Chapter 2: Natural Capital Baseline Assessment: Mapping for Nature Recovery

Introduction

Natural capital

Natural capital is "the stock of renewable and non-renewable natural resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people"[1].

Understanding where semi-natural habitats are located is of key importance, as these places are high in biodiversity, support nature recovery and provide multiple other ecosystem services. For example, understanding how farmed land relates to the urban landscape is key to understanding how rural areas currently help mitigate problems such as flooding, poor water quality and carbon loss. Conversely, understanding where semi-natural habitats are not present, but could be restored, will help mitigate and prevent such problems.

For natural capital accounting it is important to distinguish between the natural capital stocks and the flows of benefits they provide; projecting benefits into the future and linking them to the extent and condition of assets. The intention is to ensure that decisions prioritise maintaining the assets to sustain a range of benefits, and not to maximise one of the benefits at the expense of others, or the natural capital asset itself.

Nature Recovery Network (NRN)

The Nature Recovery Network (NRN) is a major commitment in the Government's 25 Year Environment Plan that brings together partners, legislation and funding to restore and enhance the natural environment. It seeks a national joined-up network of marine, water and terrestrial habitats where nature and people can thrive. More than a map, it is an active, adaptive spatial plan that identifies the best opportunities to deliver nature's recovery. The NRN helps deal with the challenges of biodiversity loss, climate change and human wellbeing, and establishing the NRN will:

- enhance sites designated for nature conservation and other wildlife-rich places - newly created and restored wildlife-rich habitats, corridors and stepping stones will help wildlife populations to grow and move
- improve the landscape's resilience to climate change, providing natural solutions to sequester or store carbon and manage flood risk, and sustaining vital ecosystems such as improved soil, clean water and clean air
- reinforce the natural, geological and cultural diversity of our landscapes, and protect our historic natural environment

[1] Natural Capital Protocol *https://naturalcapitalcoalition.org/natural-capital-protocol/*

- enable us to enjoy and connect with nature where we live, work and play - benefiting our health and wellbeing

Local Nature Recovery Strategies

To deliver the NRN there is a requirement for mapping and data and this involves Local Nature Recovery Strategies (LNRS) to effectively target action and investment in nature. LNRS are a new mandatory system of spatial strategies for nature established by the Environment Act 2021. They are designed as tools to encourage more coordinated practical and focused action and investment in nature and will link to funding streams, policy and statutory duties that will incentivise the restoration and creation of habitats and help deliver the NRN through collaboration and partnership working.

Mapping for the Local Nature Recovery Strategy

The mapping of habitats, ecological networks and opportunities for biodiversity in Derbyshire provide the evidence base for the county natural capital strategy, and provides the baseline for the LNRS.

Creating a habitat map of Derbyshire

In order to map and quantify the natural capital assets and provide data to inform the natural capital baseline accounts, a habitat map is needed for the whole of Derbyshire. This habitat map can be maintained as a 'living map': an excellent resource to build upon and keep updating as new survey data becomes available, and restoration projects are established.

Choice of classification system for the habitat map

Many counties have data from a variety of habitat and land use surveys, conducted over many years, and that use differing classification systems. A single classification system was needed for a countywide analysis. To facilitate this, the construction of the habitat map used the UK Habitat Classification (UKHab) as a land classification system. In addition, other data from several sources was used. The UKHab is a framework that enables data from differing habitat classifications to be brought together and translated to a single system. By combining data from multiple sources, the mapping provides a more accurate and complete estimate of the coverage of land and habitat types to include in the Asset Register.

The relevant top tier UKHab classification used includes cropland, grassland, heathland and shrub, rivers and lakes, sparsely vegetated land, urban, wetland and woodland. A full overview of the habitat classifications used in this account is provided in Appendix 1.

UKHab is a nested system, which means that habitat analysis can be disaggregated if higher detail is required. The use of UKHab also facilitates links to datasets with more or fewer categories, including those used in other parts of the region (e.g., mapping of natural capital in the DCC area), at a national scale (e.g., the Broad Habitats used by the Natural Capital Committee), and to other assessment frameworks (e.g., the Defra biodiversity metric).

