quality.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Create visitor management plans for peak times and honeypot areas. Identify areas that are vulnerable to crowding and influence behavioural changes to spread out visitor impact
- Manage visitor numbers at high-risk sites and events.

Transport links into the PDNP

Key adaptation recommendations for transport links into the PDNP:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Review and adapt vegetation management to keep routes open.
- Incentivise reduced demand for services through behaviour change and the use of more efficient technologies.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Support changes such as enlarging drainage capacity for roads, railways and other routes to enable them to cope with increases in rainfall, and the implementation of speed limitations during times of extreme temperature.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Identify alternative and creative ways of delivering services, for example using green spaces to aid flood management.
- Natural Flood Management in the uplands of the PDNP through habitat restoration and woodland establishment is a key adaptation to reduce the impacts of flooding on transport infrastructure.

CULTURAL LANDSCAPES

Boundaries and patterns of enclosure

Key adaptation recommendations for boundaries and patterns of enclosure:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor boundary changes at a landscape scale, for example quantify the loss of walls and hedges. Ensure that management mitigates piecemeal changes to enclosure patterns that may seem insignificant on their own, but that can have cumulative and large impact upon landscape character over time.
- Encourage the use of agricultural buffer strips to protect hedges from human behaviour changes (e.g. intensification of agriculture) which may occur because of climate change.
- Ensure management practices allow for the maintenance of walls and historic field patterns. Explore opportunities in future environmental land management schemes.
- Undertake research to understand the significance of different boundary types and patterns. Appreciate that boundaries may have different components, including natural features. Also appreciate the time-depth in enclosure, for example prehistoric boundary patterns may underly the dominant, later enclosure patterns, and be visible only as earthworks. This will help inform future adaptation planning.
- Help land managers within the PDNP to enter into environmental stewardship type agreements or secure funding for capital works by providing assistance with advice and logistics - see Moors for the Future Partnership's Private Land Project as a possible model.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Focus efforts on restoring and reconnecting fragmented hedges and walls in priority areas. It is important to avoid further loss and restore boundaries. This will improve their function as wildlife corridors and improve their overall resilience to change. Ensure targeted conservation efforts are informed by historic character and relative significance.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Diversify the landscape and increase the proportion of tree cover to reduce the impact of flooding from rivers and overland flow.
- Restore and connect fragmented hedges with native species sourced from further south in the UK. Increase species diversity of hedges to buffer against single species losses.

Estate lands and designed landscapes

Key adaptation recommendations for estate lands and designed landscapes:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Carry out research and survey into designed landscapes, especially those at a smaller scale that might not previously have been recognised as significant. This will help inform future adaptation planning.
- Increase the resilience of the surrounding landscape to help create a buffer for estate lands and designed landscapes. Form estate level plans for improved climate resilience, such as improving moorland condition to reduce flood risk.
- Nurture partnerships with big estates and landowners.
- When planning any future adaptations ensure existing archaeological complexity is taken into consideration.
- Consider the cumulative impact on estate lands by visitor pressure and events.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify field boundaries that are at risk and work to restore or improve them.
- Manage and replace veteran trees (scattered trees in historic parklands and in field boundaries are a key characteristic of the Derwent Valley).
- Harvest and store rain water at drought sensitive sites (already in place at some properties).

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase woodland establishment and enhancement of habitats where appropriate, while maintaining the significance of key views and designed elements. This will strengthen existing landscape character, whilst in the future lower lying landscapes adjacent to the river could provide useful floodwater storage services.
- Increase the diversity of planting in parklands to make them more resilient.

BUILT ENVIRONMENT

Villages associated with medieval strip fields

Key adaptation recommendations for villages associated with medieval strip fields:

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

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- Ensure conservation area boundaries and appraisals include relevant fieldscape setting when they are revised.
- Use sites themselves as valuable assets for example to sustainably generate money for their upkeep. Explore opportunities in future environmental land management schemes.
- Consider reducing or maintaining low stocking levels in fields with buried archaeological sensitivity.

