University of Reading

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INTERNATIONAL ASSOCIATION FOR LANDSCAPE ECOLOGY

LANDSCAPE CHARACTERISATION:

METHODS & APPLICATIONS IN LANDSCAPE ECOLOGY

ialeUK Conference

7–9 SEPTEMBER 2016, THE UNIVERSITY OF READING, UK

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Foreword

These proceedings contain the abstracts of the 23rd ialeUK conference on Landscape Characterisation - Methods and Applications in Landscape Ecology held at the University of Reading 7-9 September 2016.

Delegates from nine countries across Europe will attend the conference, covering the latest developments in landscape characterisation, classification and assessment, including methods for engagement and participation, use of open data and spatial analysis techniques. We hope the conference will offer a stimulating opportunity for delegates to explore how we capture differences in landscape and how methods are applied across a wide range of practical and research applications including landscape planning, nature conservation, environmental assessment, land management, catchment management, heritage interpretation and place-based initiatives.

The conference is structured in four symposia:

- Characterisation and classification: methods and challenges - introducing the variety of methods and techniques used to characterise and classify landscapes
- Engaging stakeholders: participatory approaches - exploring the current and potential role of stakeholders and the value of engaging with local communities
- Landscapes of the present: evolution and assessment - examining the application of landscape character assessment, historic landscape characterisation and ecosystem services assessment over the years
- Landscapes of the future: change and vision - discussion and perspectives on the approach and application of landscape characterisation and how it is likely to change in the coming years

The ialeUK conference has been made possible by organisational support from The University of Reading and the ialeUK committee. Student participation was possible through five grants funded by ialeUK, and generous support from The University. We are grateful to the Earth Trust for their active support in the field excursion,

allowing delegates to continue to have discussion whilst learning about landscape characterisation in the beautiful Oxfordshire countryside.

Jess Neumann, Geoff Griffiths and Jonathan Porter.

Reading, September 2016

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Wed 7 Sept am - Characterisation and classification: methods and challenges

Where are we now with Landscape Character Assessment?

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Throughout the world pressures for land use change are bringing about profound changes in both special and everyday 'ordinary' landscapes. Systems to control and shape such changes require the use of practical tools that enable landscape to be taken into account in land use and development decision making. The history of the UK's move to an approach based on Landscape Character Assessment (LCA) is well documented (1) and will not be repeated at length here. Suffice it to say that the approach eventually emerged in the mid-1980s. Its significance was that it set out to separate the classification and description of landscape character, that is what makes one area 'different' or 'distinct' from another, from the then more usual approach of landscape evaluation, with its obsession with relative value.

The emergence of the European Landscape Convention, extended this thinking to European states, by placing emphasis on the need to consider 'all landscapes' and not just those that are officially designated as special. The UK approach to LCA has undoubtedly had an impact on research and practice in Europe and elsewhere (2), perhaps influenced by the activities of the Landscape Character Network and the free to download availability of the LCA Guidance document.This document is for example cited 85 times on Google scholar in papers that originate in countries across the world, and the approach has inspired interest and local application in countries as far afield as Israel, Japan, Korea and Taiwan.

LCA has survived remarkably well in the roughly 30 years since it first emerged. But the situation has become increasingly complex with the emergence of other parallel approaches, notably Historic Landscape Character Assessment and its equivalents, and, more recently, the science driven agenda of ecosytem services and landscape ecological approaches. While LCA and HLCA approaches have much common ground, it seems there is still a gulf between LCA and landscape ecological approaches.

This keynote address will briefly summarise the background to LCA and its influence and will raise a number of critical current questions about the approach in the current policy climate in the UK:

- Why are scientists apparently resistant to understanding and using landscape character frameworks to provide the context for their work;
- How is LCA regarded by policy makers in the UK at present - is it considered to be anti-development and therefore dangerous?
- With so many layers of LCA and HLCA work now in existence, and the landscape ecology approach emerging in parallel, is the whole thing just getting too complicated to be useful?
- Whatever happened to public engagement in LCA in the UK - do 'ordinary' people understand what we are getting at in one, let alone all, of these approaches?

  Do we all speak the same language when it comes to talking about landscape - the example of 'landscape scale'?
- Are the things that most people without specialist knowledge care about in their landscapes - like beauty, sense of place, etc, being lost among the science of landscape ecology?

(1) Swanwick, C. (2003) The Assessment of Countryside and Landscape Character in England: An Overview. In: From Global to Local: Developing Comprehensive Approaches To Countryside and Nature Conservation. Bishop, K. et al. (eds) Earthscan, London.

(2) Wascher, DM. (ed). (2005) European Landscape Character Areas – Typologies, Cartography and Indicators for the Assessment of Sustainable Landscapes. Final Project Report. Page 1 (deliverable from the EU's Accompanying Measure project European Landscape Character Assessment Initiative (ELCAI), funded under the 5th Framework Programme on Energy, Environment and Sustainable Development).

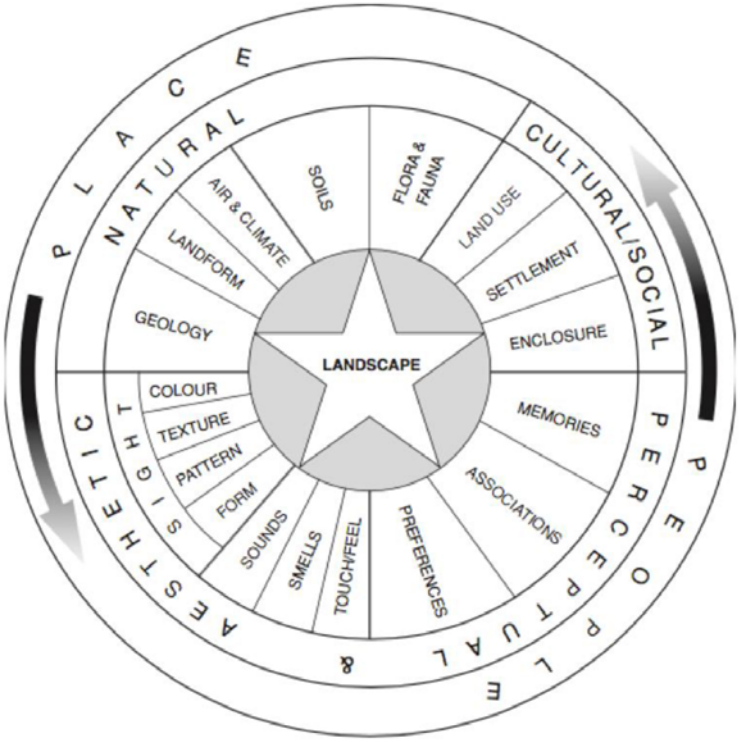

Figure 1: Landscape as an integrating concept

LANDSCAPE EVALUATION	LANDSCAPE ASSESSMENT	LANDSCAPE CHARACTER ASSESSMENT
• Focused on landscape value • Claimed to be an objective process • Compared value of one landscape with another • Relied on quantitative measurement of landscape elements	• Stressed differences between inventory, classification and evaluation of landscape • Recognised role for both subjectivity and objectivity • Provided scope for incorporating other people's perceptions of the landscape	• Focused on landscape character • Divided process of characterisation from making judgements • Stressed potential for use at different scales • Linked to Historic Landscape Characterisation • Emphasised need for stakeholders to be involved
Early 1970s ⇒	Mid 1980s ⇒	Mid 1990s ⇒ (continuing)

Figure 2: The Evolution of Landscape Character Assessment

Landschaftsbild Assessment in Germany

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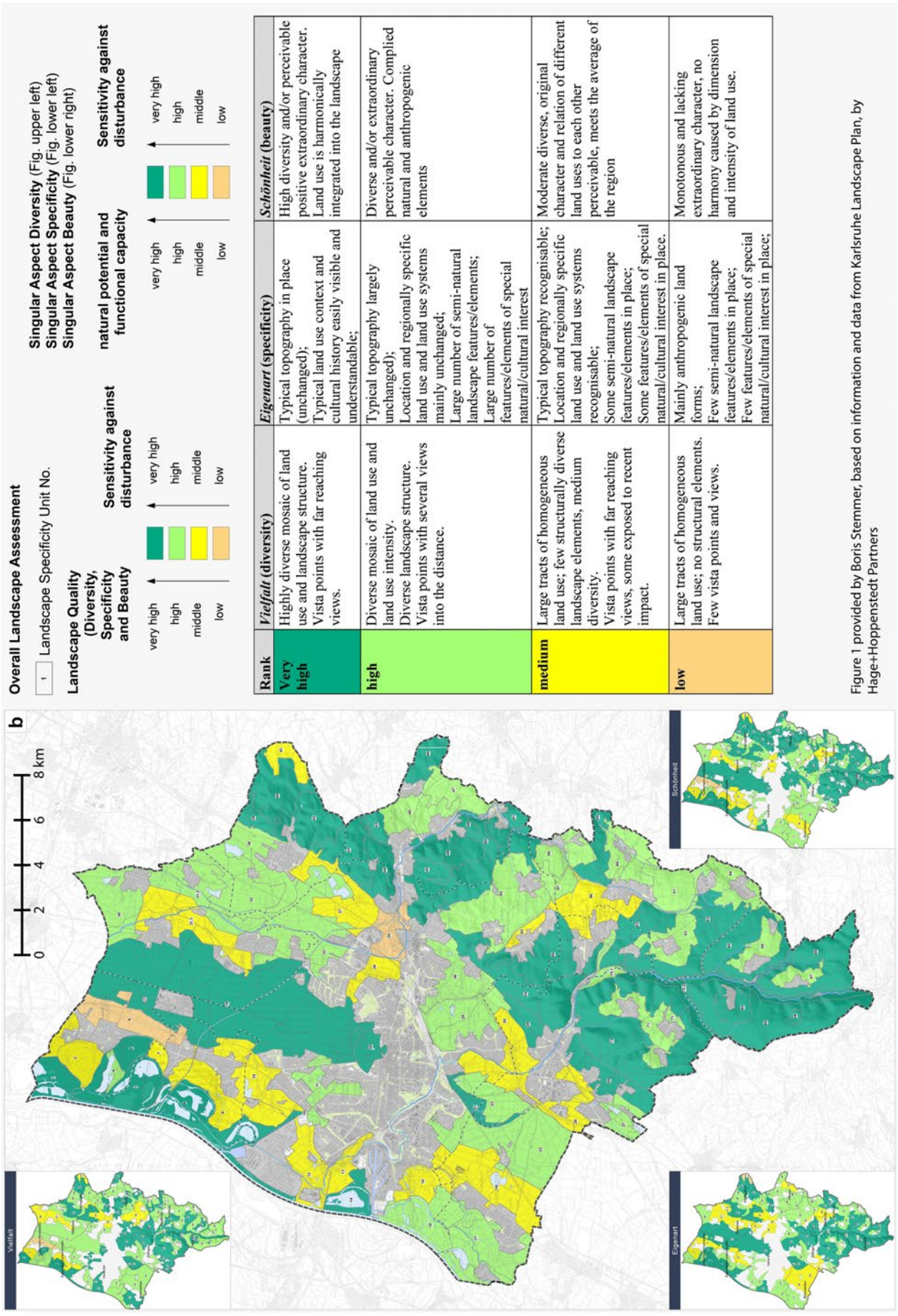
In German landscape assessment distinctions are made, historically and conceptually, between the term Landschaft meaning both a particular territory and the perceived image of such a territory, and on the other hand the term Landschaftsbild referring to visual aspects of a Landschaft. Landscape assessment is required in statutory landscape planning. Starting around the 1930s, landscape ecology became the foundation upon which systematic German landscape planning was built. Since than, and unlike in LCA practice, factors such as soils, climate, flora and fauna are commonly treated separately from Landschaftsbild. Landschaftsbild assessment mainly puts the focus on Schönheit (beauty), Eigenart (distinctiveness) and the experience of Vielfalt (diversity) of landscapes. Landscape assessment practice is shaped by different regional legislations and the many opinions of practitioners. The public is rarely involved. While no standard exists most Landschaftsbild methods commonly include desk studies, field surveys and assessment. First, landscape units may be delineated on the basis of topography, land use and other visible features. Second, natural and cultural features are mapped that, from a specialist point of view, lend beauty, distinctiveness and diversity to a landscape. Third, for the assessment of beauty, distinctiveness and diversity, many consultants use ordinal ranking such as 'high', 'medium' and 'low'. Sometimes the indicators used for rankings are arbitrary. For example, when deciding on naturalness as an indicator for landscape beauty, landscape consultants might be accused of being ecologically "tainted". Local people may disagree with judgement made on their area. Why, one may ask, would finding only few "semi-natural landscape features" automatically lead to a "low" ranking of landscape beauty? Compared with ecological assessments that use natural science based methods, Landschaftsbild assessment is often questioned for its validity and reliability. In their search for ways forward academics and practitioners are collaborating in pursuing different paths. One path is to generate even more quantifiable data; another one is to involve members of the public and not only rely on judgments made by one or two specialists. For engagement with general public members to be successful it is critical that attractive, interesting and user-friendly invitations are extended. Since specialist assessment is documented employing GIS procedures, offering interactive online platforms using Web-GIS technologies appear promising in fusing specialist and local knowledge and to include data on what people give value to in their surroundings. When implementing the European Landscape Convention, landscape can no longer be allowed to remain an exclusive field of study or action monopolized by specialists. It may be time, also in Germany, for a wider conception of landscape assessment. In this context, two important challenges need addressing. The first challenge is how to include intangible values such as place-attachment into landscape assessment. The second challenge is how to involve greater numbers of the public into assessment procedures, and to do so in an inclusive manner. The fact that Germany has not signed and ratified the ELC is taken here as a sign that both challenges are slow in being recognised as needing to be taken serious.



