UK Centre for Ecology & Hydrology

Department for Environment Food & Rural Affairs

Defra-UKCEH Strategic Partnership Agreement (MoA)

Mapping and measuring natural capital

The Strategic Partnership

Department for Environment Food & Rural Affairs

A strategic research partnership, which allows the Defra group to build on UKCEH's National Capability (NC) research (UKSCAPE) funded by NERC in line with government policy requirements. It aims to:

- Facilitate increased sharing of data, models, skills and facilities between UKCEH and the Defra group;
- Enable Defra to identify elements of UKCEH research funded under NC that may be relevant to Government policy requirements; and
- Allow Defra to make funding available for the development of specific policy applications aligned to this NC.

Partners

Department for Environment Food & Rural Affairs

- MoA Partners - Defra, UKCEH and Natural England
- Defra programmes involved:

Environmental Analysis Unit

- Programme management and coordination,
- Integrating monitoring data,
- Earth Observation,
- Developing indicators for 25 yr environment plan,
- Natural Capital accounts

Future Farming

- Future land use modelling

Air Quality

- National Emissions Ceiling Directive (NECD) reporting

Wildlife

- Evaluation of Biodiversity 2020

Current Tasks & Leads

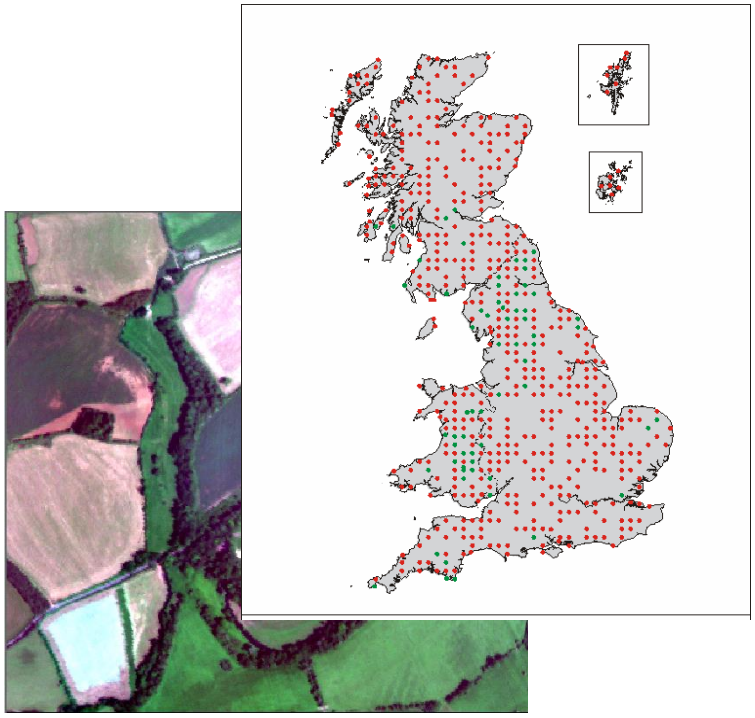
Tasks	Activity	UKCEH	Defra group
Future Land Use Modelling	The application of the ASSIST framework (including scenario development) to address current evidence gaps relevant to policy	Richard Pywell	Andrew Cuthbertson
Integrated Monitoring at a range of spatial scales	To support the identification of extent, condition and trends of key natural capital assets and co-located environmental variables to allow identification of key drivers of change	Don Monteith & Lisa Norton	Mike Morecroft (NE)
Satellite-based land cover and habitat monitoring	Examining the relevance of current ground activity for the derivation and validation of EO products	Dan Morton	Tim Ashelford
Biodiversity 2020 Evaluation	An evaluation of extent of progress towards the outcomes described in Biodiversity 2020	Nick Isaac	Jemilah Vanderpump
Air Quality policy and reporting support	Support for NECD Article 9 Reporting and an integrated data management system	Christine Braban	David Vowles
Indicator development for the 25 YEP	Support for indicator development (approx. 10 indicators from the framework), developing evidence chains for natural capital indicators and work to support Natural Capital Accounts	Laurence Jones	Debbie Boobyer

