Existing Nature Network mapping – Further Information

Purpose

The purpose is to identify the most important areas of mainland Cornwall for the benefits they deliver in terms of biodiversity value and selected ecosystem services. The method assigns a ranking to the entire landscape of mainland Cornwall (divided into 100 x 100 metre grid cells) in terms of these natural assets.

Intended uses of the map are to inform a range of strategic planning applications such as:

- possible expansion of the existing network of protected areas;
- strategic targeting of resources to protect biodiversity and ecosystem services;
- identifying key areas where future change in land use or development risks a strategic loss of biodiversity or ecosystem service provision;
- identifying areas of strategic value that could benefit from better management and/or restoration to improve their value and the services they deliver.

A high ranking does not necessarily imply that the biodiversity or services provided cannot be augmented by changes to management, land cover or use. Likewise areas that receive a low ranking does *not* imply that the area lacks any biodiversity value or service provision.

Outline of Methodology

The mapping is produced using the Zonation software of spatial prioritization, which has been widely used for guiding the creation of protected areas, and the expansion of existing networks. The approach exploits both spatial data and expert judgement concerning the relative importance of different services and habitats. The approach ranks areas using these indicators of biodiversity and the capacity to deliver ecosystem services.

The methodology involves the following steps:

i. **Identify spatial data that are indicators of biodiversity and the provision of ecosystem services.** Data includes habitat cover, biodiversity-related designations and estimates of key ecosystem services (namely: flood mitigation, carbon storage, water pollution and soil loss mitigation, pollination services).

ii. **Identify spatial data describing 'constraining' factors** likely to decrease benefits. Factors include the presence of built-up or infrastructure areas deemed to reduce the biodiversity of an

area. The suitability of an area for alternative land use (*ie* 'opportunity costs') are ***not*** included.

iii. **Assign weights to data layers:** the relative importance of different services, habitats and designations informing the prioritization is determined by assigning weights. Positive weights describe the relative value or benefits of different services and features. Constraining factors receive a negative weight.

iv. **Assign method of accounting for habitat connectivity:** matrix connectivity (Lehtomaki et al 2009) was used to represent the predominantly agri-urban environment of Cornwall and its effect on fragmented semi-natural habitats. A matrix of coefficients (0 to 1), representing the mutual connectivity of different habitats, is used to weight a dispersal model of habitats.

v. **Spatial prioritization of landscape:** the ranking methodology begins with the conceptual assumption that the whole area as highly valued and then iteratively removes the least valued areas, taking into accounts their assets, constraints and the connectivity of habitats. Higher rankings generally reflect areas that deliver multiple benefits.

vi. **Extraction of core areas:** the most highly ranked cells of the landscape are extracted to form the core area of the existing nature network. The size of the chosen area is guided by various factors including the area of existing semi-natural habitats and designated areas. Existing statutory protected areas (SSSI, SPA, SAC, local & national nature reserves) are included in this core area.

vii. **Identification of connecting corridors:** a second Zonation analysis, using the corridor building method (Pouzols & Moilanen 2014), was used to identify corridors connecting core network areas. The method uses a penalty to decrease the structural connectivity embedded in the prioritization process that allows balancing local habitat quality and structural connectivity without pre-defined habitat patches or starting points for corridors (Jalkanen et al 2019).

Types of Map on Lagas

Three versions of existing nature network maps are available:

- **Nature network landscape ranking map** - provides a relative ranking for the whole of mainland Cornwall above mean high water. The most highly ranked areas are extracted to form the core areas of the network.
- **Existing nature network core area map** - shows the most highly ranked area of mainland Cornwall, above mean high water, corresponding to about 25% of the area of mainland Cornwall including both currently protected areas and other areas.
- **Existing Nature network map with linking corridors** - shows the most highly ranked area of mainland Cornwall corresponding to about 25% of the area of mainland Cornwall (identical to 1 above) and suggested 'corridor' opportunities for linking-up these core areas. The corridors are proposed routes to improve connectivity of the most highly ranked, core areas. The suggested corridors correspond to about 4% of the area of mainland Cornwall and many follow watercourses across the landscape.

Using the Maps

It is important to recognize that the methodology and the spatial datasets used in the mapping affects how the maps should be used. Some of the key limitations affecting the maps are outlined below:

- ✓ The existing nature network maps identify the most valued 'core areas' of mainland Cornwall, based on their relative biodiversity value and provision of ecosystem services.
- ✓ The linking corridor areas can be considered priority areas for improving habitats and biodiversity features to render the 'core areas' more functional.