Rank	*Vielfalt* (diversity)	*Eigenart* (specificity)	*Schönheit* (beauty)
Very high	Highly diverse mosaic of land use and landscape structure. Vista points with far reaching views.	Typical topography in place (unchanged); Typical land use context and cultural history easily visible and understandable;	High diversity and/or perceivable positive extraordinary character. Land use is harmonically integrated into the landscape
high	Diverse mosaic of land use and land use intensity. Diverse landscape structure. Vista points with several views into the distance.	Typical topography largely unchanged); Location and regionally specific land use and land use systems mainly unchanged; Large number of semi-natural landscape features/elements; Large number of features/elements of special natural/cultural interest	Diverse and/or extraordinary perceivable character. Complied natural and anthropogenic elements
medium	Large tracts of homogeneous land use; few structurally diverse landscape elements, medium diversity. Vista points with far reaching views, some exposed to recent impact.	Typical topography recognisable; Location and regionally specific land use and land use systems recognisable; Some semi-natural landscape features/elements in place; Some features/elements of special natural/cultural interest in place.	Moderate diverse, original character and relation of different land uses to each other perceivable, meets the average of the region
low	Large tracts of homogeneous land use; no structural elements. Few vista points and views.	Mainly anthropogenic land forms; Few semi-natural landscape features/elements in place; Few features/elements of special natural/cultural interest in place;	Monotonous and lacking extraordinary character, no harmony caused by dimension and intensity of land use.

Figure 1 provided by Boris Stemmer, based on information and data from Karlsruhe Landscape Plan, by Hage+Hoppenstedt Partners

Aberdeen - A Changing City Landscape

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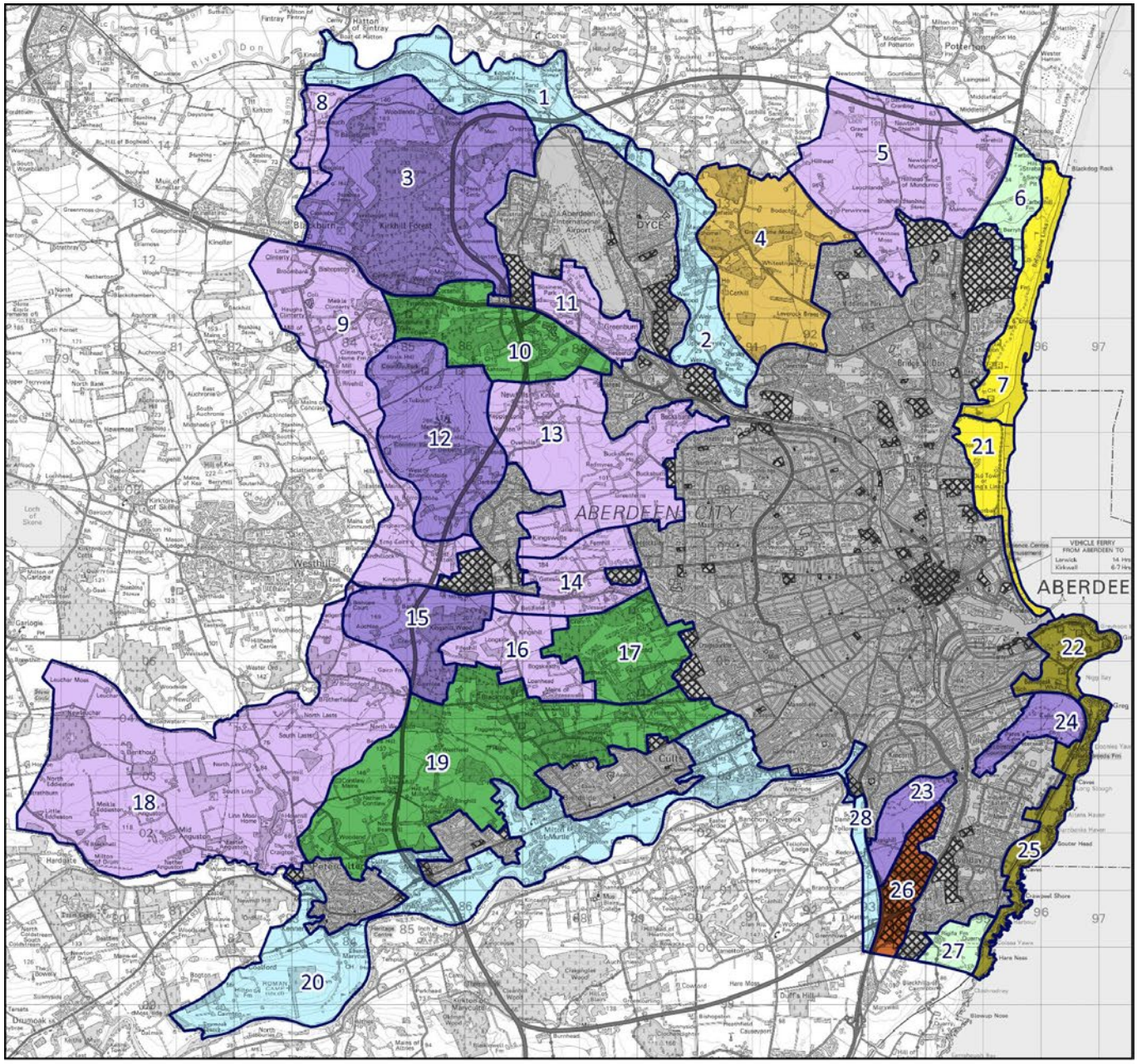
Largely as a consequence of sustained economic growth from the oil and gas boom, the City of Aberdeen has been subject to significant demand for additional housing, land for business and industrial expansion, and other related infrastructure such as roads and port development. In response to these pressures, Aberdeen City Council, working in partnership with Scottish Natural Heritage, has embarked on an ambitious landscape planning project titled the 'Aberdeen Landscape Study' (ALS).

In taking forward the holistic principles of the European Landscape Convention (ELC), this project includes the production of a Landscape Character Assessment, Coastal Character Assessment, Peri-urban Assessment, Landscape Capacity Assessment, Landscape Strategy, and Management Guidelines. Once complete, the ALS will provide a robust evidence base to inform a wide range of future planning and management activity across the entire city region.

In the context of the ELC, this project fully embraces a systematic approach to landscape planning and management. Taken collectively, the constituent parts of the project will provide the Council and other stakeholders with a comprehensive evidence base of landscape assessment, clearly defined planning and management objectives, and an associated monitoring framework.

Although the practice of Landscape Character Assessment is generally well integrated into UK local authority work, urban fringe issues tend to receive little attention in spatial planning and as such, there is a need for a strategic approach to their effective planning and management. Through providing a detailed understanding of the character and condition of Aberdeen's peri-urban landscapes, this part of the study aims to provide a framework in which to facilitate positive outcomes for a wide range of changes taking place across this dynamic environment.

Although landscape characterisation is typically applied to more rural landscapes, the ALS is perhaps unique in a UK context as it takes an integrated approach to rural, coastal and urban fringe planning of rapid and extensive urban expansion. This presentation will therefore explore how the implementation of the ALS can help to ensure Aberdeen's unique landscape is conserved and enhanced, whilst informing forest and woodland expansion, green network planning, and strategic biodiversity enhancements.



Aberdeen Landscape Character Assessment

Draft
September 2016

Landscape Character Area
Developed / under construction

Landscape Character Type
- Beaches, Dunes and Links
- Cliffs and Rocky Shore
- Coastal Farmed Plain
- Hills
- River Valley
- Undulating Open Farmland
- Undulating Wooded Farmland
- Urban
- Urban and Farmland Mosaic
- Wooded Estatelands

0 1 2 3 km

A new system for nature and landscape characterisation in Norway (NiN)

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NiN – Nature in Norway (1) is a system for typification of variation in nature. The system addresses variation at different levels, from microhabitats through ecological systems to landscape types (Fig. 1). The ecological systems address habitats and ecosystems and form the basis for secondary type systems for nature components and nature complexes. Ecological systems are defined for all nature, i.e., with wall-to-wall coverage, of terrestrial, freshwater and marine systems, including waterbodies. At each of the three primary levels, the type system is supplemented by a description system with variables that address within-type variation.

The division into types at the ecological system level is based on analysis of variation in species composition along complex environmental variables, accounting for discrete as well as gradual variation. Types are defined by criteria based upon the magnitude of species compositional change.

The landscape-type level (including the sea floor) is designed to meet the demands of the European Landscape Convention and the Norwegian Nature Diversity Act (which explicitly addresses geodiversity, biodiversity and landscape diversity) for an operational concept of landscape types. Landscape types are defined in a multidimensional space with gradients in the abundance and occurrence intervals of observable landscape elements as axes. We use variables derived from existing data bases, including digital maps, terrain, geology, land cover and infrastructure. A pilot typification have been carried out for the county of Nordland (Fig. 2). The landscape types are grouped in four main types (coastal plains, fjord-, valley- and hill/mountain landscapes). Mapped units (landscape polygons) are typically 4–30 km2.

The landscape-type system for Norway will result from analyses of a new data set generated to be representative for variation in landscapes in entire Norway. This data set comprises 100 test areas, covering 56 400 km2 (Fig. 3), for which more than 80 variables have been sampled in a total of 4 166 sampling units delineated according to principles from the Nordland pilot. The landscape-type system opens for mapping the distribution of landscape types, thereby facilitating regional comparisons with respect to representativeness and rareness. The formalised description system, opens for more detailed descriptions of a wide range of properties of importance for scientific, monitoring and management purposes. The description system links the landscape types with the process of assessing landscape character and value.

The landscape-type system is scheduled to be finished within year 2016 and the first version of a complete landscape-type map for Norway may thereafter be produced within one year, depending on funding.

(1) www.biodiversity.no/. Accessed 29 July 2016.