SQ6 - An inspiring space for escape, adventure, discovery and quiet reflection

BUILT ENVIRONMENT

Country houses

Key adaptation recommendations for country houses:

Improve current condition to increase resilience

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- Have emergency plans in place for limiting damage during major climate events.
- Include country houses and their parklands in landscape scale flood risk management plans.
- Increase the resilience of the surrounding landscape to help create a buffer for these country houses and parklands. Form estate level plans for improved climate resilience, such as improving moorland condition to reduce flood risk.
- Consider collections and archives that could be at risk, and store those that are potentially vulnerable to damage from water, pests and overheating in places where these impacts will be smaller.
- Remedial work completed after damage has occurred should be appropriate for the specific building. See the Historic England's 2010 (2015 edition) document 'Flooding and Historic Buildings' for examples.

Adapt infrastructure for future conditions

These recommendations are adaptations to physical infrastructure that should allow the features to better resist or recover from future climate change.

- Install rain harvesting and storage facilities at sites which are sensitive to drought. This is already in place at some properties.
- Keep abreast of new research into the performance of alternative materials for future climate adaptations.

Paths, tracks, and trails

Key adaptation recommendations for paths, tracks and trails:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor condition of paths, tracks and trails and reassess vulnerability on an ongoing basis.
- Invest time in developing further crowd-sourced funding for adaptation of paths, tracks and trails, fostering a sense of ownership among user groups.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Assess which specific stretches of path, track or trail are likely to be most vulnerable to climate change.
- Maintain and upgrade those areas subject to heavy usage or those likely to be most vulnerable. Understand the heritage significance of trails to factor this into decision making.

COMMUNITIES

Local events

Key adaptation recommendations for local events:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Provide advice and support to help event organisers of locally run, volunteer led and traditional events to adapt to climate change and implement more robust processes.
- Assess the value of events and traditions to the PDNP economy and consider whether financial support and grants would be feasible to support the most vulnerable traditions.
- Adapt to increased visitor numbers as a result of hotter, drier summers. Encourage public transport usage for larger events and encourage the provision of extra buses and trains, and low carbon transport, to reduce congestion and improve air quality.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Create visitor management plans for peak times and honeypot areas. Identify areas that are vulnerable to crowding and influence behavioural changes to spread out visitor impact
- Manage visitor numbers at high-risk sites and events.

Open access land and public access

Key adaptation recommendations for open access land and public access:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor condition of paths, tracks and trails and reassess vulnerability on an ongoing basis.
- Provide funding for resilience planning. Take a proactive approach to improve path structure in a smaller way rather than waiting for a damaging event before acting.
- Invest in and encourage natural flood management across the PDNP including the restoration of upland habitats and the regeneration of large areas of woodland and scrub.
- Invest time in developing further crowd-sourced funding for adaptation of paths, tracks and trails, fostering a sense of ownership among user groups.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Maintain and upgrade those areas subject to heavy usage or those likely to be most vulnerable.
- Create visitor management plans for peak times and honeypot areas. Identify areas that are vulnerable to crowding and influence behavioural changes to spread out visitor impact
- Continue to foster partnerships to help manage the impacts affecting open access land.

Transport links into the PDNP

Key adaptation recommendations for transport links into the PDNP:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Review and adapt vegetation management to keep routes open.
- Incentivise reduced demand for services through behaviour change and the use of more efficient technologies.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Support changes such as enlarging drainage capacity for roads, railways and other routes to enable them to cope with increases in rainfall, and the implementation of speed limitations during times of extreme temperature.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Identify alternative and creative ways of delivering services, for example using green spaces to aid flood management.
- Natural Flood Management in the uplands of the PDNP through habitat restoration and woodland establishment is a key adaptation to reduce the impacts of flooding on transport infrastructure.

GEOLOGY, GEOMORPHOLOGY AND SOILS

High open moorland and edges

Key adaptation recommendations for high open moorland and edges:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Native trees and scrub should be encouraged around the plateau edges to increase resilience of upland habitats and protect blanket peat, but archaeological sensitivities need to be taken into account in the management of tree cover. More trees across the currently open upland landscape may assist with climate adaptation and mitigation, along with ecosystem service provision.
- Pilot a 'rewilding' or 'wilding' trial scheme with no fixed conservation aims and monitor the impact on this feature.
- Reduce fragmentation via restoring and improving corridors between moorland habitats to strengthen the ecological network.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Encourage flexible land management to facilitate the development of a more diverse habitat composition and structure.
- Enable habitats to respond to climate change - do not view the landscape as fixed but allow room for change.