Creating the habitat map of Derbyshire

A full list of datasets used to produce the habitat map is provided in Appendix 2; the key input datasets are:

- Amenity and urban greenspace data (Chesterfield, Derby)
- Ordnance Survey MasterMap
- Derbyshire Wildlife Trust habitat data (e.g. open mosaic habitats (OMH), ponds, lowland lakes)
- Natural England - Priority Habitat Inventory data
- Peak District National Park Authority (PDNPA) - Priority Habitat data
- National Trust - Phase 1 habitat data
- Defra - Annex 1 habitat data
- Other habitat inventories: traditional orchards, National Forest Inventory, Ancient Woodland Inventory
- Rural Payments Agency – CROME (Crop Map of England)
- Earth observation (EO) imagery: LiDAR, Sentinel-1 and Sentinel-2 data

An extensive consultation exercise was undertaken to review the habitat map and receive stakeholder feedback to ensure that as much detail as possible was captured for both urban and rural areas. This was compiled through the design and build of a private website where stakeholders could log in to mark corrections and upload photos, maps and other data.

The input habitat datasets utilised a range of classification systems with differing survey dates which were each translated into UKHab notation at Level 2 classification. These were then summarised to derive an overarching Level 1 classification (see Appendix 3) with fewer classes.

The habitat map was generated by combining all available existing habitat data. However, once combined, there were still gaps in coverage. To address this, UKHab Level 1 habitats were mapped for these locations using Sentinel-2 satellite imagery (from 2021).

The datasets were then merged to form a seamless habitat dataset for Derbyshire. This was done in a way that gave priority to certain datasets, so the final version of the habitat map utilises the most up to date information for each area (Figure 3). Where there were data conflicts, a judgement was made of which dataset should be used depending on the land category and data quality assessment.

Air photo analysis was used to quality assure the resulting outputs, concentrating on classes with less certainty. For example, areas identified as improved, intensely managed grassland in the urban areas, were checked and reclassified as playing fields or other green space as appropriate.

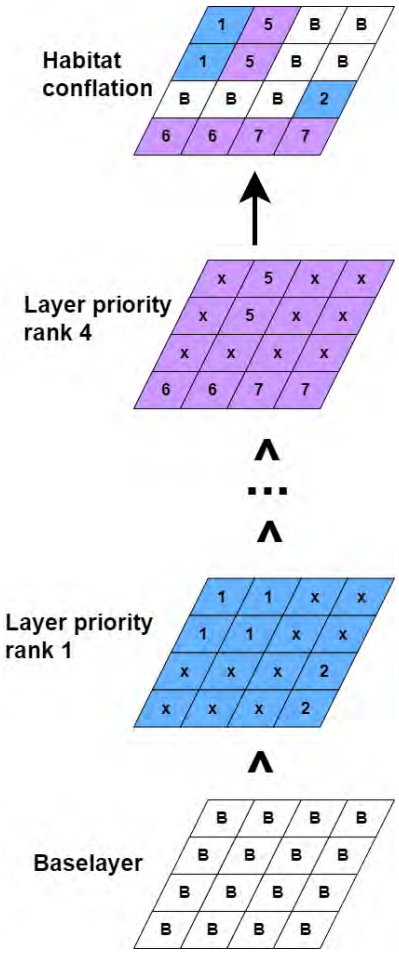

Figure 3: Merging data to create the habitat map

No existing datasets mapping hedgerows were available to the project. Hedgerows are important habitats that have a profound influence on ecosystem service delivery in Derbyshire, and as such an inability to factor the presence (and absence) of hedgerows into the analyses would be a significant limitation. Hedgerows, which support biodiversity, help intercept water, contribute to carbon storage and abatement and, in the correct places, can have a significant effect on water quality and flood management.

In the absence of existing data, a hedgerow map was created using the available EO datasets. LiDAR, which records the height of features in the landscape, was available for some areas outside the uplands and was used to map hedgerows. In the uplands, in the absence of LiDAR data, a combination of satellite image classification, followed by aerial imagery processing (which helped exclude walls and tracks) was also used to classify and map hedgerows. The mapping of hedgerows in the uplands is therefore less accurate than the lowland areas mapped using LiDAR.

In some areas there are very dense networks of hedgerows as illustrated in Figure 4.

Figure 4: Extract of habitat map showing hedgerow and woodland classes

The habitat map of Derbyshire

The Level 1 habitat map classification is shown in Figure 5. In this map it can be seen that heath (purple) and wetland (pink) dominate the upland environments in northern parts of the county. Woodlands (dark green) are located on the sides of steep linear valleys in the uplands, and typically alongside water bodies and rivers (blue) in the lower lying areas. There also some larger blocks of woodlands and parklands, for example in the larger estates. Arable land (orange) is located more to the east and south of the county, and the eastern areas are more urbanised. Hedgerows are a feature of the agricultural land in southern and eastern areas. In the county-scale map hedgerows and stone walls are coloued mid-green, although a larger-scale map is needed to fully identify these narrow features (e.g Figure 4).

