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GIS Technical Report

Client

Leicestershire County Council

Project

Leicester, Leicestershire and Rutland LNRS

Date

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CONTENTS

TABLES

Rev	Issue Status	Prepared/Date	Approved/Date
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1.0   INTRODUCTION

1.1   This report details the technical GIS details of a project to determine areas of importance for the development of a Local Nature Recovery Strategy (LNRS) within Leicestershire County, the City of Leicester, and the county of Rutland.

1.2   Local nature recovery strategies are driven by the Environment Bill and are designed to prioritise and map key actions for the recovery of nature. Furthermore they look to wider environmental benefits that can be delivered.

1.3   The project involved three stages of work: the creation of a county wide habitat map; the creation of landscape scale connectivity mapping; and the overlaying of the first two stages, as well as further relevant datasets.

1.4   By identifying areas of spatial significance for habitat recovery one can assess the constraints and opportunities present and prioritise areas which could provide the greatest increase in connectivity and overall diversity within the target area.

2.0   AIMS AND OBJECTIVES

2.1   The aim of this report is to summarise the technical details for the creation of the GIS outputs suitable to be used to locate areas of key importance for nature in the local nature recovery strategy for Leicester, Leicestershire and Rutland.

2.2   The objectives were to:

- Create a habitat map of the project area

- Model habitat connectivity within the project area

- Overlay various data sources suitable for the determination of key areas for nature in a format that can be understood by various stakeholders

3.0   METHOD

Habitat Mapping

3.1   Habitat data from 7 sources (Table 1) were examined and a ranking system was determined whereby the most accurate and specific data source was preferentially used. Habitats were assigned to existing OS Mastermap polygons by majority. This process is used to give a programmatical desktop habitat estimate on best available evidence at a county scale.

Determination of accuracy

3.2   To determine the ranking order of data sources each input layer was investigated for 2 criteria: specificity of habitat and accuracy of habitat. Specificity could be judged by the examining the attributes.

3.3   Determination of habitat accuracy first involved dividing each input data source by habitat type. A random sample of each habitat type for each input was investigated using aerial imagery to determine if it was likely accurate, possibly accurate, or likely inaccurate. For some data sources habitat accuracy was higher for certain habitats and lower for others. In these cases the layers were divided and either used at two separate stages in the ranking order, or if the accuracy for certain habitats was too low these were discarded.

3.4   The final data source, which would provide all missing habitat areas was the Living England Habitat map from Natural England. It was however evident that while most habitats were of a reasonable standard there were serious issues with the wetland habitat type. This was therefore discarded and where there was no other data available for these locations the vegetation object model dataset from the Environment Agency was used. This is a LIDAR based dataset that provides height of vegetation. Any below 2m on average was deemed to be grassland, 2-5m was scrub, and above 5m was woodland, however no missing areas were above 5m on average.

Table 1: Data sources for the creation of county wide habitat map

Data source	Specificity	Accuracy
OS Mastermap	Low	Very High/Low
Phase 1 data from Leicestershire CC	High	High
Priority Habitats Inventory	High	Medium
National Forest Inventory	Medium	High/Low
OS Open Greenspace	Low	High
Living England	Low	Medium/Very Low
Vegetation Object Model	Very Low	Low

Classification

3.5   Habitat classification was aligned with both the Statutory Biodiversity Metric and the BAP Habitat system. Additional habitat types for unspecified parks and miscellaneous habitats were added for categories that do not easily fall into existing habitat types but were felt to offer ecological benefits that would not otherwise be captured.

Additional data

3.6   A distinctiveness rating was added to the habitat types according to the statutory biodiversity net gain metric and a habitat specific ecosystems services score from the Environmental Benefits from Nature Tool. Distinctiveness and a sample ecosystem service rating for flood regulation have been given a graduated styling in GIS.

3.7   The data in the habitat vector layers shows the sourced data, the final habitat type, distinctiveness, permeability estimated for typical focal species as well as raw EBN tool values for those habitats.

Connectivity Modelling

3.8   After an initial project to determine the most useful method of determining habitat connectivity within the project area, it was determined that an approach based on least cost modelling[1] was appropriate. A maximum likely distance from core habitat areas can show which areas are functionally connected and which are functionally isolated.[2] [3]

3.9   For this approach focal species were required, upon which would be based the core areas of existing habitat of a suitable size; the maximum dispersal distance which a species could

reasonably be expected to traverse; and a permeability factor determining the comparative difficulty of traversing the landscape.

