Natural England Research Report NERR068

Developing a measure of High Nature Value Farmland (HNVF) for the Rural Development Programme for England

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Developing a measure of High Nature Value Farmland (HNVF) for the Rural Development Programme for England

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Executive Summary

The concept of High Nature Value Farmland (HNVF) refers to the causality between certain types of farming activity and corresponding environmental outcomes, including high levels of biodiversity and the presence of environmentally valuable habitats and species[1]. Many studies have attempted to mobilise this concept and quantify the amount of HNVF in different European countries.

Since 2008 HNVF has been an impact indicator in European Rural Development Programmes (RDP's). This report explains how we have approached the task of identifying HNVF in England to meet this requirement for the 2014 – 2020 RDP for England. The three types of HNVF, identified by the European Environment Agency (EEA) (EEA, 2004) have been defined in an English context, and the spatial distribution of each type mapped to meet the RDP requirement.

This report gives a summary of the analysis undertaken for each type, together with the associated mapping and figures, and the final combined map and area of HNVF in England at 31st March 2015. Using this method approximately 18% of England, or approximately 25% of farmland, has been identified as being of High Nature Value.

[1] High nature value farmland. Characteristics, trends and policy challenges. European Environment Agency Report 1/2004. http://www.eea.europa.eu/publications/report_2004_1/#parent-fieldname-title [accessed 8/2/2016]

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1 Background

High Nature Value Farmland (HNVF) refers to the causality between certain types of farming activity and corresponding environmental outcomes, including high levels of biodiversity and the presence of environmentally valuable habitats and species (EEA, 2004).

The concept of HNVF was developed in the early 2000's. A European Environment Agency (EEA) report in 2004 (EEA, 2004) identified three specific types of HNV farmland and put forward a methodology to establish an area using CORINE land cover data. The EEA originally estimated that between 15-25% of the utilised agricultural area of the European countryside would qualify as HNVF, with a mean of 27% of HNVF in the United Kingdom as a whole.

HNVF was adopted as a context and impact indicator for rural development programmes during the 2007-13 period. The European Commission published guidance in 2009 (European Evaluation Network for Rural Development, 2009) giving much greater flexibility in definition than the earlier work and, importantly, left it to individual member states to adopt their own methodologies within the three type framework.

There have been several previous attempts to define HNVF in an English context (Radley et al 2009) but none of these were concluded, primarily because of limited data availability. However, it is a requirement, as part of England's 2014-20 Rural Development Programme (RDP) approval, that a measure of HNVF is submitted to the Commission. HNVF is a compulsory impact indicator (see Appendix 1 for details) within the common monitoring and evaluation strategy (CMES) framework of RDP monitoring.

The impact indicator is defined by the Commission as:

% of Utilised Agricultural Area (UAA) farmed to generate High Nature Value

Commission guidelines state HNVF should be assessed three times during the programme:

- a baseline assessment;
- as part of the ex-post evaluation;
- one update during the programme.

2 HNVF types

Three types of HNVF were defined by the EEA in an attempt to capture the distinct types of farmland that could be considered of high value to nature. Farming systems across Europe are very different, with each system benefiting nature to a greater or lesser extent, and the definitions were designed to reflect that biodiversity conservation goals in Europe will not be met solely by protecting specific habitats or species.

Types of HNV

- Type 1: Farmland with a high proportion of semi-natural vegetation.
- Type 2: Farmland dominated by low intensity agriculture or a mosaic of semi-natural and cultivated land and small-scale features.
- Type 3: Farmland supporting rare species or a high proportion of European or world populations.

For the purposes of the RDP indicator the guidance does not provide a defined methodology to follow to calculate the HNVF area. Instead it is left to individual Member States to develop measures that are consistent with the guidance, but that reflect specific data availability and farming system contexts leaving considerable room for interpretation, especially in relation to characteristics such as 'high proportion' and 'dominated' which are inherent to the types.

3 Natural England's approach

Small scale approaches to defining HNVF in particular areas in England have been undertaken in a number of locations, for examples see Jones (2014) and Beaufoy and Jones (2012). These projects were able to draw on local data and knowledge, in addition to nationally available data, and use large scale mapping and aerial photography to identify or confirm areas of HNVF. Whilst this work is very valuable at the local level, and enables valuable ground-truthing/validation, it is not possible to scale up these highly resource intensive approaches to cover all of England.

Natural England had also made previous attempts at defining HNVF at an England level, (see Porter 2008 and Radley et al, 2009) but limited data availability, the challenges of combining different data sets and the subjective nature of the work meant a final methodology wasn't concluded. This previous work has been used to inform and shape this project.

For this project a key principle was established - to use only readily available existing data; there was no resource available to commission new survey work or purchase data. This approach did introduce challenges and constraints and these are considered in this report.

Pre-requisites for the project included the requirement of defining a transparent and repeatable method and using data that already existed. In addition Agri-environment scheme uptake data was excluded from the analysis, allowing potential future analysis the option of examining the impacts of agri-environment schemes on the extent and quality of HNVF.

The impact indicator calls for the area of HNVF to be given as a percentage of Utilisable Agricultural Area (UAA)[2], however a spatial dataset for UAA was not available to the project (UAA is derived from an aggregation of farm-level survey/census data and is not mapped) and consequently the Rural Land Register [3](RLR) dataset was used as a proxy. This may result in a small overestimate of the proportion of HNVF in UAA. In England in 2013 there were 9,018,000ha of UAA (.gov.uk, rdpe-england-2014-2020), and 9,567,268ha of land registered on the RLR in England as at 31st March 2015.

Given the constraints imposed by data availability this project did not set out to develop a sophisticated definition of HNVF that could be applied precisely at the farm or field level, but focused solely on broad quantifications of the three types, using available data to report against the impact indicator. This approach has limitations which mean that it is not suited to being replicated for more local or specific assessments and it is important to recognise this. As the availability of consistent national data sets increases, eg from earth observation, a more sophisticated national approach may become feasible in future.

[2] All arable and horticultural crops, uncropped arable land, common rough grazing, temporary and permanent grassland and land used for outdoor pigs (excludes woodland and other non-agricultural land (.Gov.uk, 28/05/15)

[3] The Rural Land Register (RLR) holds mapping information for agricultural land (including some woodlands) within England. It is updated by the Rural Payments Agency (RPA). Land must be accurately registered on the RLR before land management grants can be given.

4 Methodology

The flow chart (figure 1), outlines a simplified version of the method the process used to establish HNVF in England.

Deciding on the datasets to use in the analysis was fundamental to the project, along with agreeing how they should be analysed, including if any cut off and threshold rules should be applied. The latter was done through trialling different options and comparing and contrasting the results before decisions were taken. Feedback from consultations, both within Natural England and Defra and with external stakeholders both informally and via the RDPE Programme Monitoring Committee, was also taken into consideration prior to making final decisions.

All data used was cut by RLR boundaries to ensure that only data occurring on farmland was considered during the analysis, ensuring the focus was kept on agricultural land. Concentrations of habitats or species outside of the RLR were excluded from the analysis.