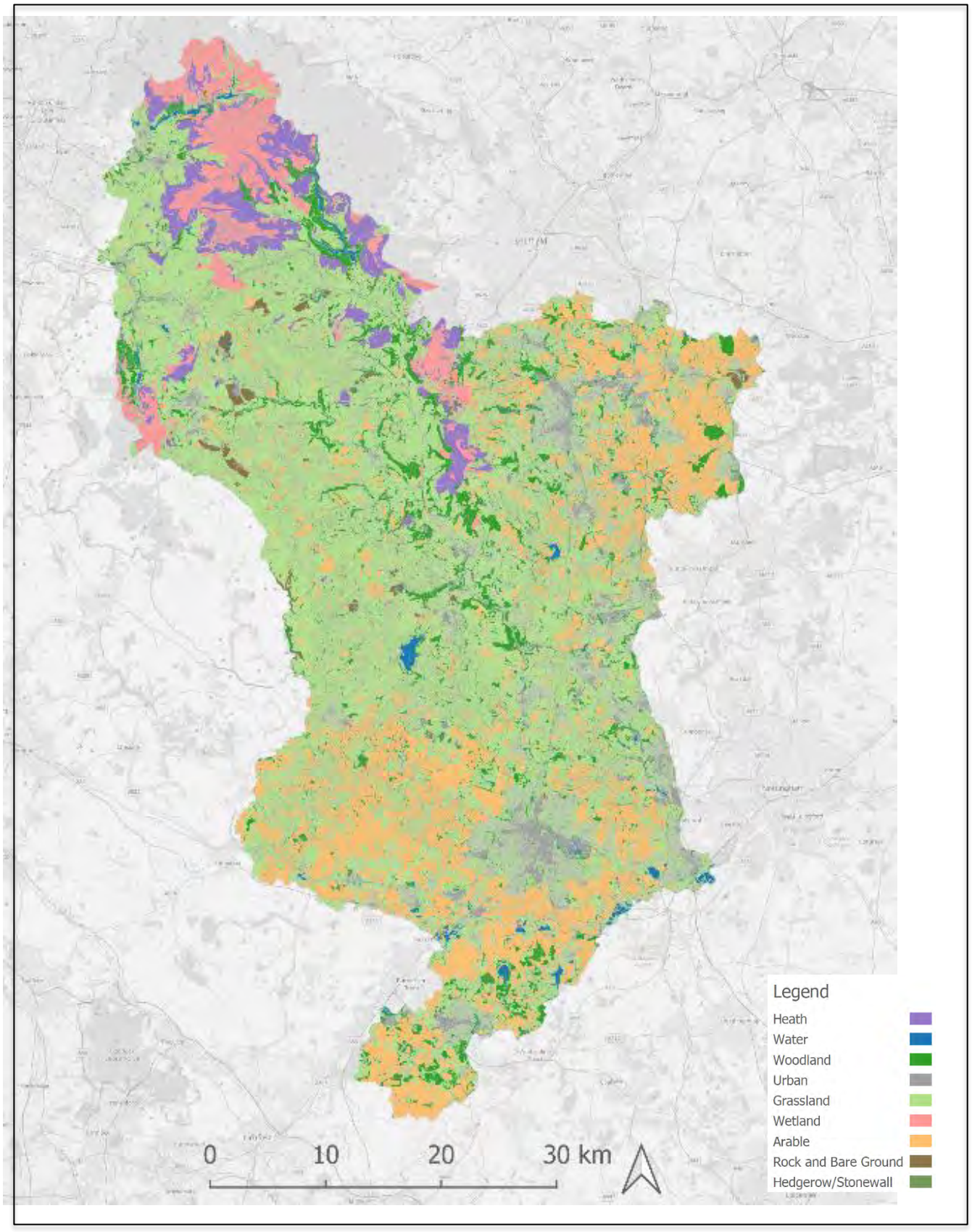

Figure 5: Habitat map showing Level 1 classification

Baseline ecological networks

Ecological networks describe how well individual habitat patches are connected across the landscape. The closer patches of habitats are together, the better they are able to share resources such as pollinators, and seeds. Where habitats are close enough to share these resources, an ecological network is formed. These networks are significant as they increase the resilience of the habitats within them. For example, a woodland patch that is damaged by a storm will have a better chance of regenerating to its former level of biodiversity if it lies within a network of other woodlands, as animals and seeds will be able to disperse from neighbouring patches to recolonise the damaged area. Conversely, habitat patches that are isolated will be less able to regenerate to the same habitat type, or level of diversity. Networks are important as restoring habitats within the overall network generally protects the existing resource, whilst also allowing a more robust habitat to form which provides better ecosystem services overall.

