Greenspace Information for Greater London CIC
the capital's environmental records centre

Document Type: Project Report
Document Prefix: PR007
Document Description: Habitat Suitability Modelling Project Report
Related documents: DP007

Issue Date	November 2024
Review Date	If changes occur to process
Issue Number	1
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Contents

1. Introduction

A habitat suitability model attempts to predict areas that have potential for the restoration or re-creation of new habitat, and to quantify the relative suitability of the predicted areas.

GiGL modelled ten priority habitats relevant to Greater London. These were:

- Coastal Grazing Marsh (CGM)
- Floodplain Grazing Marsh (FGM)
- Lowland Calcareous Grassland (LCG)
- Lowland Dry Acid Grassland (LDAG)
- Lowland Heathland (LH)
- Lowland Meadows (LM)
- Lowland Mixed Deciduous Woodland (LMDW)
- Purple Moor Grass and Rush Pastures (PMGRP)
- Reedbeds (RB)
- Wet Woodland (WW)

We based our methodology on that used in Hampshire (GeoData Institute, 2009), adapting for London-specific factors and simplifying where possible.

2. Methodology

Overview

The methodology is based on dividing London into 2500m^2 grid cells which were then assessed for their suitability for each of the priority habitats. An initial screening removed cells which overlapped areas that are generally not suitable for habitat restoration or re-creation such as urban areas and open water. This left a grid of potential cells used as the starting point for each habitat model.

For each priority habitat, in depth research was done using literature, expert assessment and statistical calculation to ascertain the major factors influencing the distribution of the habitat. Where identified factors were available as digital spatial datasets, they were included in the habitat model.

Habitat models were constructed by combining the various factors influencing the suitability for restoration or re-creation of each habitat using an additive factorial Multi-Criteria Analysis (MCA) technique for each cell in turn. The product is a 'Suitability Score' value for each cell.

Validation of each model was performed by comparing the suitability score of cells containing existing habitat of the type being modelled and examining the distribution of these cells within the complete grid.

Creating the Grid

A division of the landscape was required for the modelling so that different areas could be assessed for their suitability and comparisons between the areas could be made. A regular grid of square cells was chosen as the most suitable form of division as it ensured that the geometry of the units was kept simple and consistent, and the introduction of bias or spatial errors by using irregular units was minimised.

The square cells used were derived from the British National Grid coordinate system to make sure they aligned with GiGL's species records. A 50m side length was chosen to maximise the spatial accuracy of the modelling without exaggerating the precision of some of the model inputs, and to keep the computation processing manageable.

Initial Screening

To reduce computation times and give the model outputs a realistic distribution, some cells were excluded from the modelling on the grounds that they consisted of land cover types that were not appropriate for any habitat re-creation or restoration. Those land cover types considered unsuitable were urban land, transport corridors and open water (rivers, canals and standing water). See Table 1 for more information.

Suitability Criteria Review

For each priority habitat, research was undertaken to determine the current understanding of factors influencing the distribution of the habitat and affecting the suitability of land for the restoration or re-creation of the habitat. Literature and previous studies gave a lot of insight into this (Appendix 1), but further work was done using statistical calculation and knowledge of London to adapt the criteria to a more urban environment. Once all such factors had been identified, digital datasets were sought that directly reflected the spatial distribution of the factors. Table 2 gives the sources of each of the datasets used in the modelling.

Feasibility and Scoring Criteria

For each habitat suitability model, cells were excluded where they were definitively unsuitable for the restoration or re-creation of that habitat. For example, most priority habitats rely on certain soil types to grow so those soil types that wouldn't be viable for the habitat in question were excluded from the model. These criteria were termed **feasibility criteria** (F) and can be found in Table 3.

The digital datasets relating to each suitability criterion were then overlaid with each feasible model cell to generate a score for that criterion within that cell. Score values were generated using GIS overlay and summary operations to measure the area or length of the criterion dataset in each cell. The measurement was then converted into a score value either through a simple ratio

Table 1: Feasibility of cells for initial screening			
	Dataset	**Cell Exclusion Criteria**	**Notes**
Urban areas	OS MasterMap	More than 80% cover by area	Only excluded if cell is mostly urban (>80%) and there is >250 sq metres of land opportunity.
Transport corridors	OS MasterMap	More than 80% cover by area	Only excluded if cell is mostly transport corridor (>80%) and there is >250 sq metres of land opportunity.
Water	OS MasterMap	More than 95% cover by area	Only excluded if cell is almost entirely water (>95%) and there is <125 sq metres of land opportunity.
Feasible criteria (soil, floodplain, geology, proximity to water, etc.)	Variety of datasets, see Table 2	More than 95% cover by area	Only included if cell is almost entirely (>95%) that feasible criteria

Table 2: Data used and their sources	
Factor	**Data Source**
Soils	Cranfield University Soilscapes
Indicator Species	GiGL's Species Database and Axiophyte list provided by Mark Spencer and Paul Losse and indicator species lists of birds, butterflies and moths provided by species experts
Current Land Cover – Priority and Non-Priority	GiGL's Habitat and Land Use (HLU) dataset
Geology	British Geological Survey Geology layer at 1:50,000 resolution
Floodplain – Fluvial and Coastal	Environment Agency Flood Zone 2 layer -representing a frequency of 1 flood in 1000 years
Floodplain – Groundwater	British Geological Survey Groundwater Flooding
Shallow Slow Flowing Water	Ordnance Survey Master Map Water Lines and Polygons
Presence of Ditch Drainage	
Proximity to Water	

Table 3: Model Scores, where "F" indicates a feasible criterion. Non-feasible criteria are scored 1-9, where 9 has the highest weighting in the total cell score

Model	Factor	GiGL Weighting
Lowland Dry Acid Grassland	Soils	**F**
	Soils	9
	Current land cover	5
	Indicator species	3
Wet Woodland	Soils	**F**
	Floodplain (fluvial & groundwater)	**F**
	Shallow slow flowing water	9
	Current land cover	3
	Indicator species	3
Floodplain Grazing Marsh	Floodplain (fluvial)	**F**
	Soils	9
	Presence of ditch drainage	7
	Indicator species	3
	Current land cover	5
Purple Moor Grass and Rush Pastures	Soils	**F**
	Floodplain (fluvial)	**F**
	Soils	9
	Current land cover	5
	Indicator species	3
Lowland Meadows	Soils	**F**
	Soils	7
	Current land cover	9
	Floodplain (fluvial)	3
	Indicator species	3
Lowland Heathland	Soils	**F**
	Soils	9
	Current land cover	5
	Indicator species	3
Lowland Calcareous Grassland	Bedrock geology	**F**
	Soils	9
	Current land cover	5
	Geology - superficial deposits	5
	Indicator species	3
Reedbeds	Proximity to water	**F**
	Current land cover	**F**
	Shallow slow flowing water	9
	Current land cover	3
	Indicator species	3
Coastal Grazing Marsh	Floodplain (coastal)	**F**
	Soils	9
	Presence of ditch drainage	7
	Current land cover	5
	Indicator species	3
Lowland Mixed Deciduous Woodland	Soils	**F**
	Indicator species	5
	Current land cover	9

adjustment or via additional score lookups. The score value ranged from zero to nine, with a higher score reflecting a greater suitability. This was the first stage in the MCA technique used. Further details on how each factor was prepared and scored are below.

Species

GiGL's comprehensive species database was used to collate the indicator species for each habitat. The records used were based on a National Grid Reference with coordinate precisions of 1m, 10m, 100m, 1km and 2km.

The basic principle used when generating scores from the species data was to count the number of species occurring in each model cell and scale the range of the resulting totals up or down to the maximum score of 9. As there was variation in the precision of the records they were represented as squares reflecting their reference precision.

To represent the uncertainty in the location of lower precision records, the influence of any record with an extent greater than the area of a model cell (2500m^2) was reduced in inverse proportion to the area that it related to. Thus, a record with a precision of 100m would be represented by a square with an area of 10,000m^2 and would receive an influence of 0.25. Records that were equal to or smaller than the area of a model cell received an influence of 1. The effect of this was to greatly reduce the contribution made by lower precision records.

To combine the individual species occurrences into scores for each model cell, a sum of the influence values of all species polygons overlapping the cell was calculated. Where multiple occurrences of the same species with different influence values were present, the largest influence value was used.

Soils

Soil types were used as both feasibility and suitability criteria. Feasibility criteria used the presence of >95% quantity of suitable soil type in a model cell as the inclusion rule. Suitability scoring was done by assigning a score of 0-9 to each combination of soil type and modelled habitat. The scores used are in Table 4. To calculate a model cell's score for a particular habitat, the scores of each soil type present in the cell were multiplied by the proportion of the cell covered and then summed.

Land Cover/Habitats

The habitat data used was GiGL's Habitat and Land Use (HLU) dataset. This dataset gives complete polygon coverage of Greater London based on Ordnance Survey MasterMap and GiGL's legacy habitat data which uses London Survey Methodology. The HLU data was used as the source for the extent of existing habitat and land use types, both priority and otherwise.

Scoring of existing habitat types was carried out by assigning a score of 0-9 to each combination of existing habitat and modelled habitat. The scores are shown in Table 5 and 6 for non-priority

Table 4: Soil Scores per habitat. Scores are 1-9 with 9 being the most suitable soil. Greyed out boxes are not suitable and do not score.										
	CGM	FGM	LCG	LDAG	LH	LM	LMDW	PMGRP	RB	WW
Freely draining lime-rich loamy soils			5				9			
Freely draining slightly acid but base-rich soils			7	3		3	9			
Freely draining slightly acid loamy soils				7	3	9	9			
Freely draining slightly acid sandy soils				7	5	5	9			
Freely draining very acid sandy and loamy soils				9	9	3	9			
Loamy and clayey floodplain soils with naturally high groundwater		9				9		7	9	9
Loamy and clayey soils of coastal flats with naturally high groundwater	9					9		7	9	9
Loamy soils with naturally high groundwater	9	9		3	3	5		7	9	9
Naturally wet, very acid sandy and loamy soils				7	9			5	7	9
Shallow lime-rich soils over chalk or limestone			9				9			
Slightly acid loamy and clayey soils with impeded drainage	5	5		3		5	9	3		9
Slowly permeable seasonally wet acid loamy and clayey soils	7	7		3		1	9	5		9
Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils	7	7		5		9	9	5		9

Table 5: Non-Priority land cover scores per habitat. Scores are 1-9 with 9 being the most suitable land cover. Greyed out boxes are not suitable and do not score.

	CGM	FGM	LCG	LDAG	LH	LM	LMDW	PMGRP	RB	WW
Arable	6	6	2	5	3	4		6		
Bog										
Bracken	5	5		9	9	7				
Built environment										
Fen, marsh and swamp	7	7			3			7	7	7
Improved grassland	7	7	3	6	4	5		7		
Inland rock										
Linear vegetation			5	5		5				
Mudflats										
Open vegetation	5	5	5	5	5	5	5	5	5	5
Other secondary woodland			4	7	7		6			6
Plantation woodland			4	7	8		9			9
Scrub	5	5	7	9	9	8	9			9
Semi-improved grassland	9	9	9	9	7	9		9		
Swamp	3	3						5	9	3
Transport										
Unconfirmed acid grassland				9	9			5		
Unconfirmed calcareous grassland			9							
Unconfirmed neutral grassland	5	5				9		5		
Undetermined mixed habitat	5	5	5	5	5	5	5	5	5	5
Water										

Table 6: Priority land cover scores per habitat. Scores are 1-9 with 9 being the most suitable land cover. Greyed out boxes are not suitable and do not score.

	CGM	FGM	LCG	LDAG	LH	LM	LMDW	PMGRP	RB	WW
Lowland Calcareous Grassland			9							
Lowland Dry Acid Grassland				9	7			3		
Lowland Heathland				7	9					
Lowland Meadows	5	5				9		3		
Lowland Mixed Deciduous Woodland			3	3	5		9			5
Purple Moor Grass and Rush Pasture	5	5				3		9		3
Reedbeds									9	
Traditional Orchards			7	7		3				
Wet Woodland					3				3	9
Lowland Beech and Yew Woodland										
Coastal and Floodplain Grazing Marsh	9	9								
Lowland Fens	5	5			3			3	5	5
Wood-Pasture and Parkland			7	7	7	5				
Coastal Saltmarsh										

habitat and priority habitat respectively. To calculate a model cell's score for a particular habitat, the scores of each existing habitat present in the cell were multiplied by the proportion of the cell covered and then summed.

Geology

Generally, soils data was used in preference to geology, with the exception of Lowland Calcareous Grassland. In this case, cells were only included if they overlapped with the spatial extent of chalk bedrock geological units. The remaining cells were scored for the lack of non-chalk superficial deposits.

Floodplains

The distinction between Coastal and Floodplain Grazing Marsh was made on the basis of the flooding 'Type' attribute recorded in the Flood Zone dataset. Coastal Grazing Marsh used the 'Tidal Events/Models' as a feasibility criterion, whereas Floodplain Grazing Marsh used the 'Fluvial Events/Models'. Areas containing both tidal and fluvial events/models were used for both habitats. Purple Moor Grass and Rush Pastures and Lowland Meadows also used fluvial floodplain as a criterion. Wet Woodland combined fluvial floodplain with groundwater flooding data to produce the feasibility layer.

Presence of Ditch Drainage

The presence of ditches as water level management structures is important for Coastal and Floodplain Grazing Marsh habitats. Manmade drainage channels were distinguished from natural water channels by using the Environment Agency's Detailed River Network (EA's DRN), which is a centreline representation of watercourses in England and Wales based on Ordnance Survey Master Map (OSMM) data. Manmade drainage features were represented by water lines from the OSMM Topographic Line that did not overlap the EA's DRN or water polygons from the OSMM Topographic Area, and features with the Descriptive Term attribute set to 'Drain'.