CS - Field Survey – high resolution, sample

Countryside Survey, designed for measuring extent and condition of GB natural capital

45 environmental strata – GB (England, Wales and Scotland)

stratified random sample

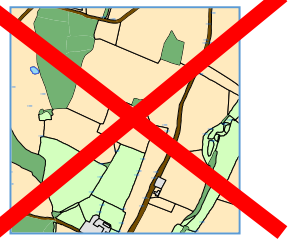


Based on 40 underlying variables gleaned from OS data on climate, soils, topography and geology classified using PCA to give 45 land classes across Great Britain

Surveys: 1978, 1984, 1990, 2000, 2007, 2019 (rolling programme initiated)

CS – Integrated monitoring

Habitats and landscape features



Plant and invertebrate (soil and water) species

- ~~Soil profiles~~
- Soil ~~and water~~ chemistry
- ~~Land use~~

Integrated monitoring

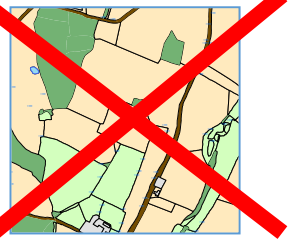
(~~habitats~~, vegetation, ~~landscape features~~, soils ~~and water~~)

For understanding relationships between variables and patterns of change.

CS – Integrated monitoring

Challenge
The 25 YEP needs to be monitored
CEH can afford limited monitoring in UKSCAPE
What is needed by Defra?
Is extending timelines critical or do we start from scratch using new techniques?

Habitats and landscape features

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CS – Integrated monitoring

Challenge
The 25 YEP needs to be monitored

Ha

What do earth observation and citizen science have to offer to fill the gaps?
Cost effectiveness

Plant and invertebrate (soil and water) species

- **Soil ~~and water~~ chemistry**
- **~~Land use~~**

Integrated monitoring

(~~habitats~~, vegetation, ~~landscape features~~, soils ~~and water~~)

For understanding relationships between variables and patterns of change.

Questions/Areas

1) Can we use EO data for national estimation of habitat extent (as has been done with CS)?
2) Can we use LIDAR data to collect data on linear features?
3) Using UKSCAPE data as a counterfactual for agri-environment impact
4) Consolidating datasets across national vegetation monitoring
5) Developing landscape character indicators
6) Developing indicators of Habitat Quality (Quantity and Connectivity)

Delivering key indicators to the 25 YEP

- What data is going to be needed? And how can it be most efficiently collected?

1) Can we use EO data for national estimation of habitat extent (as has been done with CS)?

LCM provides data on habitat extent at a coarser resolution than field collected data and measuring change has proved difficult- (although LCM change map due soon)

For use of EO data (with field data) , large plots (5 per square) are essential as they are closest to EO pixel sizes However:

- Uncertainties will be high
- Some habitats may not feature at all (as they are not found in large contiguous areas)
- We need to test how sensitive revised mapping approaches may be to change (compared to previous approaches)

Full square

Delivering key indicators to the 25 YEP

2) Can we use LIDAR data to collect data on linear features?

We can use LIDAR data, it is coarser than field collected data but it may give us extent of woody features and aspects of condition

LIDAR data

- How much is available? (temporally and spatially)
- How do you make the data into linear features?
- How can it be aligned with field boundaries?

CS 591 squares in 2007

(8 squares full LIDAR in 2007)

Comment	Count
Good alignment	137
Poor alignment	9
Good alignment, LiDAR data missing 20%	4
Good alignment, LiDAR data missing 25%	1
Good alignment, LiDAR data missing 50%	11
Good alignment, LiDAR data missing 75%	9
Good alignment, LiDAR data missing 90%	5
No LIDAR data present in square	69
No CS Linear data present in square	33
Sparse LIDAR and CS data	13
Grand Total	**291**