Ecological networks were mapped for four habitat types: woodland, wetland, heathland and grassland. Connectivity was modelled using a cost-distance approach, using the comprehensive Derbyshire habitat map.

In the cost-distance approach larger blocks of habitats are recognised as being more resilient and able to sustain viable populations of species, and therefore are classed as 'core habitats'. Smaller habitat areas are classed as stepping stones. An animal might use the small isolated area of habitat (stepping stone) to pass through or forage in, but the stepping stone is too small to provide all of the resources the animal needs to make its permanent home there; for this, an area of core habitat is needed.

All habitats and land cover types in the habitat map were considered in terms of how easy or difficult it would be for a typical grassland / heathland / wetland / woodland species to move through and forage within; each habitat type is assigned a movement cost. Core habitats were assigned a movement cost of 0, meaning that the associated species can easily exist in these patches. The cost value increases for habitats that are more difficult for species to traverse, with intensively managed agricultural land or urban areas normally having the highest cost values.

Woodland ecological network

The woodland network is shown in Figure 6 and includes ancient woodlands, broadleaved woodlands and mixed plantation woodlands. Core woodland habitat is located predominately in central and north-eastern areas of Derbyshire. There is generally high connectivity of woodlands throughout Derbyshire except in areas that are managed intensively for agriculture; a very strong woodland network follows the Derwent and Wye valleys, from the upper catchments to the valley bottom. Hedgerows form a very important part of the woodland network in the Needwood & South Derbyshire Claylands region, and south of Chesterfield, and are particularly important for connecting the many smaller woodland core habitat patches. There is a high abundance of small, highly fragmented woodland patches in the Trent Valley Washlands region, and northern Melbourne Parklands, where hedgerows are less common; in these areas the woodland network is not functioning well. There are large areas of core woodland habitat in the

Mease/Sense Lowlands region, that are relatively poorly connected at present; this area lies within the National Forest boundary.