- An area that does not feature among the most highly ranked cells **does not imply** it has no biodiversity or ecosystem service value. Areas that do not feature among the most highly ranked cells for the whole of Cornwall might be of local importance in terms of biodiversity or service provision.

- Conversely, if an area is highly ranked it **does not imply** that its biodiversity and service value cannot be improved by, for example, better land management or habitat creation/restoration.

- The spatial unit of prioritization is 100 square metre cells but may finer resolution land cover features are accounted for whether it be the number of ancient or venerable trees or the percentage cover of different habitats derived from 10 metre resolution mapping.

- The mapping does not consider the benefits of alternative land uses ('opportunity costs') or provide a cost-benefit analysis.

- The maps are not currently informed by information on species distribution but rely on habitat information and land designations as indicators of biodiversity value.

- The maps include little information about land management or use. Land management methods have major implications for the biodiversity and services provided by, in particular, arable land, grassland and hedgerows.

- Landcover information were derived from a compilation of several landcover data sources and augmented with remote-sensing information. Nevertheless, no landcover information is fully accurate or up-to-date and inveitably errors will affect map rankings.

- The maps do not fully account for the 'condition' of habitats or existing protected areas as there is limited reliable, up-to-date information available.

- The estimates of ecosystem service provision are based upon the *existing* distribution of habitats and factors affecting service 'demand', such as population distribution and location of infrastructure.

- The maps are indicative *not* prescriptive - not all the factors affecting the biodiversity value or service provision are included in the analysis.

References

Lehtomaki J, Tomppo E, Kuokkanen P, Hanski I, Moilanen A 2009 Applying spatial conservation prioritization software and high-resolution GIS data to a national-scale study in forest conservation. Forest Ecology and Management 258, 2439–2449.

Moilanen A, Pouzols FM, Meller L, Veach V, Arponen A, Leppanen J, Kujala H 2014 Zonation - Spatial conservation planning methods and software. Version 4. User Manual. University of Helsinki, Helsinki.

Jalkanen J, Toivonen T, Moilanen A 2020 Identification of ecological networks for land-use planning with spatial conservation prioritization. Landscape Ecology 35, 353–371.

Data sources – use and copyright

Data used in the creation of the existing nature network and related maps on Lagas are listed here.

Annex – Zonation features and weightings

Table A1: Features and weightings used in Zonation mapping of existing nature network and habitat opportunities organised by category. For each feature the type of data and the primary publisher of key underlying data is provided (see here). For each category of features, the maximum observed weighted cell value is provided. Core, excluded areas and connectivity method also given.

Features	Type of data	Weightings				Source data	Notes
		Existing Nature Network	Opportunity mapping				
			Woodland	Wetland	Heathland		
Habitat Cover	Max cell values:	30					
Acid grassland	% cover	15	-10	-5	0	Land cover data	Includes grass moorland
Arable	% cover	0	0	0	-5	Land cover data	
Bracken	% cover	10	0	0	20	Land cover data	
Builtup / Artificial Surfaces	% cover	-10	-10	-10	-20	Land cover data	
Coniferous woodland	% cover	15	10	0	5	Land cover data	
Deciduous woodland	% cover	20	10	-5	-10	Land cover data	Includes orchards
Felled woodland	% cover	15	10	0	0	Land cover data	
Heathland	% cover	20	-10	-5	20	Land cover data	
Improved grassland	% cover	0	0	0	0	Land cover data	
Inland rock	% cover	10	-20	-20	10	Land cover data	
Maritime rock	% cover	15	-20	-20	0	Land cover data	
Maritime sediment	% cover	15	-20	10	-20	Land cover data	
Mudflats	% cover	20	-20	10	-20	Land cover data	
Saltmarsh	% cover	25	-20	10	-20	Land cover data	
Sanddunes	% cover	20	-20	10	0	Land cover data	
Scrub	% cover	15	0	0	0	Land cover data	Includes some low density woodland
Seminatural grassland	% cover	10	0	0	0	Land cover data	Low weighting reflects low data reliability.
Water	% cover	10	0	-5	0	Land cover data	
Wet grassland	% cover	20	-20	10	-20	Land cover data	Includes grazing marsh & purple moor grass
Wetland	% cover	20	-20	10	-20	Land cover data	
Other habitat features	Max cell values:	23					
Builtup Greeness*	%cover x quality	10	0	0		Land cover data	Quality derived from NDVI
Hedgerows	%cover	5	10*	**0**	-10	ERCCIS	*Woodland opp uses hedges >5m tall
Old trees	Number	5	10	-10	-5	WT	
Headwaters	% cover	5	0	0	0	NE	
River ecological quality	% cover x quality	20	0	5	0	EA/NE	
Open Rivers	% cover	0	0	0	-5	OS	
Historic habitats	Max cell values:	0	0	30	30		
Wetland	%cover	0		30	0	EA	
Heathland	%cover	0		0	30	RSPB	
Biodiversity designations	Max cell values:	70/40					
Ancient woodlands	%cover	10	0	-10	-20	NE	
High level stewardship	%cover	5	5	0	0	NE	
Plantlife designated area	%cover	20	-10	-10	-10	PL	
RSPB reserve	%cover	30	-40	-20	-20	RSPB	
County wildlife site	%cover	20	-20	-20	-20	ERCCIS	Where not under statutory protection
Wildlife Trust Reserve	%cover	25	-20	-20	-20	ERCCIS	Where not under statutory protection
Non-dominant priority habitats	%cover	5	-5	-5	0	NE	
Statutory protected area	%cover	50		excluded		NE	SSSI, SPA, SAC, national or local na
BAP Priority habitat	%cover	10	-10	-10	-10	NE	
Other designations	Max cell values:						
Moorline	%cover	0	-30	0	0	NE	
Agricultural grade 1	%cover	0	0	0	-20	NE	
Agricultural grade 2	%cover	0	0	0	-10	NE	
Agricultural grade 3	%cover	0	0	0	0	NE	
Agricultural grade 4	%cover	0	0	0	0	NE	