(2) Erikstad, L. et al. (2015). Characterisation and mapping of landscape types, a case study from Norway. Belgeo. 3: http://belgeo.revues.org/17412.

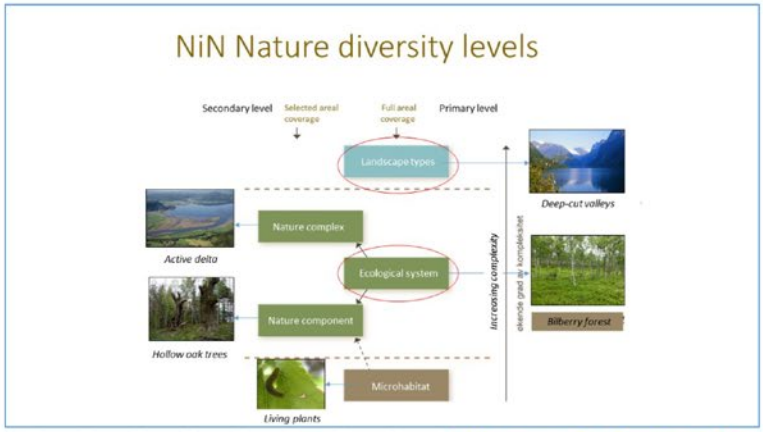

Figure 1. *The NiN typification system with examples.*

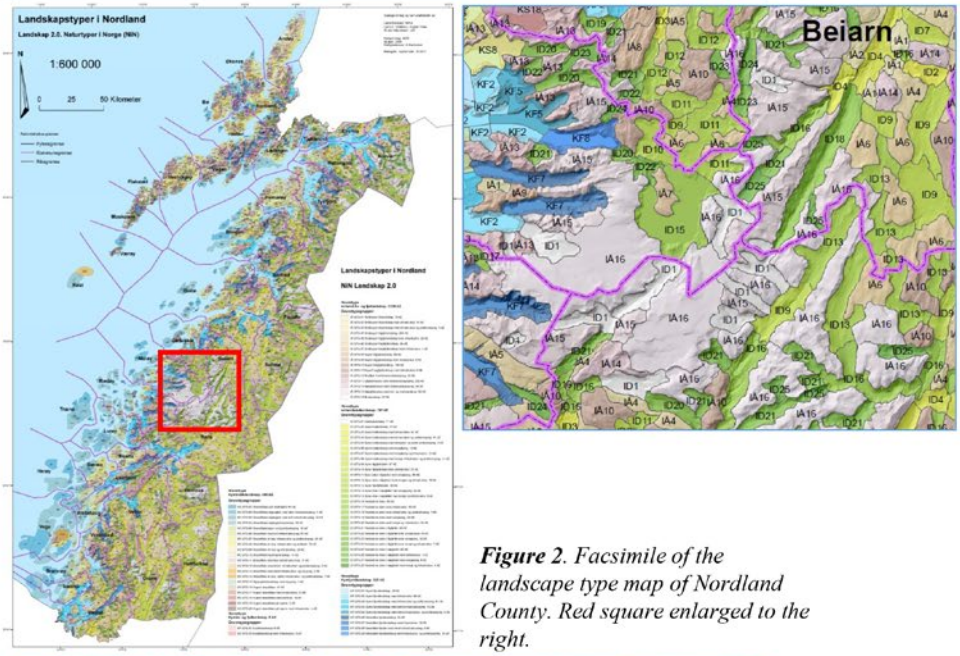

Figure 2. *Facsimile of the landscape type map of Nordland County. Red square enlarged to the right.*

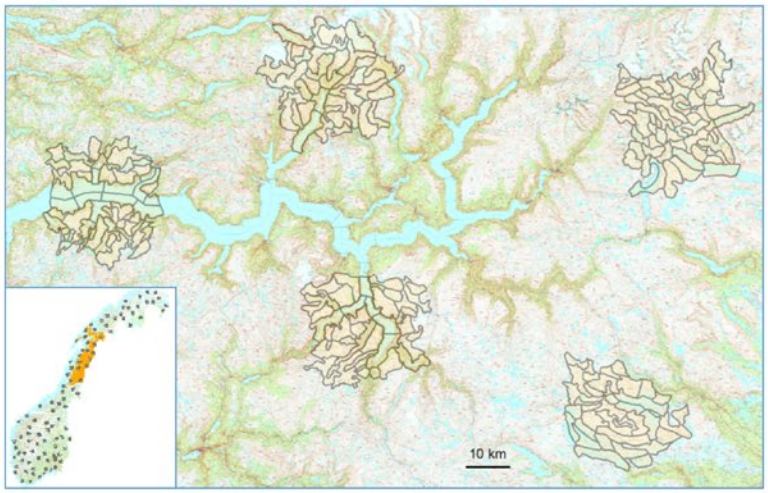

Figure 3. Delineation of *landscape-type* polygons *for 5 out of the 100 areas selected to represent variation in Norwegian landscapes. Insert map shows the position of all 100 within Norway, with Nordland county in orange.*

GIS-based approach to landscape function system mapping

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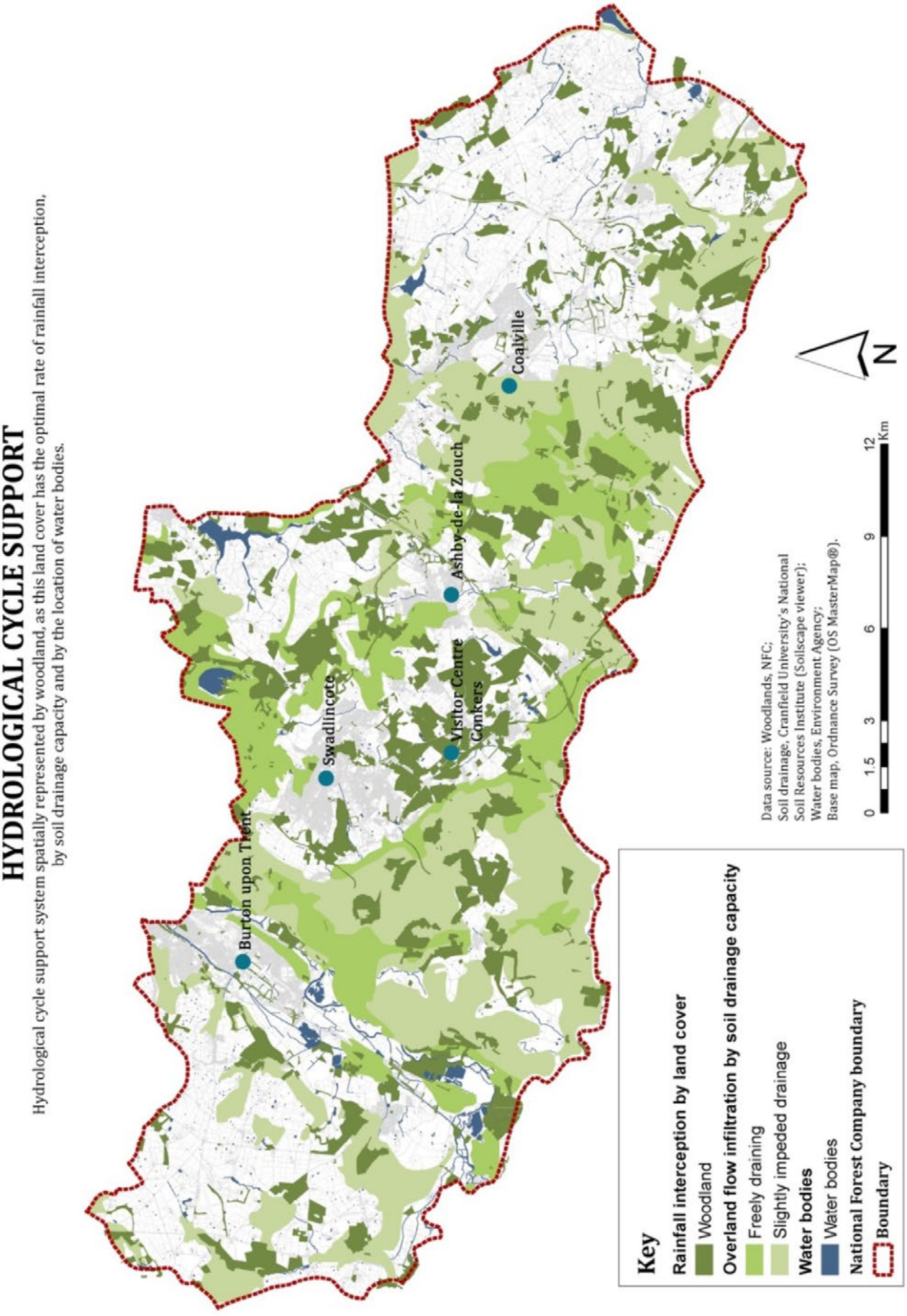
Landscape practice, research and policy frameworks recognise that landscapes are the manifestation of complex relationships between people and natural processes. Acknowledging these interactions requires addressing the complexity associated with a wide range of social and ecological functions. The spatial representation of these functions has an important role in understanding landscape complexity as a basis for protecting and re-generating highly valued landscape properties such as resilience, distinctiveness and ecosystem services provision. As part of a proposed integrative framework for assessing landscape multifunctionality, this study aims to build on existing approaches to mapping functions by exploring landscapes as social-ecological systems. The final aim is to produce process–oriented maps to help practitioners see the landscape in terms of its systems components and processes.

The methodology was applied to the area managed by the National Forest Company, in England. Initially, two existing GIS-based methods were explored (1), (2); building on them, a third GIS approach was developed. This identifies spatial elements and conditions that indicate the spatial extent of different landscape function systems based on existing literature. For example, the hydrological cycle support function system has been represented by three elements - woodland land cover, soil drainage capacity and location of water bodies - as these are key elements for processes associated with rainfall interception, infiltration and water storage and supply, Figure 1. Six landscape function systems were mapped: provision, hydrological cycle support, atmospheric regulation, biodiversity support, information and carrier and community. The resulting maps were used as support information during a series of workshops carried out as part of a Soft System Methodology (SSM) approach. During the SSM workshops the maps were not specifically evaluated in terms of their content: rather, they were used to generate discussion regarding their key roles within an integrated decision-making framework.

This study found limitations in previous spatial approaches in terms of their ability to successfully account for landscape complexity. Its approach therefore combined landscape function maps with a qualitative approach that supported decision-making at different stages: collecting local contextual information, analysing potential points of interventions, and presenting results and actions.

(1) The Mersey Forest (2009). A Green Infrastructure Planning Method.

(2) Willemen, L. et al. (2008). Spatial Characterization of Landscape Functions. Landscape and Urban Planning. 88: 34–43.


HYDROLOGICAL CYCLE SUPPORT
Hydrological cycle support system spatially represented by woodland, as this land cover has the optimal rate of rainfall interception, by soil drainage capacity and by the location of water bodies.
Coalville
Ashby-de-la Zouch
Visitor Centre
Conkers
Swadlincote
Burton upon Trent
N
0 1.5 3 6 9 12 Km
Data source: Woodlands, NFC;
Soil drainage, Cranfield University's National Soil Resources Institute (Soilscape viewer);
Water bodies, Environment Agency;
Base map, Ordnance Survey (OS MasterMap®).
Key
Rainfall interception by land cover
Woodland
Overland flow infiltration by soil drainage capacity
Freely draining
Slightly impeded drainage
Water bodies
Water bodies
National Forest Company boundary
Boundary

A Compound Eye on the Landscape: Beetle Communities and Landscape Character in the Agricultural Mosaics of Southern England

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Landscape character assessment inevitably calls to mind an anthropocentric perception of what constitutes the landscape scale. However, if we accept that landscape ecology processes operate at a range of scales depending on the range size and behaviour of the organisms in question (1), then management decisions that follow from human-scale assessments may be said to overlook many components of biodiversity in the landscape. This could be especially true for invertebrates, where landscape processes operate at spatial scales down to tens of meters and below. Few studies employ a landscape model with fine enough resolution to incorporate the types of small habitat patches that may be important refugia for invertebrates, or seek to assess the potential impact of landscape conservation projects targeting vertebrates or more charismatic invertebrates (e.g. butterflies) on wider invertebrate biodiversity.