Scoring of drainage features was in proportion to the total length of identified drainage features in each cell. To remove the influence of outliers on the scoring distribution, scores reached a maximum of 9 at a length of 100m.

Shallow Slow Flowing Water

Open water transitions are used as a feasibility and suitability criterion for Reedbeds, and a suitability criterion for Wet Woodland. Ideally transitions to slow moving, shallow water would be used, but a dataset was not found that could provide this level of detail. Instead, water polygons extracted from the OSMM Topographic Area layer were used as a proxy for the feasibility criterion for Reedbeds – any cell overlapping one of these was counted.

For the Wet Woodland suitability criterion, the length of the transition in a cell, be it river bank or coastal shoreline, was used. This was derived from water edge lines extracted from the OSMM Topographic Line layer. Waterbodies less than 1 metre in width in urban areas (and 2 metres in

rural areas) are usually represented by a single line in OSMM and therefore these will have a lower influence than waterbodies represented by two distinct bank lines. This was not corrected. Scoring of the length of shore or bank was done in proportion to the length of water edge features in each cell. To remove the influence of outliers on the scoring distribution, scores reached a maximum of 9 at a length of 200m.

For Reedbeds, the suitability criterion was based on a more complex metric; the ratio of the area of water present in the cell to the length of bank was used, the intention being to score cells containing ponds or large, wide water features more highly than narrow watercourses such as ditches. The ratio calculated was liable to generate very high values for cells containing intertidal ground and a very small length of shoreline, so some thresholds were set to prevent this:

- Cells containing more than 2,400m^2 of water, or less than 20m of bank / shoreline received a score of zero.
- Shoreline lengths of less than 40m were rounded up to 40m.

Proximity to Water

Reedbeds require close proximity to water. To map this feasibility criterion, those cells containing >5% coverage of water from OSMM Water polygons were kept in.

Weighting

The second stage in the MCA process is to generate a single habitat suitability score from the multiple input criteria represented as score values. The multiple score values for the different criteria are combined by calculating the weighted mean (Figure 1), with the weights reflecting the relative importance of each criterion (Table 3).

	Habitat	Species	Soil
Cell A Scores	8	6	7
Cell B Scores	3	5	7
Weights	15	8	7

Cell A HSI: (15x8 + 8x6 + 7x7) / 30 = **7.2**

Cell B HSI: (15x3 + 8x5 + 7x7) / 30 = **4.5**

Figure 1. Simplified weighted scoring process

Whilst the scoring stage is driven by literature values and expert opinion, the process of generating weight values is subjective, and multiple scenarios can be generated by adjusting the weight values to reflect differing stakeholder aims and priorities.

Model Validation

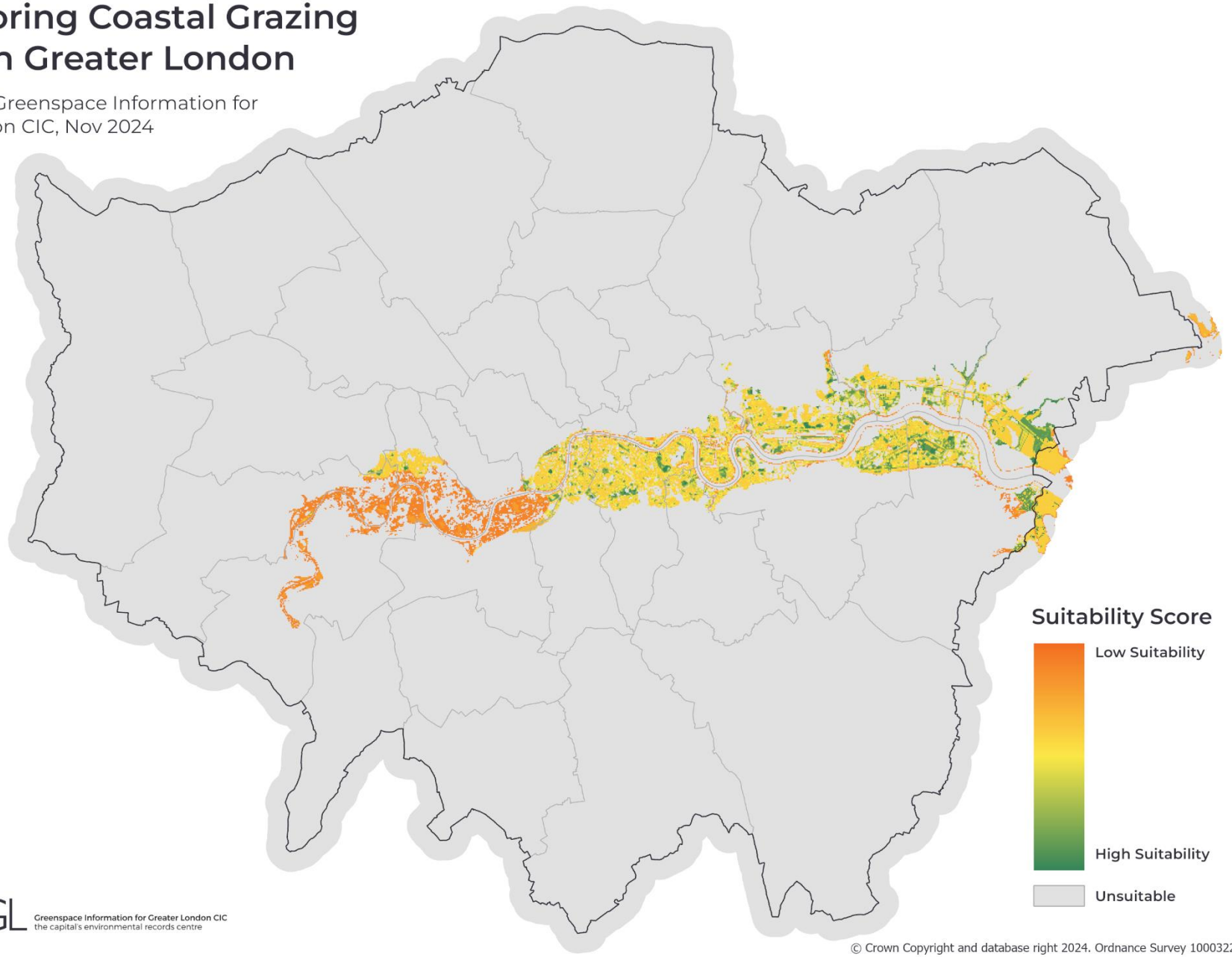
Each model underwent a final stage of validation by including cells that contain a large proportion of existing habitat of the type being modelled. If the model worked then the cells containing the existing habitat should receive amongst the highest suitability index scores. To assess the validity of the model, the distribution of cells containing existing habitat was plotted against their suitability rank out of all the cells in the model.

3. Results

The following maps show the final suitability scores for each grid of the ten priority habitats.

Suitable Locations for Creating or Restoring Coastal Grazing Marsh in Greater London

Produced by Greenspace Information for Greater London CIC, Nov 2024



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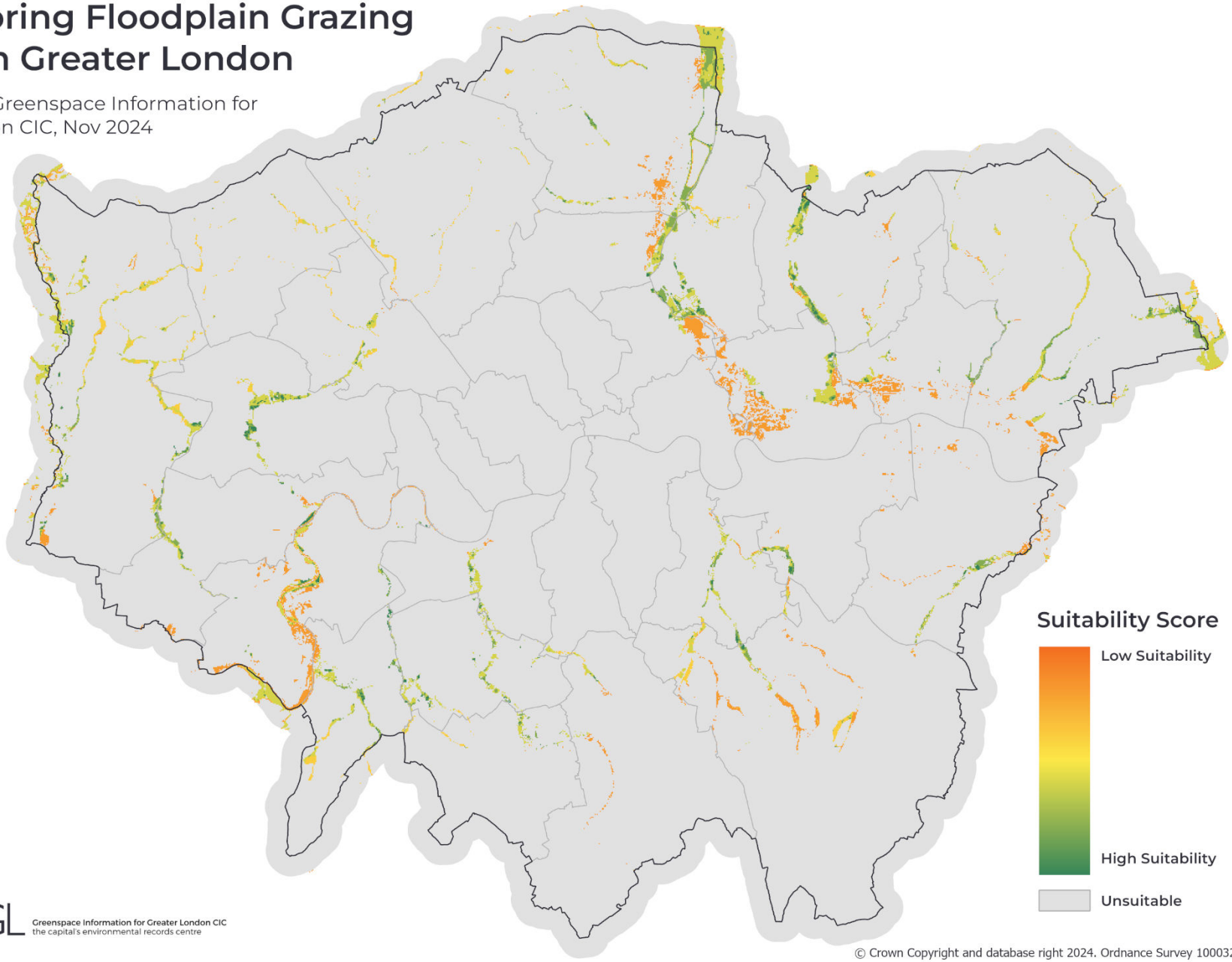
Suitable Locations for Creating or Restoring Floodplain Grazing Marsh in Greater London

Produced by Greenspace Information for Greater London CIC, Nov 2024



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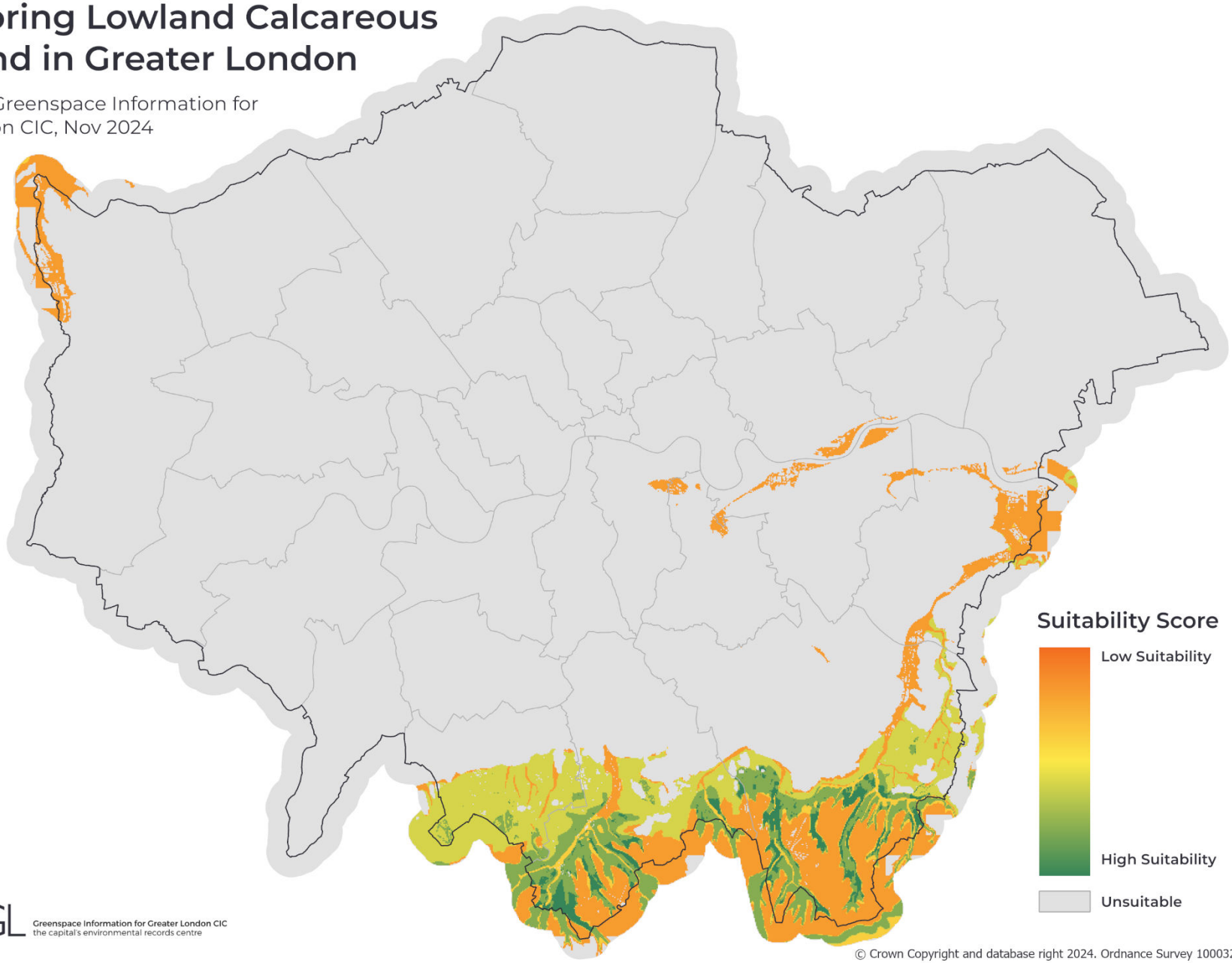
Suitable Locations for Creating or Restoring Lowland Calcareous Grassland in Greater London