The majority of data used in this project was vector data; in order to enable different data sets to be combined together data sets were turned into grid data prior to analysis. Analysis was then completed against the RLR and 1km^2 grid squares, giving the area of the dataset in RLR in each km grid square.

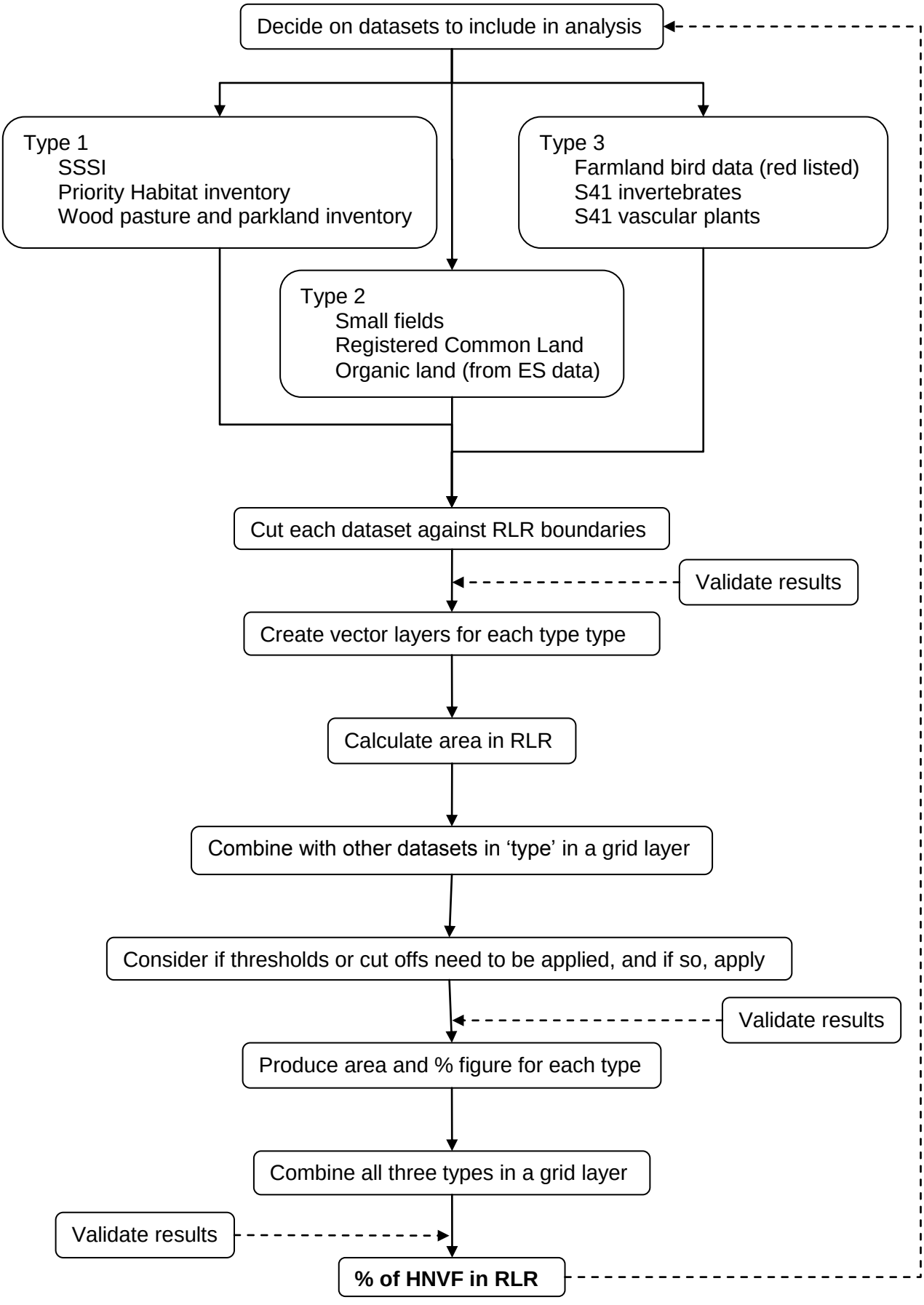

Figure 1 The process of establishing HNVF

Data Used

Data used in the analysis came from several sources with different creation dates and update frequencies (Table 1). As far as possible analysis has been as at 31st March 2015, however some contributory datasets were considerably older. As previously described, this indicator has to be reported on once during the programme and ex post, as well as establishing the baseline, however some datasets will not be updated and will remain static during the course of this RDP programme. Full metadata for the datasets used in this project is available from Natural England.

Dataset	HNVF Type dataset contributes to			Date	Update frequency	Comments
	1	2	3			
Rural Land Register Parcel (RLR) Boundaries (Anonymised)	√	√	√	2012	Continuous	
Sites of Special Scientific Interest (SSSI)	√			Feb 2015	Monthly	
Natural England's Priority Habitats' Inventory v2.0 beta	√			2015 / Version 2	Annual	
Wood-Pasture and Parkland BAP Priority Habitat Inventory for v2.0	√			2015	Irregular	
Small fields - Rural Land Register Parcel Centroids (Anonymised)		√		2012	Irregular	Dataset used to create layer specifically for this project Due to be replaced by a different product
Organic land – Environmental Stewardship Scheme (ESS) Live Option Points		√		2013	Monthly	As ES agreements expire and transfer to Countryside Stewardship (CS) this will need to be reflected in future analysis
All Areas Conclusive Registered Common Land		√		2005	Irregular	CRoW Act 2000 - S4 Conclusive Registered Common Land
Bird Conservation Targeting Project – Farmland Birds[4]			√	2011	Not planned	Red listed[5] birds subset used
S41 Priority Species Records			√	2015	Annual	Invertebrates and vascular plants only

Table 1 Datasets used and their update frequency

[4] © Bird Conservation Targeting Project, 2010 (a partnership between the British Trust for Ornithology (BTO), Natural England (NE), the RSPB and Scottish Natural Heritage (SNH)). All rights reserved. The Bird Conservation Targeting Project partners are grateful to the contributions of the data providers listed at www.rspb.org.uk/targeting

[5] RSPB conservation status

Method and Analysis

Analysis was done separately for each type, with the final analysis combining all three Types together.

Type 1 involved removing polygons identified as Good Quality semi-improved grassland (GQSIG), deciduous woodland and 'no main habitat but additional habitats present' and grass moorland from the Priority Habitats Inventory (PHI) (data layers found within this dataset are at Appendix 2) except where they intersected with Site of Special Scientific Interest (SSSI) land. The removed polygons were felt to either not be agricultural land or in the case of GQSIG be derived from Farmed Environment Plan (FEP) data. . The Wood Pasture and Parkland (WP&P) dataset was also cut to remove any land within SSSIs as this was already included within the analysis. Each dataset was cut by the RLR to remove non farmed land, and the tailored PHI and WP&P datasets, together with the SSSI dataset were then combined together, merging any overlapping parcels to avoid double counting in area calculations. This dataset was then converted into a grid format and the area of Type 1 land per km square was calculated. Full details of the process can be found in Appendix 3.