Limestone dales

Key adaptation recommendations for limestone dales:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Protect geological features and maintain their visibility by removing or managing vegetation.
- Improve water use efficiency and rainwater harvesting, especially in remote locations which are dependent on springs and susceptible to drought.
- Provide advice, information and support to farmers on increasing organic matter in soils and other measures to increase carbon storage and improve drought tolerance of farmland.
- Maintain historic environment records to enable historic environment advice to be integrated with other land management advice.
- Encourage sympathetic management, restoration and creation of riparian habitats, particularly grassland, woodland and wetland, to stabilise river banks and reduce erosion and diffuse pollution.
- Install settlement ponds and silt traps to intercept run-off and sediment before it reaches watercourses.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Undertake stream revetment schemes to slow flow, reducing rock face undercutting, stream bank erosion and minimise downstream flooding.
- More research is required to better understand the hydrology and role of artificial drainage on low flow river systems.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Monitor the spread of tree diseases, in particular ash dieback, and ensure appropriate mitigation measures. However, deadwood is a very valuable habitat and should be left standing unless it is a public safety hazard.
- Manage visitor access to popular locations to minimise traffic, disturbance, footpath erosion and other negative environmental impacts.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- In areas where it does not have a negative impact on the landscape character, establish trees to provide shade for wildlife, livestock and people and to regulate the temperature of watercourses.

River valleys

Key adaptation recommendations for river valleys:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Accept that landscape character and habitat types cannot remain static in PDNP river valleys, and that management changes will need to happen to enable resilience to climate change.
- Improve the management of riverside grasslands, and create more wet meadows. They can be used to temporarily store floodwater and reduce the effects of large rainfall events.
- Remove manmade impoundments where appropriate, especially those in small watercourses to help increase habitat quality, decrease downstream flooding and landscape aesthetics.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Regular monitoring of key sensitive heritage features (such a listed bridges).
- More research is required to better understand the hydrology and role of artificial drainage on low flow river systems.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Management of river valleys should allow space for natural processes to occur. Allow rivers to meander, and exclude livestock to allow space for riverside woodland and scrub to develop in appropriate locations. This should help to control nutrient input and may reduce water temperature increases.
- Manage the whole catchment including the upper slopes to reduce run-off and increase lag-times. Create more clough woodland to reduce flood risk and erosion of valley sides.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

- The potential for new reservoirs should be raised as an issue in the review of the Local Plan for the PDNP where this supports climate change adaptation, nature recovery and effective visitor management.

Show caves and caverns

Key adaptation recommendations for show caves and caverns:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Ensure cave management plans consider need for increased ventilation, and continue to monitor levels of radon and other gasses such carbon dioxide into the future.
- Ensure planning policies are flexible and open to sympathetic adaptations for caves that do not harm historic significance.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced

- Encourage natural flood management techniques within the catchments feeding the caverns – for example allow some pasture to revert to scrub or woodland in suitable places.
- Reduce farming inputs such as fertilizers, or paper pulp into system, to improve water quality and reduce toxin build-up in caves. Livestock levels should be lowered around streams and rivers as slurry is the main contributor to nutrients in rivers. Give consideration to good management of waste to improve catchment quality, including effective slurry store management. Low nutrient feed should be encouraged. Fertiliser and pesticide inputs should also be reduced to prevent spread into the watercourse.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

- The potential for new reservoirs should be raised as an issue in the review of the Local Plan for the PDNP where this supports climate change adaptation, nature recovery and effective visitor management.