Produced by Greenspace Information for Greater London CIC, Nov 2024



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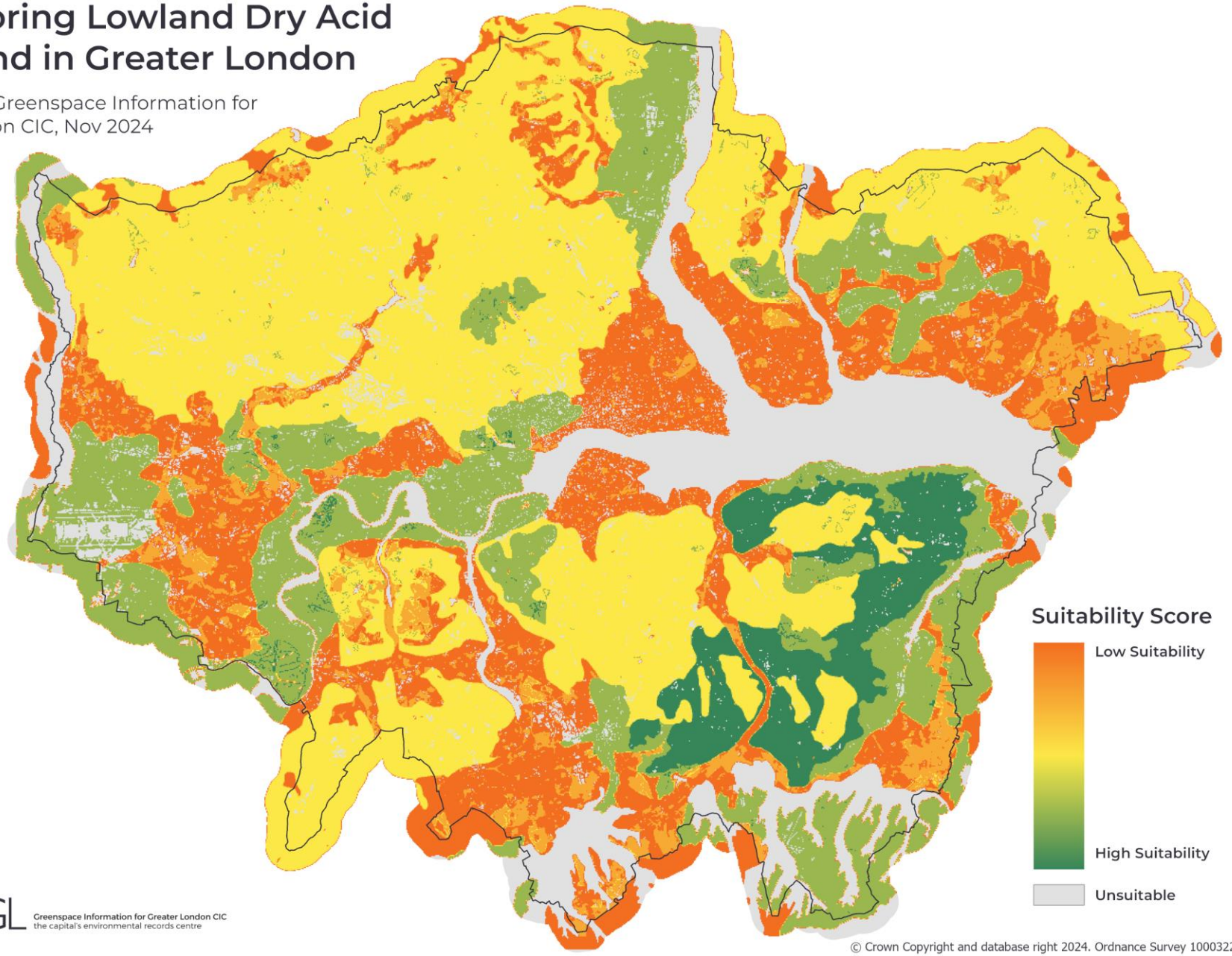
Suitable Locations for Creating or Restoring Lowland Dry Acid Grassland in Greater London

Produced by Greenspace Information for Greater London CIC, Nov 2024



GiGL Greenspace Information for Greater London CIC
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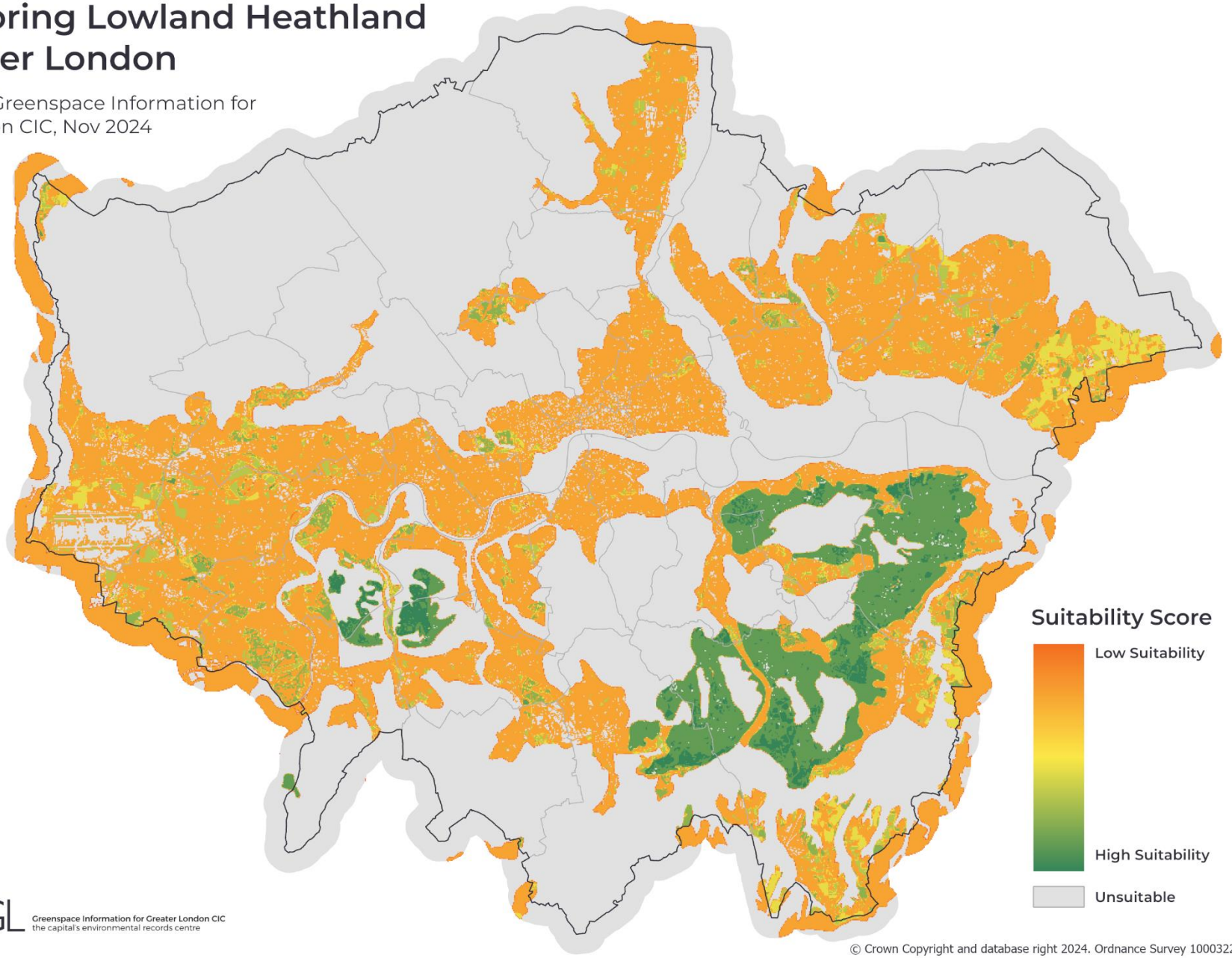
Suitable Locations for Creating or Restoring Lowland Heathland in Greater London

Produced by Greenspace Information for Greater London CIC, Nov 2024



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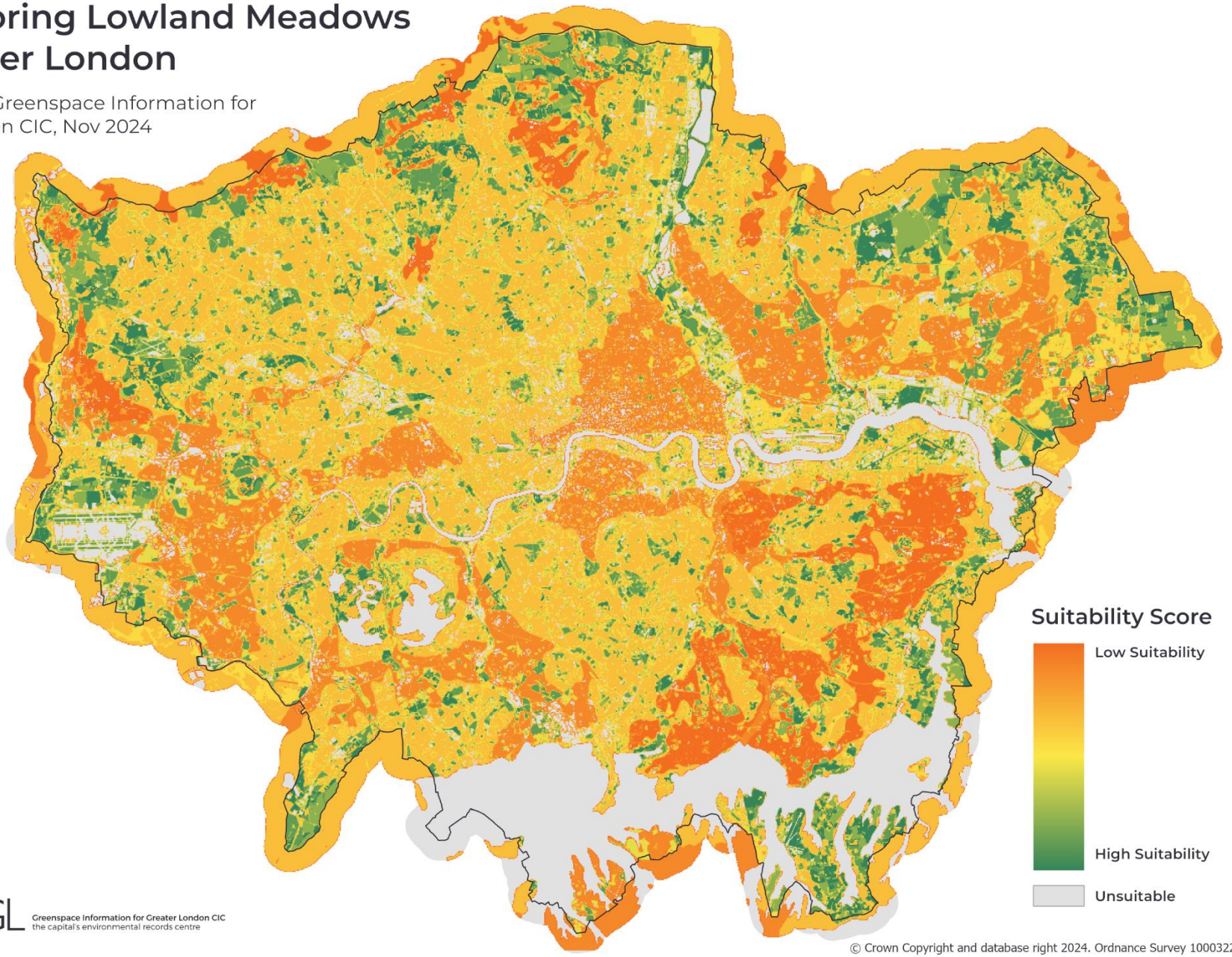
Suitable Locations for Creating or Restoring Lowland Meadows in Greater London