Type 2 involved creating a small fields (parcels) dataset through using the RLR centroid point dataset to identify all parcels that were 2ha or less in size, then calculating the number of small parcels in each 1km square and finally only 1km squares that contained 8, or more, small parcels (60^{th} percentile) were taken forward in the analysis. The threshold of 8 or more small fields in a grid square was used to try and prevent isolated small fields of limited benefit being included, and recognise the importance of the landscape the small fields sit within. Both the 2ha and ≥8 parcels cut offs were chosen to best represent small fields in a landscape context. It is acknowledged that a shortcoming of this methodology is the exclusion of groups of small fields that occur across different grid squares, ie each grid square having less than 8 small fields, but combining field parcels on the border of two squares would give 8 or more; due to time and processing constraints no nearest neighbour analysis was carried out to include these areas.

The Organic layer was created by selecting all ESS parcels that had OU1 (Organic management) option assigned. The small parcels, organic land and Registered Common Land were then joined together, having been cut by the RLR, merging any overlapping parcels to avoid double counting in area calculations, converted to grid format and the area figure calculated. Full details of the process can be found in Appendix 4.

Type 3 proved the most difficult type to analyse, partly because of the nature of the datasets used, full details can be found in Appendix 5. The farmland bird data was based on tetrads, whilst the S41 species data was varying resolution (1m – 10,000m). The first step in the Type 3 analysis was to create tetrad level circular buffers of derived species densities (Figure 2, number of species in red). A cut off was used to only include land where ≥4species of birds occurred together, although this did introduce a degree of bias because of the range of species included and the potential for greater than four species to occur together, this was especially relevant to the south west of England. This cut data was then cut against the RLR and combined with a pre-prepared S41 dataset that had also been cut against the RLR.

Following the initial analysis it was found that large tracts of land were identified as important for birds, including unexpected areas eg intensive arable areas; this created a particular challenge in dealing with Type 3. As a result, and following much discussion and debate, the decision was taken to implement a cut-off for the bird dataset by using the ≥95% quintile. Whilst this cut off was arbitrary, it was thought to be the best solution, given the data available, focusing on the most important bird areas and preventing the bird data skewing the overall distribution of HNVF. Using this cut-off has meant that additional caveats have been brought in, squares have been included that are 100% arable, even though due to the tetrad nature of the original bird data the survey point may be up to 2km away.

By using the 95% cut off, squares with 94ha of farmland potentially of high nature value are excluded from the Type 3 analysis (there are 100ha in a km square). If these same areas of land have also

been identified as Type 1 and /or Type 2 they will obviously be included within the final combined figure and distribution.

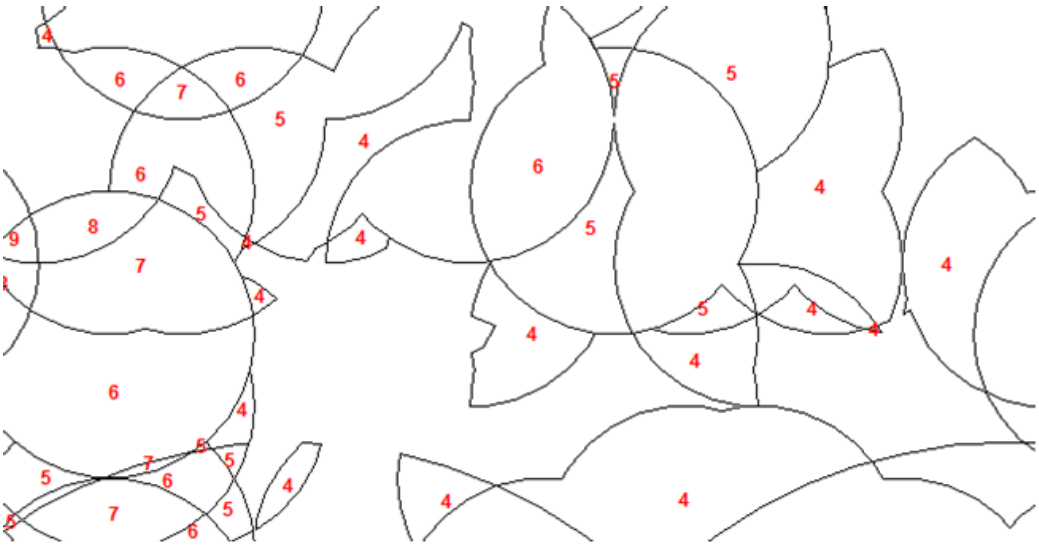

Figure 2 Coincidence mapping (cut by RLR)

Combining the Types was the last stage in the analysis and involved combining all three Types (Appendix 6) and producing a combined figure for submission to the European Commission via Defra.

The total area of HNVF was established by calculating the agricultural (RLR) area in each grid square classified as meeting the HNVF definition, then summing this area. Coincident areas were counted once only, this is particularly relevant for the combined analysis.

Datasets excluded

Some datasets, whilst in existence, were excluded from this analysis for a number of reasons. For example farming intensity data eg livestock units, whilst apparently a potential way to identify areas of low intensity agriculture, was not used in this analysis due to the difficulties it presents in linking livestock numbers at a farm level to specific land parcels, and cut offs that should be applied.

Validation

At each stage in the process validation was undertaken to confirm the data manipulation and analysis were correct, and decisions valid. This took several forms, including focusing on particular areas by overlaying data cuts with aerial photos etc, and cross checking with other data sources eg land use data.

5 Results

In this section, the results are displayed for each HNVF Type, with the combined results (the baseline) being given in section 6.

Type 1

Analysis of Type 1 showed that 1,239,957ha, ~13% of farmland, equivalent to ~ 9% of England, was covered by the definition. A breakdown of the distribution by quintile is given in Table 2, with the map in Figure 3. The contribution of each priority habitat inventory is shown in Table 3.

The distribution of Type 1 has key areas in the uplands and the south west, whilst having a more 'scattered' approach elsewhere, and this was expected as it reflects the distribution of the underlying data – both SSSIs and habitat inventories occur throughout England

HNVF Type 1 quintiles (% of RLR 1km2 covered by type 1)	RLR Area (ha) of Type 1	1km 2 Count
>0 to 20%	196,358	41,357
>20 to 40%	194,858	6,817
>40 to 60%	180,031	3,652
>60 to 80%	177,521	2,548
>80%	489,008	5,149
Outside grid	2,180	
Total area (vector)	1,239,957	
Total count (grid)		59,523

Table 2 Distribution of Type 1 by quintile

Priority Habitat / Designation	**Hectares within RLR**
Blanket bog	222,976
Calaminarian grassland	208
Coastal and floodplain grazing marsh	194,669
Coastal saltmarsh	215,63
Coastal sand dunes	5,978
Coastal vegetated shingle	1,976
Deciduous woodland	100,947
Fragmented heath	9,016
Good quality semi-improved grassland[1]	8,195
Grass moorland[1]	46,101
Limestone pavement	1,194
Lowland calcareous grassland	56,045
Lowland dry acid grassland	13,236