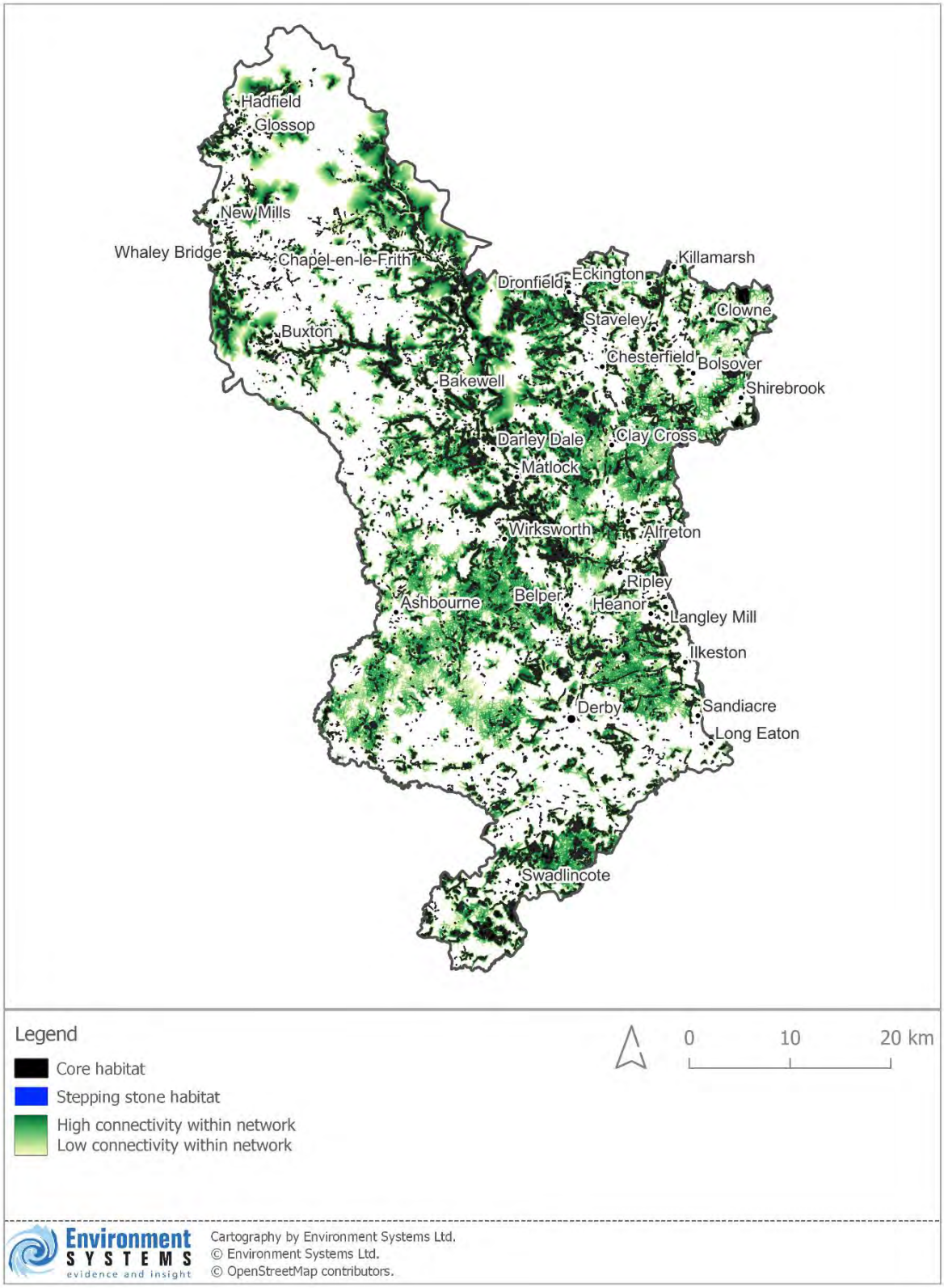

Figure 6: Woodland network

Heath ecological network

Heath is more difficult to re-establish than woodland as the heather forms a relationship with mycorrhizal fungi in the soil which helps heather germinate and grow. Heath networks therefore need an existing heath very closely associated with them or propagules with soil will need to be transported from a donor site. The heath network in Derbyshire is associated with the uplands and is mostly located within the Peak District National Park and the upland parts of the Peak Fringe & Lower Derwent region (Figure 7).