Produced by Greenspace Information for Greater London CIC, Nov 2024



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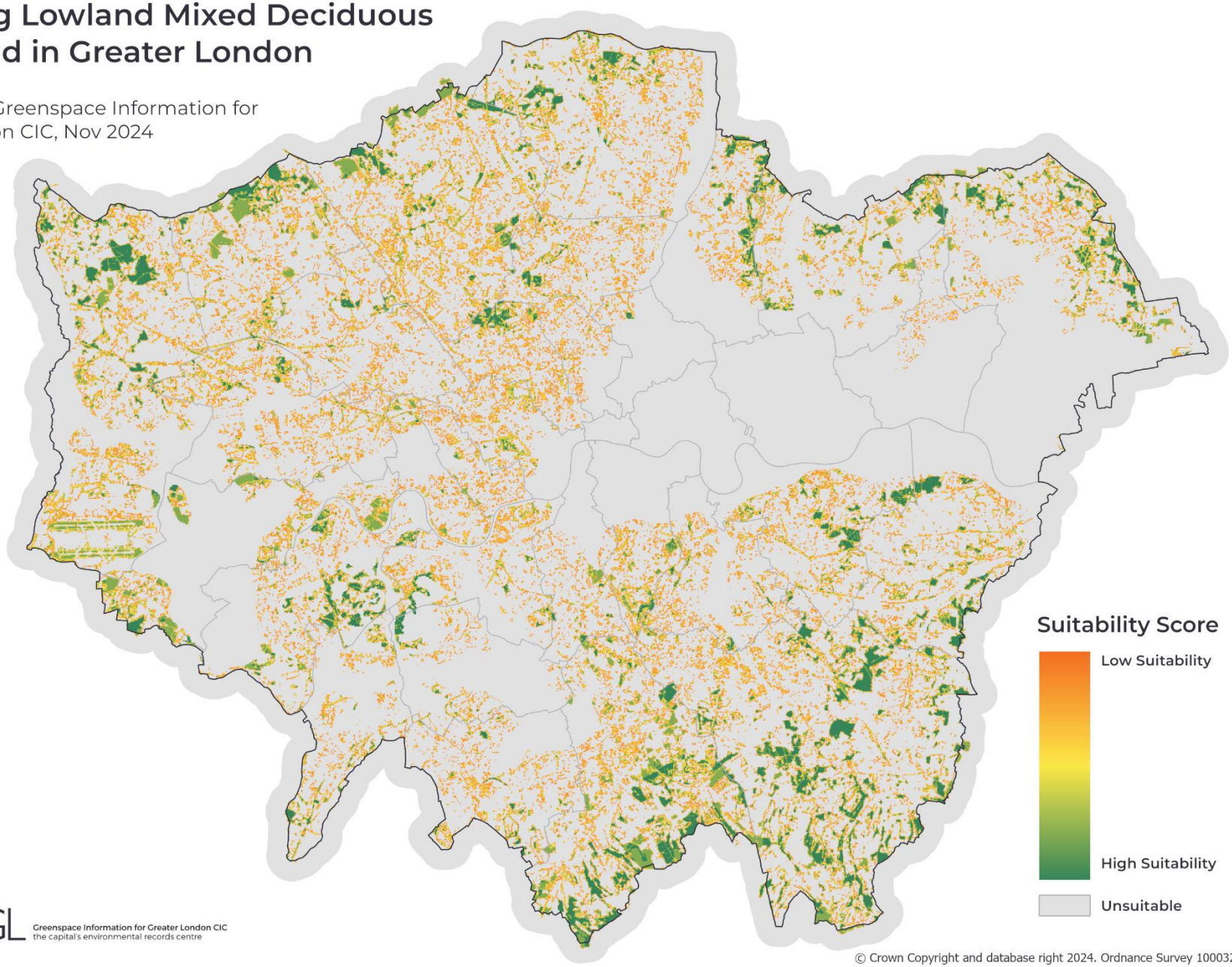
Suitable Locations for Creating or Restoring Lowland Mixed Deciduous Woodland in Greater London

Produced by Greenspace Information for Greater London CIC, Nov 2024



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Suitable Locations for Creating or Restoring Purple Moor Grass and Rush Pasture in Greater London

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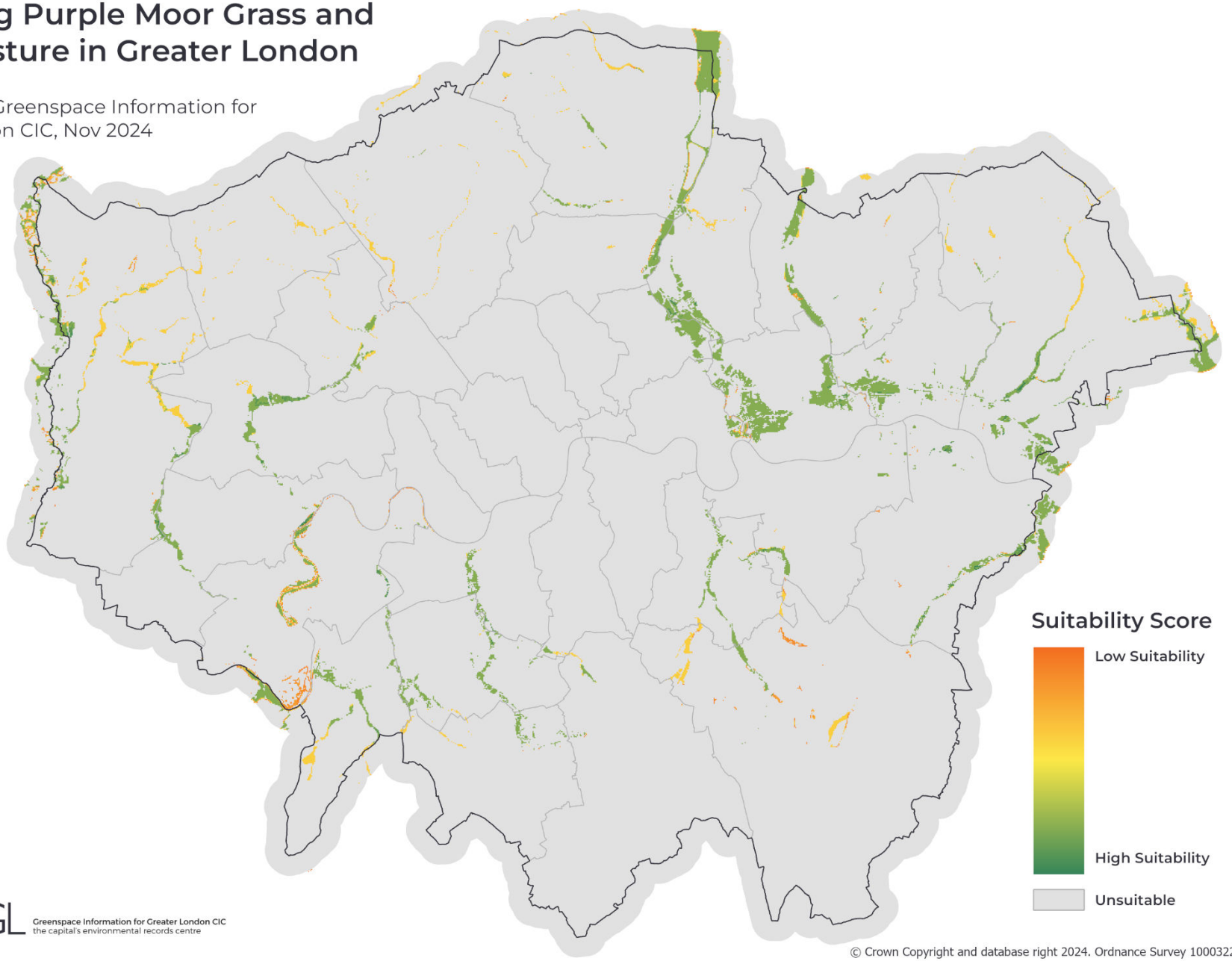

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Suitable Locations for Creating or Restoring Reedbeds in Greater London

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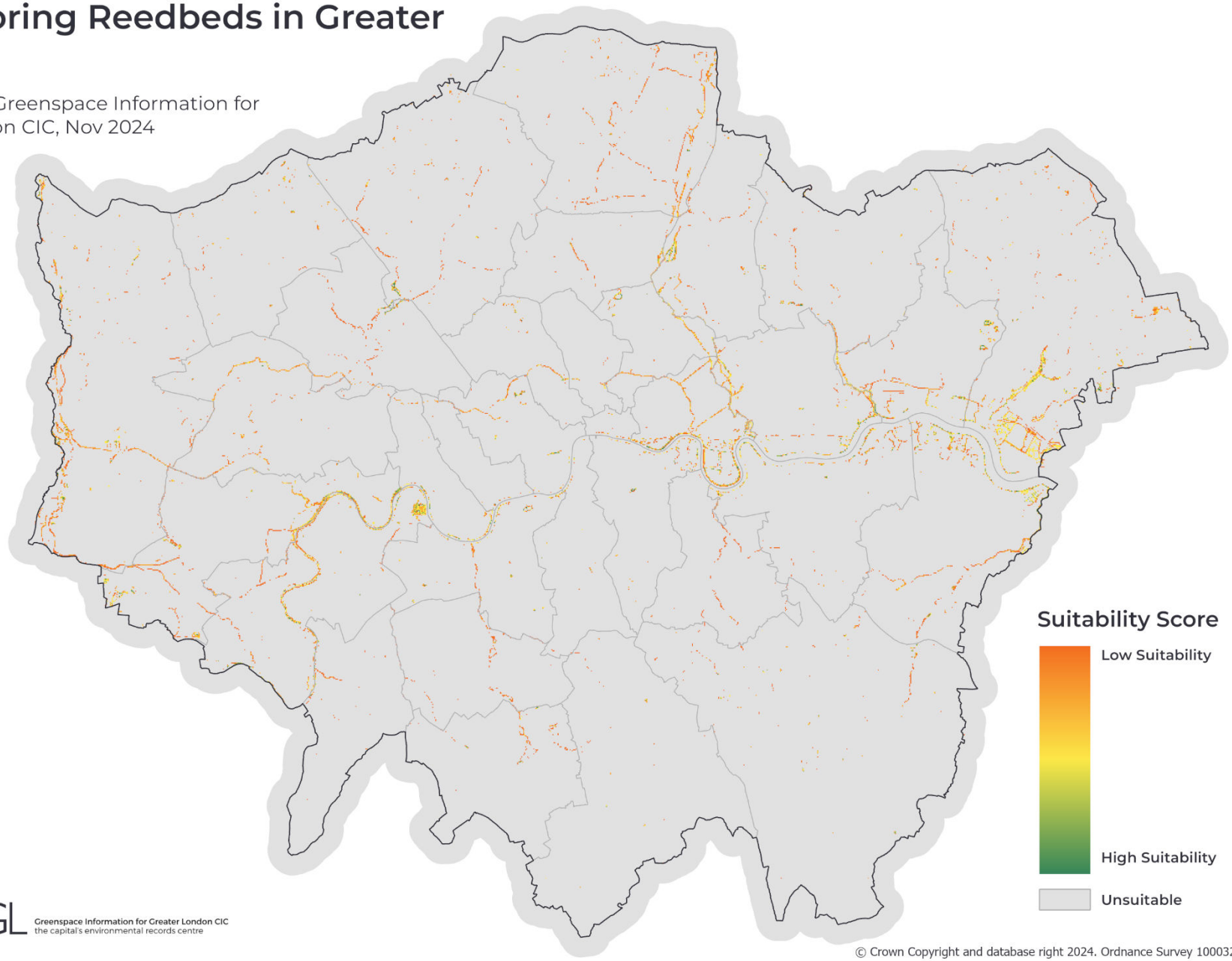

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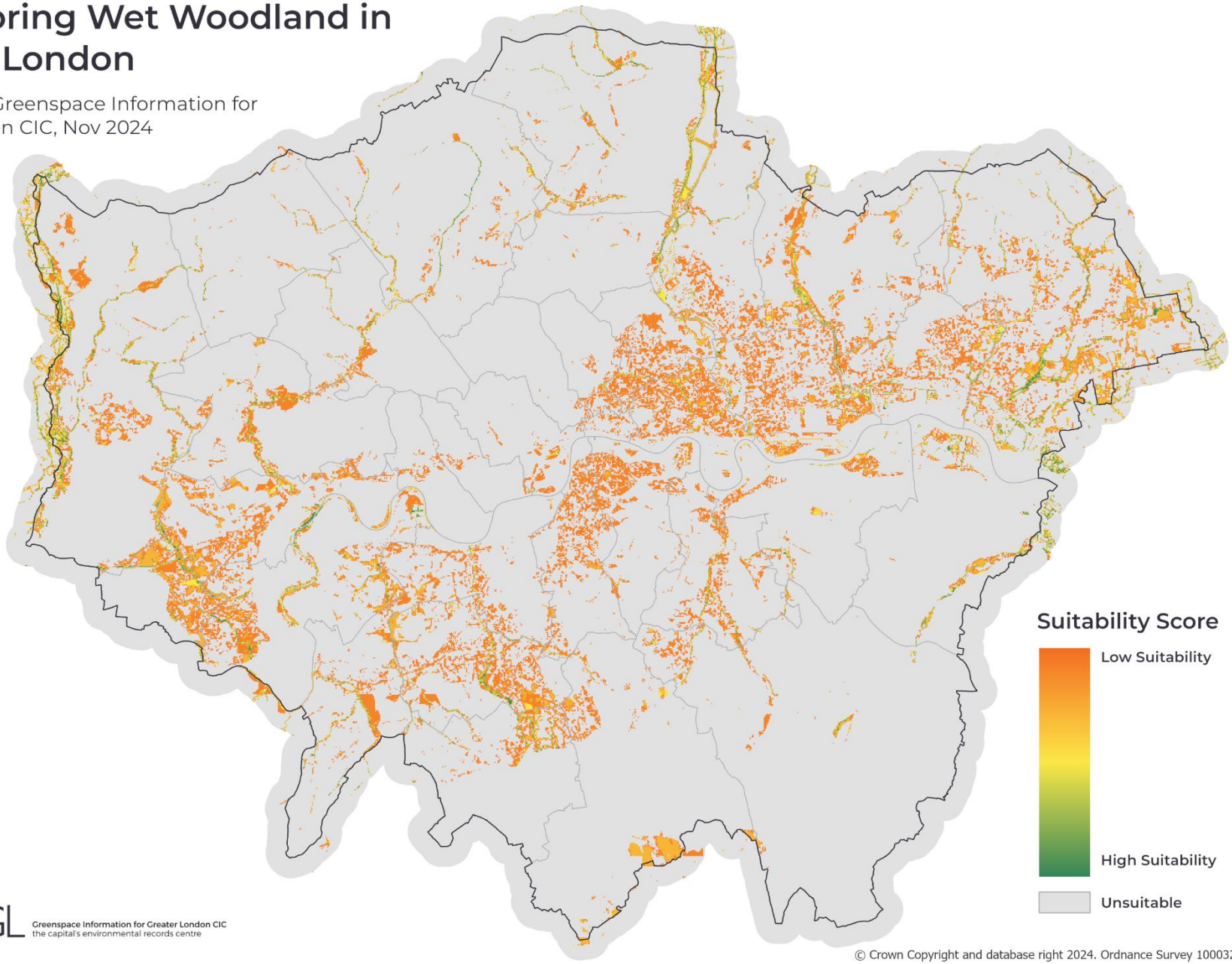
Suitable Locations for Creating or Restoring Wet Woodland in Greater London

Produced by Greenspace Information for Greater London CIC, Nov 2024



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4. Validation

The following validation graphs show the correlation between percent coverage of the habitat within a cell vs the score of that cell. Graphs should show a strong positive correlation if the models have worked, however it is known that the precision of the data on location of existing priority habitats is poor, thus explaining the more gentle inclines that most of these graphs show. There are no records for CGM, FGM and LMDW in GiGL's habitat database so these models could not be validated. All PMGRP in recorded in London fell outside of the scored grid.