Lowland fens	16,578
Lowland heathland	48,829
Lowland meadows	19,486
Lowland raised bog	3,991
Maritime cliff and slope	7,466
Mountain heaths and willow scrub	1,310
Mudflats	3,799
No main habitat but additional habitats present	30,941
Purple moor grass and rush pastures	8,616
Reedbeds	2,503
Saline lagoons	355
Traditional orchard	9,754
Upland calcareous grassland	9,103
Upland flushes, fens and swamps	9,689
Upland hay meadow	2,396
Upland heathland	221,184
Wood-pasture and Parkland	116,006

Table 3 Area of priority habitat inventory identified as contributing to HNVF

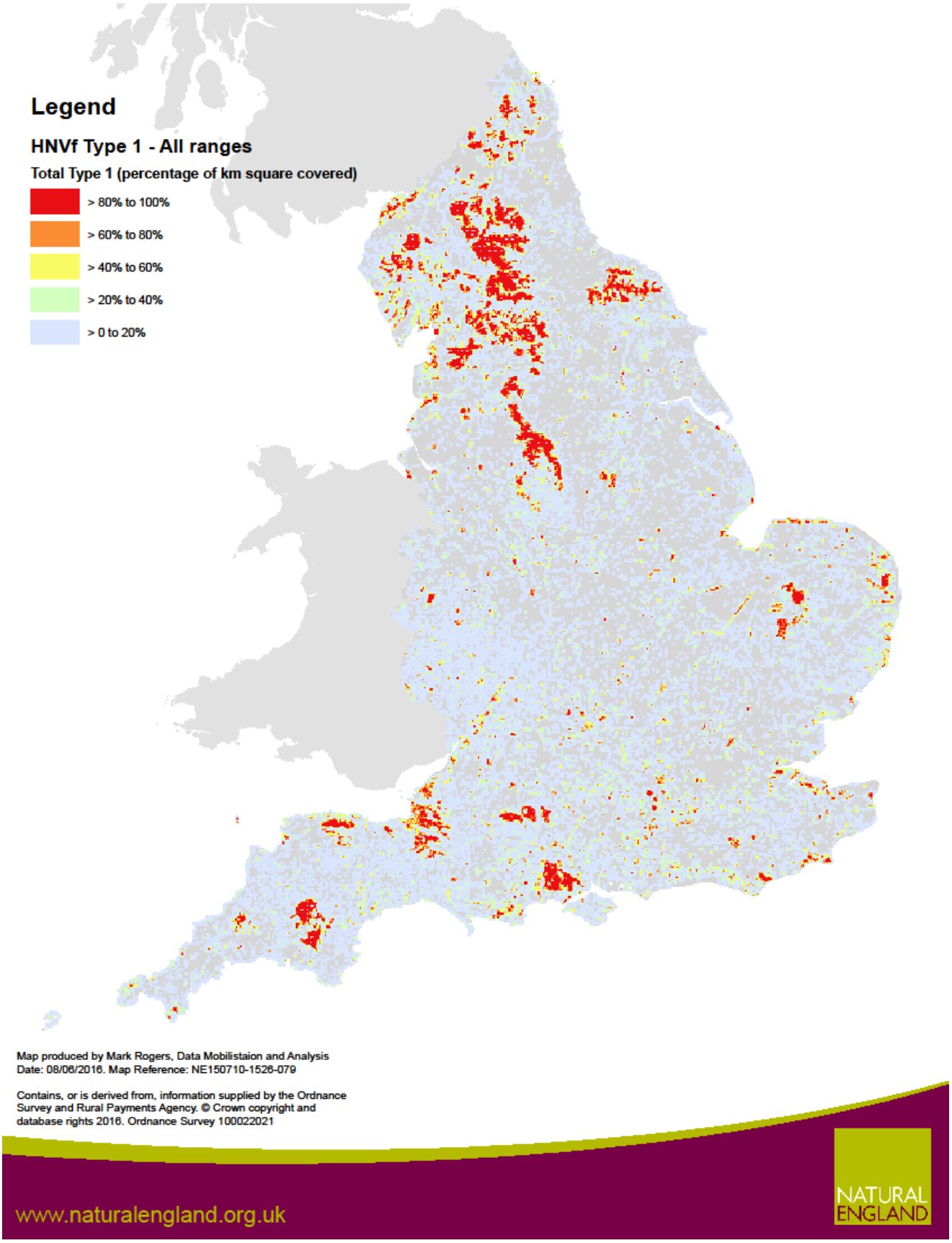

Figure 3 HNVF Type 1 distribution

Type 2

Analysis of Type 2 showed that 12% of farmland, equivalent to ~9% of England, was covered by the definition for this type. A breakdown of the distribution by quintile is given in Table 4, with the map in Figure 4. The distribution of higher concentrations, less isolated, areas of Type 2 has a more northerly distribution than Type 1, with the addition of the upland areas of the south west, reflecting the less intensive farming landscape of smaller fields in the uplands and the distribution of common land.

HNVF Type 2 quintiles (% of RLR 1km2 covered by type 2)	RLR Area (ha)	1km 2 Count
>0 to 20%	434,970	65,333
>20 to 40%	269,249	9,840
>40 to 60%	133,663	2,754
>60 to 80%	96,898	1,393
>80%	222,394	2,340
Total area (vector)	1,157,173	
Total count (grid)		81,660