HABITATS

Blanket bog

Key adaptation recommendations for blanket bog:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Increase effort to restore hydrology and raise the water table.
- Increase effort to revegetate any remaining bare peat areas.
- Increase *Sphagnum* re-introduction, including as diverse a mix of appropriate species as possible.
- Research is needed to look into promoting the growth of bog edge woodland or scrub where appropriate, through tree establishment and natural regeneration, to reduce wind effects, provide shade and stabilise peat blanket edges.
- Cease the use of burning for heather management on blanket bog sites – but consider alternative techniques such as cutting if there is a high fuel load (e.g. bog is or has become dry heath on peat) as an interim measure until the bog is wet enough.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity.
- More research into peat pipes is needed.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify key areas to focus work on; especially those, which are likely to remain hydrologically suitable. Further study required.
- Develop visitor management plans to influence public behaviour in areas of high wildfire risk.

Heather moorland and mixed heath

Key adaptation recommendations for heather moorland and mixed heath:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Continue program of moorland rewetting.
- Identify sites within the uplands that can act as climate change refugia due to complex micro-topography, robust hydrology, and high species diversity, and manage these accordingly.
- Minimise erosion through management of access, appropriate grazing levels, and reduction of burning.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity.
- Bracken may need to be controlled through grazing and other management.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase the diversity of heather dominated areas - adapt to mixed heath.
- Maintain and enhance structural diversity within heathland vegetation, including wet heath patches, diverse age classes of dwarf shrubs, and scattered trees and scrub.
- Continue clough woodland creation/restoration to increase scrub and woodland cover within upland mosaic which will help improve habitat heterogeneity and provide refugia for sensitive plants and invertebrates.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Develop visitor management plans to reduce fire risk on areas of high wildfire risk.
- Cease the use of burning for heather management on vulnerable sites – but consider alternative techniques such as cutting.
- Strengthen footpaths and manage increased visitor access to minimise disturbance in key areas.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Adapt management intensity to changing characteristics of heather moorland – alter grazing pressure, types/breeds of livestock, and burning/cutting cycles to suit future climatic conditions.
- Consider that designated natural and cultural site features of interest may change.

Limestone grassland

Key adaptation recommendations for limestone grassland:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- There is scope for expansion of limestone grasslands onto some parts of the plateaux where limestone is close to the surface or exists as outcrops. Where expansion is limited by underlying geology, grading into continuous neutral grassland, heathland or scrub should be encouraged.
- Adapt management to avoid fertilizer inputs.
- Reduce non-climate sources of harm.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Grassland in greatest need of considering conservation options further is perhaps MG2 Jacob's-ladder grasslands.
- Restore priority areas where scrub has encroached, but maintain some scrub in the landscape.
- Work to identify the best refugia sites and ensure these are managed appropriately.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase size and connectivity of existing patches, including connectivity with other habitat types in a mosaic.
- Increase connectivity by restoring species rich grassland. This should also increase resistance to drought and increase carbon capture.
- Increase wood pasture on the plateau. Increase trees in fields and along margins to help with summer drought and forage for stock.
- Have an integrated management plan for each of the Dales in the PDNP for the different habitats within them.

Adapt land use for future conditions

These recommendations are adaptations to the way in which people use the land. Flexibility in land management - reacting to or pre-empting changes caused by the future climate - should afford this feature a better chance of persisting.

- Adapt grazing regimes to allow for more flexibility of timing and stocking density.

Accept changes to feature

These recommendations are about adapting ways of thinking to be accepting of inevitable change. While some changes may be negative, this also presents a chance to seek out any positive opportunities that may be caused by climate change.

Woodlands

Key adaptation recommendations for woodlands:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Reduce grazing pressures where possible. Recognise the importance of an integrated deer management plan for the park.
- Encourage more continuous cover forestry – to maintain higher levels of carbon storage and decrease soil losses.
- Improve protection, management and recruitment of veteran trees.
- Consider water management in woodlands predicted to experience drought.
- Further study is required to explore appropriate opportunities for woodlands to be used in local wood fuel schemes.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase diversity of tree species; especially in single species woodlands. Accept change in composition of woodlands, such as accepting species not previously native to the PDNP.
- Continue improving woodland condition – more native woodland creation, encourage regeneration to increase structural diversity, increase patch size (>2ha) to meet habitat requirements for birds and other species, increase decaying wood for replenishing soils.
- Natural woodland regeneration by excluding stock should be seen as preferable to tree establishment, with the latter principally to increase diversity - importance of scrub is underestimated.
- Convert small or unused conifer plantations to broadleaf/mixed woodlands.
- Increase establishment of field and boundary trees, particularly across the White Peak, to increase habitat diversity and connectivity, replace trees lost to Ash Dieback, enhance the landscape and provide shade and better grazing for livestock in hotter summer conditions.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Increase connectivity between woodlands to provide wildlife corridors.
- Increase woodland cover – to keep waterways cool, provide shelter for other species as temperatures increase, increase carbon storage, and improve water quality.