This project focusses on a community of flower-visiting beetles within the agricultural mosaic landscapes of southern England. Beetles were collected from flowering plants in the family Apiaceae from 200 m transects alongside roads and public footpaths. Selecting a landscape scale that balances between known dispersal distances for the species collected and those scales used in existing studies of this type, study landscapes were defined around each transect by applying a 200 m buffer in ArcGIS. Landscape composition data were based on OS MasterMap, with a combination of CEH landcover (2007) and reference to satellite imagery used to reclassify polygons. Boundaries between patches that were identifiable as discrete vegetative features were digitized as linear landscape elements and placed into three categories: no trees, trees or woodland edge (Fig. 1). Finally, the effect of landscape composition on the makeup of beetle communities was examined using Canonical Correspondence Analysis performed in R with the Vegan package.

Preliminary analysis focussing on the families Scraptiidae and Cerambycidae (Fig. 2) suggests that beetle community composition does reflect surrounding landscape character at this scale, with higher diversity and of saproxylic species in more wooded landscapes. Further analysis using the full suite of species data should highlight potentially differing responses to landscape structure between beetle families, and also aims to evaluate the importance of landscape heterogeneity and the presence of small patches of 'rough' vegetation (such as road verges) in community diversity. By using a family of plants with both ecological (2) and cultural significance as a sampling platform (Figure 3), this project also seeks to facilitate connections between the science of landscape ecology and the everyday public enjoyment of biodiverse landscapes.

(1) Farina, A. (2000) Landscape Ecology in Action. Springer Netherlands.

(2) Pocock, MJO. et al. (2012) The Robustness and Restoration of a Network of Ecological Networks. Science. 335: 973-977.

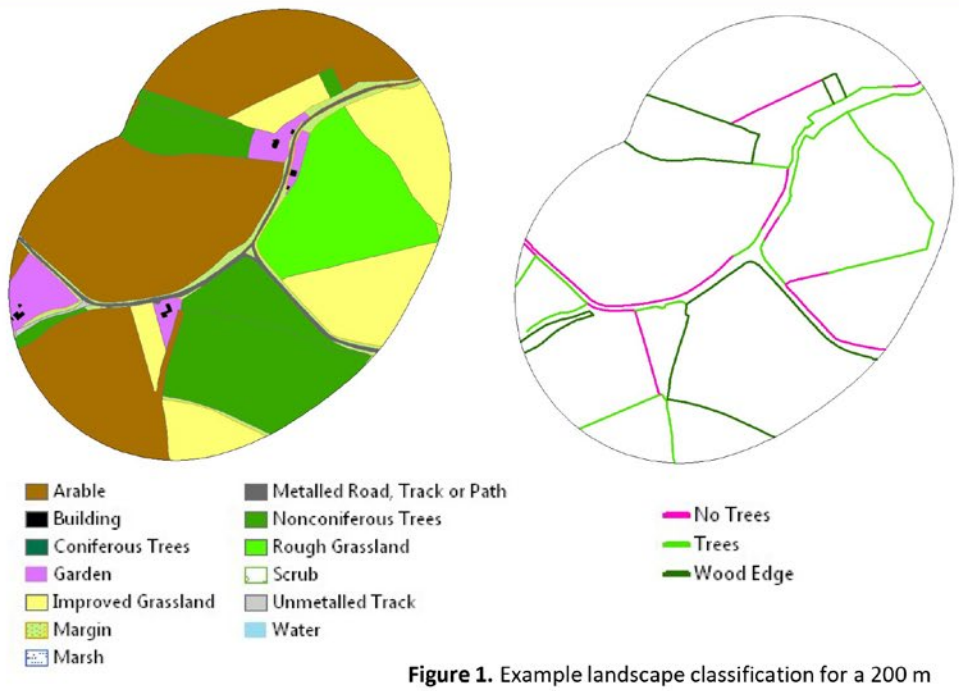

Figure 1. Example landscape classification for a 200 m buffer around a 200 m linear transect in Hampshire, England showing landscape composition (left) and linear features (right).

Figure 2.
Scraptiidae *(Anaspis regimbarti and Anaspis fasciata)*, Cerambycidae *(Rutpela maculata)*

Figure 3. Apiaceae species such as hogweed and cow parsley have been recognised as keystone plant species; they also make important contributions to the visual characteristic of landscapes in spring and summer.

Creating a "bee's-eye view" of the forage landscape - using bumblebee colony models as a conservation management tool in agricultural landscapes

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Bumblebees are important pollinators of wild flowers and some crops at a landscape scale and therefore, their recent widespread decline raises serious concerns about the future of pollination for biodiversity and food security. Understanding the spatially and seasonally dynamic resource use of bumblebees foraging in complex landscapes is therefore essential to make effective policy and management recommendations.

We introduce our new bumblebee population model; Bumble-BEEHAVE, as an example of a landscape characterisation method in Landscape Ecology and its potential applications. Our model simulates multiple bumblebee colonies interacting in a realistic digitised landscape and builds upon our existing suite of Individual-Based pollinator models (1, www.beehave-model.net). We characterise the landscapes using a "bee's-eye view"; where multiple spatially and temporally dynamic floral resources provide pollen and nectar.

We have developed a multi-layered landscape method where multiple nectar and pollen flower species are available in different resource types that are specific to the season and the bumblebee feeding morphology. In Bumble-BEEHAVE, Bumblebee individuals make decisions on what to forage for (nectar or pollen), what patches to forage from and which forage species to forage on. This depends on their past experience of forage distance, quality and quantity and the needs of the colony. By characterising the landscape using this multi-resource layered method we can explore management and conservation scenarios such as the distribution, concentration and species composition of pollinator-friendly Countryside Stewardship options for example.

Our model is spatially and temporally explicit; therefore, the effect of management and conservation implemented at the landscape scale, over multiple years, on Bumblebee population, colony and individual level processes can be tested. We illustrate this using the example of tailoring the distribution and concentration of pollinator-friendly crop margin options to specific sites in order to deliver the optimum ecological benefits.

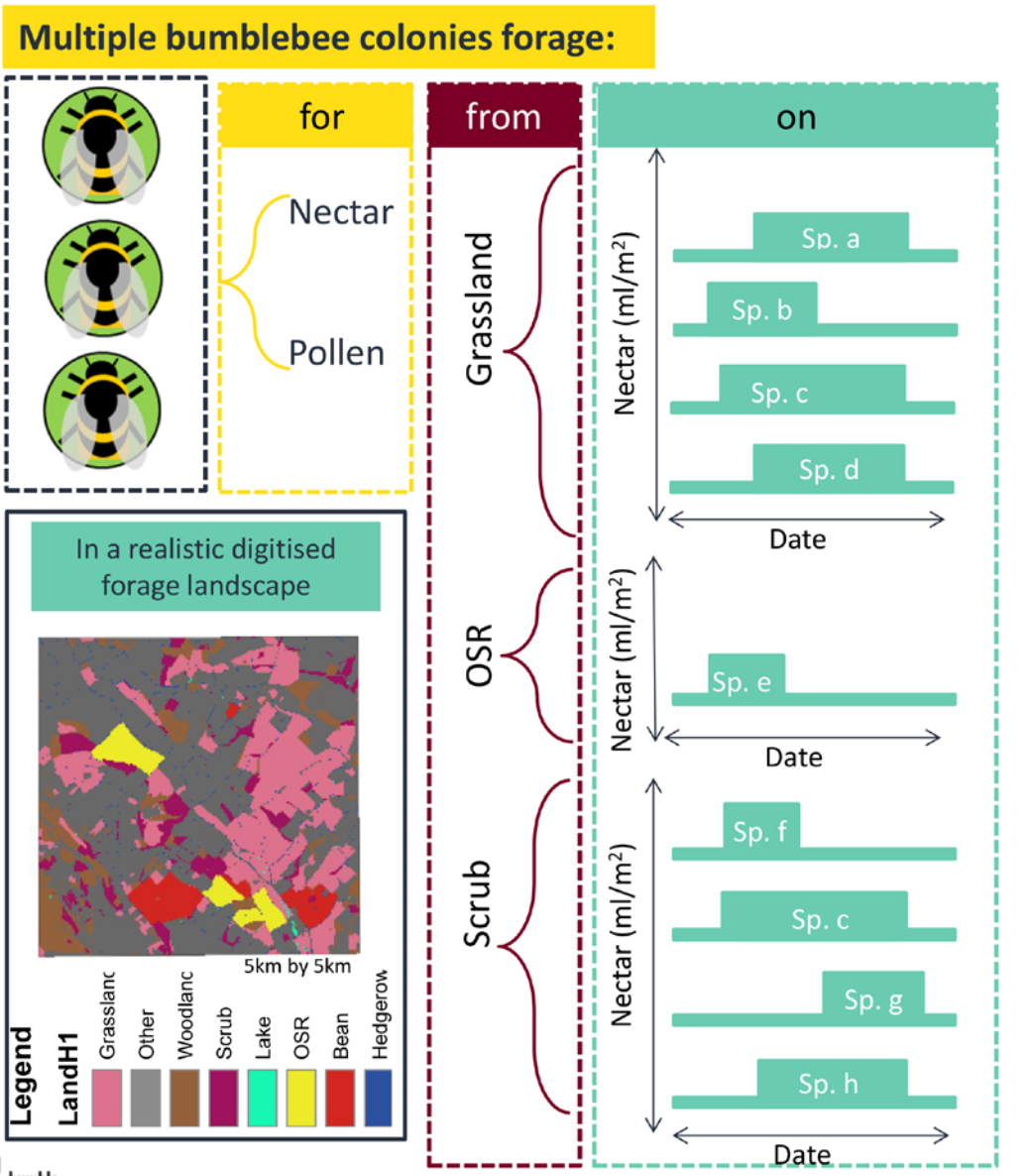
Through the characterisation of floral resources at a landscape scale, Bumble-BEEHAVE can be used to predict and identify the variables associated with bumblebee colony success. We are developing at network of local, regional and national users which can utilise Bumble-BEEHAVE to aid pollinator conservation and management decision making. Thus, providing a management tool for the conservation of pollinators in agricultural landscapes and the ecosystem service that they provide.

(1) Becher, MA. et al. (2014). BEEHAVE: a systems model of honeybee colony dynamics and foraging to explore multifactorial causes of colony failure. Journal of Applied Ecology. 51(2): 470-482.

Creating a "bee's-eye view" of the forage landscape- using bumblebee colony models as a conservaton management tool in agricultural landscapes

Grace Twiston-Davies, Matthias A. Becher, Juliet L. Osborne

In the *Bumble*-BEEHAVE model, Bumblebee individuals make decisions on what to forage for (nectar or pollen), what patches to forage from and which forage species to forage on. This depends on their past experience of forage distance, quality and quantity and the needs of the colony.



Example of multiple forage patches and multiple nectar providing species
OSR (Oilseed rape; *Brassica napus*), Bean (Broad bean; *Vicia faba*)

Building a hybrid Biotope database method for Stockholm County: From utopia to the real world

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Stockholm, along with major cities in general, is ever expanding, facing the challenges to do it in a sustainable way to maintain biodiversity and healthy ecosystems. This calls for efficient mapping support, emphasizing an ecological assemblage of the landscape, where planners can pinpoint which urban and rural values to preserve and strengthen (1). There is also an increasing demand from the landscape ecology research community for detailed spatial data on biotopes and their key qualities for spatial analyses. To meet this demand, Stockholm University is developing a refined biotope database mapping method targeting Stockholm County, building on a previously developed method for Stockholm City (2). While this applied project is in close partnership with end users, it also relies on refinements of advanced remote sensing and mapping techniques. Indeed, a trade-off has to be found between the needs of detailed information and efficiency; how can we detect consistent qualities of the landscape without losing the efficiency in terms of time, money, and computer power?