Focal species

3.10 A focal species is either an exact specific species that represents the area of interest, or as in this case a focal species can be representative of a wider assemblage of species.

3.11 Following consultation with various stakeholders along with the shortlist of species selected for inclusion in the LNRS, various species were researched for literature containing information on area requirements and likely maximum dispersal distances. In order to be suitable the species must have suitable guiding literature, have habitat requirements that can be gauged remotely, and be limited by terrestrial habitat. Some species assemblages were found to have quite different requirements and where it was not possible to subdivide an average was taken.

3.12 Five focal species were created with the properties detailed in Table 2. These were felt be a reasonable balance between quality of results and what could be done with the time and resources available.

Table 2: Details of focal species

Focal species	Area requirement	Maximum dispersal distance	Species modelled on
Grassland (High dispersal)	5ha	4000m	Hare[4][5] Grass snake[6][7]
Grassland (Low dispersal)	2ha	1500m	Grizzled Skipper[8] Adder[9][10][11][12] Amphibians[13][14][15] Reptiles[16][17]
Woodland (High dispersal)	8ha	2500m	Butterflies - Oak Lutestring[9], Flounced Chestnut[9] Birds - Generic[18], Nuthatch, Great Tit Bats – Generic[18]
Woodland (Low dispersal)	3ha	500m	Dormouse[9][12][19] Woodland plants[18][20] Moths – Generic[18] Wood mouse[21]
Urban	1ha	1000m	Hedgehog[19] Slow worm[22][23] Common frog[13][14][15]

Core areas

3.13 Using the results of the habitat mapping core areas for each focal species were created. Suitable habitat for each species was extracted and the polygons were given a small initial buffer to link adjacent parcels. The area of suitable habitat in these buffered areas was summed and those above the core area requirement were used as start points.

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<u>Permeability</u>

3.14   Permeability was calculated using existing data[19][19] as well as expert opinion[24][25] to determine how difficult it would be for the 5 focal species to traverse the underlying habitat. The scale ran from 0 – core habitat to 100 – very difficult to traverse.

3.15   Included within permeability calculations were linear features such as hedges and major roads. Hedges were considered to aid species dispersal but were not considered barriers. Major roads were separated into two categories. Motorways and dual carriage ways were considered particularly hard to cross therefore were given the maximum difficulty rating of 100. Other A roads were given a value of 50.

<u>Functionally joined habitats</u>

3.16   The maximum dispersal extent of each focal species was run twice. First, to join all suitable habitats that were considered functionally joined i.e. that they were within the maximum dispersal extent of both. Then again, to determine where habitats lied between one and two times the maximum dispersal distance from one another. These areas were highlighted as of key importance as they represent good candidates for investigating the possibility of joining two currently isolated habitats.

<u>Creation of GIS output</u>

3.17   Various layers were considered for the final GIS output of this project. These were amended following consultation of stakeholders. The final list is in Table 3. Layers were given symbologies enabling multiple layers to be selected at once while still retaining broad readability. Layers were further arranged into groups and themes. The themes selected were:

- Agricultural

- Areas of existing value

- Areas that could become of particular importance

- Constraints

- Default

- Filtered grasslands

- Grassland

- Open mosaic habitat

- Rivers, surface water and flooding

- Urban

- Wildlife corridors

- Woodland

3.18   For common themes some layers were combined for ease of use. These were constraints, areas of existing value, and areas that could become of particular importance.

3.19   A vector layer that consisted of 1km grid squares over the project area was created and data for the total proportion of each broad habitat type was summarised in each of the monads. For

4

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ancient woodland the data was additionally provided in area. In the case of hedges this data is in total distance in metres broken down by CEH height classification.

Table 3: Vector layers in final GIS output

Layer Name	Feature Count	Styles in Database
5km Buffer box	1	1
Agricultural land classification (grades 1 and 2)	26	1
Agricultural land classification (grades 4 and 5)	22	1
Air quality - NOx	6840	1
Air quality - pm10	6840	1
Air quality - pm2.5	6840	1
Ancient woodland	1067	1
ANGSt	2020	1
Areas of existing value	1	1
Areas that could become of particular importance	1	1
Built environment	1096486	1
Canals and Locks 10m buffer	1	1
Constraints	1123389	1
Distinctiveness	2028293	2
Ecological status of operational catchments	227	2
Flood zone 3	1222	1
GCN Strategic opportunity areas	39	1
Grassland - high dispersal - core area	770	1
Grassland - high dispersal - maximum extent	294	1
Grassland - low dispersal - core area	1346	1
Grassland - low dispersal - maximum extent	915	1
Habitats	2028293	2
Hedgerows	1144161	1
Historic railways 10m buffer	1	0
Irreplaceable habitats	254	1
Leicestershire and Rutland landscapes	15	2
Leicestershire, Leicester, and Rutland	1	1
Local nature reserves	222	1
Local wildlife sites (LWS) - Notified	1174	1
Medium - high confidence other neutral grassland	8,519	0
Merged designated sites	1854	1

