Natural England Research Report NERR054

National biodiversity climate change vulnerability model - User documentation

Annex 1

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1 Introduction

1.1 A healthy natural environment is important not only for biodiversity but for society as a whole, as our health, wellbeing and our economy is underpinned by it. Over many years the natural environment has been under pressure from changes in land use and management leading to habitat degradation and destruction. We are now facing the impacts of climate change which brings a variety of direct and indirect consequences and will exacerbate these existing pressures.

1.2 Many species and habitats are strongly influenced by factors such as temperature and rainfall and the interactions between them (Morecroft and Speakman, 2013). As our climate changes, so too will the ecological communities that form our landscapes.

1.3 In order to deliver successful conservation in a changing climate, it is important to assess the vulnerability of different species, habitats and landscapes to climate change, and to understand the factors putting them at risk. In the face of potentially large changes, and limited resources to respond, we will increasingly need to go beyond traditional approaches to conservation based on individual species or sites.

1.4 We have developed the National Biodiversity Climate Change Vulnerability Assessment Tool (NBCCV Assessment Tool) that allows us to undertake analysis of current datasets to provide an assessment of the relative vulnerability of priority habitats to climate change. This will help to assess vulnerability and target action to increase biodiversity resilience.

1.5 This document provides an introduction to the assessment to accompany the standard GIS outputs available. You should have the following suite of documents and products to enable you to use the NBCCV Assessment data:

- Natural England Research Report (NERR054) Annex 1 - National biodiversity climate change vulnerability assessment - User documentation (this document);
- NBCCV Assessment GIS data; and
- PDFs showing the NBCCV analysis for your area.

1.6 There is also a Natural England Research Report (NERR054) and a Technical Report which give further details on the technical aspects and the development of the model.

Approach

1.7 The UK Climate Impacts Programme's (UKCIP) vulnerability model of sensitivity, exposure and adaptive capacity (Willows and Connell, 2003) provides a useful framework for considering the components of climate change vulnerability. We have used this model to create a practical method to estimate relative vulnerability to inform conservation efforts. We have done this by developing the National Biodiversity Climate Change Vulnerability Assessment Tool to enable us to assess the relative vulnerability of priority habitats to climate change based on a series of parameters or 'metrics'. Key outputs are a series of maps which provide a visual representation of the relative vulnerability of priority habitats to climate change.

1.8 A few key points about the NBCCV Assessment, it:

- Is based on the UKCIP definition of vulnerability and framework for assessment.
- Assesses vulnerability of Priority Habitats in situ as they are currently distributed, providing a snapshot of the current situation based on the existing distribution and condition of priority habitats (although data can be easily updated).

- Is based on vulnerability to climate change defined in terms of a broad 'direction of travel'[1] rather than using projections from specific climate change scenarios.
- Provides a spatial representation of relative vulnerability of priority habitats based on a set of principles on biodiversity adaptation to climate change.
- Provides additional evidence on which to base action to increase resilience alongside other data such as habitat opportunity mapping.
- Provides a broad approach for targeting action within which local detail should define specific action based on local ecology and opportunities and constraints etc.

1.9 The assessment does not include species responses to climate change or model specific climate scenarios. However, the model has been designed so that such data can be readily combined and integrated.

Biodiversity climate change adaptation principles

1.10 The approach we have used to assess vulnerability is underpinned by the UK Biodiversity Partnership principles in the document '**Conserving biodiversity in a changing climate: guidance on building capacity to adapt**' (Hopkins *et al*., 2007). They provide guiding principles for adaptation action for biodiversity and they underpin the elements of this biodiversity climate change vulnerability model, they are:

1) Conserve existing biodiversity:
   - Conserve Protected Areas and other high quality habitats.
   - Conserve range and ecological variability of habitats and species.
2) Reduce sources of harm not linked to climate.
3) Develop ecologically resilient and varied landscapes:
   - Conserve and enhance local variation within sites and habitats.
   - Make space for the natural development of rivers and coasts.
4) Establish ecological networks through habitat protection, restoration and creation.
5) Make sound decisions based on analysis:
   - Thoroughly analyse causes of change.
   - Respond to changing conservation priorities.
6) Integrate adaptation and mitigation measures into conservation management, planning and practice.

[1] Direction of travel – instead of using a specific climate change projection from the **UK Climate Projections 2009** (UKCP09), we have used the key message that summers will get hotter and drier overall and winters will get warmer and wetter overall. We have used the UKCP09 projections - 2050s, medium emissions scenario, 50% probability - to help us think about how habitats will be affected.

2 Methodology

2.1 Following the framework provided by UKCIP's vulnerability model, the assessment has been broken down into stages, in which each component of vulnerability is considered separately before these are combined into an overall assessment. The process can be summarised as follows:

1) **Identify biodiversity assets:** in this case priority habitats.
2) **Sensitivity:** assess the sensitivity of the assets identified in stage 1 to climatic change.
3) **Adaptive Capacity:** assess the capacity of assets to adapt to climate change and consider the influence that additional sources of harm, not attributable to climate change, may have on their adaptive capacity.
4) **Vulnerability:** combine the assessments made in stages 1 to 3 to derive an overall assessment of relative vulnerability to climate change.
5) **Conservation Value:** the Conservation Value of the assets under the current designated site mechanisms can be used to help prioritise actions.