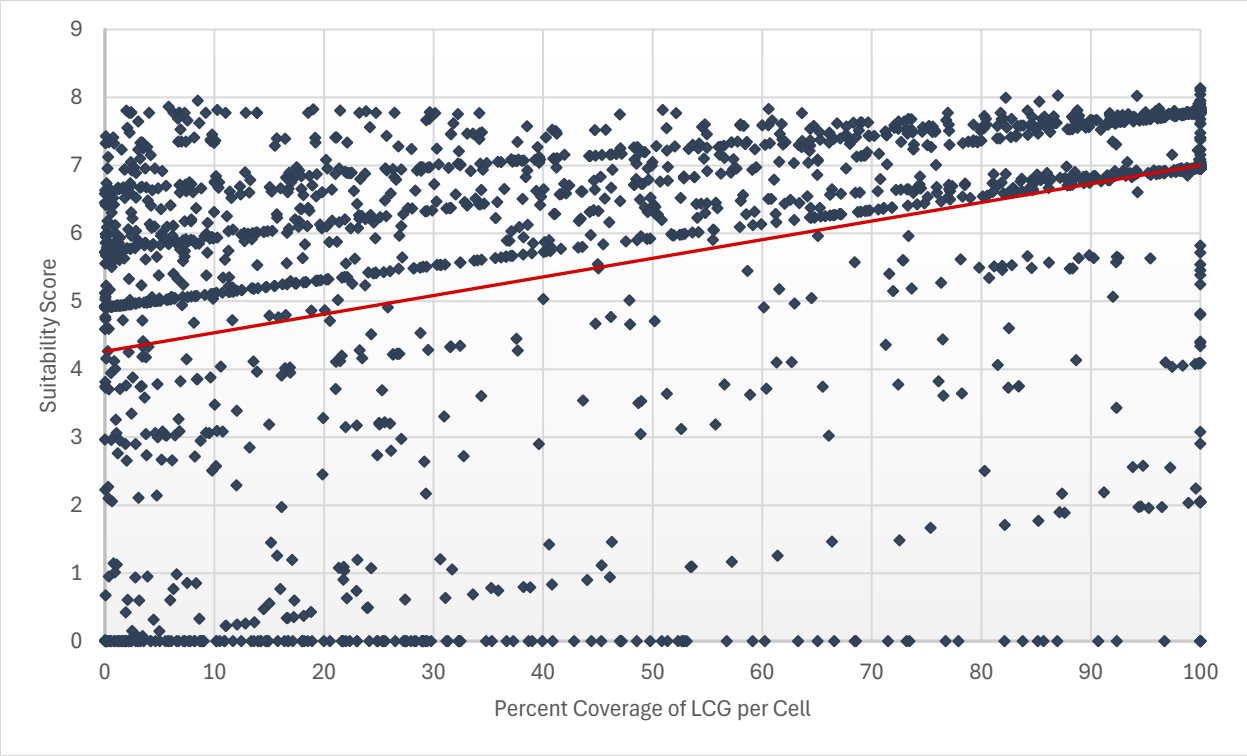

Figure 2 *Validation of the Lowland Calcareous Grassland model*

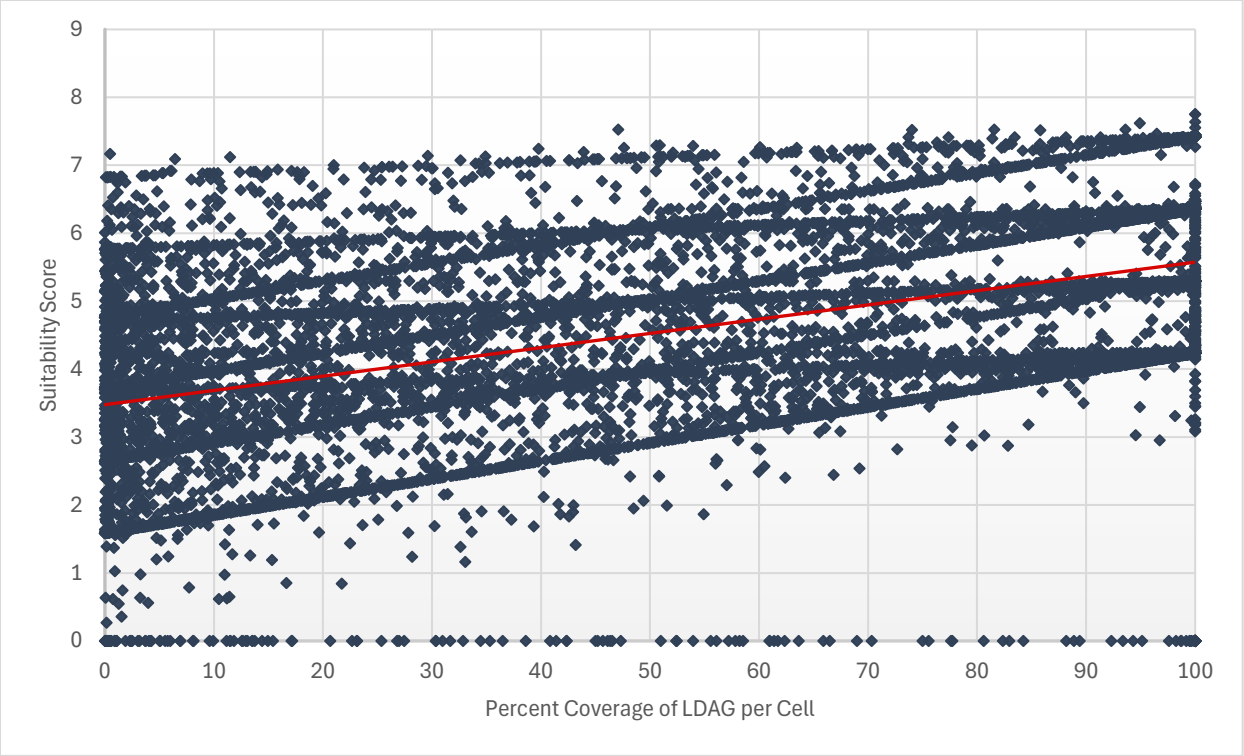

Figure 3 *Validation of the Lowland Dry Acid Grassland model*

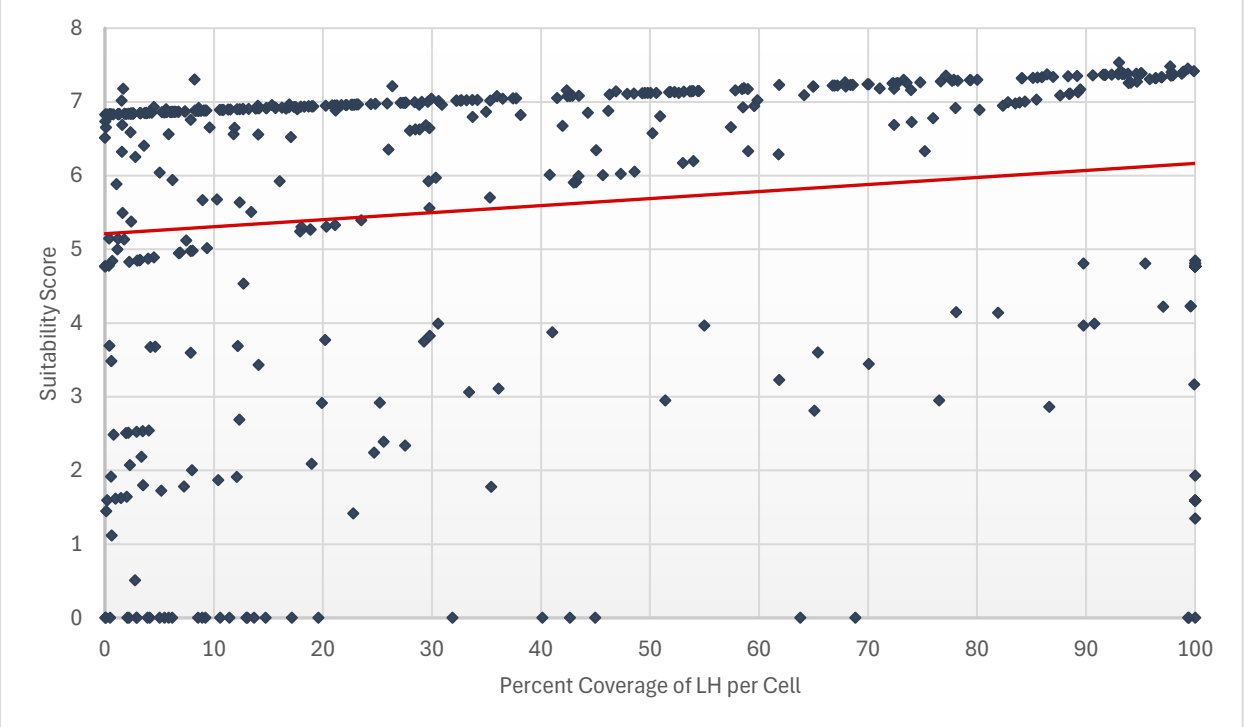

Figure 4 *Validation of the Lowland Heathland model*

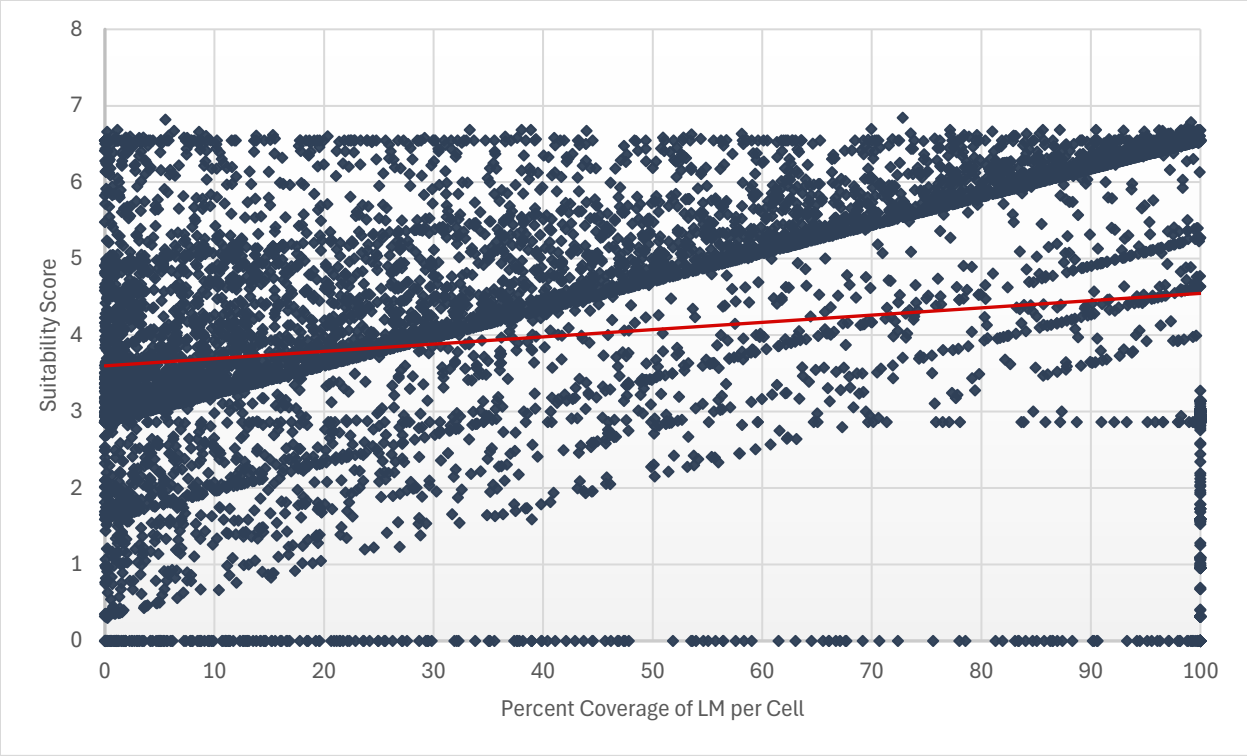

Figure 5 *Validation of the Lowland Meadows model*

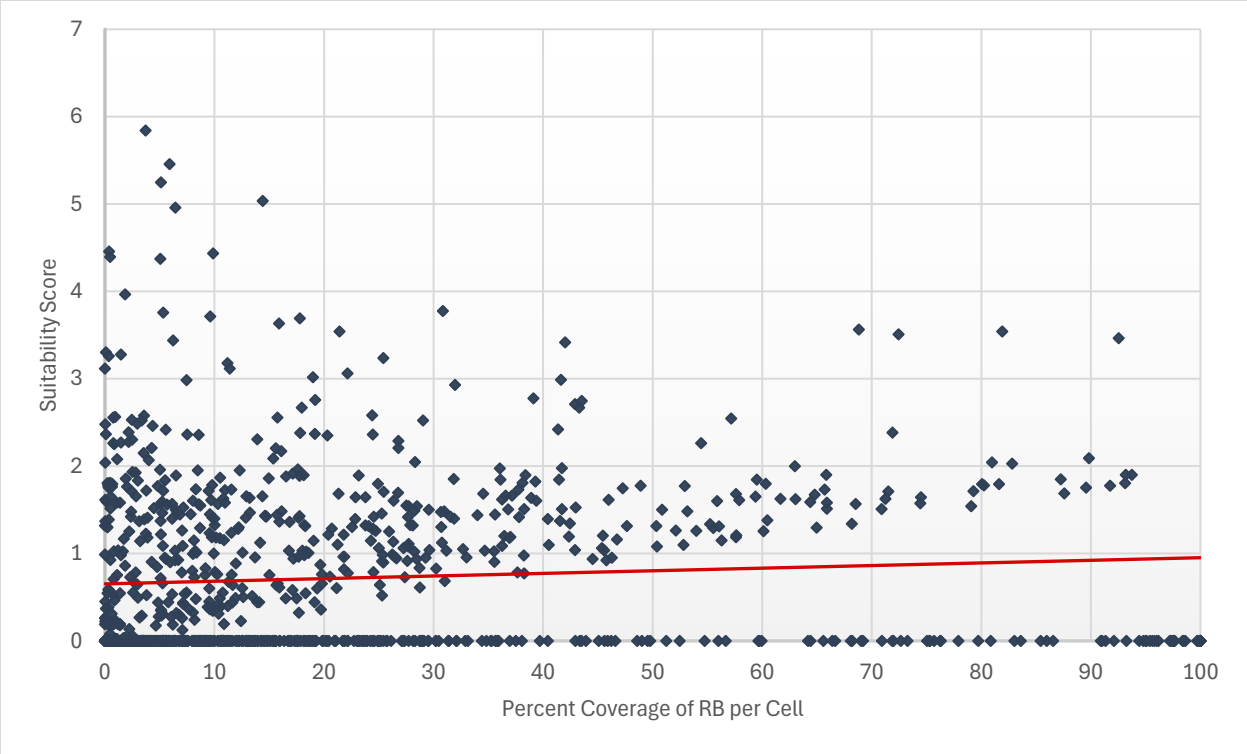

Figure 6 *Validation of the Reedbeds model*

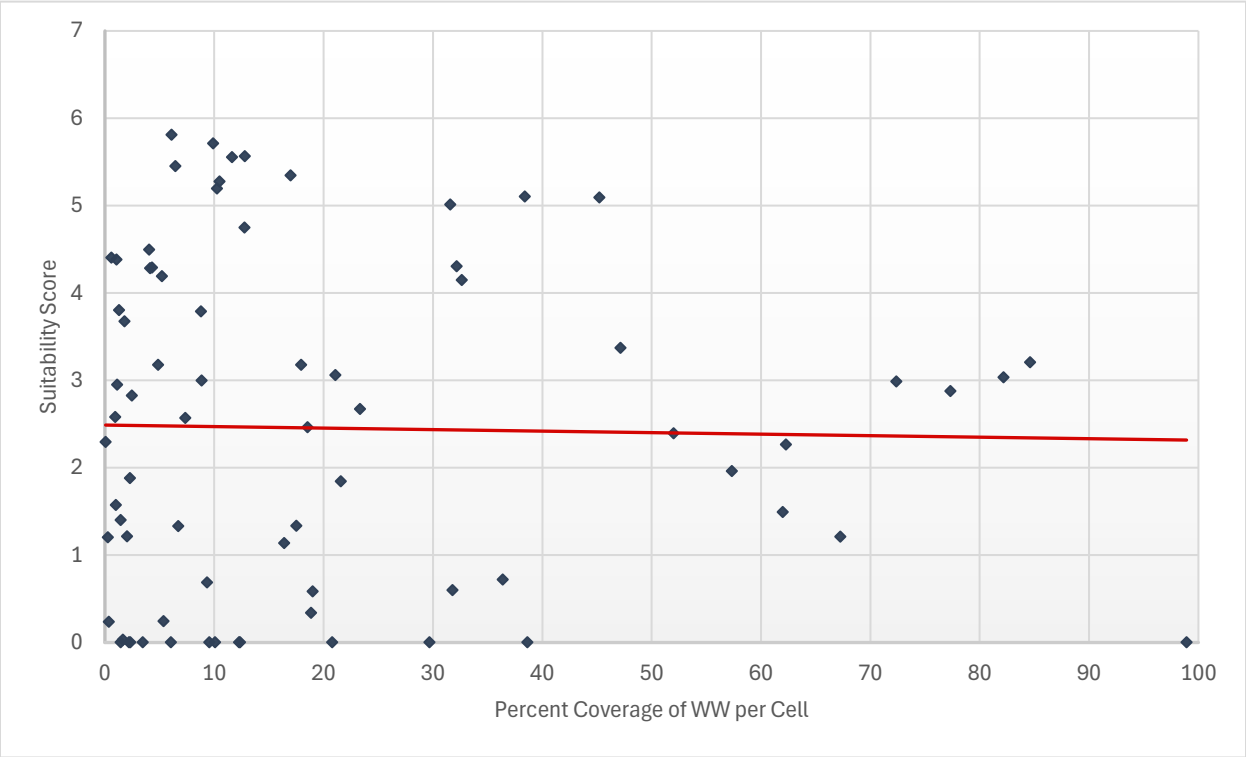

Figure 7 *Validation of the Wet Woodland model*

5. Considerations and Further Work

- Gardens were included in the feasible area
- Existing priority habitats were included in the feasible area as we don't have a high confidence of their location
- The lack of evidence and precision of the location of priority habitats in London made it more difficult to determine the suitable soil types to use in the models and made it more difficult to validate the quality of the models.
- No landscape type criteria were considered, such as proximity to existing habitat and potential site size, nor factors such as land ownership and management. These factors are critical in the practicality of restoring or re-creating habitats in the areas identified. However, data to support these factors can be introduced later by cross-referencing the model outputs with other datasets, such as GiGL's habitat and open space datasets.
- No consideration was made of the age of the species records.
- Some datasets were unavailable, too expensive, or were considered more appropriate to use in later phases of the process rather than influence the scoring from the outset.
    - Agricultural Land Classification: High quality agricultural land is represented as grades 1 and 2 of the Agricultural Land Classification. Typically, areas of such land would not be considered suitable for restoration or re-creation of priority habitats

because, not only are they less likely to contain remnants of former priority habitats, but their quality also makes them less financially viable to take out of productive use. However, high quality agricultural land has not been used as either a feasibility factor or directly when scoring any habitats. If required, it can be readily introduced in a later phase of the project or when employing the models to identify suitable areas of land.

- Natural England national BAP Habitat inventories were not used as the GiGL habitat data was considered more precise and permitted a consistent habitat base to be used.
- EA Depth to Groundwater contours were investigated as an indicator of ground wetness. They were not used as they were not available for the whole of Greater London.
- The Centre for Ecology and Hydrology dataset, Hydrology of Soil Types (HOST) was also considered as a measure of ground wetness. This dataset was not used as it was only produced at a 1km national grid square resolution which was much larger than the model cells, and less detailed than the other soil data available, even though that lacked the more detailed hydrological information.
- Rainfall data was available from the Met Office, but had a licensing charge associated with it, and data was only available at a coarse 5km grid resolution. It was also felt that the variation in rainfall across Greater London was not sufficient to warrant its inclusion as a suitability criterion.
- Flood storage areas were available from the EA Flood Map data and are suggested as a suitable location for Grazing Marsh habitat. However, there were only a few such areas in London, and so the data was not used as a suitability factor with the assumption that it could become a consideration in the subsequent evaluation of the model outputs.
- Seed banks: Maps of the historic habitat distribution for woodland and heathland would be a useful for modelling both habitats as the seed banks for both are known to persist in the soil for a long time. However, GiGL are not aware of suitable datasets to use for either habitat.
- Altitude could be a suitability factor for Reedbeds, with areas at higher altitude, e.g. above 150m, being less suitable. However, there are few areas of London likely to be above 150m. And given the financial and time cost involved in analysing a Digital Elevation Model for the whole of London, altitude was not included as a criteria.

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Appendix 1: Habitats

Lowland Dry Acid Grassland (Acid Grassland)

Acid Grassland [1]

Characterised by vegetation dominated by grasses and herbes on a range of lime-deficient soils which have been derived from acidic bedrock of from superficial deposits such as sands and gravels. Such soils usually have a low base status with a pH of less than 5.5. This habitat type includes a range of types from open communities of very dry sandy soils to damp acidic grasslands typically found on shallow peats.

The plant assemblages that develop on acid soils are different from those that develop on neutral soils and calcareous soils and are characterised by the presence of a combination of calcifuge species. The NVC describes 6 types of acid grassland (Rodwell, 1991-2000) as U1-6 plus two types of inland dune communities, SD10 and SD11.

