Powys Replacement Local Development Plan (LDP) 2022-2037

Green Infrastructure Assessment

Appendix B: Powys Nature Recovery Action Plan Mapping Methodology

August 2024

Powys

The below has been supplied by the Biodiversity Information Service for Powys & Brecon Beacons National Park

Powys Nature Recovery Action Plan Mapping Methodology

Resilient Ecological Networks

In 2016/17 Environment Systems was commissioned on behalf of the Powys Nature Partnership (PNP) to review the Powys Local Biodiversity Action Plan written in 2002. As part of this process they undertook habitat network analysis for Powys excluding Brecon Beacons National Park, for grassland; woodland; wetland and heathland. A full explanation of the methodology extracted from the draft General Action Plan (GAP) can be seen below.

Introduction

The application of the ecosystem approach to local biodiversity action planning provides a scalable method to assess how habitat type, condition and extent contributes to biodiversity parameters (e.g. relativity and naturalness, connectivity and diversity). By baselining and monitoring habitat parameters, it is possible to identify key vulnerabilities within a landscape and opportunities to improve resilience through targeted management plans; protecting, restoring, creating and enhancing priority habitats and species.

Connectivity is a key biodiversity parameter of ecosystems, enabling abiotic, genetic and species pathways between habitats. This increases the capacity of a system to adjust to changes, both localised (e.g. urban development) and systemic (e.g. climate change), dependent on the scale of connectivity.

Therefore, by assessing the biodiversity value of habitats to ecological networks, it is possible to identify means of aligning priority habitat and species management plans, to address wider structural challenges in biodiversity resilience as well as identifying tradeoffs with wider socio-economic development goals.

Methods for spatially analysing habitat distribution and connectivity have developed to help provide the evidence needed to manage ecosystem resilience. This PNRAP used the Spatial Evidence for Natural Capital Evaluation (SENCE) toolkit for preparing opportunities to create more resilient ecosystems and habitats throughout Powys.

The SENCE toolkit aims to identify and use the most suitable, existing and modelled data for analysis. The methodology reflects possible data limitations by using an expert rule base, where datasets are evaluated in terms of both the knowledge about the habitat and ecosystem under consideration and the knowledge about the data used. The PNRAP makes use of the SENCE Habitat Asset Register and Resilient Ecological Networks.

To the south of the Brecon Beacons National Park (BBNP) is Ystradgynlais. Connectivity analysis with available data at the scale is likely to lead to inaccurate permeability scores which could lead to mis-understanding during data interpretation and management. The concepts of connectivity analysis can be applied to the Ystradgynlais area but this will have to be applied on a site by site basis until the Powys and BBNP can be brought together.

Habitat Asset Register

The Habitat Asset Register (HAR) is a tool which conflates a number of habitat datasets with discrete polygons to create the best available overall habitat map at the time of analysis. This is necessary to provide spatially explicit data on which to model ecological networks.

The data conflation is largely based on available data from Natural Resources Wales fused Phase 1 Habitat Survey. This provides the base level of habitat data entering the HAR. More recent and/or more detailed survey data was also available to the preparation of the PNRAP. These included:

- Abergwesyn Phase 1 Habitat Survey 2003 & 2009[1]
- Phase 2 surveys[2] for:
    - Grassland mosaics
    - Grasslands
    - Woodlands
    - Lowland Heathland
    - Peatland
    - Saltmarsh
- Ordnance Survey MasterMap for urban features[3]

During processing, more recent/detailed data was set to overwrite the data from layers with a lower priority, e.g. the layers with older/less detailed data. For example, a polygon might be referred to as “Broadleaved woodland” in the Phase 1 Habitat Survey, but the Phase 2 Woodland Survey provides a more detailed data layer based on the National Vegetation Community classification which enables an understanding of the structure of the woodland. This value is then retained for the HAR. The breakdown of coverage by data source is shown in Table 1.

On completion of the HAR the data was used to provide a baseline on which to spatially map the Resilient Ecological Networks of Powys. A copy of the HAR data is held by the Biodiversity Information Service (BIS) for Powys & Brecon Beacons National Park.

Table 1: Breakdown of habitat data sources for the Habitat Asset Register

Data source	Area Coverage	Percentage Coverage
NRW Phase 1 Habitat Map	400,839 ha	94%
Phase 2 Surveys	2,369 ha	1%
Abergwesyn surveys	6,931 ha	2%
OS MasterMap	445 ha	4%

Data Limitations

Within the Phase 1 Habitat Survey data approximately 1.9km2 was delivered with ‘no habitat data’. When reviewed, these polygons were small slivers spread throughout Powys. Given the small size of the polygons with no data it is unlikely that they have affected the Resilient Ecological Network analysis. These polygons were given a neutral score in the network analysis.