SQ7 - Vital benefits for millions of people that flow beyond the landscape boundary

BUILT ENVIRONMENT

Paths, tracks, and trails

Key adaptation recommendations for paths, tracks and trails:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor condition of paths, tracks and trails and reassess vulnerability on an ongoing basis.
- Invest time in developing further crowd-sourced funding for adaptation of paths, tracks and trails, fostering a sense of ownership among user groups.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Assess which specific stretches of path, track or trail are likely to be most vulnerable to climate change.
- Maintain and upgrade those areas subject to heavy usage or those likely to be most vulnerable. Understand the heritage significance of trails to factor this into decision making.

COMMUNITIES

Open access land and public access

Key adaptation recommendations for open access land and public access:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Monitor condition of paths, tracks and trails and reassess vulnerability on an ongoing basis.
- Provide funding for resilience planning. Take a proactive approach to improve path structure in a smaller way rather than waiting for a damaging event before acting.
- Invest in and encourage natural flood management across the PDNP including the restoration of upland habitats and the regeneration of large areas of woodland and scrub.
- Invest time in developing further crowd-sourced funding for adaptation of paths, tracks and trails, fostering a sense of ownership among user groups.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity. Influence visitor and behaviour management plans and practices to minimise ignition risk.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Maintain and upgrade those areas subject to heavy usage or those likely to be most vulnerable.
- Create visitor management plans for peak times and honeypot areas. Identify areas that are vulnerable to crowding and influence behavioural changes to spread out visitor impact
- Continue to foster partnerships to help manage the impacts affecting open access land.

Transport links into the PDNP

Key adaptation recommendations for transport links into the PDNP:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Review and adapt vegetation management to keep routes open.
- Incentivise reduced demand for services through behaviour change and the use of more efficient technologies.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Support changes such as enlarging drainage capacity for roads, railways and other routes to enable them to cope with increases in rainfall, and the implementation of speed limitations during times of extreme temperature.

Improve current condition to increase resilience: Increase structural diversity of the landscape to improve resilience to change

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the landscape in which the feature is found. By doing so the condition of the feature, and therefore its resilience to climate change impacts, should be enhanced.

- Identify alternative and creative ways of delivering services, for example using green spaces to aid flood management.
- Natural Flood Management in the uplands of the PDNP through habitat restoration and woodland establishment is a key adaptation to reduce the impacts of flooding on transport infrastructure.

GEOLOGY, GEOMORPHOLOGY AND SOILS

Healthy soil

Key adaptation recommendations for healthy soil:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Increase woodland and scrub creation schemes in appropriate locations to reduce run-off and replenish soil organic matter.
- Strongly discourage the removal of native woodland or trees in planning cases, and increase mitigation needed when it does occur.
- Shift perception of the landscape away from being fixed to a more dynamic system. Accept that change should happen and habitat types need to be allowed to change in some areas for a net environmental gain, where it would benefit the special qualities of the PDNP.
- Significantly reduce artificial fertiliser and pesticide use in agriculture.
- Encourage farmers to reduce ploughing or change ploughing implements and use cover crops on any arable land.
- Create and maintain diverse hedgerows and buffer strips around fields.
- Create more flower-rich meadows.
- Continue reducing bare peat areas and revegetate other bare patches on blanket bogs.
- Pilot a 'rewilding' or 'wilding' trial scheme with no fixed conservation aims and monitor the impact on soil health.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Reduce livestock levels and trampling especially in areas vulnerable to erosion.