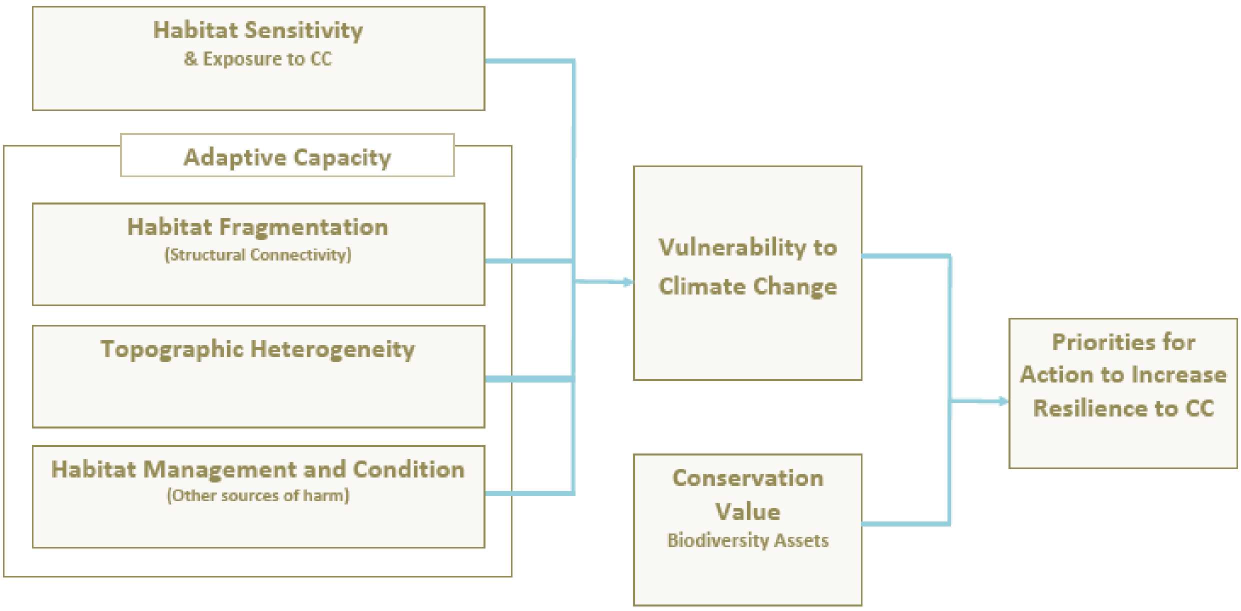


Figure 1 Flow diagram illustrating the components and process of the NBCCVM

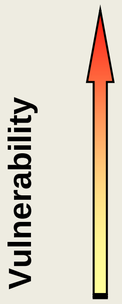
The GIS model

2.2 We have used a GIS grid model to undertake the spatial analysis required to inform the climate change vulnerability assessment. The relevant datasets have been generalised to 200m x 200m grid squares providing the framework for analysis (for more detail see the Natural England Research Report (NERR054) and the Technical Report). This GIS grid approach provides the flexibility to analyse the data contributing to the four stages of the model (Sensitivity, Adaptive Capacity, Conservation Value and Overall Vulnerability) separately, to analyse these stages for all priority habitats or for individual habitats, and to aggregate the data to other scales or geographies, for example, Local Authority or National Character Area boundaries. The size of the grid, 200m x 200m, was chosen because it provides a fine grained approach that can produce good data at a local level and can provide a strategic overview of biodiversity climate change vulnerability at a strategic level.

Climate change vulnerability metrics

2.3 The following section introduces each metric individually with a one page description then describes the Overall Vulnerability Assessment.

Climate Change Sensitivity metric



High: At risk from particular threats such as sea level rise, particularly high sensitivity to hydrological changes on top of a wide range of changes from all climate change variables. Significant loss of extent/increase in unfavourable condition by 2050 (scores high sensitivity in the model).

Med: Largely includes habitats at risk from hydrological changes alongside a wide range of changes from all climate change variables. Some loss of extent or increase in unfavourable condition by 2050, climate change affects part of range or sub-types (scores medium sensitivity in the model).

Low: At risk from the broad range of changes from all climate change variables (scores low sensitivity in the model).

Figure 2 An overview of the sensitivity of habitats showing that a higher Sensitivity metric classification contributes to a greater level of vulnerability in the assessment

2.4 Inclusion rationale - The sensitivity of a habitat to the range of potential impacts from climate change will contribute to its Overall Vulnerability.

2.5 Calculation - The classifications for habitat sensitivity to climate change are predominantly based on England Biodiversity Strategy classifications of risk of direct impact (Mitchell *et al*., 2007), with Natural England habitat specialist expert opinion filling any gaps. A 'direction of travel'[2] approach (for example, hotter and drier summers) has been used to frame our thinking on sensitivity. Each square is scored as to whether it contains the following.

Table 1 Scoring for the Sensitivity metric

Vulnerability description	Score displayed in data
Priority habitats with high sensitivity classification	3
Priority habitats with medium sensitivity classification	2
Priority habitats with low sensitivity classification	1

[2] Direction of travel – instead of using a specific climate change projection from the **UK Climate Projections 2009** (UKCP09), we have used the key message that summers will get hotter and drier overall and winters will get warmer and wetter overall. We have used the UKCP09 projections - 2050s, medium emissions scenario, 50% probability - to help us think about how habitats will be affected.