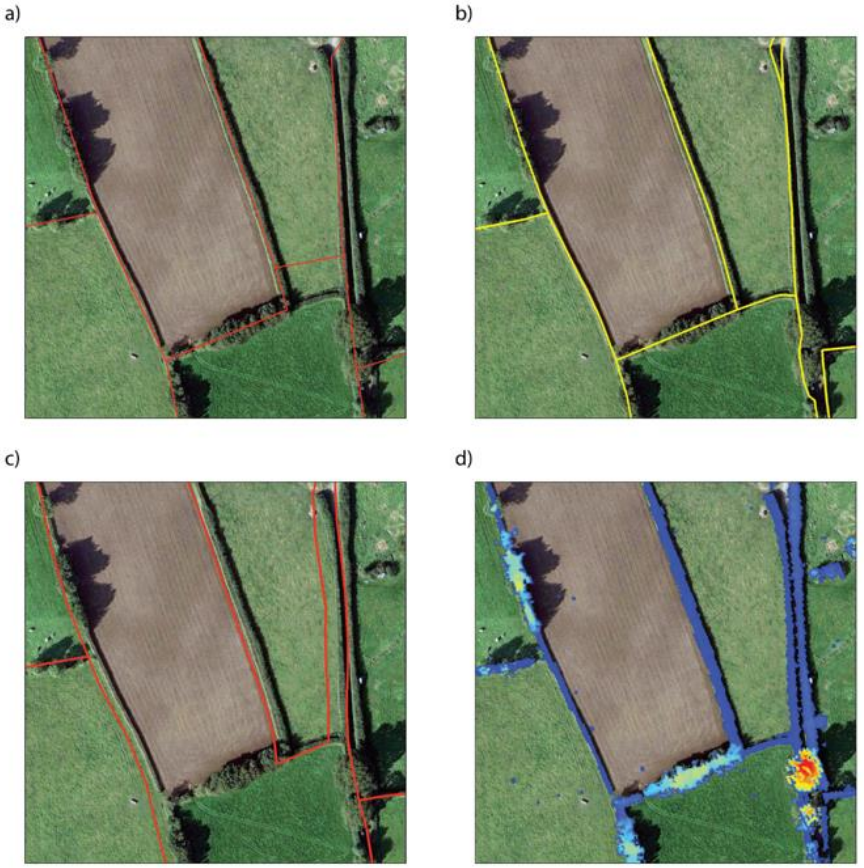
Delivering key indicators to the 25 YEP

1) Can we use LIDAR data to extend the CS linear feature dataset?

LiDAR data was used in object-oriented classification (OOC), to allow it to be transformed into a map of tree locations and geometry (Forestools in R)

Key questions

- Can we differentiate between linear feature types? Lines of trees/relict hedges/managed hedges (75% accuracy)
- What elements of condition can we measure?
- How effectively can we use LIDAR to measure change?



a) LCM spatial framework, b) RPA data, c) CS data, d)LIDAR

Delivering key indicators to the 25 YEP

Using UKSCAPE data as a counterfactual for agri-environment impact

Kevin Walker, Oliver Pescott, Felicity Harris, Christine Cheffings, Hayley New, Niki Bunch and David Roy

Early-purple Orchids, among other plants, in a woodland habitat. Richard Revels

- Aim: To assess **scheme** (HLS) performance
- using HLS monitoring and a counter-factual
- Previous baseline using CS2007
- No survey since, hence use NPMS (2016/2017) to examine change

- Change CS-NPMS compared to HLS change was possible
- BUT NPMS data showed bias towards higher quality patches
- Also focused on publicly accessible land (potentially with different management?) and on easily accessible locations (close to urban areas)

- **Locational bias (place and quality of patches) in volunteer data can limit its use**