Lowland Acid Grassland [2]

Lowland acid grassland typically occurs on nutrient-poor, generally free-draining soils with pH ranging from 4 to 5.5 overlying acid rocks or superficial deposits such as sands and gravels. It includes NVC U1-4 plant communities.

Definition of lowland acid grassland is problematical but here it is defined as both enclosed and unenclosed acid grassland throughout the UK lowlands (normally below c. 300m). It covers all acid grassland managed in functional enclosures. It often occurs as an integral part of lowland heath landscapes, in parklands and locally on coastal cliffs and shingle. It is normally managed as pasture.

Acid grassland is characterised by a range of plant species with species abundance depending on community type and locality. Dwarf shrubs such as heather and bilberry can also occur but at low abundance. Lowland acid grassland often forms a mosaic with dwarf shrub heath. Acid grasslands can have a high cover of bryophytes and parched acid grassland can be rich in lichens. Acid grassland is very variable in terms of species richness and stands can range from relatively species-poor (less than 5 species per 4m^2) to species-rich (in excess of 25 species per 4m^2). Parched acid grassland in particular contains a significant number of rare and scarce vascular plant species many of which are annuals. The bird fauna of acid grassland is very similar to that of other lowland dry grasslands which collectively are considered to be a priority habitat for conservation action. Many of the invertebrates that occur in acid grassland are specialist species which do not occur in other types of grassland. The open parched acid grasslands on sandy soils in particular, can support a considerable number of ground-dwelling and burrowing invertebrates such as solitary bees and wasps. A number of rare and scarce species are associated with the habitat.

Lowland Dry Acid Grassland [3]

This habitat is strongly influenced by soil type, being associated with nutrient poor, free draining soils (BRIG, 2008). Soil types were therefore used for the feasibility criterion, and subsequently as a suitability criterion where soil types within the feasible area were assigned varying suitability.

Existing habitat types regarded as being most suitable for Lowland Dry Acid Grassland were no-priority, unimproved acid grassland, followed by scrub and bracken and then woodland. Afforested heathland was counted as being more suitable than other woodland.

Lowland Calcareous Grassland (Chalk Grassland)

Calcareous Grassland [1]

Characterised by vegetation dominated by grasses and herbs on shallow, well-drained soils rich in bases (principally calcium carbonate) such as chalk and other types of limestone. Although the such soils usually have a high base status with a pH above 6, it may also be more moderate and calcareous grassland communities can occur on soils with a pH as low as 5.

The plant assemblages that develop on calcareous soils are different to those that occur on neutral and acid soils and characteristically include a range of strict calcicoles (plants that thrives in lime rich soil). The NVC describes 14 types of calcareous grassland (Rodwell, 1991-2000) as CG1-14.

Lowland Calcareous Grassland [2]

Lowland calcareous grasslands are developed on shallow lime-rich soils generally overlying limestone rocks, including chalk. These grasslands are now largely found on distinct topographic features such as escarpments or dry valley slopes and sometimes on ancient earthworks in landscapes strongly influenced by the underlying limestone geology, but remnant examples do occur on flatter topography. They are typically managed as components of pastoral or mixed farming systems, supporting sheep, cattle or sometimes horses; a few examples are cut for hay.

The definition of calcareous grasslands covers a range of plant communities in which lime-loving plants are characteristic. Lowland types are defined as the first eight calcareous grassland NVC communities, CG1 to CG8 as these communities are largely restricted to the warmer and drier climates of the southern and eastern areas of the United Kingdom.

Lowland calcareous grasslands support a very rich flora including many nationally rare and scarce species. The invertebrate fauna is also diverse and includes scarce species and these grasslands also provide feeding or breeding habitat for a number of scarce or declining birds.

Scrub is frequently associated with calcareous grassland and can contribute to local biodiversity by providing shelter for invertebrates and scrub edge conditions suitable for some species. Dwarf

shrubs and herbs characteristic of acid soils are also sometimes associated with calcareous grassland, forming chalk or limestone heath.

Lowland Calcareous Grassland [3]

Lowland Calcareous Grassland benefits from having some well-defined factors affecting suitability, and was the focus of a Habitat Suitability model developed in Hampshire by HBIC (Foy, 2006)

The feasibility criterion used was the presence of underlying chalk bedrock. Free draining, shallow, lime rich soil types were then considered an important suitability criterion (BRIG, 2008).