Table 4 Distribution of Type 2 by quintile

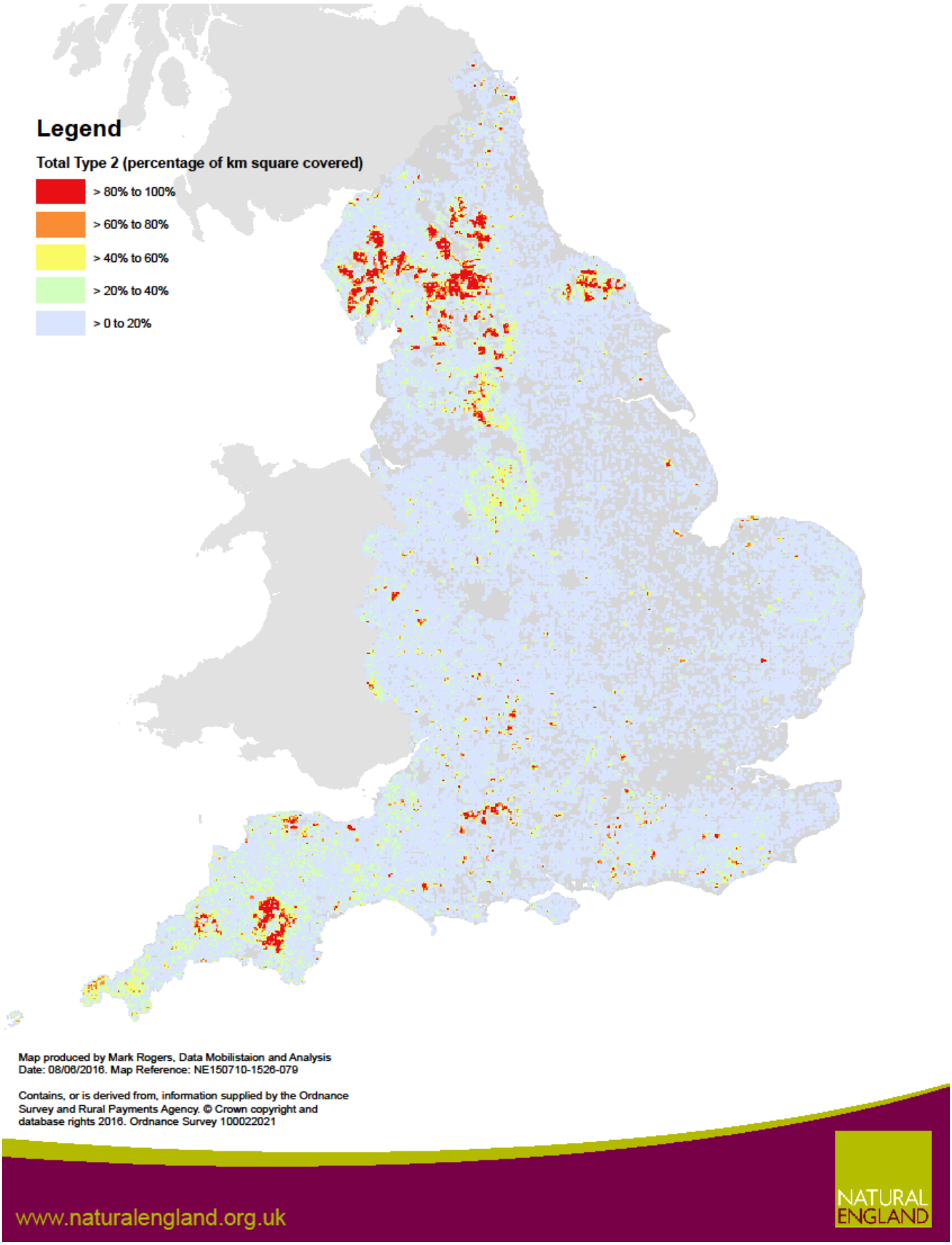

Figure 4 HNVF Type 2 distribution

Type 3

The definition of Type 3 created many challenges and resulted in a 95% cut off for the bird data being implemented, as set out in Section 4. The final decisions and analysis resulted in an area of HNVF of 5% of farmland, equivalent to ~ 3% of England. A breakdown of the full distribution by quintile is given in Table 5, with the areas not meeting the cut off shown in grey, with Figure 5 only showing >95%, distribution. The distribution for Type 3 was more scattered throughout England, reflecting the more varied distribution patterns of the selected birds and S41 species. Areas which are possibly not considered rich in wildlife eg intensive agricultural areas in the East of England, are also represented, and this is largely driven by the birds data.

HNVf Type 3 (% of RLR 1km2 covered by type 3)	RLR Area (ha)	1km 2 Count
>0 to 20%	30,544	3,474
>20 to 40%	212,978	7,334
>40 to 60%	163,595	3,202
>60 to 80%	582,126	8,115
>80 to 85%	305,361	3,701
>85 to 90%	462,795	5,279
>90 to 95%	372,724	4,044
>95%	434,755	4,447
Total area (vector)	2,564,879	
Total count (grid)		39,596

Table 5 Distribution of Type 3 by quintile

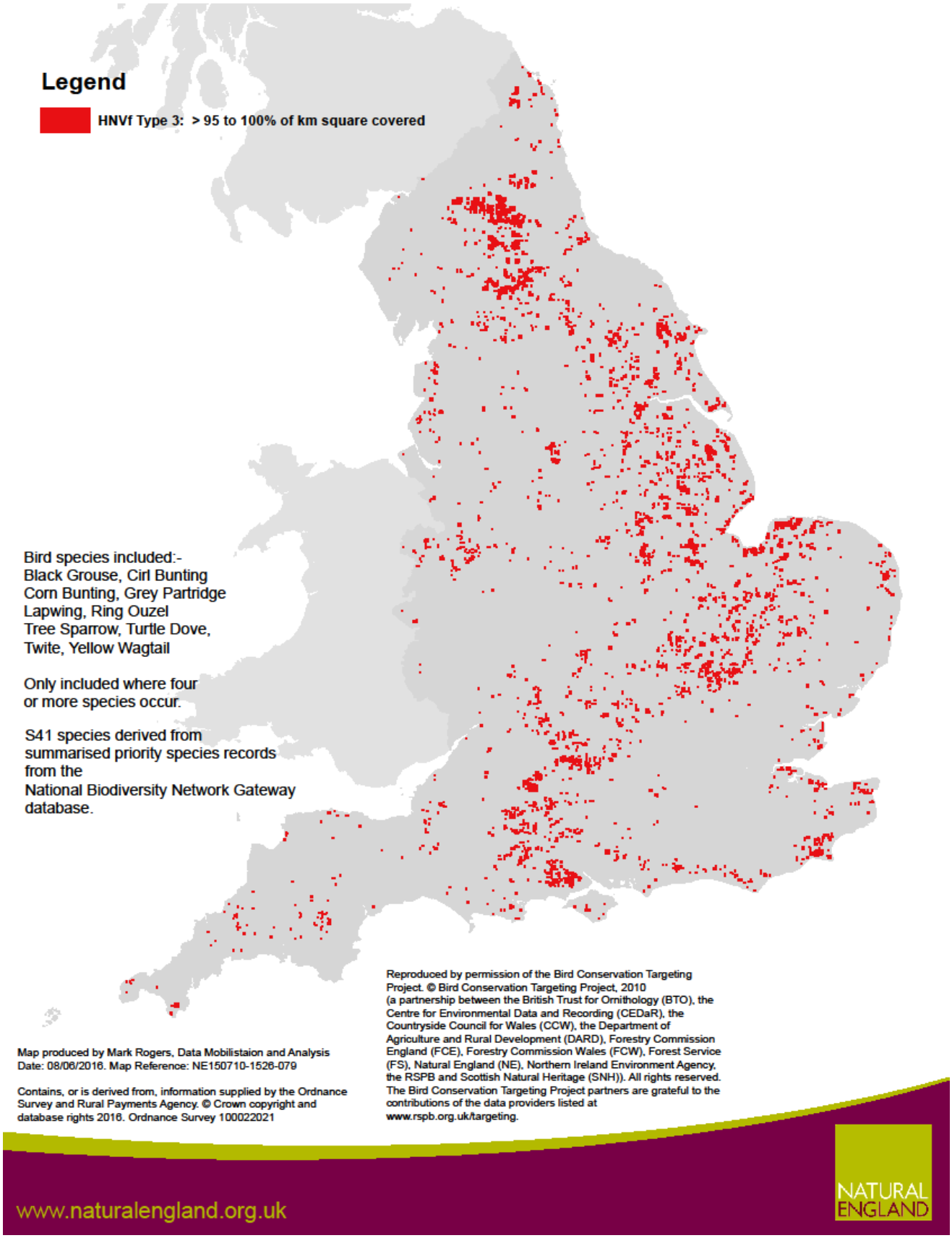

Figure 5 HNVF Type 3 distribution (occurrences of 95% or greater)

6 HNVF – 2015 Baseline

The ultimate aim of the project was to establish a baseline figure for the area of HNVF in England at 31st March 2015. All three agreed component types were combined together, ensuring coincident land was only counted once.