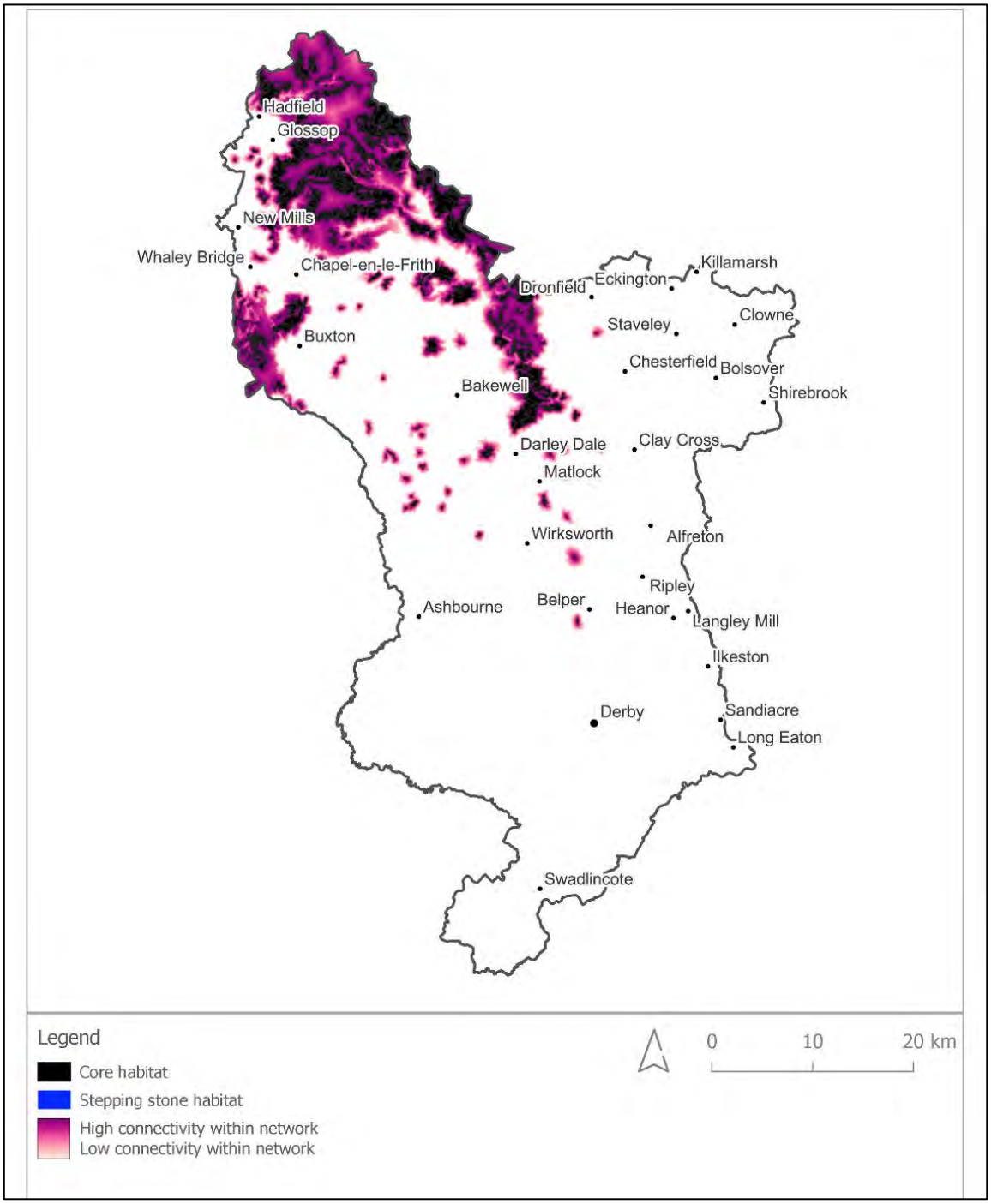

Figure 7: Heath network

Wetland ecological network

The wetland network is determined by the rivers and lakes, as well as occurring on extensive areas of blanket bog in the uplands of the Peak District National Park, and the upland parts of the Peak Fringe & Lower Derwent region; areas that also feature strongly in the heath network (Figure 7).