Delivering key indicators to the 25 YEP

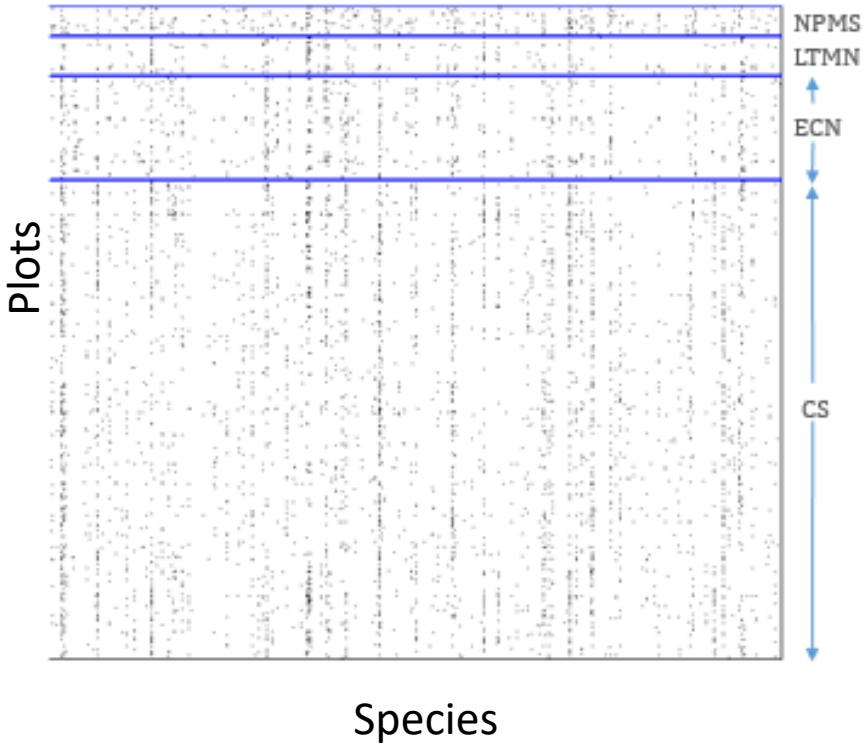
Consolidating datasets across national vegetation monitoring

- Plot size
- Survey frequency
- Survey measurements
- Age of scheme
- Site choice
- Geographic extent
- Bryophytes
- Spatial bias

Scheme	Plot size	Cell size
CS X	1 x 1m, 2 x 2m, 5 x 5m, 7.07 x 7.07m, 14.14 x 14.14m	
CS Y	2 x 2m	
CS U	2 x 2m	
ECN VC	2 x 2m	40 x 40cm
ECN VF	10 x 10m	40 x 40cm
LTMN VC	2 x 2m	40 x 40cm
NPMS	5 x 5m	

Countryside Survey CS
Environmental Change Network ECN
National Plant Monitoring Scheme NPMS
Long Term Monitoring Network