Table 2 The climate change Sensitivity classifications for each habitat

Habitat	NBCCVM classification	England Biodiversity Strategy classification (Mitchell *et al.*, 2007)
Coastal Grazing Marsh	H	H (combined floodplain and coastal)
Coastal Saltmarsh	H	H
Lowland Raised Bog	H	Not in Mitchell *et al*., classification
Maritime Cliff and Slope	H	H
Montane	H	H
Saline Lagoons	H	H
Standing Water	H	H
Upland Hay Meadows	H	Not in Mitchell *et al*., classification
Floodplain Grazing Marsh	M	H (combined floodplain and coastal)
Purple Moor Grass and Rush Pasture	M	M
Coastal Vegetated Shingle	M	M
Lowland Meadows (wet)	M	M
Reedbeds	M	Not in Mitchell *et al*., classification
Blanket Bog	M	Not in Mitchell *et al*., classification
Coastal Sand Dunes	M	M
Lowland Fen	M	Not in Mitchell *et al*., classification
Upland Fens and Flushes	M	Not in Mitchell *et al*., classification
Lowland Heathland	M	M
Rivers	M	M
Upland Heathland	M	M
Intertidal Mudflats	M	L
Limestone Pavements	L	Not in Mitchell *et al*., classification
Lowland Meadows (Dry)	L	L
Deciduous Woodland	L	Not in Mitchell *et al*., classification (they used separate classes for different woodland types)
Lowland Calcareous Grassland	L	L
Lowland Dry Acid Grassland	L	L
Upland Calcareous Grassland	L	Not in Mitchell *et al*., classification

Habitat Fragmentation metric

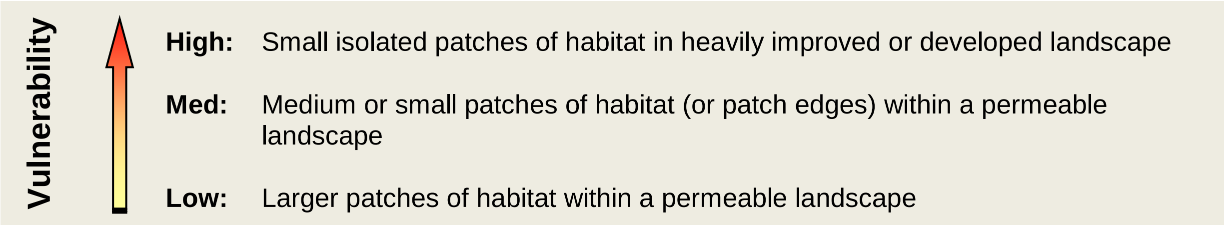


Figure 3 An overview of the Habitat Fragmentation metric, showing the general principle that as the fragmentation of habitats increases, vulnerability to climate change increases

2.6 Inclusion rationale - Larger patches support larger populations which are more resilient to extinction during extreme climatic events such as droughts and floods. They can also accommodate a wider range of soil types and topographical variations in microclimate, increasing the probability of species being able to persist in localised pockets of suitable conditions. More and better connected patches may contribute to the possibility of species dispersal into new areas and may also allow re-colonisation following local extinctions.

2.7 Calculation - The Habitat Fragmentation metric is calculated from two component metrics: the *Habitat Aggregation metric* and the *Land Cover Matrix metric*.

Habitat Aggregation metric

2.8 For each priority habitat, grid squares containing the habitat are identified. For each grid square the metric is determined by the quantity and proximity of same type of habitat in the surrounding 1km square as illustrated in the example below.

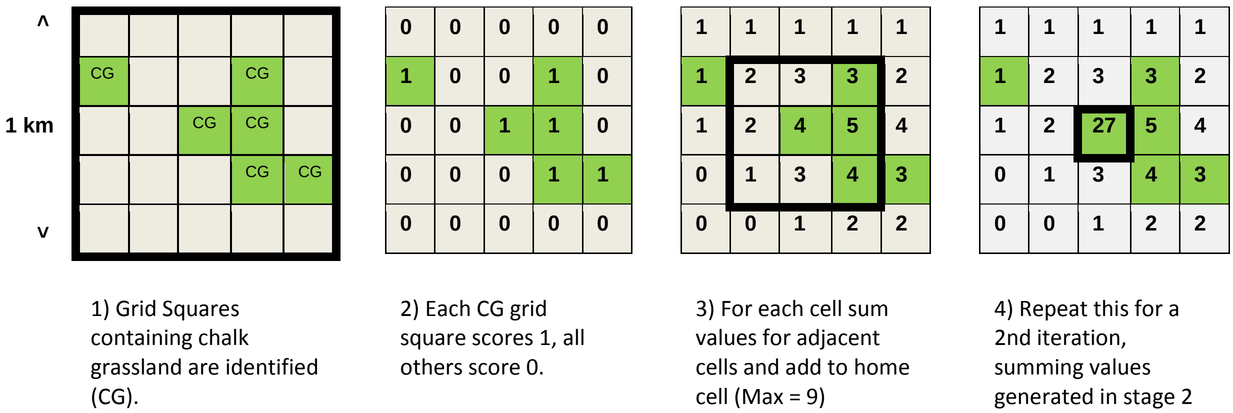


Figure 4 A diagrammatic representation of the model used to assess habitat aggregation and land cover matrix

2.9 In the example above the central chalk grassland square has three chalk grassland squares adjacent to it and two more in the wider 1km square. The more closely the central square is surrounded by squares containing the same habitat the higher it scores.