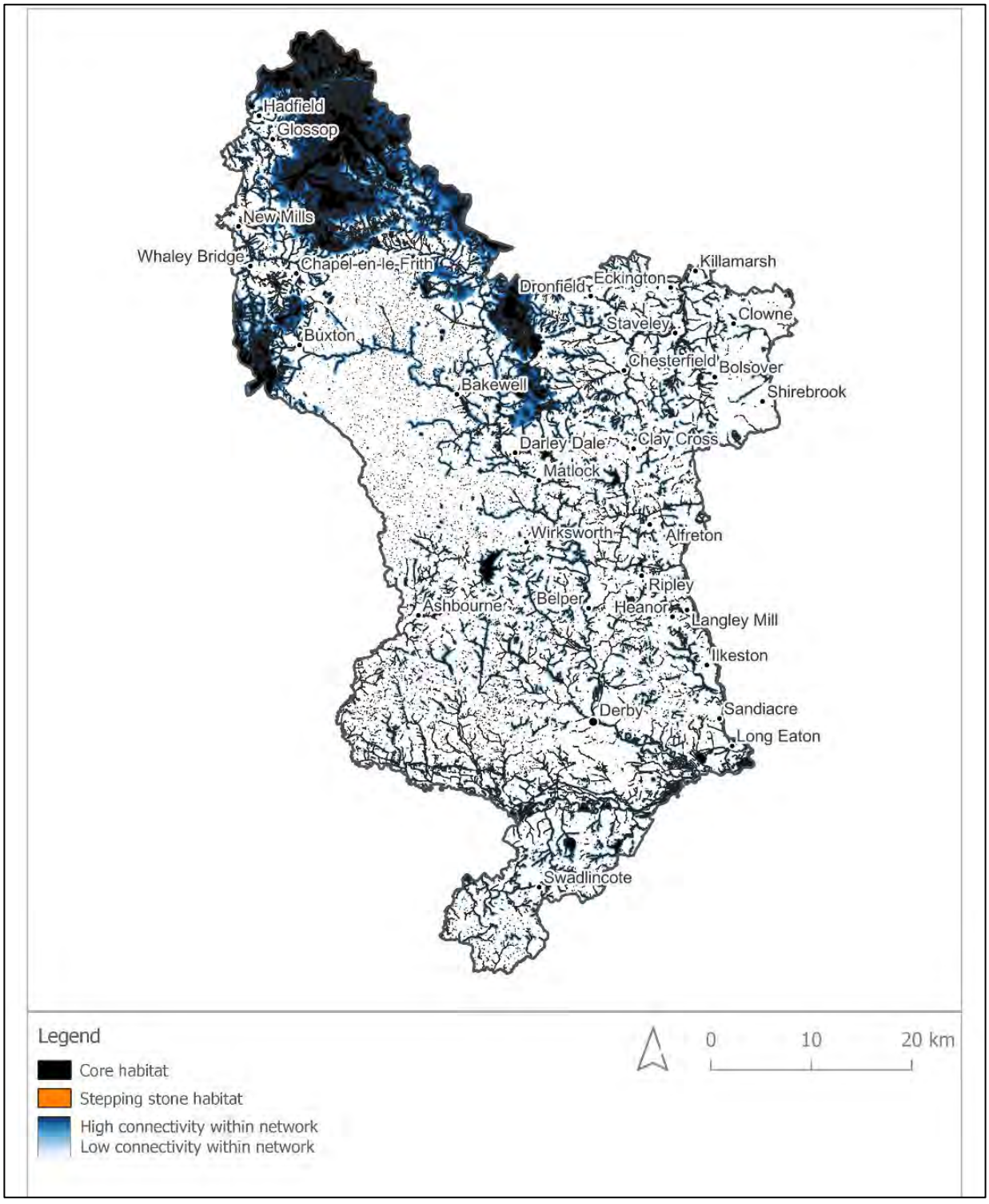

Figure 8: Wetland network

Species-rich grassland ecological network

There are several types of natural grassland in Derbyshire; the limestone grassland located on the White Peak, is of particular importance, but neutral grassland and hay meadows are also frequently found throughout Derbyshire (Figure 9). There is a large number of highly fragmented grassland habitat patches within the Needwood & South Derbyshire Claylands, and Peak Fringe & Lower Derwent regions; the grassland network is not currently working well in these areas, and these core habitat patches are likely to be less resilient/more vulnerable to pressures as a result.