This results in ~25% of farmland, equivalent to ~ 18% of England being considered of high nature value.

The overall distribution, with the focus being on the uplands, was largely expected.

The apparent coverage of large areas of England (Figure 6), is due to the gridded presentation of the map, where each grid square is represented, even if there is only a small amount of HNVF within that square. The area figures (Table 6) include the actual amount of HNVF in a grid square.

Consultation both internally and externally, including with key stakeholders, during the process and as the analysis reached its conclusion, contributed useful feedback for the analysis and gave additional confidence in the methodology and analysis.

HNVf Types 1 & 2 & 3 Combined		
Types 1 & 2 & 3 quintiles	RLR Area (ha)	1km 2 Count
>0 to 20%	462,638	66,029
>20 to 40%	425,932	15,224
>40 to 60%	289,192	5,904
>60 to 80%	242,129	3,482
>80%	956,533	9,968
Totals	**2,376,424**	100,607

Table 6 Distribution of the combined HNVF by quintile

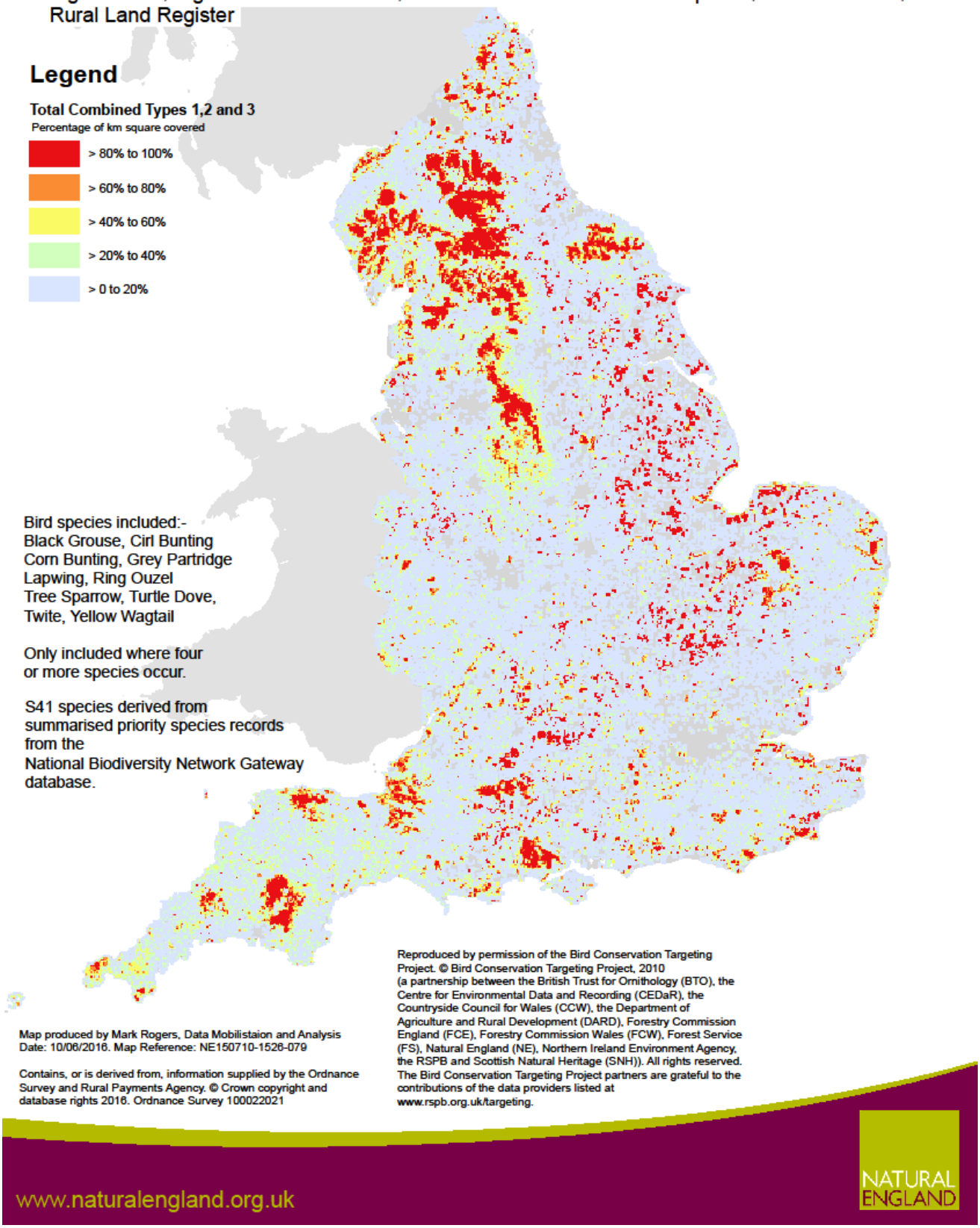

Figure 6 Distribution of HNVF in England

7 Challenges and Potential areas for future development

Several challenges arose during the course of the project that needed to be addressed or solutions found for:

- **Data.** In deciding what data should be included in the analysis for each type, the existence and or availability of datasets was considered. In some cases no spatial dataset currently exists and therefore obvious features to include within the analysis had to be excluded, for example hedges in Type 2.
- **Inclusion Thresholds.** Defining rules for analysis and any cut-off thresholds proved challenging, partly because there is little environmental evidence to inform selection of such cut-offs. Each decision had the potential to effect large areas of land, through inclusion or exclusion from the analysis and overall figures.
- **Intensive computer processing.** Analysis and mapping was time intensive due to the large scale of the project and datasets involved.
- **Data update schedules.** Contributing datasets have different creation and update schedules (see Table 1); consequently the baseline data will include data from different time periods. In addition some datasets used will not be updated before the end of RDP and will need to be reused in subsequent analyses, reducing the ability of the analysis to detect any change.

As this project has progressed, several areas of potential future work have been identified which are outlined below.

Determination of condition

The quality of HNVF can be considered equally as important as the quantity of HNVF, and therefore an analysis of the condition of the land identified as HNVF should be undertaken in the future. Many of the datasets included in this analysis do not have any assessment of quality attached to them which creates a challenge to assessing condition and a method would have to be developed. Assessing the condition of HNVF could also support any analysis of the effectiveness of agri environment schemes to maintain and/or improve the value of the land for wildlife over time.

Inclusion of additional datasets

Over time new datasets may become available that have the potential to be incorporated into any future refresh of the HNVF figure. Whilst the addition of new datasets would mean any results were not directly comparable, the benefits of improving the quality of the analysis are likely to outweigh this.

Use of Earth Observation data

Earth Observation is an area of work that is developing quickly, together with new applications for data collected. Before any refresh of the area of HNVF is undertaken, an investigation of the potential to introduce earth observation data into the process should be carried out. One potential dataset is explained below.