The proximity to arable land was considered a negative factor, as this brings an increased risk of fertilizer drift (Foy, 2006). However, as this involves the proximity to another habitat, it was decided to not include a metric for this factor in the model as it could be covered in later phases that would consider proximity effects for all models in more detail.

Davies & Waite (1998) both investigated the persistence of the calcareous grassland seed bank after abandonment and reversion through scrub to woodland, concluding that whilst a seed bank persists in such situations, it is relatively species poor, and decreases with time. Consequently, existing non-priority, unimproved calcareous grassland was viewed as most suitable for restoration or re-creation, followed in order by scrub, woodland and improved grassland.

Whilst there is an association between steeper slopes and extant Lowland Calcareous Grassland, this is thought to be due to the agricultural improvement of shallower slopes, rather than being indicative of habitat suitability (BRIG, 2008) and hence slope was not included as a factor for this model.

Lowland Heathland (Dwarf Shrub Heath)

Dwarf Shrub Heath [1]

Characterised by vegetation that has a greater than 25% cover of plant species from the heath family (ericoids) or dwarf gorse *Ulex minor*. It generally occurs on well-drained, nutrient-poor, acid soils. Heaths do occur on more base-rich soils but these are more limited in extent and can be recognised by the presence of herbs characteristic of calcareous grassland. Dwarf shrub heath includes both dry and wet heath types.

This habitat types does not include dwarf shrub dominated vegetation in which species characteristic of peat-forming vegetation such as cotton-grass *Eriophorum* spp. And peat-building sphagna are abundant, or that occurs on deep peat (greater than 0.5 m) as these are considered ‘Bog’ habitat types.

The NVC describes 14 plant communities (Rodwell, 1991-2000) most frequently encountered with dwarf scrub heath as H1-10 plus H12, H16, H18, H21, M15-16.

Lowland Heathland [2]

Lowland heathland is described as a broadly open landscape on impoverished, acidic mineral and shallow peat soil, which is characterised by the presence of plants such as heathers and dwarf gorses. Areas of heathland in good condition should consist of an ericaceous layer of varying heights and structures, plus some or all of the following additional features, depending on environmental and/or management conditions; scattered and clumped trees and scrub; bracken; areas of bare ground; areas of acid grassland; lichens; gorse; wet heaths, bogs and open waters.

Lowland heathland is a dynamic habitat which undergoes significant changes in different successional stages, from bare ground (e.g. after burning or tree clearing) and grassy stages, to mature, dense heath. These different stages often co-occur on a site. The presence and numbers of characteristic birds, reptiles, invertebrates, vascular plants, bryophytes and lichens are important indicators of habitat quality.

In terms of distinguishing between lowland heathland and genuine acid grassland, less than 25% dwarf shrub cover should be assessed as grassland, over 25% as heathland.

Lowland Heathland [3]

The Priority Habitat definition of Lowland Heathland (BRIG, 2008) includes patches of Lowland Dry Acid Grassland as important components of heath, hence the suitability criteria for these two habitats are very similar. The major difference is that Lowland Heathland can includes wet heaths, and therefore slowly permeable, seasonally wet, base poor soil types are also included in the feasibility criteria.

Walker et al (2004) give examples of viable heathland seed banks surviving for over 40 years in woodland plantations, and therefore evidence of historic heathland is regarded as a suitability criterion. Existing habitat is treated in a similar manner to Lowland Dry Acid Grassland, apart from the inclusion of non-priority fen habitats as being potentially suitable, and the lower suitability of arable and improved grassland for restoration to Lowland Heathland noted by Walker et al (2004).

Reedbeds

Reedbeds [1]

See Lowland Fens (Fen, marsh and swamp).

Reedbeds [2]

Reedbeds are wetlands dominated by stands of the common reed *Phragmites australis*, where the water table is at or above ground level for most of the year. They tend to incorporate areas of open water and ditches, and small areas of wet grassland and carr woodland may be associated with them.

Existing reedbeds tend to survive in very small, fragmented areas, with only about 50 covering an area greater than 20 ha. They are amongst the most important habitats for birds in the UK and support a distinctive breeding bird assemblage including 6 nationally rare Red Data Birds; the bittern *Botaurus stellaris*, marsh harrier *Circus aeruginosus*, crane *Grus grus*, Cetti`s warbler *Cettia cetti*, Savi`s warbler *Locustella luscinioides* and bearded tit *Panurus biarmicus*. They also provide roosting and feeding sites for migratory species and are used as roost sites for several raptor species in winter. Five GB Red Data Book invertebrates are also closely associated with reedbeds including red leopard moth *Phragmataecia castanaea* and a rove beetle *Lathrobium rufipenne*.

Reedbeds [3]

Reedbeds are a subset of the Fen habitat, characterized by a dominance of common reed *Phragmites australis* and being situated on open water transitions (BRIG, 2008).

Lowland Meadows (Neutral Grassland)

Neutral Grassland [1]

Characterised by vegetation dominated by grasses and herbs on a range of neutral souls using with a pH of between 4.5 and 6.5. It includes dry hay meadows and pastures together with a range of grasslands which are periodically inundated with water or permanently moist.

For the most part neutral grassland communities have few diagnostic indicator species but lack strong calcicoles or calcifuges of base-rich (chalk) and acid soils respectively. The NVC describes 12 types of unimproved and semi-improved neutral grassland (Rodwell, 1991-2000) as MG1-6 and MG8-13 (Improved grassland can also correspond to MG6 as well as MG7).

Unimproved, species-rich, neutral grasslands, are usually managed traditionally as hay-meadows and pastures. Semi-improved neutral grasslands are usually managed for pasture or for silage or hay. Neutral grassland differs from improved grasslands by having a less lush sward, a greater range and higher coverage of herbs, and usually less than 25% cover of perennial rye-grass *Lolium perenne*.

Lowland Meadows [2]

Lowland meadows are taken to include most forms of unimproved neutral grassland across the enclosed lowland landscapes of the UK. In terms of NVC plant communities they primarily embrace MG4, MG5 and MG8. As well as grasslands cut for hay they also take into account unimproved neutral pastures where livestock grazing is the main land use. On many farms in different parts of the UK, use of fields for grazing pasture and hay cropping changes over time, but the characteristic plant community may persist with subtle changes in floristic composition.
Unimproved hay meadows and pastures over much of Britain is now highly localised, fragmented and in small stands. Unimproved seasonally-flooded grasslands are even less widely distributed.

In non-agricultural settings, such grasslands are less frequent but additional examples may be found in recreational sites, churchyards, roadside verges and a variety of other localities.

Lowland meadows and pastures can support a specialist group of scarce and declining plant species and are important habitats for skylark and a number of other farmland birds.

Agricultural intensification has led to the extensive development of nutrient-demanding, productive *Lolium perenne* grasslands. These are managed for grazing and silage production which has widely replaced traditional hay-making. Where fertiliser input is relaxed or in swards which have only been partially improved, MG6 grassland is common; in many respects this is intermediate between improved and unimproved lowland neutral grasslands but has few uncommon species and is generally of low botanical value.

Lowland Meadows [3]

This habitat is specifically defined in the priority habitat description as consisting of the NVC MG4, MG5 and MG8 communities (BRIG, 2008). The soil types associated with each community were used in combination as the feasibility criterion.

Suitable existing land cover is primarily non-priority unimproved neutral grassland and semi improved grassland. MG4 and MG8 are both commonly found in a floodplain environment, whilst MG5 is not, so the presence of a flood risk zone could be a suitability factor, but perhaps with a reduced weighting.

Management is important for Lowland Meadows, with cutting possibly followed by grazing being the typical form (BRIG, 2008).

Coastal and Floodplain Grazing Marsh

Floodplain Grazing Marsh [1]

This is considered a mosaic habitat complex with elements drawn from a range of habitat types that vary from site to site.

Coastal and Floodplain Grazing Marsh [2]

Grazing marsh is defined as periodically inundated pasture, or meadow with ditches which maintain the water levels, containing standing brackish or fresh water. The ditches are especially rich in plants and invertebrates. Almost all areas are grazed and some are cut for hay or silage. Sites may contain seasonal water-filled hollows and permanent ponds with emergent swamp communities, but not extensive areas of tall fen species like reeds; although they may abut with fen communities.

Coastal and Floodplain Grazing Marsh [3]

This grazing marsh Priority Habitats is defined as a landscape type, or a complex of component habitats, including grassland, fen and reedbed (BRIG, 2008). Key criteria are periodic inundation and the existence of drainage structures to permit the management of water levels. Flood storage areas are often suitable sites for grazing marsh due to their periodic inundation and water level management structures (BRIG, 2008).

Coastal Grazing marsh is typically found above Mean High Water Springs (MHWS), though there is often no distinct boundary between upper saltmarsh communities and coastal grazing marsh. The MHWS mark was used as a feasibility factor, along with the zone prone to coastal flooding. Areas that were below MHWS, but behind sea defences were not excluded. A MHWS value adjusted for sea level rise predictions was used as a suitability criterion to account for the long term viability of sites.

Lowland Fens (Fen, Marsh and Swamp)

Fen, Marsh and Swamp [1]

Characterised by a variety of vegetation types that are found on minerotrophic (groundwater-fed nutrients), permanently, seasonally, or periodically waterlogged peat, peaty soils or mineral soils. Fens are peatlands which receive water and nutrients from groundwater and surface run-off, as well as from rainfall. Flushes are associated with lateral water movement, and springs with localised upwellings of water. Marsh is a general term usually used to imply waterlogged soil; it is used more specifically here to refer to fen meadows and rush-pasture communities on mineral soils and shallow peats. Swamps are characterised by tall emergent vegetation. Reedbeds (i.e. swamps dominated by stands of common reed *Phragmites australis*) are also included in this habitat type.

This habitat type does not include neutral and improvement grasslands on floodplains and grazing marshes. It also does not include areas of carr (fen woodland dominated by species such as will *Salix* agg., alder *Alnus glutinosa* or birch *Betula* spp.).

The NVC describes are wide range of plant communities (Rodwell, 1991-2000) most frequently encountered with fen, marsh and swamp including M1-14, M21-38, OV24, OV26, OV28-33, OV35, S1-S20 and S22-28.

Lowland Fens [2]

Fens are peatlands which receive water and nutrients from the soil, rock and ground water as well as from rainfall: they are minerotrophic. Fens can be described as `poor-fens` or `rich-fens`. Poor-fens, where the water is derived from base-poor rock such as sandstones and granites occur mainly in the uplands, or are associated with lowland heaths. They are characterised by short vegetation with a high proportion of bog mosses Sphagnum spp. and acid water (pH of 5 or less).

Rich-fens, are fed by mineral-enriched calcareous waters (pH 5 or more) and are mainly confined to the lowlands.

Fen habitats support a diversity of plant and animal communities. Some can contain up to 550 species of higher plants, a third of our native plant species; up to and occasionally more than half the UK`s species of dragonflies, several thousand other insect species, as well as being an important habitat for a range of aquatic beetles.

In intensively farmed lowland areas fens occur less frequently, are smaller in size and more isolated than in other parts of the UK.

Lowland Fens [3]

The Fen Priority Habitat definition is quite broad and overlaps or exists in a continuum with a number of the other habitats being modelled including Lowland Heath, Reedbeds, Grazing Marsh, Lowland Meadows and Wet Woodland (BRIG, 2008). Wheeler & Proctor (2000) suggest that fen can broadly be defined as a base rich mire, that may not necessarily be peat forming. The feasibility criterion therefore was soil based and included peat soils and drift geology.

The hydrology of a site is critical to the suitability of different wetland habitats within the continuum described above. Wheeler & Proctor (2000) state that fens can be distinguished from drier marsh habitats and wetter swamp habitats on the basis of the water table, however, they also recognise that this is constantly varying, and that properties other than the mean level, such as the frequency of extreme events, may be significant in defining the suitability of a particular habitat. As such the resulting suitability scores for Lowland Fens may be less accurate than some of the other models with more deterministic factors.

Lowland Mixed Deciduous Woodland (Broadleaved, Mixed and Yew Woodland)

Broadleaved, Mixed and Yew Woodland [1]

Characterised by vegetation dominated by trees that are more than 5m high when mature which form a distinct, although sometime open, canopy with a canopy cover of greater than 20%. It includes both native and non-native broadleaved species plus yew *Taxus baccata*, where the percentage cover of these trees in the stand exceeds 20% of the total cover of trees present (up to 80% can be conifer trees).

Stands of broadleaved, mixed and yew woodland may either be ancient or recent woodland and either semi-natural, arising from natural regeneration of trees, or planted. Recently felled broadleaved, mixed and yew woodland is also included in this habitat type where there is a clear indication that it will return to woodland.

Scrub vegetation, where the woody component tends to be mainly shrubs usually less than 5m high, and carr (woody vegetation on fens and bog margins) is included in this broad habitat type where the woody species form a canopy cover of greater than 30% and the patch size of scrub is greater than 0.25ha. An exception to this is dwarf gorse *Ulex minor* and western gorse *Ulex gallii* which are included in the Dwarf shrub heath broad habitat type.

Lowland Mixed Deciduous Woodland [2]

Lowland mixed deciduous woodland includes woodland growing on the full range of soil conditions, from very acidic to base-rich, and takes in most semi-natural woodland in southern and eastern England. It occurs largely within enclosed landscapes, usually on sites with well-defined boundaries, at relatively low altitudes, although altitude is not a defining feature. Many are ancient woods. The woods tend to be small, less than 20 ha. Often there is evidence of past coppicing, particularly on moderately acid to base-rich soils; on very acid sands the type may be represented by former wood-pastures of oak and birch.

There is great variety in the species composition of the canopy layer and the ground flora, and this is reflected in the range of associated NVC; the bulk of which falls into W8 (mainly subcommunities a - c in ancient or recent woods; in the lowlands W8d mostly occurs in secondary woodland) and W10 (sub-communities a to d) with lesser amounts of W16 (mainly W16a). Locally, it may form a mosaic with other types, including patches of beech woodland and small wet areas.