Land Cover Matrix metric

2.10 For each grid square the metric is determined by the proximity of any priority habitat or other 'permeable' land[3] in the surrounding 1km square using the same approach as illustrated for the habitat aggregation metric above.

2.11 The fragmentation metric is generated by combining the Habitat Aggregation and Land Cover Matrix component values. Each square is scored as follows.

Table 3 Scoring for the Fragmentation metric

Vulnerability description	Score displayed in data
High fragmentation	3 (top of range from 1-3)
Low fragmentation	1 (bottom of range 1-3)

Topographic Heterogeneity metric

Vulnerability

High: Little variation in either height or aspect in the habitat or surrounding landscape.

Med: Some variation in height and/or aspect in the habitat and/or surrounding landscape.

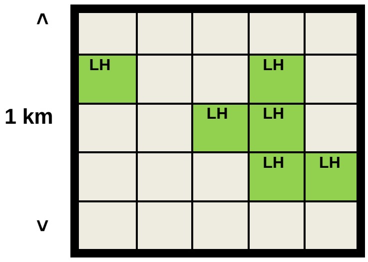
Low: Wide variation in both height and aspect over the habitat and surrounding landscape.

Figure 5 An overview of the Topographic Heterogeneity metric, showing the general principle that as the variation in topography of habitats decreases, vulnerability to climate change increases

2.12 Inclusion rationale - Heterogeneity in height and aspect provides topographical variations in microclimate which increase the probability of species being able to persist in localised pockets of suitable conditions. A higher variation in both height and aspect in an area suggests lower vulnerability.

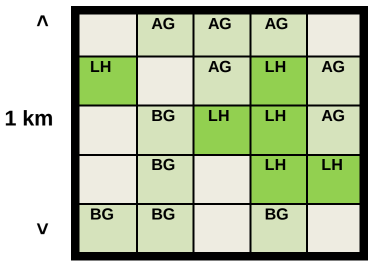
2.13 Calculation - The Topography Heterogeneity metric is calculated from four component metrics: Habitat Aggregation Height Variance, Land Cover Matrix Height Variance, Habitat Aggregation Aspect Variance and Land Cover Matrix Aspect Variance.

Habitat Aggregation Height Variance (HAHV)



For each 200m grid square containing priority habitat, the variance in height (standard deviation of the variation) is calculated across all squares containing the same type of priority habitat in the surrounding 1 km square. In this example that means the central square will be scored with the height variance over the squares that contain lowland heathland (green squares).

Land Cover Matrix Height Variance (LCMHV)



For each 200m grid square containing priority habitat, the variance in height (standard deviation of the variation) is calculated across all squares containing priority habitat or other permeable land in the surrounding 1 km square. In this example that means the central square will be scored with the height variance over the squares that contain all priority habitats and permeable land (both light and dark green squares).

Habitat Aggregation Aspect Variance (HAAV) is calculated in a similar way to Habitat Height Variance above. For the aspect data, directional variance of the range of aspects present was calculated.

Land Cover Matrix Aspect Variance (LCMAV) is calculated in a similar way to Land Cover Matrix Height Variance above. For the aspect data, directional variance of the range of aspects present was calculated.

2.14 The Topographic Heterogeneity metric is then calculated by combining the 4 component metrics. Each square is scored as follows.

Table 4 Scoring for the Topographic Heterogeneity metric

Vulnerability description	Score displayed in data
Low range of topography	3 (top of range from 1-3)
High range of topography	1 (bottom of range from 1-3)

Management and Condition metric

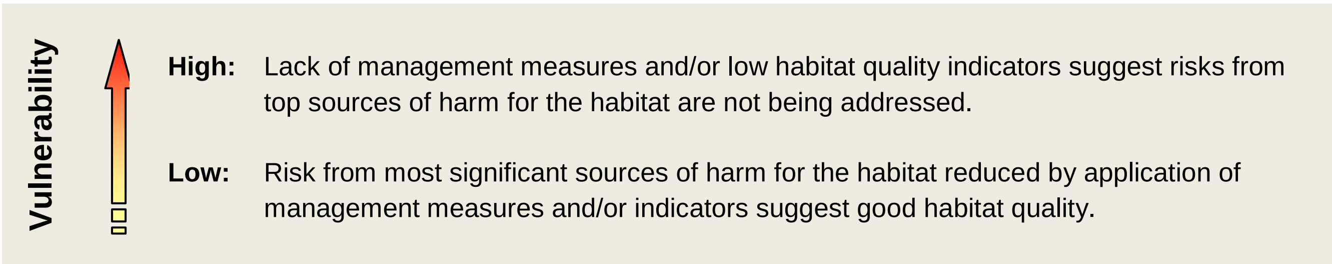


Figure 7 An overview of the Management and Condition metric, showing the general principle that as the condition of habitats decreases, vulnerability to climate change increases

2.15 Inclusion rationale - UK Biodiversity Partnership and England Biodiversity Strategy biodiversity climate change adaptation principles (Hopkins *et al*., 2007, Smithers *et al*., 2008) both recommend reducing current sources of harm to habitats that are not linked to climate change. The assumption is that where the most significant impacts are wholly or partially mitigated, the habitat's resilience to climate change is enhanced.