[1] Provided by the National Trust
[2] Provided under Open Government License by Natural Resources Wales
[3] Provided under the Public Sector Mapping Agreement via contractor link from Powys County Council

Habitat Networks

What are habitat networks?

Habitat networks consist of core and supporting habitats. Core habitats are areas of semi-natural vegetation, such as broadleaved woodland, which are large enough to support resilient species populations. They provide sufficient ecological niches for a population to maintain genetic diversity and, therefore, are able to adapt to change. At the edge of these core habitats conditions are harsher for many of the specialist species, due to the ingress of, for example, fertilizer from surrounding fields. For less specialist species, however, genetic diversity can still be maintained, if the fringe or suboptimal habitats provide conditions that allow the species to travel from one core habitat to another. This is often facilitated by patches of habitat of the same type as the core habitat, but too small to maintain a viable population of the species in the long term. These are often known as stepping stones between the core habitats. The combination of stepping stones and permeable habitats forms the supporting habitats. This combination of core and supporting habitats is referred to as an ecological network (Figure 1).

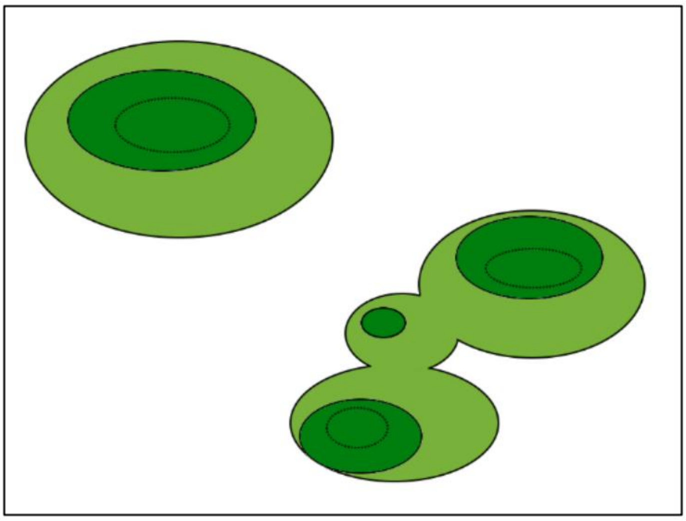

Figure 1: Schematic representation of an ecological network, with core habitat shown in dark, and supporting habitat in light green. Black outlined areas within core habitats show the areas were extreme specialist species can be found.

In order to suggest the extent of the network pseudospecies are often used (Watts *et al.*, 2010). A pseudospecies for the purposes of habitat network analysis is described as a species which is reliant on the core habitat in question, but able to move from patch to patch. In Figure 1, dark green areas are the core habitats. Areas encircled in black show areas free of edge effect, where true specialist species can thrive; how far the edge effects reaches into the core habitat depends on the adjacent land use. Light green areas are supporting habitats that more generalist species could travel through. How far they can travel depends on the type of habitats, with some types of land cover forming active barriers to species movement (e.g., one side of the bottom block of core habitat). In the example shown, species could move between the two bottom blocks of core habitat using the supporting habitats and one stepping stone. The top core habitat is not presently connected to the adjacent blocks. As shown in the example, this type of network analysis allows the functional network to be described, which will be relevant to most of the species of interest. In addition, the network can be regarded as the best place to re-instate habitats. This is because seed bank, relevant pollinator species and soil microbial communities are all near enough to move into the newly established habitat and create a functioning community in a relatively timely manner. An additional factor are limitations to where habitats are unsuitable for management intervention, e.g. areas that are already under regulated management or sites with bio-physical properties that do not allow for a specific habitat to be (re-)established. These factors are taken into account when creating opportunity maps, which show where management action benefitting a specific network could be taken.

Habitat network analysis for Powys was carried out for grassland; woodland; wetland and heathland. In addition to the individual network and network opportunity maps combined layers have been created for this project. The combined stock layer can help to identify current biodiversity hotspots, as species associated with different types of habitats co-occur at these sites.

Similarly, the combined opportunity map identifies locations with opportunities for more than one network. This can facilitate management intervention in one location enhancing more than one network, even though in some cases it might not be possible to address both opportunities in a manner that benefits both networks.

How the ecological networks are calculated

All analysis is based on the HAR created for this project (**see section 'Habitat Asset Register'**). In order to calculate the networks, the habitats were initially scored into core and non-core habitats. The non-core habitats were then given a permeability score, expressing how difficult it is for a species associated with the core habitats to move through them. For example, a species mainly associated with broadleaved woodland could disperse through an area of scrub and scattered trees much more easily than through an urban area or arable farmland; the permeability score would represent this. To calculate the total supporting area, a cost-distance model is used. This model represents the concept that the more permeable the supporting habitat, the farther the species will be able to disperse through to get from one patch of core habitat to another.