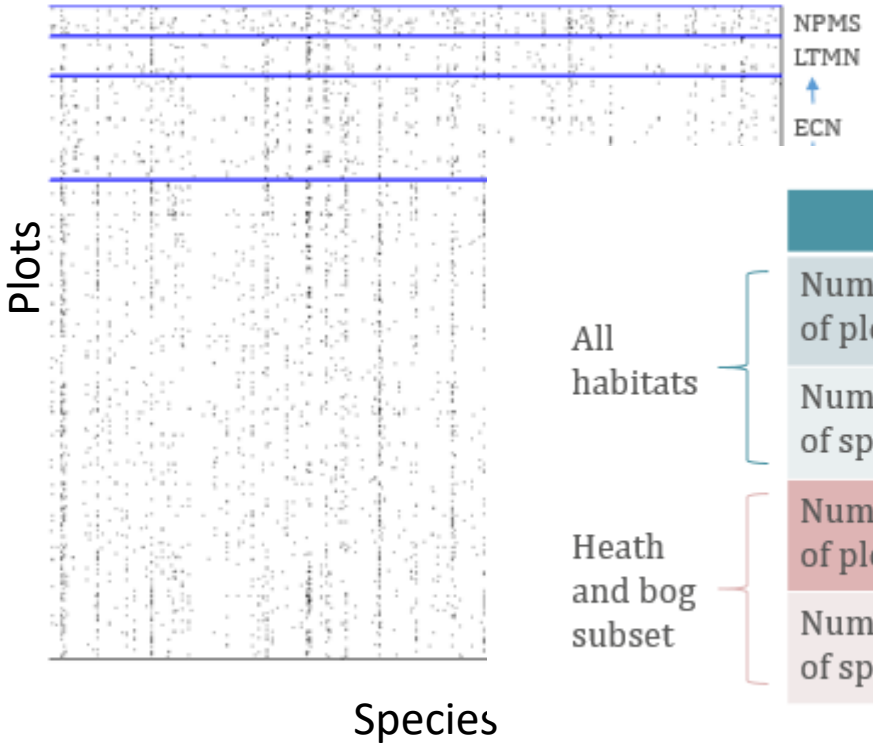
Delivering key indicators to the 25 YEP



Indicator modelling work

- Aim to produce an integrated model of change for each selected indicator
- Single estimate of change across all datasets
- Use all datasets to estimate covariate effects

Delivering key indicators to the 25 YEP



		CS	ECN	LTMN	NPMS
All habitats	Number of plots	20,348	4,385	1,698	1,286
	Number of species	1,137	730	558	1,019
Heath and bog subset	Number of plots	9,061	1,796	1,197	318
	Number of species	841	407	307	403

Indicator modelling work

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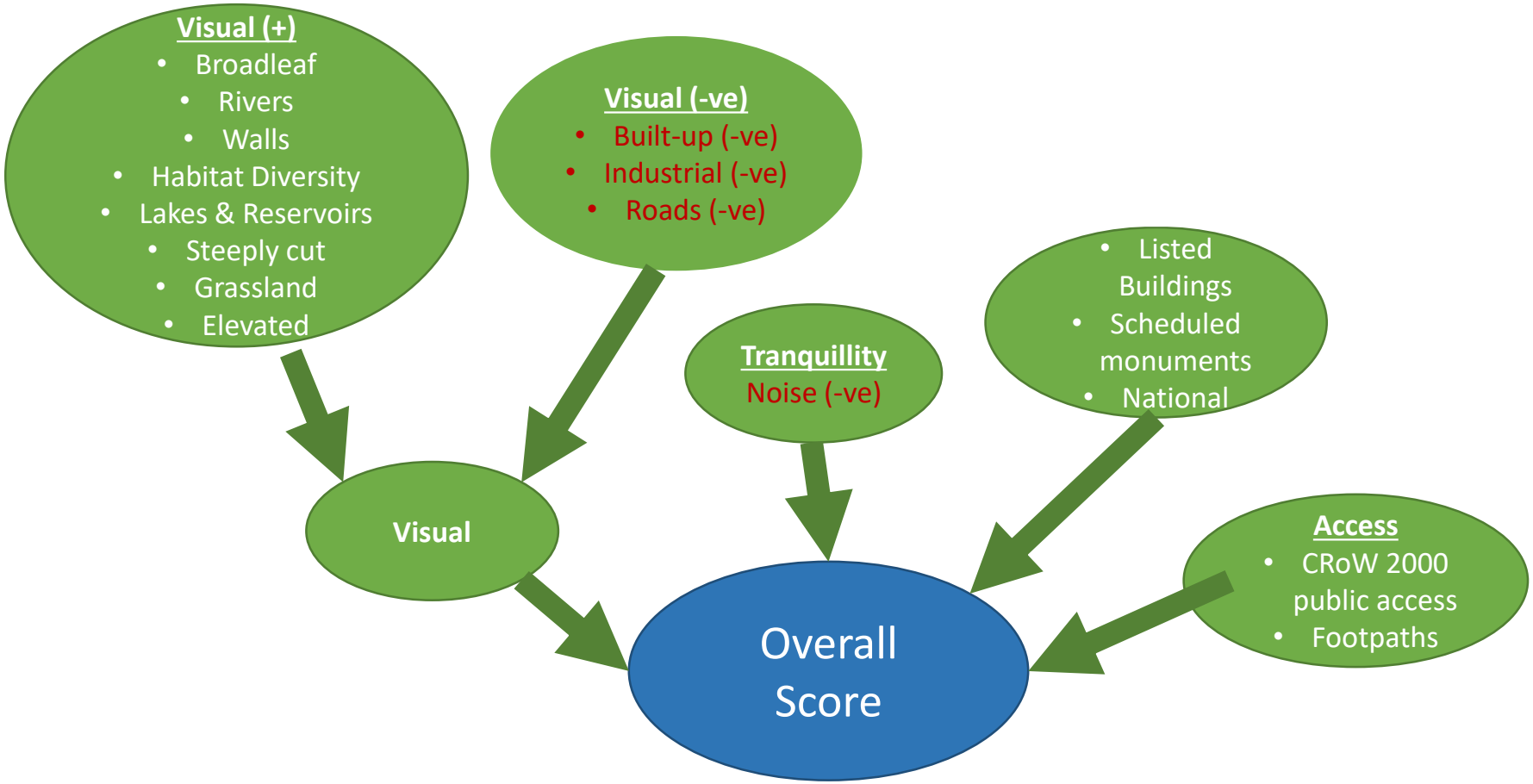
Delivering key indicators to the 25 YEP