We propose a hybrid method based on the interaction between human perception and automatic remote sensing methods, using different GIS and image analysis software. Our goal is to bridge the objectives of nature conservation and urban development, with the capacity of modern remote sensing techniques in a clever semi-automated way (see Fig. 1). We first perform a semantic negotiation of generalization principles, major break lines of class definitions and attributes, and minimum mapping units. Then, satellite imagery (10m res.) and CIR ortho-photos (0.25m res.) are used to segment and automatically delineate primary features, e.g. non-vegetation, forest, and water vegetation, too tedious to delineate by hand. We convert the background raster into an initial vector database and do further classification by visual interpretation in photogrammetric stereo environment (DAT/EM Summit Evolution seamlessly integrated with ArcGIS). Finally, the classifications are examined in the field to measure and understand the limits of the process and continuously improve the method.

Our presentation exemplifies several methodological issues such as mapping forests, and green urban structures using multiple criteria. These biotopes are semantically challenging since spectral information is no longer the crucial classifier. To reach a relevant level of information, we aim at developing a “human contextual vision” of remote sensing beyond the pixels.

(1) Löfvenhaft, K. (2009) Tools to assess human impact on biotope resilience and biodiversity in urban planning: examples from Stockholm, Sweden. In: Ecology of Cities and Towns - A Comparative Approach. McDonnell, M. J. et al. (eds). Cambridge University Press, pp. 422-438.

(2) Löfvenhaft, K. et al. (2002) Biotope patterns in urban areas: a conceptual model integrating biodiversity issues in spatial planning. Landscape Urban Plan. 58: 223-240.

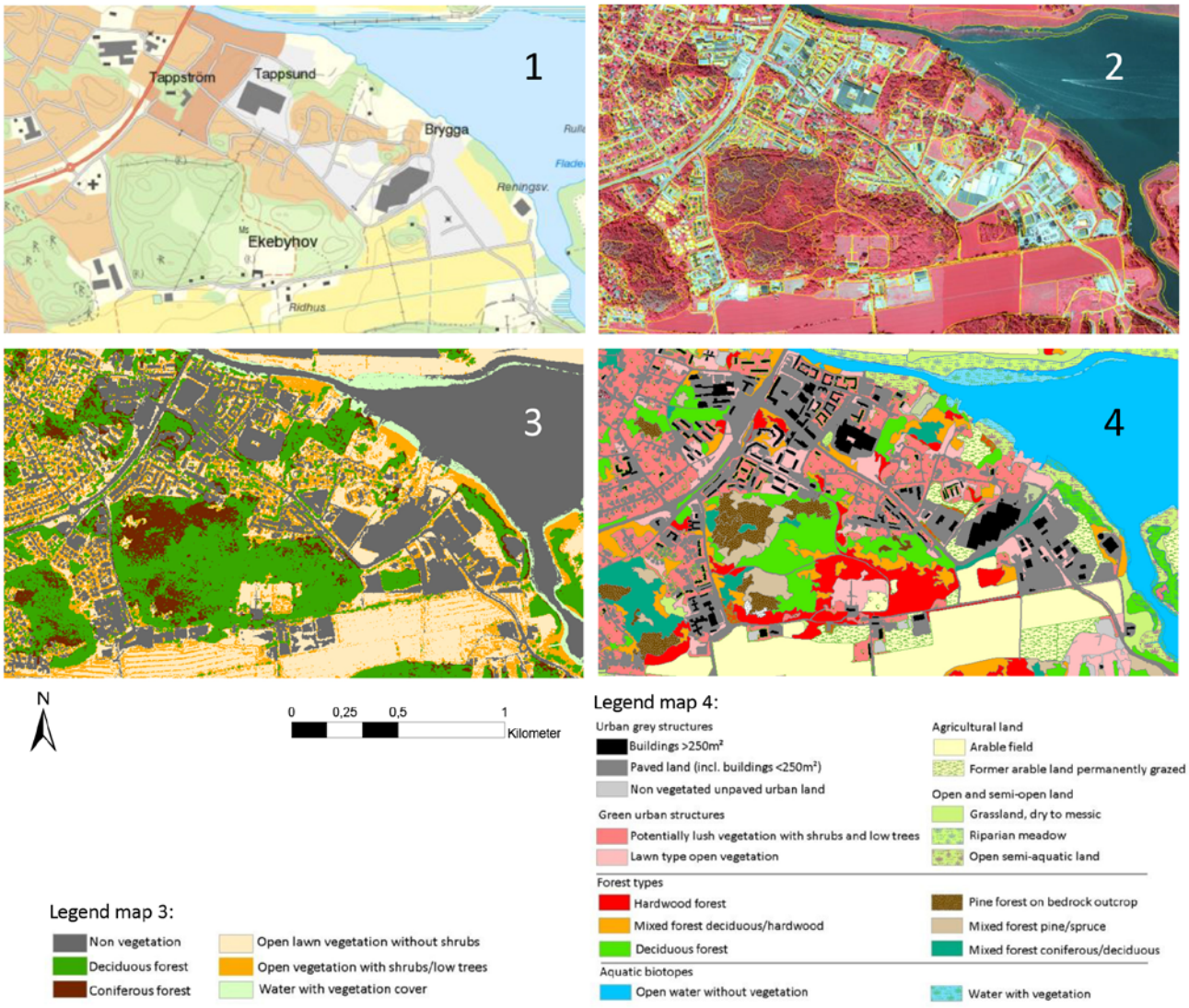

Figure 1. Illustration of some selected major steps of the mapping process used to build the future biotope database in Stockholm county – overview of a test area in Ekerö municipality.

1: Current map for official use at the municipality (© Lantmäteriet). Topographic map that shows the distribution of forest, arable fields, urban areas, and other open land. The map only has limited biotope information that is insufficient for sustainable planning and landscape ecological analysis.

2: Colour infrared (CIR) ortho-photo (0.25m) with final transparent biotope polygons for visual examination.

3: Pixel classification from automatic classification and segmentation of CIR ortho-photo and photogrammetric data on vegetation height used for initial categorization the different biotopes (1m). Major parts of this classification (non-vegetation, forest cover, and water vegetation) are used as input data through segmentation and generalization to the final visual air photo interpretation. The gain in time and effort to have these classes automatically suggested is substantial and forms the core of the developed method.

4: Prototype biotope database map with a selection of the classes visible in the map, including classes of urban grey structure, urban green structure, agricultural land, open-semi open land, forests (derived through collaboration with Metria project www.cadasterenv.se), and water areas. The database is complex, including additional attributes such as land use, forest phase, moisture regime etc., that do not show in the current map. In total the preliminary classification system has 60-70 classes, where some are still pending due to classification issues. All classification is aided by semi automatic classification and visual digital air photo interpretation.

The spatial pattern of the landscape as an effect of components interrelationships

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There are many ways to reflect the landscape spatial pattern depending on objectives of the study. In landscape ecology and geography among the widely used models of landscape spatial pattern are watershed models, landcover mosaics, structural-genetic models etc. Variety of types of landscape structures requires finding ways to identify synergetic effects of interactions between landscape patterns of different scales and types. Among the characteristics of the landscape components can exist groups of properties that are determined by landscape pattern of a specific type. In contrast, any landscape property may be the result of superposition of landscape patterns of different types and scales. Thus, the enhancement of methods for the separation of contributions of different spatial patterns in varying landscape characteristics is an important tasks for landscape ecology (1).

The purpose of this research is to reveal different landscape spatial patterns within the focus region and to identify areas of strictly determined relationships between landscape components. The study area is located in middle taiga region of North European Russia (Fig. 1). We used digital elevation models, remote sensing data and more then 200 sample plots to create maps of different landscape patterns and build statistical models of landscape components interrelationships. Widely used in Russia genetic-morphological approach to the landscape mapping is based on the principle of determinism and gives the highest taxonomic significance in landscape units hierarchy to the genesis of soil-forming deposits (Fig. 2). But this hierarchy should be strictly proven by quantitative estimates and our results show evident that in some areas landscape components don't have strong deterministic linkages within the boundaries of landscape units. Multi-structural approach to the landscape mapping is based on the consideration that landscape components are not strictly related and it is possible to evaluate a probability that landscape unit corresponds to a certain class identified according to given criteria. As a result, landscape spatial pattern at a certain scale level is an aggregate consisting of partial landscape units that are mostly evident in this scale (2). Another problem is associated with upscaling and downscaling. Data translation is possible only if the relationships type between landscape components is scale-independent which requires to reveal spatial landscape units with unified type of components interrelations at each scale level (Fig. 3).

This study was supported by the Russian Foundation for Basic Research, project №14-05-00170-A.

(1) Khoroshev, AV. (2016) Modern trends in structural landscape study. Izvestiya Rossiiskoi Akademii Nauk. Seriya Geograficheskaya. 3: 7-15. (in Russian)

(2) Khoroshev, AV. et al. (2006) Uncertainty of relations between landscape components – a tool for modeling evolution of spatial pattern. Ecology (Bratislava). Vol. 25, Suppl. 1: 122–130.

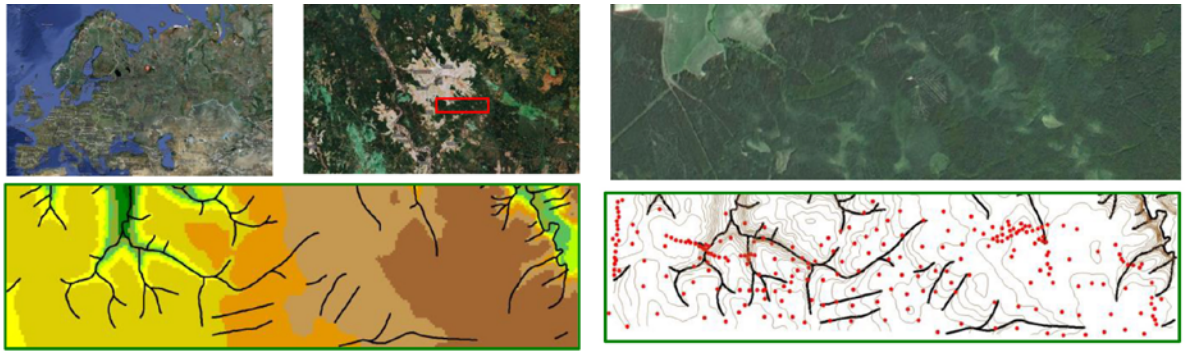
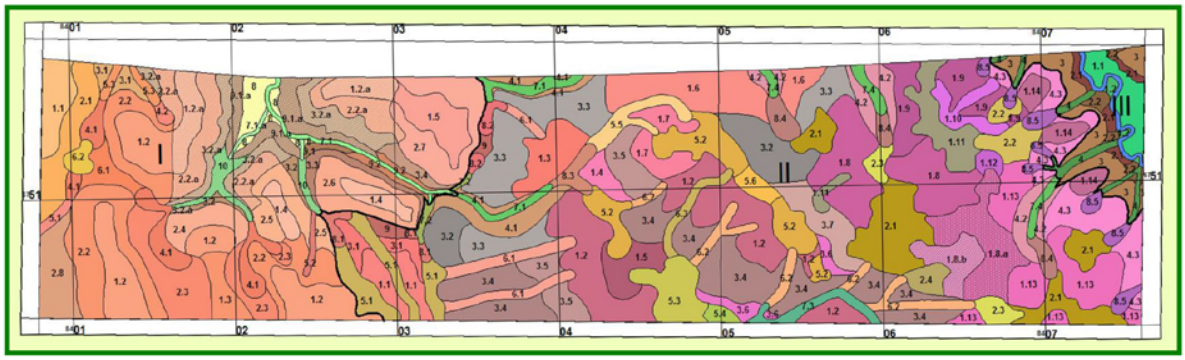