Features	Type of data	Weightings				Source data	Notes
		Existing Nature Network	Opportunity mapping Woodland	Wetland	Heathland		
Agricultural grade 5	%cover	0	0	0	0	NE	
Windfarm permission	%cover	0	-30	0	5	CC	
Heritage	Max cell values:						
World Heritage Area	%cover	0	-10	0	0	HE	
Battlefield	%cover	0	-20	0	0	HE	
Scheduled Monument	%cover	0	-20	-20	0	HE	
Land features / designations	Max cell values:						
A roads	Y/N	0	0	0	0	OS	
B roads	Y/N	0	0	0	0	OS	
Dual carriageway roads	Y/N	0	0	0	0	OS	
Railways	Y/N	0	-10	0	0	OS	
Parks and Gardens	%cover	0	0	0	-10	HE	
Golf courses	%cover	0	-10	0	5	OS	
Playing field	%cover	0	-10	-10	-20	OS	
Topography & landform	Max cell values:						
Topographical wetness	Range 0-	0	0	40	0	OS	
Wind exposure	Range 0-	0	-40	0	3	UoE	
Exposed coastland	Y/N	0	-30	0	0	OS	
Elevation	Range in metres	0	0	0	0	OS	
Elevation over 250m	Range in metres	0	0	0	-30	OS	
Predicted erosion loss	Y/N	0	-20	0	-10	EA	
Floodplain	Y/N	0	0	10	-10	EA	
Predicted loss to sea	Y/N	0	-30	10	-20	EA	
Slope	Range in degrees	0	0	-40	0	OS	
Soil properties	Max cell values:						
Contaminated land	Y/N	-5	-30	0	-10	CC	
Suitable for Heathland	Classes 0-3	0	0	0	30	NSRI	
Soil wetness	Classes 0-4	0	0	30	0	NSRI	
High carbon soils	Classes 0-1	0	-20	0	0	NSRI	
Sandy soils	Classes 0-1	0	-20	-20	0	NSRI	
Ecosystem Services	Max cell values:	36			**0**		
Carbon stock	0-100	10	0	0	0	See method	
Flood Mitigation	0-100	20	10	5	0	See method	
Water pollution mitigation	Max cell values:	10			0	See method	
• All waters	0-100	2	2	2	0	See method	
• Aquaculture waters	0-100	2	2	2	0	See method	
• Bathing waters	0-100	2	1	1	0	See method	
• Drinking waters	0-100	4	3	3	0	See method	
Soil loss mitigation	0-100	5	5	5	0	See method	
Pollination	0-100	5	-5	0	0	See method	
Air pollution mitigation	0-100	5	3	0	0	See method	
Core areas		None	Woodland cover >30%	Wetland or associated habitat cover >50%	Heathland cover>50%		
Excluded areas		None	Unsuitable landcover >75% or statutory protected area	Unsuitable landcover >75% or statutory protected area	Unsuitable landcover >75% or statutory protected area		
Unsuitable landcover defined as:		NA	Inland rock, builtup, water, maritime habitats, statutory protected area	Inland or maritime rock, builtup, statutory protected area	Inland rock, builtup, water, maritime habitats, statutory protected area		
Connectivity parameters		Matrix connectivity	Boundary linear penalty	Boundary linear penalty	Boundary linear penalty		