Normalised Difference Vegetation Index (NDVI) could be used to investigate the productivity of grasslands through remote sensing in the future to refine the HNVF methodology, by helping to distinguish improved grasslands from unimproved grasslands. Grasslands with an average annual lower productivity are likely to be an indicator of high nature value. Work would be required to establish a threshold for the NDVI to separate the lower productivity grasslands out, and link this to some evidence showing they are HNVF.

The ESA Sentinel 2a Satellite is now operational and combined with the USA's Landsat-8 satellite will provide free repeat data for the UK, from which NDVI indices can be easily calculated. The NDVI is often used an indicator of productivity. This combined with field information locating permanent grasslands should be able identify those grasslands of high & low productivity.

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Appendix 1 CAP indicator

http://ec.europa.eu/agriculture/cap-indicators/impact/2015-05-06-impact-indicators_en.pdf

INDICATOR I.09	
Indicator Name	**High nature value (HNV) farming**
Related general objective(s)	**Sustainable management of natural resources and climate action**
Definition	This indicator is defined as the **percentage of Utilised Agricultural Area farmed to generate High Nature Value (HNV)**. HNV farming results from a combination of land use and farming systems which are related to high levels of biodiversity or the presence of certain species and habitats. The common definition established *inter alia* by the EEA and JRC, recognises three categories of farmland as HNV: Type 1: Farmland with a high proportion of semi-natural vegetation Type 2: Farmland with a mosaic of low intensity agriculture and natural and structural elements, such as field margins, hedgerows, stone walls, patches of woodland or scrub, small rivers etc. Type 3: Farmland supporting rare species or a high proportion of European or world populations. This indicator is a further development of AEI 23 "High Nature Value Farmland", and the farmland component of the 2007-2013 CMEF Baseline indicator 18 "High Nature Value farmland and forestry". Methodology: For the purposes of this indicator, the common parameter "HNV farming", as defined above, is to be assessed within each Member State and individual RDP area using methods suited to the prevailing bio-physical characteristics and farming systems, and based on the highest quality and most appropriate data available. The Member State authorities are responsible for conducting this assessment and providing the values to the Commission. Methodological guidance for establishing values for this indicator has been provided in "The application of the High Nature Value impact indicator" Evaluation Expert Network (2009) : http://enrd.ec.europa.eu/app_templates/filedownload.cfm?id=6A6B5D2F-ADF1-0210-3AC3-AD86DFF73554 Several Member States raised the issue of comparability and/or aggregation if different methodologies are used. Agreement on the common parameter being measured, and

	transparency and acceptance of the various methodologies, whilst not ideal, allows for aggregation, since in all areas the land considered to fulfil the criteria for one of the three HNV types is assessed, provided that Member States have selected methodology appropriate to identifying HNV in their biophysical situation. The purpose of this indicator is not to make comparisons between territories on the basis of the extent of HNV land, but rather to consider the trends in its preservation and/or enhancement. It is therefore important that in each territory the same methodology is used for each successive assessment, so that trends are estimated correctly. When more accurate methods are developed, leading to a change in the methodology used, HNV assessments should be recalculated for the baseline year to ensure that the trend can be captured. If this is not possible, then the new methodology should be used alongside the old to allow trends to be assessed.
Unit of measurement	Percentage (%) The absolute area of UAA (hectares) and of HNV farmland is also required, to allow for aggregation to Member State/EU level.
Data source	The data sources for estimation of HNV farming are many and varied, and currently depend on the methods selected by the Member State authorities. Analysis relies principally on national/regional data, but also includes use of some EU data sets. Sources include: CORINE and other land cover data, IACS/LPIS, agricultural census data, species and habitat databases, GIS, specific sampling surveys, RDP monitoring data, designations (NATURA, national nature reserves etc.).
References/location of the data	For assessment of HNV farmland national/regional data are required (see above) UAA: EUROSTAT FSS national and regional data: Table: Land use: number of farms and areas of different crops by agricultural size of farm (UAA) and NUTS 2 regions (ef oluaareg).
Data collection level	The indicator should be established at either national, NUTS 1 or NUTS 2 level. Values should be obtained which correspond to RDP territory level. Large Member States may consider it appropriate to have a regional assessment, particularly where there are large regional variations in climate, topography, biodiversity, landscape and/or farming patterns. The level at which the data is available varies with the data source (see description above).
Frequency	Variable. Minimum requirement is 3 times between 2013 and 2022: a baseline

	assessment at the start of the 2014-2020 period (ideally for 2012 or 2013), an assessment at the end of the period (to coincide with the ex-post evaluation of the RDP territory), and one update during the period (ideally for 2017 or 2018).
Delay	Variable (depends on the data sources used, frequency of surveys/sampling, etc.).
Comments/caveats	Due to the variation in data availability, physical/ecological situation and farming systems and practices across Member States, it is not appropriate to impose a common methodology for the assessment of HNV farming. Use of one single method would restrict the analysis to data available throughout the EU, which would exclude the richest and most relevant data sources, and preclude those Member States which have developed more refined methods from using them, with a consequent reduction in the quality and accuracy of the assessment. A full assessment of HNV farming would consider both extent and quality/condition. The indicator definition proposed here only covers the extent of HNV areas, since in most Member States current methodology is not sufficiently developed to provide reliable indications of the condition of HNV areas. However, Member States are strongly encouraged to continue developing and refining the approaches used so that quality/condition can be incorporated into HNV assessments. Additional information on HNV farming throughout the EU is available in the recently published book “High Nature Value Farming in Europe”. The DG ENV study on "The High Nature Value farming concept throughout EU 27 and its maturity for financial support under the CAP" (starting October 2012) may also provide further information on assessment methodologies which could be a support to Member States. As for all other impact indicators, it is necessary to have an estimated value for this indicator for all Member States. Until an appropriate specific method for estimating HNV is identified and used by the Member State authorities, there are two existing sources of data which could be used in the interim to provide a value, although both have considerable limitations and do not give a representative assessment of the extent of HNV. Use of these values is a second-best alternative compared to use of a more accurate and appropriate method. These data sources are mentioned here solely to provide an initial fall-back option in cases where a Member State has not yet made sufficient progress to be able

	to provide more accurate starting values based on more appropriate and specific data and methods. The two fall-back options are: 1) Estimation of HNV farmland from CORINE land cover data (EEA study). Limitations: - This approach does not take account of farming systems. - Land cover assessments do not always distinguish well between abandoned land with encroaching scrub, and extensive semi-natural grassland with patches of bushes or scattered trees. - The scale used may mean that smaller areas, such as agricultural parcels within wooded areas are missed completely. - The area of agricultural land estimated from CORINE land cover data does not correspond to EUROSTAT's UAA data. - The EEA exercise is not updated regularly, so it does not provide a dynamic picture. 2) Area of UAA contained within designated NATURA 2000 sites. Limitations: - This approach does not take account of farming systems. - It is static rather than dynamic. - It underestimates the extent of HNV since it primarily addresses only Type 3 HNV farmland rather than all 3 types.