Fig. 1 Research region and materials

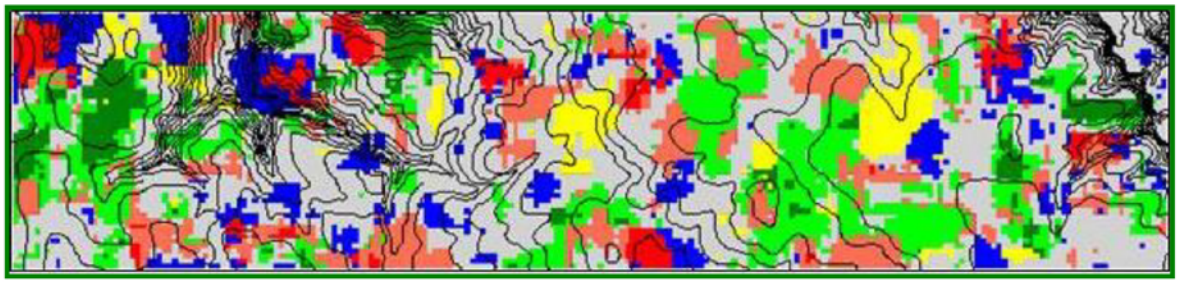


Scale 1:35000 Gauss-Kruger projection (Pulkovo 1942)

Map legend (fragment)

I. Structural-erosive hilly plain with relatively thick cover of sandy deposits on underlying loams, with pine forests and the agricultural grounds on podzolic soils on watershed areas and umbrisols on slopes	
1. Flat and weakly convex watershed areas with pine forests on agri-podzolic soils	
	1.1. Pine forests with juniper, cow-berry (*Vaccinium vitisidaea*), wolf's-claws (*Lycopodium clavatum*), bent (*Agrostis sp.*), lichens (*Cladonia*) and green moss (*Pleurozium schreberi*) on agri-podzolic soils
	1.2. Pine forests with juniper, cow-berry (*Vaccinium vitisidaea*), whortleberry (*Vaccinium myrtillus*), bent (*Agrostis sp.*), green moss (*Pleurozium schreberi*) on agri-podzolic soils
...	

Fig. 2 Structural-genetic landscape map



Classification of regression coefficients (window 390 m)

0 class (++VR)
1 class (-)
2 class (--HR, ++VR)
3 class (-HR, -D)
4 class (--VR, ++HR)
5 class (-VR)
6 class (-)
7 class (++D, ++HR)

++ strong positive relations
+ weak positive relations
-- strong negative relations
- weak negative relations

Linear multiple regression equations are computed for the system "landform-vegetation cover" in a moving window. Dependent variables - factors of vegetation differentiation based on principal components analysis of Landsat 7 image (factor of humidity). Independent variables - relief characteristics based on DEM (slopes gradient, slopes shape, distance to the nearest waterway (D), vertical ruggedness (VR - standard deviation of altitudes in certain area), horizontal ruggedness (HR - total length of waterways in certain area). Calculation is made for the different sizes of a moving window (3, 5, 7, etc. pixels), value is associated with the central pixel. As a result parameters of regression equations are received for each pixel at the different sizes of a moving window – regression coefficients (absolute and standardized), coefficient of determination and a standard error of calculation. Standardized regression coefficients reflect the contribution of every independent variable (morphometric characteristics of a relief) in the general equation. Accordingly, if classify the pixels by values of these coefficients, it is possible to reveal some classes differing with force and a character of intercomponent relations. These classes represent cogenetic mosaic systems combining the landscape units which are formed under influence of any factor and differ only by quantitative value of this factor.

Fig. 3 Landscape units with unified type of components interrelations

Wed 7 Sept pm - Engaging stakeholders: participatory approaches

Literature and Public Participation in Landscape Character Assessment

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What do people and communities need to engage with a landscape; to recognise and value its distinctiveness? The presumption at the heart of Landscape Character Assessment (LCA) is that they need knowledge, presented as clearly and objectively as possible. My argument in this presentation, which accords with a recent critique of LCA by Butler and Berglund (1), will be that this is only one of the things they need, and indeed on its own, 'objectivity' may be an obstacle to participation in the process of LCA, and engagement with its product. The subjective influences of value and belief, of custom and pastime, of memory and feeling, are all 'noise' in a system of representation which aspires to capture distinctiveness in a repeatable, value-free way, and yet these influences are vital means through which people and communities 'connect' with place and landscape. Capturing them requires a radically different methodology to LCA, but one which could be embraced as complementary.

LCA is one way of mapping landscape, literary representation of place is sometimes recognised as another. Literary quotations occasionally find their way into LCAs as illustrations of the 'inspiration' provided by a landscape's distinctive properties and a proof of its objective value. Literary inspiration is, to use Natural England's terminology, one of the 'cultural services' provided by some landscapes. If we want to unlock the power of literary writing to engage people and communities with landscape, however, we need to re-think the one-way nature of this relationship, and to appreciate that literature makes landscape as much as the other way round. Landscape is a verb as well as a noun, and it's only through acts of landscap-ing that landscapes are defined and comprehended.

My presentation will look at examples where literature has been used productively as a means of public engagement with landscape, and suggest an expansion of this approach. This kind of work could be done in parallel and in dialogue with the usual LCA work, so that subjective and objective representation can be allowed to exist in a healthy and productive tension. Incorporating existing literary work on sense of place, where it's available, helps by giving people a set of values and feelings to take into a landscape, along with their information: a framework to grow their own memories and associations around and shape their sense of purpose within the landscape. Supporting them to produce their own writing, as part of a process of community participation, fosters their sense of ownership, by licensing the subjective. It gives them a role not just in being inspired by the landscape, but in actively helping to make it.

(1) Butler, A. et al. (2014) Landscape Character Assessment as an Approach to Understanding Public Interests within the European Landscape Convention. Landscape Research. 39.3: 219-236.

The Exmoor Landscape Perceptions Study

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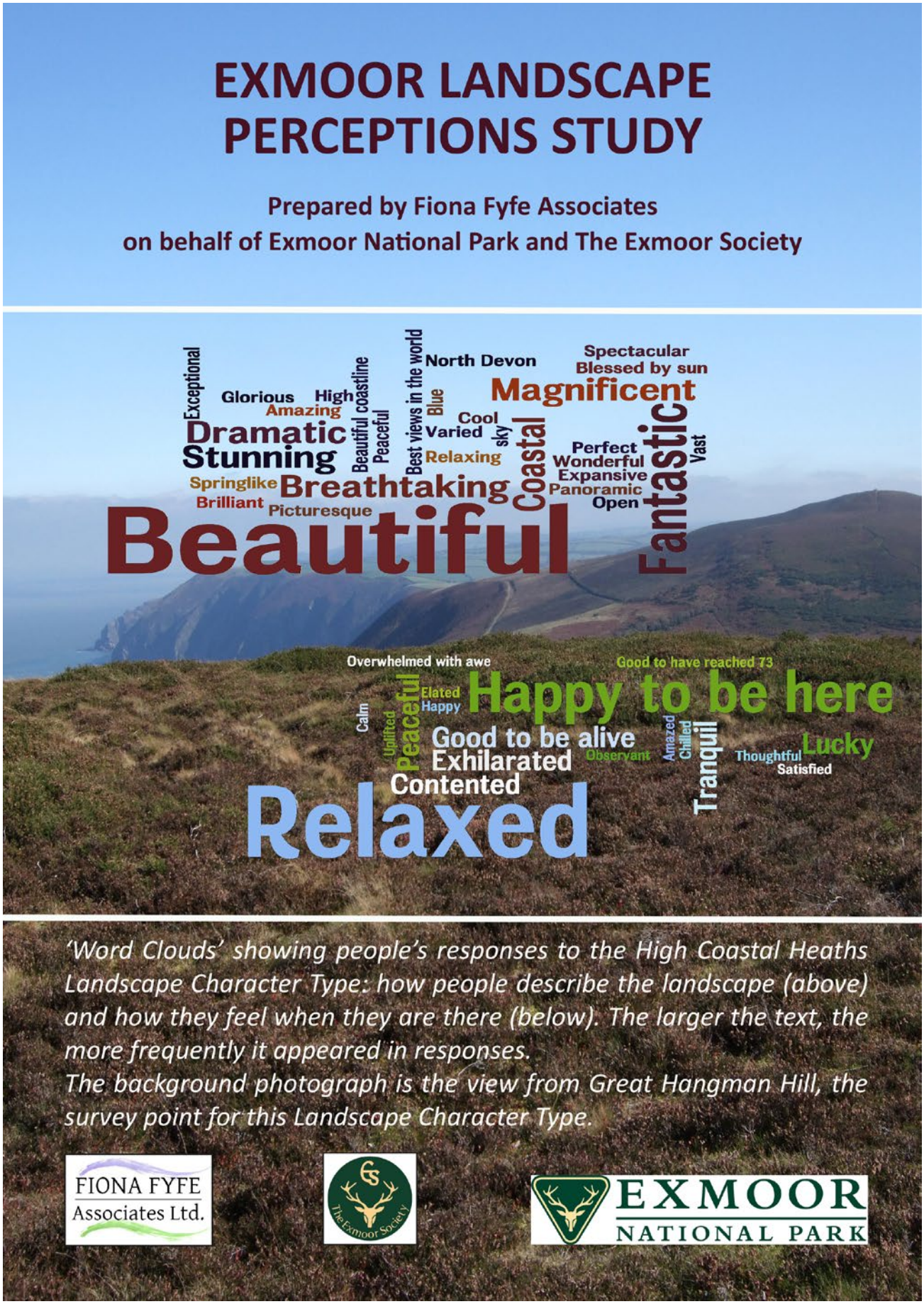
Perceptual and aesthetic characteristics of landscape have often received relatively little attention in terms of field survey and landscape policy. Recognising this, Exmoor National Park and the Exmoor Society commissioned the Exmoor Landscape Perceptions Study (ELPS) to contribute to objectives within the Exmoor National Park Management Plan. It follows-on from previous research addressing how people relate to landscape and the benefits and values of landscape to society (1). However, by working at a scale of individual Landscape Character Types (LCTs), the ELPS provides greater detail on the variations in landscape perception within the National Park.

Exmoor National Park is located in south-west England. Its diverse landscapes include high open moorlands, farmland, sheltered wooded valleys and dramatic coastal cliffs. Nine distinctive LCTs have been identified within the National Park. The ELPS gathered data on how the public perceive these different types of landscape- how they describe them, and how they feel when they are there. It also recorded responses to landscape change, favourite views, and the 'cultural services' associated with Exmoor.

A team of volunteers interviewed over 300 people (in total) throughout a year, at survey sites located in each LCT. The results of the ELPS demonstrate the public's appreciation of all the types of landscape within Exmoor National Park (not just moorland and coastal landscapes, but farmland and woodland too). This appreciation is reflected in the words used to describe the landscapes and in the emotional responses which they evoke. 'Beautiful' and 'peaceful' were the top two adjectives overall, and feature near the top of the lists for most of the individual sites. However, further down the lists the adjectives become more place-specific, and it becomes possible to identify the survey sites from the adjectives used to describe them. 144 different emotions were expressed, with 'relaxed', 'happy', 'peaceful' and 'calm' being the clear top four. Again, further down the lists for each survey site, a greater variety of emotions begin to appear, with particular emotions associated with specific landscapes.