HABITATS

Blanket bog

Key adaptation recommendations for blanket bog:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Increase effort to restore hydrology and raise the water table.
- Increase effort to revegetate any remaining bare peat areas.
- Increase *Sphagnum* re-introduction, including as diverse a mix of appropriate species as possible.
- Research is needed to look into promoting the growth of bog edge woodland or scrub where appropriate, through tree establishment and natural regeneration, to reduce wind effects, provide shade and stabilise peat blanket edges.
- Cease the use of burning for heather management on blanket bog sites – but consider alternative techniques such as cutting if there is a high fuel load (e.g. bog is or has become dry heath on peat) as an interim measure until the bog is wet enough.
- Develop fire contingency plans, and ensure management of habitats reduces fire risk e.g. rewetting and increasing species or structural diversity.
- More research into peat pipes is needed.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify key areas to focus work on; especially those, which are likely to remain hydrologically suitable. Further study required.
- Develop visitor management plans to influence public behaviour in areas of high wildfire risk.

Wet woodland

Key adaptation recommendations for wet woodland:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Map existing wet woodland habitat to assess value and content.
- Continue with sensitive woodland management.
- Continue with work on managing invasive species such as Himalayan balsam.
- Continue management of woodland along watercourses to reduce flood risk.
- Evaluate whether the introduction of beavers would be a feasible and appropriate method of delivering ecosystem service benefits such as flood mitigation, water quality and wet woodland creation.

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Identify sites for wet woodland restoration, expansion and/or creation. Care should be taken to ensure this is not at the expense of other wetland habitats that are of value. Some sites could just be scattered trees, others more dense woodland and wet scrub – smaller willows of various locally native types.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Establish trees and encourage natural regeneration to increase species diversity, structural diversity, and patch size.
- Evaluate whether there are benefits in establishing scrub to stabilise eroding edges of blanket peat, and implement if appropriate.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Increase woodland cover – to keep waterways cool and to provide shelter for other species as temperatures increase.
- Increase connectivity between woodlands to provide wildlife corridors.

Woodlands

Key adaptation recommendations for woodlands:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Reduce grazing pressures where possible. Recognise the importance of an integrated deer management plan for the park.
- Encourage more continuous cover forestry – to maintain higher levels of carbon storage and decrease soil losses.
- Improve protection, management and recruitment of veteran trees.
- Consider water management in woodlands predicted to experience drought.
- Further study is required to explore appropriate opportunities for woodlands to be used in local wood fuel schemes.
- If visitor numbers increase at easy to access locations, encourage visitors to use alternative transport such as bikes and public transport to maintain tranquillity of the area.
- Consider the impact on key views when planning adaptations.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Increase diversity of tree species; especially in single species woodlands. Accept change in composition of woodlands, such as accepting species not previously native to the PDNP.
- Continue improving woodland condition – more native woodland creation, encourage regeneration to increase structural diversity, increase patch size (>2ha) to meet habitat requirements for birds and other species, increase decaying wood for replenishing soils.
- Natural woodland regeneration by excluding stock should be seen as preferable to tree establishment, with the latter principally to increase diversity - importance of scrub is underestimated.
- Convert small or unused conifer plantations to broadleaf/mixed woodlands.
- Increase establishment of field and boundary trees, particularly across the White Peak, to increase habitat diversity and connectivity, replace trees lost to Ash Dieback, enhance the landscape and provide shade and better grazing for livestock in hotter summer conditions.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Increase connectivity between woodlands to provide wildlife corridors.
- Increase woodland cover – to keep waterways cool, provide shelter for other species as temperatures increase, increase carbon storage, and improve water quality.