2.16 Calculation - The most significant sources of harm were identified for each habitat based on expert opinion and 'Adverse Condition Reasons' from SSSI condition reports. A set of Management and Condition indicators were then identified which would suggest mitigation of the identified sources of harm for each habitat (see Table 6). Resilience was considered to be enhanced only where management was in place to mitigate all sources of harm identified for the habitat. Where this condition was met for habitat(s) within a grid square the Management and Condition metric was scored as "Yes", where this was not the case it was scored "No".

Table 5 Scoring for the Management and Condition metric

Vulnerability description	Score displayed in data
Doesn't meet management criteria	3
Meets management criteria	1

Table 6 The habitat condition measures or indicators for each habitat

Habitats	Mitigation of sources of harm At least one of the conditions which = Y must be met			Evidence of good condition All conditions which = Y must be met	
	HLS options	WGS	Designated sites (SSSIs favourable or recovering)	Good water quality	Good water supply
Rivers	Y	_	Y	Y	Y
Standing water	Y	_	Y	Y	Y
Deciduous woodland	Y	Y	Y	_	_
Lowland calcareous grassland	Y	_	Y	_	_
Upland calcareous grassland	Y	_	Y	_	_
Lowland dry acid grassland	Y	_	Y	_	_
Dry lowland meadows	Y	_	Y	_	_
Upland hay meadows	Y	_	Y	_	_
Floodplain grazing marsh	Y	_	Y	_	Y
Wet lowland meadows	Y	_	Y	_	Y
Lowland heathland	Y	_	Y	_	_
Upland heathland	Y	_	Y	_	_
Montane	Y	_	Y	_	_
Lowland fen	Y	_	Y	_	Y
Upland fens and flushes	Y	_	Y	_	Y
Purple moor grass and rush pasture	Y	_	Y	_	Y
Lowland raised bog	Y	_	Y	_	Y
Blanket bog	Y	_	Y	_	_
Reedbeds	Y	_	Y	_	Y
Limestone pavements	Y	_	Y	_	_
Coastal grazing marsh	Y	_	Y	Y	_
Coastal saltmarsh	Y	_	Y	Y	_
Coastal sand dunes	Y	_	Y	_	_
Coastal vegetated shingle	Y	_	Y	_	_
Intertidal mudflats	_	_	Y	Y	_
Maritime cliff and slopes	Y	_	Y	_	_
Saline lagoons	_	_	Y	Y	_

Conservation Value metric

Conservation Value

International designation:	Priority habitat or ancient woodland within Natura 2000 (N2K) or Ramsar sites*
National designation:	Priority habitat or ancient woodland within Sites of Special Scientific Interest (SSSI)
Priority habitat only:	Priority habitat outside of designated sites

*Natura 2000 (N2K) sites are Special Areas of Conservation (SACs) which are designated under the EC Habitats Directive and Special Protection Areas (SPAs) which are designated under the EC Birds Directive. Ramsar sites are wetlands on international importance designated under the Ramsar Convention.

Figure 8 An overview of the use of Conservation Value within the model, showing that when included the higher the Conservation Value potentially the greater the priority for action given their importance to the habitat network, their legal status and their important characteristics

2.17 Inclusion rationale - Climate change will lead to some species moving from sites they currently occupy, leading to changes in habitats and species composition. However, the sites that are currently good for wildlife are likely to continue to be good in the future. This is due to characteristics such as low soil fertility and variation in hydrology, soils, geology and landform (Grime *et al.,* 1973, Lawton *et al*., 2010).

2.18 The UK Biodiversity Partnership principles and the England Biodiversity Strategy biodiversity climate change adaptation principles (Hopkins *et al*., 2007, Smithers *et al*., 2008) both advise the conservation of existing biodiversity including protected areas and high quality habitat and the range and variability of habitats and species. Protected areas and other high quality habitats currently support the full range of England's biodiversity (Lawton *et al*., 2010) and will therefore form the basis of future biodiversity. This does not mean preserving current biodiversity exactly as it is, but does support increasing resilience and accommodating change at sites currently valuable for conservation.

2.19 This metric was calculated for each priority habitat by scoring each square as to whether it contains priority habitat alone, SSSI or N2K sites. The exception to this method was the Deciduous Woodland habitat that used presence of Ancient Woodland Inventory habitat in place of SSSI sites. This is because many SSSIs and Natura 2000 sites contain deciduous woodland that is not contributing to the designated value of the site.

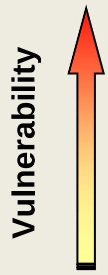
2.20 Calculation - Each square is scored as to whether it contains the following.

Table 7 Scoring for the Conservation Value metric

Vulnerability description	Score displayed in data
Priority habitat or ancient woodland within Natura 2000 or Ramsar sites	3
Priority habitat or ancient woodland within Sites of Special Scientific Interest (SSSIs)	2
Priority habitat outside of designations	1

2.21 In reality, the Conservation Value of an area does not affect its vulnerability. But it is an important consideration in prioritisation and targeting of action to build resilience to climate change so it is included in the model.