The ELPS demonstrates the range of positive emotional responses which Exmoor's varied landscape types evoke, and its resulting value to society. Whilst it is easy to dismiss these findings as 'stating the obvious' it is vitally important to demonstrate the value of landscapes to public health and emotional wellbeing, particularly to justify use of resources at a time of scarce funding. The ELPS has therefore been used as a case study within the Landscape Institute's Position Statement on Public Health and Landscape. It has also been used in practical ways- informing the Exmoor National Park Management Plan and the ongoing update of the Exmoor Landscape Character Assessment.

(1) Research Box et al. (2009) Capturing the 'cultural services' and 'experiential qualities' of landscape. Natural England. Cheltenham


EXMOOR LANDSCAPE PERCEPTIONS STUDY
Prepared by Fiona Fyfe Associates
on behalf of Exmoor National Park and The Exmoor Society
Exceptional
Glorious
High
Amazing
Dramatic
Stunning
Beautiful coastline
Peaceful
Best views in the world
North Devon
Blue
Cool
Varied
sky
Relaxing
Spectacular
Blessed by sun
Magnificent
Coastal
Perfect
Wonderful
Expansive
Panoramic
Open
Fantastic
Vast
Springlike
Breathtaking
Brilliant
Picturesque
Beautiful
Overwhelmed with awe
Good to have reached 73
Happy to be here
Calm
Uplifted
Peaceful
Elated
Happy
Good to be alive
Exhilarated
Contented
Relaxed
Observant
Amazed
Chilled
Tranquil
Thoughtful
Satisfied
Lucky
'Word Clouds' showing people's responses to the High Coastal Heaths Landscape Character Type: how people describe the landscape (above) and how they feel when they are there (below). The larger the text, the more frequently it appeared in responses.
The background photograph is the view from Great Hangman Hill, the survey point for this Landscape Character Type.
FIONA FYFE Associates Ltd.
The Exmoor Society
EXMOOR NATIONAL PARK

Development of ubiquitous technology tools to support awareness of protected landscapes

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Landscapes play a major role within the environment with approximately 26% of England's land falling under a National Park (NP) or Area of Outstanding Natural Beauty (AONB) designation, both of which have a common aim to conserve and enhance the natural beauty of high scenic quality landscapes. The European Landscape Convention highlights the need to establish procedures for the participation of the general public and other stakeholders in the creation and implementation of landscape policies. AONB and NP management plans also highlight the importance of promoting awareness and understanding of protected landscapes. The success of AONB management plans often depends on community engagement, as there are many benefits to public participation. The European Landscape Convention (ELC), clearly identifies the need for the public to play an active part in the protection, management and planning of those landscapes most sensitive to change (1).

Public participation is problematic as it is reliant on people attending pre-arranged community meetings, where only stakeholders with an immediate interest participate (2). Many studies have focused on bridging the gap between landscape experts and communities by making use of visualisation techniques using computer based technologies however these practices are reliant on the use of IT-based tools in workshop scenarios (2).

It is thought, by introducing ubiquitous technology into landscape management, protection and planning, it would alleviate this issue as anyone with a smartphone can take part while in situ.

This research project has resulted in the development of two apps called 'Rate My View (RmV)' and 'Landscape Connect'. The RmV allows user to provide continuous landscape related feedback while in situ. It uses GPS to pinpoint the users location and detects the direction the person is facing. Users then submit words or short phrases that sum up their view (Fig. 1). The Landscape Connect app builds upon the previous RmV platform, adding new features for workshop organisers. The app allows users to download questionnaires to their devices before going into the field. The process of geolocation is automatically performed when the user takes a photo, ensuring any responses they create are geographically linked. A dashboard allows workshop organisers to track responses coming in to the system in real-time, allowing greater collaboration with users out in the field.

This research has highlighted new characteristics of public participation, underlining the key behaviours and motivations and what it enables for the future of in-situ public participation in landscape planning decisions.

(1) Council of Europe. (2000) European Landscape Convention [Online] Accessed 1 July 2016.

(2) Berry, R. et al. (2012) Gauging levels of public acceptance of the use of visualisation tools in promoting public participation; a case study of wind farm planning in South Wales, UK. Journal of Environmental Planning and Management. 55(2): 229-251.

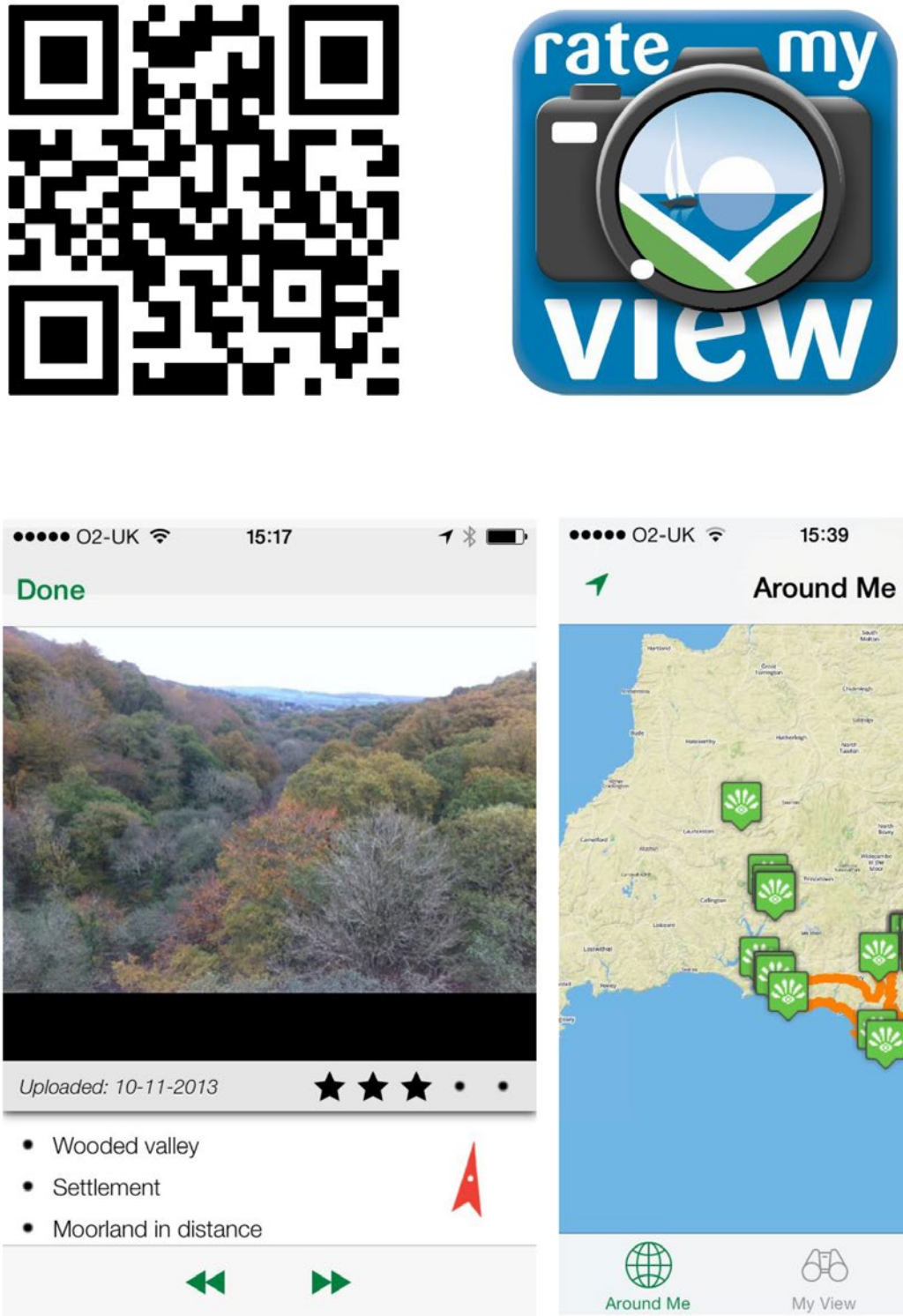

Figure 1: App user interface

Re-coupling social and ecological landscape components

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The aim of this work was to test a valuation model that could include both stakeholders' engagement and landscape integrated management dynamics. The tool box of ISO 37101 standard on Sustainable development in communities - Management systems - Requirements with guidance for resilience and smartness was used to classify ecosystem benefits and values through six variables for sustainability against twelve areas of community management. It provided guidance with questions interconnecting socio-cultural (yellow) and ecological issues (green, Table 1), on a matrix representing the intersection of the variables and areas, which could be used to measure the progress of the community towards sustainable development.

The first step collected European landscape innovative initiatives, from expert web selection and complementary local knowledge through a series of 3 workshops with stakeholders in 5 study landscapes. In the second step, these strategies were sorted through the matrix (Table 1), by testing the samples' performance against at least three of the matrix indicators, displaying the most frequently observed topics, with a blue gradation from 0 to more than 5 initiatives. Culture and community identity and Education and capacity building were the most addressed topics. Synergies were observed between environment and beneficial socio-cultural services, and culture offered a support for ecological practice, domestic biodiversity and enforced an integrated landscape approach. Health and safety were the most difficult issues to value due to contradictory perception of nature as a source of danger, expressed in terms of physical safety and personal safety (1), though it can be shown that trees have a positive effect on childrens health (2).

The third step included discussion on how use of the model can give keys for compilation and prioritisation of policy options. There are no policy measures that can be recommended in every European cultural landscape, as examples are different and stakeholders have diverse expectations, however, the field of practice can be illustrated in a global frame but must be applied in context.

A dynamic management approach offers keys to engage stakeholders not only at the project stage, but also through a continuous process of experimentation and feedback. Furthermore, it can support a qualitative landscape management assessment frame; useful for assessing both risks and opportunities and to be accountable to local actors, as was tested on one of the initiatives through a set of stakeholders' interviews (Table 2).

(1) Gobster, PH. et al. (2004) The human dimensions of urban greenways: planning for recreation and related experiences. Landscape and Urban Planning. 68(2-3): 147-165.

(2) Schellenbaum Lovasi, G. et al. (2008) Children living in areas with more street trees have lower asthma prevalence. J Epidemiol Community Health doi:10.1136/jech.2007.071894.

HERCULES

Table 1 - European landscape heritage initiatives sorted through ISO 37101 social (yellow) and ecological (green) issues and purposes

PURPOSES→ ↓ISSUES	Attractiveness	Social cohesion	Well-being	Preservation and improvement of environment	Resilience	Responsible resource use
Governance	AUG + DAR + EDE + GPMJ + HEP + LES	DAA + DAR + LES	DAA + DAR + LES	AUG + COL + DAR + GAN + LES		DAR + GAN + LES + MER
Education and capacity building	AUG + COL + DAA + DAR + DEV + MPS + OHF	DAA + LES + VOK + POG	COL + DAR + GAN + LES + MER + OHF	BER + CFP + DAR + LES + OAM + POG + UBB	CFP + OHF + UBB	CFP + DAR + GAN + GPMJ + OHF
Innovation, creativity and research	GAN + MPS + OHF + STW	COL + DAR + GAN + GPMJ + HID + OHF + STW	COL + EAR	AUG + COL + DAR + GAN + OAM + OHF	OHF + SAVE + PdP + PTSP	MER + OHF
Health and care in the community		MER	JAS + MER	GAN		STW
Culture and community identity	AUG + COL + DAR + HEP + HID + MPS + OHF + SPE + STW + VOK + WAG	OHF + COL + SPE + OAM + DEV	AUG + EAR + JAS + GPMJ + HID + OHF	WAG + COL + OHF + POG	DAR + GAN + OHF + SAVE + STW	COL + HEP + OHF
Living together, interdependence and mutuality	AUG + COL + DAA + DAR + HID + LES + STW	AUG + COL + HID + STW + WAG	COL + DAR + JAS	COL + HID + GPMJ + STW	DAA + DAR	DAA
Economy and sustainable production and consumption	DAR + LES + GPMJ + OHF + PTSP + TIM	DAR + GPMJ + LES + OHF + TRI		DAR + GAN + GPMJ + LES + OHF	TIM + TRI	BER + DAR + GAN + OHF + TIM + TRI
Living and working environment	EDE + VOK + PIPA + PdP	EDE + LES	EAR	DAA + DAR + PIPA + PTSP	PdP	GAN + OHF
Safety and security			COL + HID	COL + GAN + PIPA		GAN
Infrastructures collectives	COL + SPE + OHF	COL		GPMJ	GPMJ	OHF + GPMJ
Mobility	SPE	COL + STW			GPMJ	COL + STW
Biodiversity and ecosystem services	AUG + DAR + GAN	AUG + COL + DAR + GAN + OHF	AUG + COL + DAR + GAN	AUG + BER + GPMJ + UBB	AUG + DAR + GAN + SAVE	AUG + DAR + GAN + GPMJ + OHF + SAVE

Table 2 - Example of cultural landscape SWOT assessment based on stakeholders' interviews

PURPOSES→ ↓ISSUES	Attractivity	Social cohesion	Well-being	Environment preservation and improvement	Resilience	Responsible resources use
Governance						
Education						
Innovation and creativity						
Health and car						
Culture and identity						
Living together						
Economy and sustainable consumption						
Living and working environment						
Safety and security						
Community infrastructures						
Mobility						
Biodiversity and ecosystem services						

Legend: Strength/Weakness / Opportunities/Threats - Prior action potential for the considered landscape are framed in .