Patches scored as 'core' can either be true core habitat or stepping stones. To distinguish between them, the total area of the patch of 'core' is calculated; if this exceeds the minimum viable patch size for the habitat (Table 2) the area is true core habitat.

The combined network map counts the number of networks any area contributes to, either through core or supporting habitats. The set-up of the GIS processing allows tracing back to the type of network present in an area, and whether the area contains core or supporting habitats for this network.

Table 2: Minimum viable patch sizes for core habitat

Ecological Network	Minimum viable patch size used
Grassland	1 ha
Woodland	2 ha
Wetland	0.5 ha
Heathland	1 ha

Ecological network opportunity mapping

To identify areas well connected to existing seedbanks, the extent of the existing network is used; opportunities falling inside the existing networks could allow for establishment of additional core habitat. As not all types of habitat are suitable for management intervention, all habitats present throughout Powys have been scored with regards to whether or not one would want to consider modifying this habitat or creation of new habitat for each of the respective networks (grassland, woodland, wetland, or heathland). Generally, it is not considered suitable to change one high value habitat to another, which is why any habitat that is 'core' for at least one of the networks under consideration is removed from the analysis. The combination of opportunity habitats and extent of existing network forms the intermediate GIS opportunity layer. This intermediate step distinguishes between opportunities inside and outside of the existing network. Special cases are opportunities adjacent to current core habitat and stepping stones; the very close proximity to existing core habitat will facilitate easy habitat restoration and the increase in size of these patches will strongly enhance the network in question.

The intermediate data are then modified, with further unsuitable areas being excluded. For all networks, areas already under management relevant designated sites (e.g. SSSIs, RAMSARs, NNRs, etc.) were not regarded as opportunities, as management in these areas is already regulated. With the specific need to prepare a Habitat Action Plan for Fridd and Scrub as part of this project, a Fridd Map was created from HAR. Network specific opportunity rules are then applied to refine the intervention locations as follows:

Grassland

For the grassland opportunities, no additional areas were excluded.

Woodland

Woodland species depend strongly on patches of core habitat being of sufficient size in order to be able to utilise them. Therefore, opportunities limited to patches of less than 2 ha were excluded, as they will not strengthen the existing network in a way benefitting most species utilising the network.

Wetland

Wetland can only be restored on sites with sufficient moisture, which is why all opportunities not within 150m of water courses or existing wetlands were considered invalid. The only exception to this rule are areas that used to contain wetland in the past, as conditions on these sites are likely to allow for wetland to be re-instated.

Heathland

Heathland creation / restoration is limited by biophysical requirements. Therefore, only opportunities on elevations higher than 400m and on slope less than 3° were considered. The only exception to this rule are areas that used to contain heathland, as conditions on these sites are likely to allow for heathland to be re-instated.

Indicators of habitat fragmentation

Identifying and determining indicators of habitat fragmentation can provide an important link between concepts and principles of landscape ecology and natural resource management. The consequences of habitat fragmentation are generally well understood (Collinge, 1996) and disruption of continuous habitat usually results in changes to core habitat boundary edges which affects plant and animal communities present. The area of individual habitat patches can also be attributed to influencing ecological processes occurring therein. These ecological processes can affect more than just the genetic diversity of species but also the ability of semi-natural vegetation to help improve our natural resources such as water quality, soil condition, climate regulation, etc. In addition to just mapping habitat networks the existing patch size for each network was also calculated.

Patch size is an indicator of fragmentation as a decrease can be related to shrinkage of habitats, which could result in increasing edge effects and loss of habitat cores and stepping stones (Roche and Giejzendorffer, 2013). The resulting effect of a decrease in patch size is very likely to result in a reduction in biodiversity (Lindenmeyer and Franklin, 2002). The patch size per network has been calculated using statistics from the outputs of the Resilient Ecological Networks maps. This is reported in Table 3 and can be used as a new reporting measure in future reviews of the PNRAP and LBAP monitoring.

More indicators are possible such as habitat patch density, mean patch shape index and habitat richness density which help to describe using statistics the current state or condition of landscape habitats throughout Powys.

Table 3: Calculated habitat patch sizes for each ecological network

Ecological Network	Largest core habitat patch	Mean core habitat patch size	Core habitat standard deviation	Mean stepping stone patch size	Stepping Stone standard deviation
Grassland	3772.61 ha	12.15 ha	±89.43 ha	0.12 ha	±0.21 ha
Woodland	94.69 ha	6.57 ha	±7.12 ha	0.14 ha	±0.29 ha
Wetland	4253.23 ha	11.07 ha	±120.51 ha	0.07 ha	±0.10 ha
Heathland	1261.23 ha	22.47 ha	±83.98 ha	0.14 ha	±0.21 ha