Developing landscape character indicators – uses LCM and external datasets (e.g. DTM, road networks, tranquillity data (NE)



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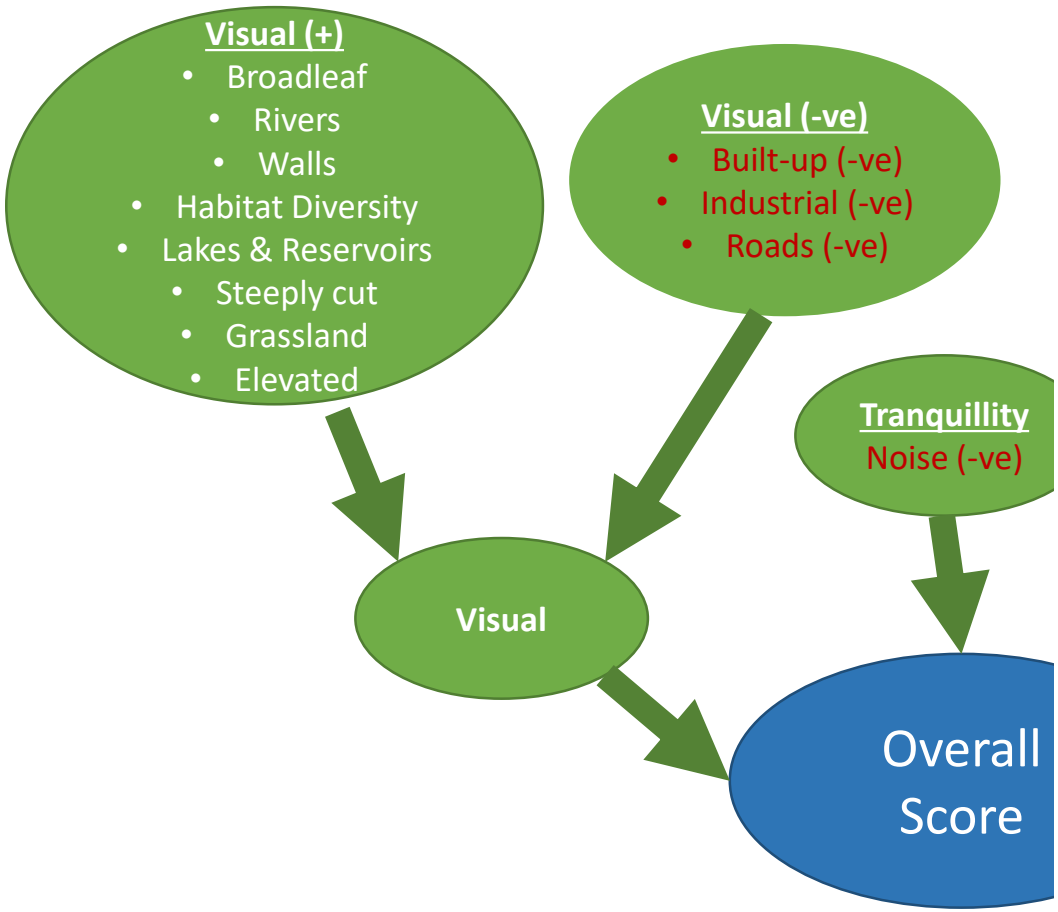