Layer Name	Feature Count	Styles in Database
Monads	6512	2
National forest estate ownership	95	1
National Forest Inventory	5676	1
National nature reserves (NNR)	14	1
Open mosaic habitat - Draft	392	1
Priority grassland habitats	19018	4
Priority Grasslands	1179	0
Priority heathland habitats	19018	4
Priority wetland and river habitats	19018	4
Priority woodland habitats	19018	4
Railways	4266	1
Registered parks and gardens	92	1
Ridge and furrow	3204	1
River obstacles buffered	1408	1
Scheduled monuments	596	1
Site allocations	182	1
Site allocations	182	1
Sites of special scientific interest (SSSI)	293	2
Special areas of conservation (SAC)	6	1
Special protection areas (SPA)	9	1
Urban - core area	289	1
Urban - maximum extent	36	1
Urban areas - bounding boxes	9	1
Water	21393	1
Woodland - high dispersal - core area	207	1
Woodland - high dispersal - maximum extent	162	1
Woodland - low dispersal - core area	498	1
Woodland - low dispersal - maximum extent	445	1
World heritage sites	2	1

Assumptions and Limitations

3.20   The project is based on habitat data which contains inaccuracies and the better quality data is relatively limited in extent. The remote sensed data which makes up a significant proportion of the overall project area is particularly prone to inaccuracies and it is suspected that the proportion of neutral grassland to modified grassland is significantly overstated.

3.21   A focal species based approach is limited to the data available on various species. The species chosen were done so using professional ecological judgement and may be prone to bias and human error. Focal species based on assemblages can by definition be only a picture of likely species dispersal.

4.0   RECOMMENDATIONS

4.1   It is expected that this project will be re-run to maintain an up to date LNRS in future therefore some recommendations have been made for improving the accuracy and final output of the project.

4.2   <u>Final habitat data set</u>

4.3   As part of the habitat modelling there needs to be a habitat data set with 100% coverage to catch any areas where better quality data is lacking. The Living England data proved to have a number of inaccuracies. In the preliminary work the UK CEH Land Cover map was found to contain fewer errors, although it remains far from perfect. The UK CEH data is refined each year and the aim of the Living England Map is to update every 2 years so both are likely to improve with time. The recommendation would therefore be to trial both, as well as any other 100% coverage habitat GIS layers, when the LNRS is updated.

<u>Upcoming data sources</u>

4.4   Open mosaic habitat dataset is expected to be released shortly which will likely be a significant improvement on the draft version which was not used to directly inform the habitat map as testing found a likely accuracy rating of ca. 50%. Future iterations of this project should conduct research into datasets which become available and not be tied to the exact sources used in this project.

<u>Refining of the grassland mapping</u>

4.5   As previously mentioned the Living England map delivered a higher proportion of neutral grassland to modified grassland than would be expected, leading to an over estimation of suitable habitat for grassland species. This is likely to remain an issue due to the difficulty of remote sensing a grassland type. Ideally, the recommendation would be to fund a project to refine the current model.

<u>Phase 1 work</u>

4.6   LCC have indicated that they intend to continue the work to survey the county to phase 1 standard. On the ground survey by experienced surveyors will provide the best baseline for habitat modelling and is unlikely to be supplanted by remote sensed data in the near future. It is therefore recommended that this work is continued.

5.0 ABBREVIATIONS

ANGSt	Accessible Natural Greenspace Standard
BAP	Biodiversity Action Plan
CC	County Council
EBNT	Environmental Benefits from Nature Tool
GCN	Great Crested Newt
GIS	Geographic Information System
LCC	Leicestershire County Council
LIDAR	Light Detection and Ranging
LNRS	Local Nature Recovery Strategy
LWS	Local Wildlife Site
OS	Ordnance Survey
UK CEH	United Kingdom Centre for Ecology and Hydrology

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7.0 CITATIONS

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