Overall Vulnerability



High	Coloured red, these areas have been assessed as having highly sensitive habitats with low adaptive capacity.
Medium	Coloured orange, these areas could have a greater range of scores, for example, the squares could have been assessed as having medium sensitivity and medium adaptive capacity or potentially low sensitivity but also low adaptive capacity.
Low	Coloured light orange, these areas have been assessed as having low sensitivity habitats and high adaptive capacity.

Figure 9 An overview of the Overall Vulnerability calculation, showing the general principles that confer climate change vulnerability and the colours used to represent them in the map illustrations

2.22 Rationale - In order to identify where habitats are most vulnerable due to a range of different issues, we combine the metrics to give an Overall Vulnerability score. This is because a grid square that scores badly across many of the metrics will be more vulnerable than one that scores badly across only one.

2.23 For this assessment the scores produced by the metrics for 4 components – Sensitivity, Habitat Fragmentation, Topographic Heterogeneity and Management and Condition - were combined to give an overall climate change vulnerability score for each 200m grid square. We currently have no evidence to show that any one metric will be more significant than any other, so an equal weighting was applied to each. If, as we progress our understanding, one or more factors emerge as having greater influence it is possible to adapt the assessment by applying an appropriate relative weighting to reflect this. Each metric can also be used independently through the NBCCV Assessment Tool, this flexibility means that the model can provide a range of outputs using any combination and weighting of the metrics. The Conservation Value metric can be used to consider prioritisation and targeting of action to build resilience to climate change.

2.24 Calculation - The results of the metrics included in the assessment were added together to create a picture of relative Overall Vulnerability of priority habitats to climate change. Each square is scored as follows.

Table 8 Scoring for the Overall Vulnerability Assessment

Vulnerability description	Score displayed in data
Low vulnerability	3 (top of range from 1-3)
High vulnerability	1 (bottom of range 1-3)

2.25 Where there is more than one habitat in a grid square, the most vulnerable habitat is used to generate the scores. Here is an example output from the model.