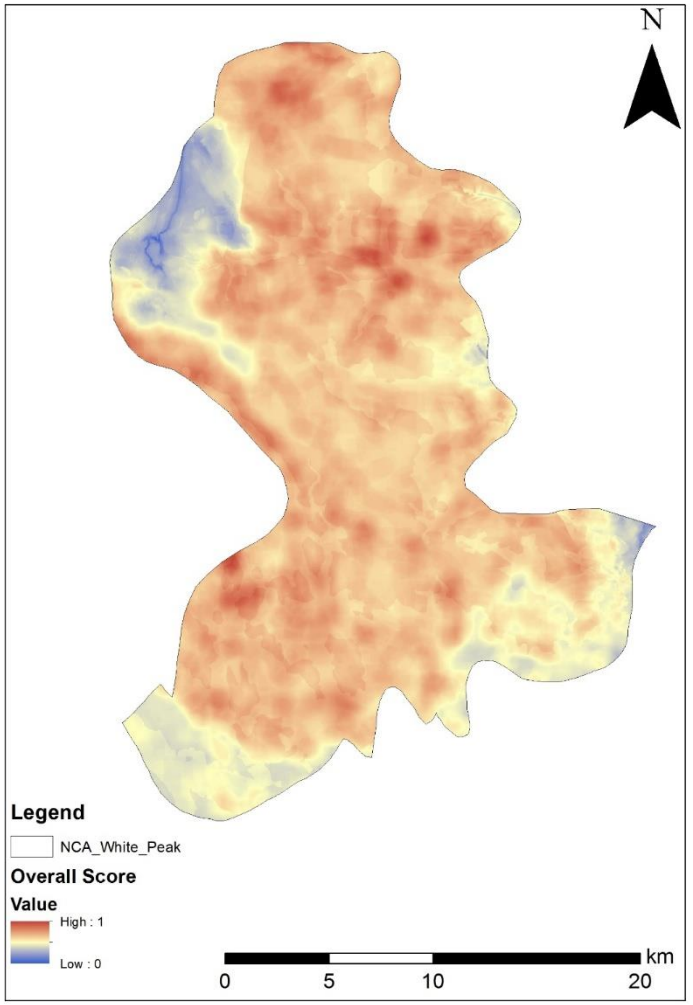

White Peak

Delivering key indicators to the 25 YEP

Developing indicators of Habitat Quality (Quantity and Connectivity)

Aims:

1) To establish consensus on what constitutes habitat quality
2) To identify datasets for monitoring across habitats at a national scale

Condition measures

- Common Standards Monitoring
- Favourable Condition Status
- Natural England Natural Capital Indicators
- NFI indicators
- Net gain…. Etc.

Functional elements	Potential Indicators
Nutrient status	NPP productivity
	Ellenberg N species
	grass:forb ratio
	Critical loads - link to other indicator
	Water quality in relation to condition/extent of habitats- link to indicator
Naturalness of hydrology	soil moisture
	extent of artificial drainage
	Link to indicator
Plant species composition	Positive plant indicators of habitat quality or functional groups
	Cover of negative plant indicators (e.g. rushes, bracken)
	Invasive non-natives- link to indicator
Vegetation structure & management	Woody cover
	Bare ground
	Sward height/structural diversity
	Management
	Other
Soil/ sediment processes	Soil health - link to other indicator
	Soil erosion
Habitat heterogeneity	Length of woody linear features
	Habitat diversity
	Patch size
	Hedgerow quality
	Woody cover
	Transitions between habitats

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