WATERCOURSES, PONDS AND RESERVOIRS

Good water quality

Key adaptation recommendations for good water quality:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Carefully manage water usage, especially during the summer.
- Establishment of riparian areas to maximise vegetation cover can help to reduce nutrient and sediment load entering watercourses.
- Restoration of soils can help to improve infiltration rates and reduce run-off and the risk of erosion.
- Buffer strips to trap sediment before it reaches a watercourse should be established wherever possible.
- Continue moorland restoration work to improve water quality.
- Restoration of natural processes across the catchment will improve watercourse health and therefore resilience to change.
- Minimise agricultural inputs, especially fertilisers and pesticides. Give consideration to good management of waste to improve catchment quality, including effective slurry store management.
- Restoration of healthy soils in river catchments will increase infiltration of water and reduce runoff, thereby reducing sedimentation. Tree establishment is a known method to improve infiltration and reduce pollutant spread from runoff.
- Restoration of semi-natural vegetation on critical runoff pathways will slow the flow and reduce erosion.
- New hydroelectric power developments should not be allowed to prevent restoration of natural processes in river systems.
- Use of low nutrient livestock feeds will reduce contamination of the watercourse.
- Evaluate whether the introduction of beavers would be a feasible and appropriate method of delivering ecosystem service benefits such as flood mitigation, water quality and wet woodland creation.

Reservoirs and water management features

Key adaptation recommendations for reservoirs and water management features:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Water catchment management practices can be targeted at minimising flood risk and peak water flows. This may include increased woodland cover within the PDNP, restoration of blanket bog and sensitive farming practices, as well as drain blocking in headwater regions.
- Ensure surveyed features are included in Historic Environment Records and Selected Heritage Inventory for Natural England (SHINE) datasets.
- Nurture collaborative networks to build capacity for monitoring (e.g. volunteer groups).

Improve current condition to increase resilience: Targeted conservation efforts for important sites and at risk areas

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are conservation measures aimed at those sites that will have the biggest impact for this feature – either because they are particularly important for the feature or because they are most at risk from climate change.

- Research the most suitable adaptations for individual historic sites taking into account their situation and current use. This could include plans or physical barriers to reduce foot traffic, or physical reinforcement for the most valuable features. Care must be taken to avoid maladaptation.
- Undertake regular monitoring (including at landscape scale) of selected sites to identify those likely to be most vulnerable in terms of archaeology and ecology and to document change and help inform interventions where possible.
- Put forward key sites for scheduling.

Improve current condition to increase resilience: Increase structural diversity to improve resilience at a landscape scale

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations focus on increasing the structural diversity of the area or habitat in which the feature is found. This can help to offset the effects of climate change on the feature, as well as to allow it to be in a better position to recover from future climate changes.

- Plantation woodlands in the uplands and those surrounding reservoirs should be managed to reduce erosion and slow run-off. Structural and species diversification with native broadleaved trees should be investigated. Encourage continuous cover forestry – to maintain higher levels of carbon storage and decrease soil losses.

Rivers and streams

Key adaptation recommendations for rivers and streams:

Improve current condition to increase resilience

The current condition of a feature is an important factor alongside its sensitivity and exposure, in determining its vulnerability to climate change. These recommendations are aimed at improving the condition of the feature at present, therefore making it better able to withstand future changes to climate.

- Restoration of natural processes across the catchment will improve watercourse health and therefore resilience to change.
- Consider removal of impoundments and weirs to restore natural river flow and improve species dispersal.
- Minimise agricultural inputs, especially fertilisers and pesticides. Give consideration to good management of waste to improve catchment quality, including effective slurry store management.
- Restoration of healthy soils in river catchments will increase infiltration of water and reduce runoff, thereby reducing sedimentation. Tree establishment is a known method to improve infiltration and reduce pollutant spread from runoff.
- Restoration of semi-natural vegetation on critical runoff pathways will slow the flow and reduce erosion.
- New hydroelectric power developments should not be allowed to prevent restoration of natural processes in river systems.
- Use of low nutrient livestock feeds will reduce contamination of the watercourse.
- Block artificial drainage where possible.
- Manage invasive species, including botanical species and signal crayfish.
- Evaluate whether the introduction of beavers would be a feasible and appropriate method of delivering ecosystem service benefits such as flood mitigation, water quality and wet woodland creation.

Adaptations that could aid other features

These recommendations are changes that could be made to this feature, which will have a positive impact on the ability of other vulnerable features to withstand future climate change.

- Creation of riparian shade through tree and scrub establishment will be beneficial to freshwater habitats, and may offset some of the effects of temperature rises.