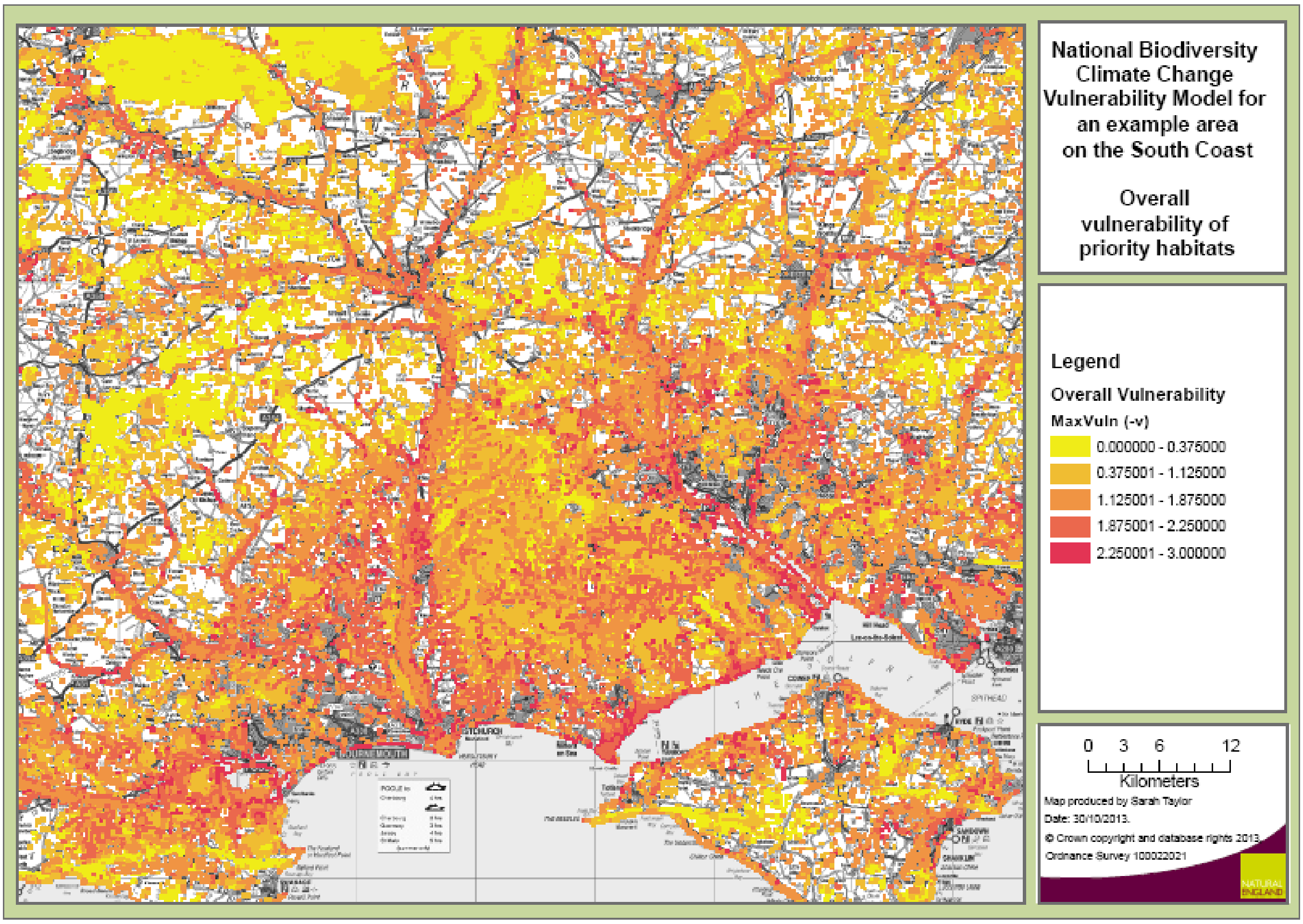


Figure 10 A map showing the Overall Vulnerability Assessment results for an area on the South Coast of England

Available outputs

2.26 The following list describes the basic GIS outputs currently available:

1) Individual metrics:
   - Habitat Sensitivity
   - Habitat Fragmentation
   - Topographic Heterogeneity
   - Management and Condition
   - Conservation Value
2) Overall Vulnerability (adding the sensitivity, fragmentation, topography and management metric results together).
3) Overall Vulnerability plus Conservation Value (adding all 5 of the above metric results together).

2.27 For a technical explanation of how the model was produced please see the Technical Report.

3 Products and uses

3.1 Using the results of the vulnerability assessment we can develop products to inform decisions on local priorities and help target resources. For example, at a strategic level we can use the Overall Vulnerability results to highlight areas that have relatively high vulnerability. We can then use some of the individual metric results to investigate why that is the case and target appropriate action to build resilience. This may be particularly useful when we are looking at the adaptive capacity metrics. For example, we can produce different combinations of metrics to help us to identify areas with high Habitat Fragmentation or low management scores that could be targeted for improved management or action to reduce fragmentation.

3.2 In this way, the model can help us highlight where to start delivering the priorities highlighted through other reports, for example, the '**Making Space for Nature**' review (Lawton *et al*., 2010). This review concludes that England does not currently have a coherent ecological network and suggests a number of approaches to address this, these are neatly summarised in the report as *More*, *Bigger*, *Better* and *Joined*. We can use the model to help us decide where we prioritise action that would help address these priorities.

Integrated uses

3.3 The outputs of this model are designed to be considered as an addition to your current evidence base, used alongside the wealth of local data, knowledge and experience you already have. The outputs from the NBCCV Assessment will add to your current suite of evidence and help to inform decisions in the same way you use existing data. For example, this data can be used alongside other targeting approaches, such as biodiversity opportunity mapping, to further prioritise action and enhance decision making exercises.

3.4 As an example of how to use the data, we carried out an exercise to highlight the grid squares that have either high or medium scores for Habitat Fragmentation or low Management and Condition scores that fall within the South East England Biodiversity Forum's Biodiversity Opportunity Areas. The resulting map highlighted areas that are vulnerable to climate change but where there is potential to implement adaptation action for increasing habitat management or connectivity. Using the Biodiversity Opportunity Areas highlights where the greatest potential opportunities for action exist. This highlights the way in which two parts of the evidence base used for targeting action can be brought together.

3.5 We have trialled the use of the vulnerability data with a range of partners, for example Local Authorities and Nature Improvement Area partnerships. Through this trialling a range of uses for the data has been suggested, for example:

- Contributing to the evidence base for spatial planning, for example, Local Plans and green infrastructure strategies.
- Contributing to the evidence base for protected landscape management plans.
- Planning conservation action within Nature Improvement Areas and monitoring progress. For example, the fragmentation metric can be used as an indicator of progress in increasing connectivity in an area over a given time period, as the data can be updated on a regular basis and fragmentation scores can be compared.
- Local Nature Partnerships can use the data to plan action and identify priority areas for landscape scale conservation action, for example, local NIAs.
- Contributing to the evidence base used to target land management agreement priorities.

National Biodiversity Climate Change Vulnerability Assessment Tool (NBCCV Assessment Tool)

3.6 We have developed the GIS based NBCCV Assessment Tool to allow us to carry out the vulnerability assessment regularly and make changes when the latest evidence suggests we should. The development of the tool enables a great deal of flexibility in the production of assessments and the production of outputs. The following highlights some of this capability.

Some of the flexibility provided by the Biodiversity Vulnerability Assessment Tool

- The habitat data used to form the basis of the assessment can be changed, for example, national inventories can be updated and local habitat data can be used if it is more detailed than the national inventories used in this assessment. A sub-set of habitats can also be chosen to run the analysis on.
- The data used in the all metrics can also be changed.
- All metrics and sub-metrics are currently equally weighted in their contribution to the Overall Vulnerability output, they can all be weighted differently using the Assessment Tool.
- Outputs can be created to represent any combination of the metrics and sub-metrics. For example if you wanted to look at the results using the fragmentation and sensitivity metrics only, you could exclude the other metrics from the analysis.
- The tool can create datasets to allow habitat creation and management scenario testing. These scenarios may be based on actual opportunities on the ground or explore the range of potential opportunities and can help to evaluate the best resilience building options for a given location.
- The vulnerability assessment can be generated at different grid sizes, for example, $200m^2$, $100m^2$ and $50m^2$.
- The metric classifications for Habitat Sensitivity, Management and Condition and Conservation Value can be changed, for example, the sensitivity classification (high/medium/low) for each habitat can be changed if new evidence emerges.