Appendix 2 Priority Habitat Inventory layers

Blanket Bog;
Coastal and Floodplain Grazing Marsh
Coastal Sand Dunes
Coastal Vegetated Shingle
Deciduous Woodland
Fragmented Heathland
Grass Moorland
Good Quality Semi-Improved Grassland
Lowland Calcareous Grassland
Lowland Dry Acid Grassland
Lowland Fens
Lowland Heathland
Lowland Meadows
Limestone Pavements
Lowland Raised Bog
Maritime Cliffs and Slope
Mountain Heath and Willow Scrub
Mudflats
Purple Moor Grass and Rush Pasture
Reedbeds
Saltmarsh
Saline Lagoons
Traditional Orchards
Upland Calcareous Grassland
Upland Fens Flushes and Swamps
Upland Heathland
Upland Hay Meadows

Appendix 3 Technical process Type 1

Layers Used: Sites of Special Scientific Interest layer (SSSI), Priority Habitats Inventory layer (PHI), Wood Pasture and Parkland layer (WPP) and Rural Land Registry layer (RLR) . The latter was used as a representation of agricultural land – most landowners registering for the Single Farm Payment will have their land registered in this layer.

Metadata for Layers: Available from Natural England

Methodology:

Process the SSSI layer

1. Cut the SSSI layer by the RLR layer to exclude non agricultural areas.

Process the PHI Layer

2. Filter out some selected priority habitat classes from the PHI layer that were not felt to appropriate for HNVf Type 1. These were :-
    a. Deciduous woodland
    b. Good Quality Semi Improved Grassland
    c. Grass Moorland
    d. No main habitat but additional habitats present
3. Cut the remaining PHI habitats by the SSSI layer to remove any habitats already included within the SSSI layer.
4. Cut the resultant layer by the RLR layer to exclude any Priority Habitats that are not on agricultural land.

Process the WPP Layer

5. Cut the WPP layer by the SSSI layer to remove any land already included within the SSSI layer.
6. Cut the resultant layer by PHI to remove land already included within the PHI layer
7. Cut the result with the RLR layer to ensure it is only agricultural land within the WPP land that is included in the final WPP result layer.

Final Aggregation Process

8. Add the three result (SSSI, PHI, WPP) layers together to form one final Type 1 layer.
9. Intersect this layer with the 1km grid layer to produce a final Type 1 Intersect Layer that shows the areas of type 1 land by each 1 km square. Calculate total area (in hectares) per 1 km grid..
10. Using an attribute join on the Km square identifier, create a final Grid layer of Type 1 farmland. This shows the amount of Type 1 land per km square. Symbolise by amount of Type 1 land per square.

Appendix 4 Technical process Type 2

Layers Used: Registered Common Land (RCL), Environmental Stewardship Option Points layer (ESS) and Rural Land Registry layer (RLR) . The latter was used as a representation of agricultural land – most landowners registering for the Single Farm Payment will have their land registered in this layer.

Metadata for Layers: Available from Natural England

Methodology:

Process the RCL layer

1. Cut the RCL layer by the RLR layer to exclude non agricultural areas.

Process the RLR Layer to create a Small Parcels Layer

2. Create a subset of all RLR parcels that are 2 ha or less in area.
3. Create centroid point dataset for all the parcel subset.
4. Use the centroid points to calculate how many small parcels there are for each 1 km square.
5. Add this information back into the subset parcel layer created in step 2. Then use this information to select only those small parcels where there are 8 or more small parcels per km square.

Process the ESS Organic Layer

6. Use the point file for all ESS parcels that have the “OU1” organic management option to select the appropriate RLR parcels.

Final Aggregation Process

7. Add the three result layers (RCL, Small Parcel Layers and ESS Organic Layer) together to form one final Type 2 layer using the Union spatial operator to ensure overlapping parcels are merged into one to avoid double counting of area calculations.
8. Intersect this layer with the 1km grid layer to produce a final Type 2 Intersect Layer that shows the areas of Type 2 land by each 1 km square. Calculate total area (in hectares) per 1 km grid..
9. Using an attribute join on the Km square identifier, create a final Grid layer of Type 2 farmland. This shows the amount of Type 2 land per km square. Symbolise by amount of Type 2 land per square.

Appendix 5 Technical process Type 3

Layers Used: Farmland Birds, S41 Species and Rural Land Registry layer (RLR). The latter was used as a representation of agricultural land – most landowners registering for the Single Farm Payment will have their land registered in this layer.

Metadata for Layers: Available from Natural England

Methodology:

Process the S41 species layer.

1. This layer is made up of two vector layers – S41 Vascular Plants and S41 Invertebrates showing sightings as squares of differing sizes depending upon the precision of the grid references given. The precisions of the sightings were 1m, 10m, 100m, 1000m and 10,000 m.

2. Discard the 10,000 metre precision sightings as these were considered too coarse in precision (there were only a handful of these records)

3. Convert rectangle sightings to points based upon the centre of the square.

4. Combine Vascular Plants and Invertebrates Layers into one combined point layer

5. Use the combined S41 points layer to calculate for each 1km square how many S41 species records there were.

6. Discard any 1km square which only has zero or only one species records.

7. For the remaining 1km squares clip against the RLR layer to produce a final S41 species layer of RLR 1km Grid squares where > 1 species records occur.

Process the Farmland Birds layer

8. Combine the vector tetrad layers for each separate selected bird species (Black Grouse, Cirl Bunting, Corn Bunting, Grey Partridge, Lapwing, Ring Ouzel, Tree Sparrow, Turtle Dove, Twite and Yellow Wagtail) using a “union” geoprocessing option.

9. Select the vector polygons where four or more of the selected bird species exist. Discard the rest..

10. Clip the RLR against these vector areas to produce an RLR clip for farmland areas that contain four or more bird species.

Final Aggregation Process

11. Combine the two resulting RLR layers (S41 Species and Farmland birds) together using a “union” geoprocess method.
12. Intersect this layer with the 1km grid layer to produce a final Type 3 Intersect Layer that shows the areas of Type 3 land by each 1 km square. Calculate total area (in hectares) per 1 km grid.
13. Using an attribute join on the Km square identifier, create a final Grid layer of Type 3 farmland. This shows the amount of Type 3 land per km square.

14. Create a final subset of 1km squares that meet the final selection criteria (that the RLR area makes up 95-100% of each 1 km square).

Appendix 6 Technical process Combined

Layers Used: Type 1 final vector layer, Type 2 final vector layer, Type 3 final vector layer.

Metadata for Layers: No new datasets were used

Methodology:

Final Aggregation Process

1. Combine the three final vector layers for Type 1, Type 2 and Type 3 together using a “union” geoprocess method (this avoids duplicating RLR land that exists in more than one HNV Type).
2. Intersect this layer with the 1km grid layer to produce a final Combined Type Layer that shows the areas of Combined Type land by each 1 km square. Calculate total area (in hectares) per 1 km grid.
3. Using an attribute join on the Km square identifier, create a final Grid layer of Combined Type farmland. This shows the amount of Combined Type land per km square.

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