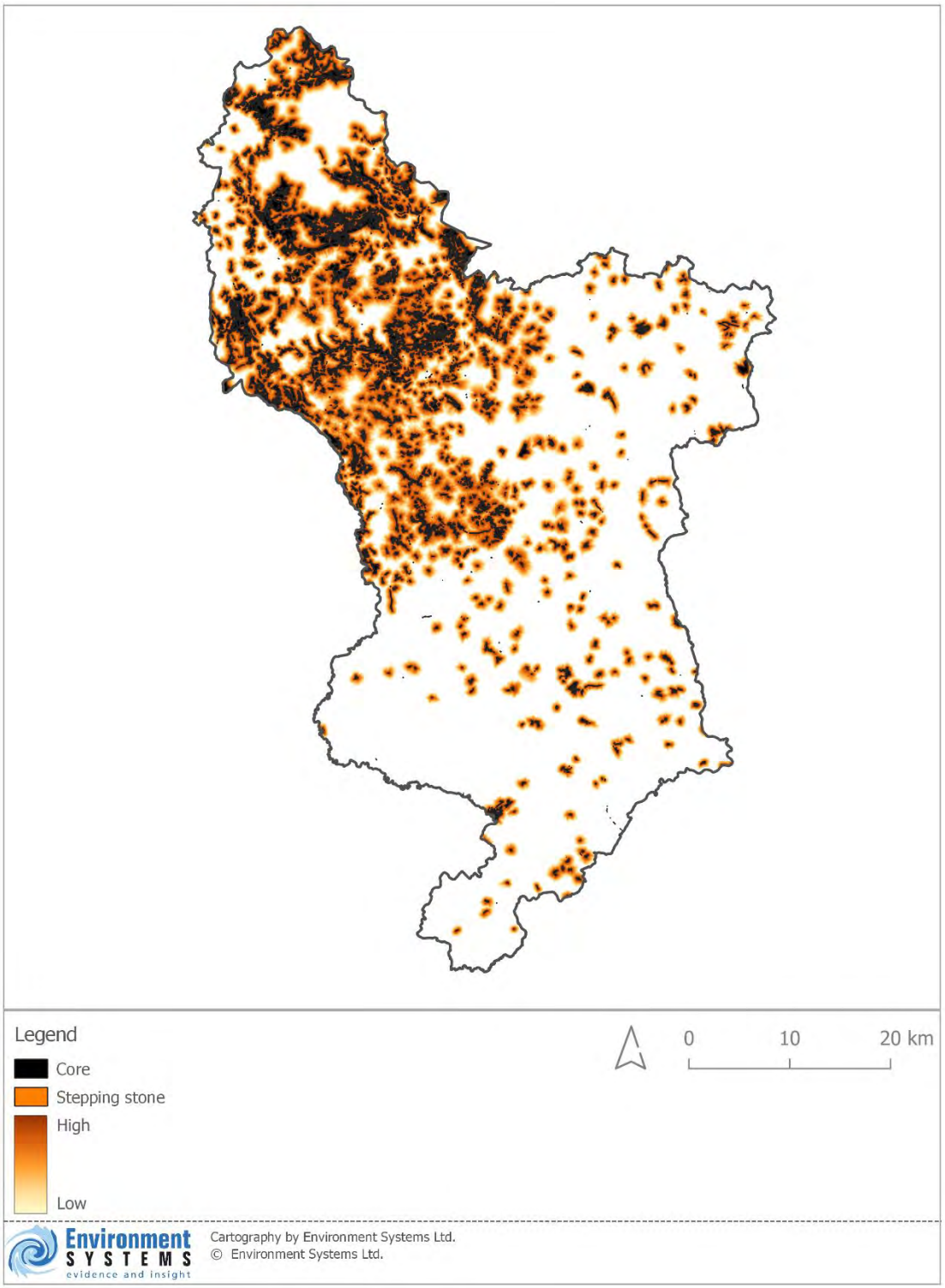

Figure 9: Natural grassland network

Opportunities for biodiversity restoration

The success of habitat restoration projects depends on the selection of appropriate sites, and the ecological networks form an important part of this decision-making process; restoration areas located within an existing ecological network will serve to enhance the resilience of the existing network and core habitat patches, while also increasing the chances of success at the restoration site, as a site located within an ecological network will benefit from species dispersal from the surrounding areas. Therefore, ecological networks will be a key component of the overall natural capital strategy.

Habitat Condition

It is important to understand the condition of habitats as this affects the delivery of ecosystem services, and what kind of opportunities exist for nature recovery. The natural capital asset register (Chapter 2: Natural Capital Baseline Assessment: Mapping for Nature Recovery) incorporates data on current habitat condition; both the extent and condition of habitat assets form the basis of the benefits assessment, which combine these data with unit value and other context data.

The Derbyshire habitat map provides information on habitat extent, and this directly feeds into the natural capital asset register. The habitat map also provides information on current habitat condition (for example the location of priority habitats, and areas of degraded habitats), that is incorporated into the asset register. Additional datasets were sourced to further describe habitat condition in the asset register.

Examples of datasets representing indicators of condition, that were utilised in this work include; land use types (habitat map), recreational land (parks), open access land, and statutory and local site designations such as Sites of Special Scientific Interest (SSSI), Ancient Woodland, Country Parks, Local Nature Reserves and National Nature Reserves; and existing monitoring and condition data (e.g. SSSI condition monitoring data, Water Framework Directive status, and flood zone areas).

Habitat condition is not a static attribute, and regular monitoring is required to maintain an accurate picture of biodiversity and wider ecosystem service analyses, and for natural capital accounting. Habitat condition is influenced by soil and vegetation management practices both locally and in the wider catchment, as well as pollution, the spread of invasive non-native species, and climatic conditions. Climate change is a significant emerging threat to habitat condition due to range shifts in ecological niches, and the frequency and magnitude of extreme events such as drought, flooding and storms[2].

Summary

A habitat map has been created for the whole of Derbyshire to inform the natural capital baseline accounts and is the foundation for ecosystem service analysis, the identification of opportunities and the formulation of natural capital strategy. The maps of ecological networks are key environmental information for modelling opportunities to enhance biodiversity and inform the LNRS. A new dataset of hedgerows has been specifically created to support the natural capital strategy. The coverage

[2] UK Climate Change Risk Assessment 2022. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf

and level of detail that these maps provide gives Derbyshire County Council a particularly good start on designing local nature recovery projects.

Derbyshire currently has a very strong woodland network following the Derwent and Wye valleys, with large blocks of well-connected core habitats. Where hedgerows occur these greatly enhance woodland connectivity, and are particularly important for connecting the numerous smaller core habitat patches. The National Forest provides an opportunity to improve connectivity of large blocks of core woodland habitat that are currently poorly-connected in the Mease/Sense Lowlands region.

Mapping existing ecological networks is fundamental step before targeting habitat restoration and creation activities. Much greater biodiversity resilience can be created by focusing activity on sites that are within the existing networks. Habitat restoration can still be undertaken outside the existing networks, but the habitats and species they support are likely to be less resilient to pressures and disturbances. This means they will not serve to protect and enhance the existing biodiversity assets and therefore, in purely biodiversity terms they may be considered to represent a lower return on investment.

However, habitat restoration outside the ecological networks may be valuable in terms of increasing the delivery of other ecosystem services; for example, a site may not enhance the local biodiversity resilience a great deal but could lead to great improvements in the level of surface water runoff regulation, and therefore be considered a viable, value-for-money project. For this reason, a broad view must be taken, to consider the full range of ecosystem services that could be enhanced by taking action in a specific location, and to consider who/what would benefit. This is addressed in Chapter 5: Natural Capital Baseline Assessment - landscape character