3.7 For a full list of model capabilities please see the Natural England Research Report (NERR054) and the Technical Report.

GIS capacity

3.8 The national data from the model along with copies of the maps can be provided for your local area but to make the best use of the data you will need to have some GIS capability within your organisation or partnership. In order to use the NBCCV Assessment Tool to utilise some of the flexibility described above a greater GIS capacity will be required. Contact us if you need to discuss technical GIS capabilities.

Strengths and limitations

3.9 The following tables highlight some of the strengths and limitations of the assessment as highlighted by our trial partners. The limitations of this assessment, need to be taken in to account when using the data, as when using all data.

Table 9 Assessment strengths

It provides additional objective evidence that can provide a decision support tool for users.
The national scale, use of established principles and use of nationally verified data, gives credibility to the outputs.
The ability to alter the assessment, by tweaking metrics or using local datasets, to suit local requirements and conditions is an advantage.
The broad range of familiar datasets included in the assessment adds strength to the outputs.
The quality of visual outputs is particularly good.

Table 10 Assessment limitations

Limitations	Actions to address limitations
The main limitation of the assessment identified through a testing period is the quality of datasets. Including concerns about the accuracy of national scale habitat data, the availability of desirable datasets or, cross boundary issues.	This can be addressed by using more accurate local datasets to run the assessment and updating the national data used in the national products as it is refined. However, all datasets have limitations and these should be considered when using assessments and data.
The use of priority habitats as a focus makes sense for many partners, but it does not for all. For example, in some urban areas where there is little priority habitat. In these areas, other habitats such as those identified in green infrastructure strategies can be of high importance and these habitats could also be vulnerable to the impacts of climate change.	This limitation can be overcome at a local level if GIS data on other land cover and/or green infrastructure exists. Consideration as to whether the overall approach used by the assessment applies to these land use types (for example, if all of the metrics would apply to these land uses in the same way) and, if it is applicable, local decisions would need to be made for some of the parameters, for example, the relative sensitivity classifications for each land cover type.
The classifications used within the assessment, for example, the nationally applied relative sensitivity classifications, might not reflect local issues.	It is possible to re-run the assessment using local data, and change classifications within metrics such as habitat sensitivity or habitat condition to reflect local conditions and using single habitat relative vulnerability outputs. As with the above, local decisions would need to be made for some of the parameters.

3.10 It must be remembered that all datasets and automated assessment approaches have limitations and inaccuracies and this must be considered when using any dataset. However, when we are planning climate change adaptation it is important to use the best available data now, in the absence of the perfect data, as action on climate change cannot wait until we have all possible data available. This is why decisions that provide win-wins and low-regrets actions and adaptive management approaches are important. It doesn't mean that current data is not useful, but it does mean that local knowledge and expertise provides invaluable refinement and should be part of the decision and planning process alongside data when prioritising action.

4 References

GRIME, J. P. 1973. Competitive exclusion in herbaceous vegetation. Nature, 242: 242-347.

HOPKINS J.J., ALLISON H.M., WALMSLEY C.A., GAYWOOD M., THURGATE G. 2007. Conserving Biodiversity in a changing climate: guidance on building capacity to adapt. Defra, London.

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC). 2007. 'Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 976pp.

LAWTON, J.H., BROTHERTON, P.N.M., BROWN, V.K., ELPHICK, C., FITTER, A.H., FORSHAW, J., HADDOW, R.W., HILBORNE, S., LEAFE, R.N., MACE, G.M., SOUTHGATE, M.P., SUTHERLAND, W.J., TEW, T.E., VARLEY, J., & WYNNE, G.R. 2010. Making Space for Nature: a review of England's wildlife sites and ecological network. Report to Defra.

MITCHELL, R.J., MORECROFT, M.D., ACREMAN, M., CRICK, H.Q.P., FROST, M., HARLEY, M., MACLEAN, I.M.D., MOUNTFORD, O., PIPER, J., PARR, T.W., PONTIER, H., REHFISCH, M.M., ROSS, L.C., SMITHERS, R.J., STOTT, A., WALMSLEY, C.A., WATT, A.D., WATTS, O. AND WILSON E. 2007. 'England Biodiversity Strategy - towards adaptation to climate change'. Final report to Defra for contract CRO327.

MORECROFT, M. AND SPEAKMAN, L (eds.). 2013. Terrestrial Biodiversity Climate Change Impacts Summary Report. Living With Environmental Change.

SMITHERS, R.J., COWAN, C., HARLEY, M., HOPKINS, J.J., PONTIER, H. AND WATTS, O. 2008. England biodiversity strategy climate change adaptation principles: conserving biodiversity in a Changing climate, Defra, London.

WALTERS, C. 1997. Challenges in adaptive management of riparian and coastal ecosystems. Conservation Ecology [online]1(2):1. **www.consecol.org/vol1/iss2/art1/** [Accessed January 2014].

WILLOWS, R.I. AND CONNELL, R.K. (eds.). 2003. Climate adaptation: risk, uncertainty and decision making. UKCIP Technical Report, UK Climate Impacts Programme, Oxford.

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