Lowland Mixed Deciduous Woodland [3]

This BAP Priority habitat is very broad category and encompasses most of the semi-natural woodland in southern and eastern England (Erlanger, 2001a). Within Greater London the distribution of woodland suggests that the primary factor controlling the distribution is simply the requirement for non-waterlogged soils (Erlanger, 2001a). Therefore, non waterlogged soil types were used as the single feasibility criterion.

Of all the habitats modelled, woodland is thought to have the longest time to establishment, partly due to the long lifecycles and poor dispersal capacities of the major species (Morris & Stark, 2004). As a result, the current habitat being non-priority habitat quality woodland, and sites of Ancient Woodland that had been converted to plantation woodland (plantations on ancient woodland sites, PAWS) were considered important factors controlling the suitability.

Wet Woodland

Wet Woodland [1]

See Lowland Mixed Deciduous Woodland (Broadleaved, mixed and yew woodland).

Wet Woodland [2]

Wet woodland occurs on poorly drained or seasonally wet soils, usually with alder, birch and willows as the predominant tree species, but sometimes including ash, oak, pine and beech on the drier riparian areas. It is found on floodplains, as successional habitat on fens, mires and bogs, along streams and hill-side flushes, and in peaty hollows.

These woodlands occur on a range of soil types including nutrient-rich mineral and acid, nutrient-poor organic ones. The boundaries with dryland woodland may be sharp or gradual and may (but not always) change with time through succession, depending on the hydrological conditions and the treatment of the wood and its surrounding land. Therefore, wet woods frequently occur in mosaic with other woodland key habitat types and with open key habitats such as fens.

In terms of NVC plant communities this habitat is characterised by W1-3 W4c and W5-7. Just as small wet woodland patches may be treated as part of a dry land mosaic, so dry land fringes of predominantly wet woodland areas are linked with the accompanying wet woodland.

Many alder woods are ancient and have a long history of coppice management which has determined their structure, and in some situations, it appears that this practice has maintained alder as the dominant species and impeded succession to drier woodland communities. Other wet woodland may have developed through natural succession on open wetlands (sometimes following cessation of active management) and structurally are little influenced by direct forestry treatments.

Wet woodland combines elements of many other ecosystems and as such is important for many taxa. The high humidity favours bryophyte growth. The number of invertebrates associated with alder, birch and willows, is very large. Dead wood within the sites can be frequent, and its association with water provides specialised habitats not found in dry woodland types. While few rare plant species depend on wet woodland per se, there may be relict species from the former open wetlands on site.

Wet Woodland [3]

In a similar but contrary manner to Lowland Mixed Deciduous Woodland, Wet Woodland is a broad category whose main controlling factor is whether the ground is waterlogged or not (Erlanger, 2001b).

Factors used were the same as for Lowland Mixed Deciduous Woodland but with the feasibility criterion being inverted, so that only waterlogged soil types were considered. In addition to all non-priority woodland and PAWS sites being considered suitable, some existing wetland habitats were included. As wet woodland is commonly found in floodplains (Erlanger, 2001b), the presence of a flood risk zone was also considered a positive suitability factor.

Appendix 2: Species List

Priority Habitat	Taxon Name	Common Name
Coastal Grazing Marsh	Samolus valerandi	Brookweed
Coastal Grazing Marsh	Lepidium latifolium	Dittander
Coastal Grazing Marsh	Atriplex glabriuscula	Babington's Orache
Coastal Grazing Marsh	Salicornia ramosissima	Purple Glasswort
Coastal Grazing Marsh	Carex divisa	Divided Sedge
Coastal Grazing Marsh	Ranunculus baudotii	Brackish Water-crowfoot
Lowland Calcareous Grassland	Helianthemum nummularium	Common Rock-rose
Lowland Calcareous Grassland	Hippocrepis comosa	Horse-shoe Vetch
Lowland Calcareous Grassland	Poterium sanguisorba subsp. sanguisorba	Salad Burnet
Lowland Calcareous Grassland	Campanula glomerata	Clustered Bellflower
Lowland Calcareous Grassland	Scabiosa columbaria	Small Scabious
Lowland Calcareous Grassland	Filipendula vulgaris	Dropwort
Lowland Calcareous Grassland	Anthyllis vulneraria subsp. vulneraria	Kidney Vetch
Lowland Calcareous Grassland	Bromopsis erecta	Upright Brome
Lowland Calcareous Grassland	Carlina vulgaris	Carline Thistle
Lowland Calcareous Grassland	Cirsium acaule	Dwarf Thistle
Lowland Calcareous Grassland	Clinopodium acinos	Basil Thyme
Lowland Calcareous Grassland	Koeleria macrantha	Crested Hair-grass
Lowland Calcareous Grassland	Origanum vulgare	Wild Marjoram
Lowland Calcareous Grassland	Viola hirta	Hairy Violet
Lowland Calcareous Grassland	Ophrys apifera	Bee Orchid
Lowland Calcareous Grassland	Clinopodium vulgare	Wild Basil
Lowland Calcareous Grassland	Plantago media	Hoary Plantain
Lowland Calcareous Grassland	Thymus pulegioides	Large Thyme
Lowland Calcareous Grassland	Orchis anthropophora	Man Orchid
Lowland Calcareous Grassland	Platanthera chlorantha	Greater Butterfly-orchid
Lowland Calcareous Grassland	Echium vulgare	Viper's-bugloss
Lowland Calcareous Grassland	Erigeron acris	Blue Fleabane
Lowland Calcareous Grassland	Verbena officinalis	Vervain
Lowland Calcareous Grassland	Galium mollugo subsp. erectum	Hedge Bedstraw
Lowland Calcareous Grassland	Ononis repens	Common Restharrow
Lowland Calcareous Grassland	Blackstonia perfoliata	Yellow-wort
Lowland Calcareous Grassland	Orobanche elatior	Knapweed Broomrape
Lowland Calcareous Grassland	Asperula cynanchica subsp. cynanchica	Squinancywort
Lowland Calcareous Grassland	Cupido minimus	Small blue
Lowland Calcareous Grassland	Polyommatus coridon	Chalk Hill blue
Lowland Calcareous Grassland	Polyommatus bellargus	Adonis blue
Lowland Calcareous Grassland	Rhinanthus angustifolius	Greater Yellow-rattle

Lowland Calcareous Grassland	Hesperia comma	Silver-spotted skipper
Lowland Dry Acid Grassland	Trifolium subterraneum	Subterranean Clover
Lowland Dry Acid Grassland	Senecio sylvaticus	Heath Groundsel
Lowland Dry Acid Grassland	Aira praecox	Early Hair-grass
Lowland Dry Acid Grassland	Potentilla argentea	Hoary Cinquefoil
Lowland Dry Acid Grassland	Erodium cicutarium	Common Stork's-bill
Lowland Dry Acid Grassland	Ornithopus perpusillus	Bird's-foot
Lowland Dry Acid Grassland	Spergularia rubra	Sand Spurrey
Lowland Dry Acid Grassland	Danthonia decumbens	Heath-grass
Lowland Dry Acid Grassland	Carex pilulifera	Pill Sedge
Lowland Dry Acid Grassland	Festuca filiformis	Fine-leaved Sheep's-fescue
Lowland Dry Acid Grassland	Trifolium micranthum	Slender Trefoil
Lowland Dry Acid Grassland	Aphanes australis	Slender Parsley-piert
Lowland Dry Acid Grassland	Moenchia erecta	Upright Chickweed
Lowland Dry Acid Grassland	Trifolium ornithopodioides	Bird's-foot Clover
Lowland Heathland	Salix repens	Creeping Willow
Lowland Heathland	Erica cinerea	Bell Heather
Lowland Heathland	Erica tetralix	Cross-leaved Heather
Lowland Heathland	Eriophorum angustifolium	Common Cottongrass
Lowland Heathland	Genista anglica	Petty Whin
Lowland Heathland	Scutellaria minor	Lesser Skullcap
Lowland Heathland	Ulex minor	Dwarf Gorse
Lowland Heathland	Nardus stricta	Mat-grass
Lowland Heathland	Carex binervis	Green-ribbed Sedge
Lowland Heathland	Luzula multiflora subsp. multiflora	Heath Wood-rush
Lowland Heathland	Eleogiton fluitans	Floating Club-rush
Lowland Meadow	Saxifraga granulata	Meadow Saxifrage
Lowland Meadow	Thalictrum flavum	Common Meadow-rue
Lowland Meadow	Luzula campestris	Field Wood-rush
Lowland Meadow	Lotus pedunculatus	Greater Bird's-foot-trefoil
Lowland Meadow	Tragopogon pratensis subsp. minor	Goat's-beard
Lowland Meadow	Silaum silaus	Pepper-saxifrage
Lowland Meadow	Hordeum secalinum	Meadow Barley
Lowland Meadow	Bromus commutatus	Meadow Brome
Lowland Meadow	Oenanthe pimpinelloides	Corky-fruited Water-dropwort
Lowland Mixed Deciduous Woodland	Lathraea squamaria	Toothwort
Lowland Mixed Deciduous Woodland	Orchis mascula	Early-purple Orchid
Lowland Mixed Deciduous Woodland	Polystichum setiferum	Soft Shield-fern
Lowland Mixed Deciduous Woodland	Cardamine impatiens	Narrow-leaved Bitter-cress
Lowland Mixed Deciduous Woodland	Galium odoratum	Woodfruff
Lowland Mixed Deciduous Woodland	Neottia nidus-avis	Bird's-nest Orchid
Lowland Mixed Deciduous Woodland	Sorbus torminalis	Wild Service-tree
Lowland Mixed Deciduous Woodland	Epipactis helleborine	Broad-leaved Helleborine
Lowland Mixed Deciduous Woodland	Mercurialis perennis	Dog's Mercury

Lowland Mixed Deciduous Woodland	Ophrys insectifera	Fly Orchid
Lowland Mixed Deciduous Woodland	Carex sylvatica	Wood-sedge
Lowland Mixed Deciduous Woodland	Cephalanthera damasonium	White Helleborine
Lowland Mixed Deciduous Woodland	Circaea lutetiana	Enchanter's-nightshade
Lowland Mixed Deciduous Woodland	Daphne laureola	Spurge-laurel
Lowland Mixed Deciduous Woodland	Euphorbia amygdaloides subsp. amygdaloides	Wood Spurge
Lowland Mixed Deciduous Woodland	Lamiastrum galeobdolon subsp. montanum	Yellow Archangel
Lowland Mixed Deciduous Woodland	Milium effusum	Wood Millet
Lowland Mixed Deciduous Woodland	Sanicula europaea	Sanicle
Lowland Mixed Deciduous Woodland	Adoxa moschatellina	Moschatel
Lowland Mixed Deciduous Woodland	Blechnum spicant	Hard Fern
Lowland Mixed Deciduous Woodland	Melica uniflora	Wood Melick
Lowland Mixed Deciduous Woodland	Bromopsis ramosa	Hairy-brome
Lowland Mixed Deciduous Woodland	Festuca gigantea	Giant Fescue
Lowland Mixed Deciduous Woodland	Poa nemoralis	Wood Meadow-grass
Lowland Mixed Deciduous Woodland	Scrophularia nodosa	Common Figwort
Lowland Mixed Deciduous Woodland	Ulmus glabra	Wych Elm
Lowland Mixed Deciduous Woodland	Dryopteris dilatata	Broad Buckler-fern
Lowland Mixed Deciduous Woodland	Quercus petraea	Sessile Oak
Lowland Mixed Deciduous Woodland	Cardamine flexuosa	Wavy Bitter-cress
Lowland Mixed Deciduous Woodland	Salix aurita	Eared Willow
Lowland Mixed Deciduous Woodland	Stellaria holostea	Greater Stitchwort
Lowland Mixed Deciduous Woodland	Luzula forsteri	Southern Wood-rush
Lowland Mixed Deciduous Woodland	Hypericum humifusum	Trailing St John's-wort
Lowland Mixed Deciduous Woodland	Dryopteris carthusiana	Narrow Buckler-fern
Lowland Mixed Deciduous Woodland	Ceratocapnos claviculata	Climbing Corydalis
Lowland Mixed Deciduous Woodland	Melampyrum pratense	Common Cow-wheat
Lowland Mixed Deciduous Woodland	Veronica montana	Wood Speedwell
Lowland Mixed Deciduous Woodland	Potentilla sterilis	Barren Strawberry
Lowland Mixed Deciduous Woodland	Moehringia trinervia	Three-veined Sandwort
Lowland Mixed Deciduous Woodland	Ranunculus auricomus	Goldilocks
Lowland Mixed Deciduous Woodland	Rhamnus cathartica	Buckthorn
Lowland Mixed Deciduous Woodland	Viola reichenbachiana	Early dog-violet
Lowland Mixed Deciduous Woodland	Fragaria vesca	Wild Strawbetrry
Lowland Mixed Deciduous Woodland	Carex strigosa	Thin-spiked Wood-sedge
Lowland Mixed Deciduous Woodland	Dryopteris affinis subsp. affinis	Scaly Male-fern
Lowland Mixed Deciduous Woodland	Cardamine bulbifera	Coralroot
Reedbeds	Phragmites australis	Common Reed
Wet Woodland	Frangula alnus	Alder Buckthorn
Wet Woodland	Lysimachia nemorum	Yellow Pimpernel
Wet Woodland	Chrysosplenium oppositifolium	Opposite-leaved Golden-saxifrage
Wet Woodland	Scirpus sylvaticus	Wood Club-rush

Wet Woodland	Myosoton aquaticum	Water Chickweed
Wet Woodland	Petasites hybridus	Butterbur
Wet Woodland	Lysimachia nummularia	Creeping-Jenny