The research leading to these results has received funding from the European Union's Seventh Framework Programme under grant agreement number 603447, HERCULES within the RTD activities of the Environment Thematic Priority.

Strathard – a landscape to live, work and play

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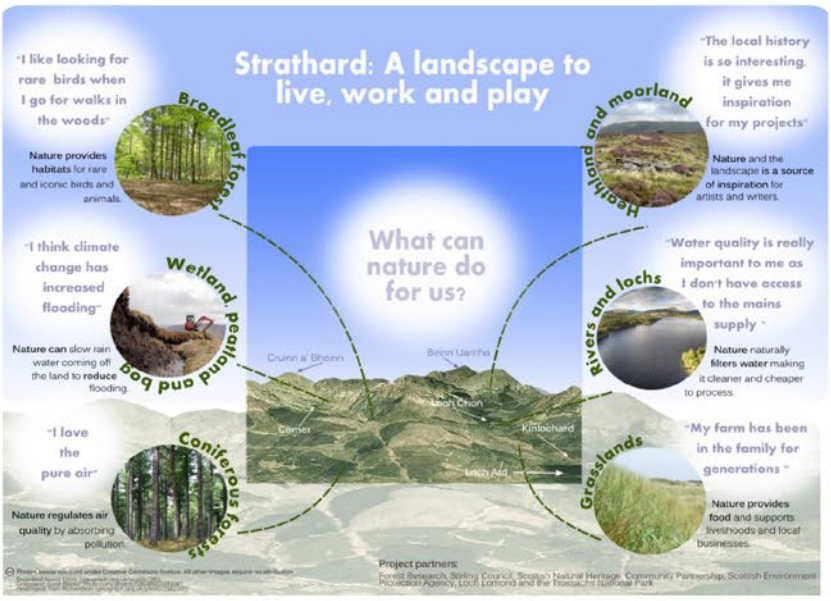
'Strathard – a landscape to live, work and play' is a multi-partner project (led by SEPA) to trial the application of an ecosystems approach for developing sustainable and resilient land and water management solutions for Strathard (a rural area in the Loch Lomond and Trossachs National Park, Scotland). The partners are engaged with land owners, managers, the local community, businesses, and visitors to foster closer working relationships, using a joint approach to identify the benefits and environmental challenges of visiting, living and working in this diverse landscape.

At Forest Research, we are working with our project partners to collate and analyse the detailed, local knowledge and information required to model and map opportunities for a number of land management actions. We have compiled a range of data encompassing social, environmental, and existing land management information for Strathard. An important aspect of the ecosystems approach is taking account of different stakeholder and local communities group views which the partnership has collected through interviews, local events, workshops, online survey, and an innovative interactive participatory mapping tool called map-me. Alongside this, we modelled ecosystem condition and ecosystem service provision, using the international frameworks Common International Classification of Ecosystem Services (CICES) and European Nature Information System (EUNIS) habitat classification.

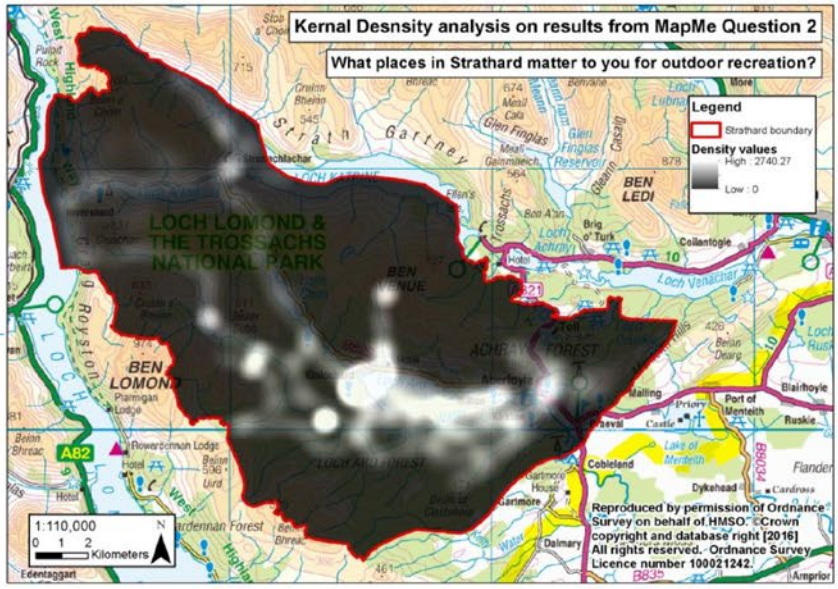
The modelled outputs are being combined and used to target areas for priority management actions. For example, addressing local flooding issues using hydrological models alongside local knowledge and expert opinion to identify candidate sites for natural flood management (NFM) measures, such as leaky woody dams and flood storage areas. Our assessment quantifies the impact of implementing the measures on flooding and accounts for constraints and other benefits associated with these measures at each candidate location. The aim is to help the Forest District to become 'run-off neutral', offsetting the impacts of tree-felling on water run off with appropriate NFM measures. The opportunity maps we're developing will help partners and the community better understand catchment processes and where potential measures may be targeted. Through a planned NFM demonstration site we will present the results of our wider analysis to the community via workshops and an online ArcGIS Story Map.

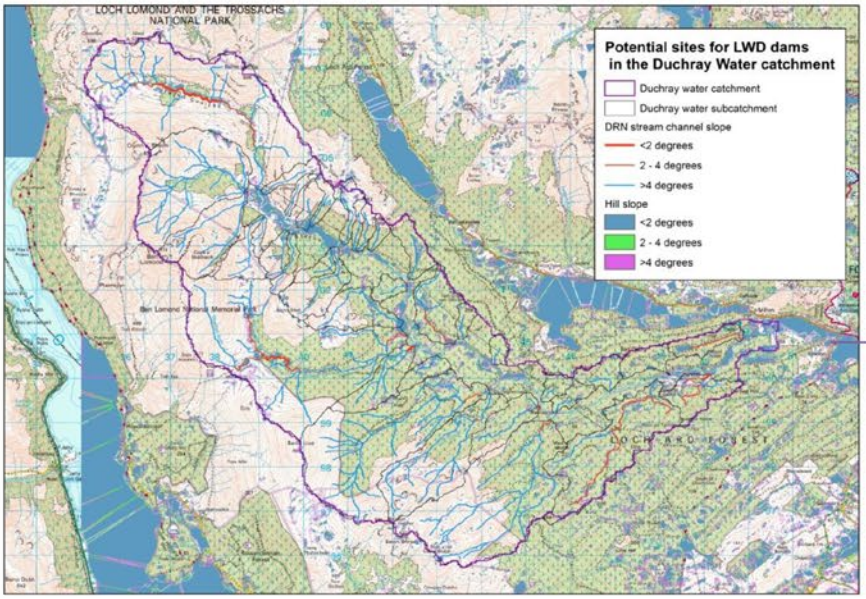
We aim to inform local and regional policy and practice by developing a transferable, standardised method for applying an ecosystems approach that can easily be adopted in other areas. The project contributes to current landscape characterisation and ecology methodologies through its use of an ecosystem service-based approach to capture variation in landscape character and ecosystem condition, and through its use of participatory GIS and community engagement as a method to enhance involvement of stakeholders and collect cultural data.

Engaging the community



Example output from the map-me survey





Opportunity mapping for leaky woody dams

Fri 9 Sept am - Landscapes of the present: evolution and assessment

Using Historic Character

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Designated sites and places make a significant but geographically small contribution to the benefits that local landscapes offer to people and wildlife. There has been increasing acceptance that no part of England is a blank canvas into which development can fit: it all results from change over thousands of years, and offers a framework for creating the next stage of changes that can enhance habitats and places for people to live, play, think and work. We need to respond to this challenge through developing a better spatial understanding of the 'historic' in the environment – rather than the 'historic environment', as if it is somehow separate from ecology and the physical landscape, providing context to and complementing the delivery of expertise in protecting, assessing and providing advice on specific buildings, monuments and areas.

An early example at a national level was the Countryside Quality Counts (1) project, which developed historical profiles to add context to where and what kinds of changes are occurring in the countryside - in the same way that the issue of biodiversity runs throughout the historically-driven patterns of woodland, settlement and other themes. This approach in turn informed Historic England's input into the National Character Areas, and has helped to raise awareness of the different scenarios for change – from woodland expansion to housing development - within which cultural and indeed all ecosystem services can be applied, and which can use an understanding of the whole historic environment and how it is changing (2).

We are now nearing completion of the GIS mapping of the present historic character of landscape and seascapes as a seamless and interlocking whole, working from broad to narrow definitions such as different types of historic field and woodland. Both can be analysed in relationship to other environmental datasets, and have informed a broad range of planning, conservation and enhancement strategies. Historic Landscape Characterisation (HLC) offers a dynamic view of landscape, highlighting how habitats such as unenclosed rough ground have come to represent a fragment of their 18th century and earlier distribution and also how fieldscapes affected by 19th and 20th century reorganisation and enlargement offer a radically different framework for the integration of wildlife corridors through replanted boundaries than fieldscapes which have retained a coherent pattern of 17th century and earlier enclosure. This talk will demonstrate through case studies how HLC should not be used on its own but with other datasets and ways of interpreting landscapes, such in as mapping the density and pattern of settlement, including farmsteads, and how these are linked to waves of investment in buildings. Above all, it will argue that an understanding of how landscapes have developed and how they are used and valued offers significant opportunities for engaging people and benefitting local ecologies, as well as presenting issues that need to be confronted if a truly inter-disciplinary approach can be achieved.

(1) http://webarchive.nationalarchives.gov.uk/20101219012433/http://countrys.... Accessed 10th August 2016.

(2) For more on this see Historic England. (2015) Facing the Future. Historic Environment Intelligence Team. Available at: https://historicengland.org.uk/images-books/publications/facing-the-future/

Unimproved open hill pasture, scrub woodland and small scale hedged fields, enclosed during the medieval – early post medieval period, on the Clent Hills in north east Worcestershire. Scattered settlement is typical of these early enclosure landscapes. Photo © Historic England NMR 27790/032

A rolling, lowland landscape east of the River Severn. This landscape developed as the open fields and

Seascape Character Assessment as an integrating tool to support marine and terrestrial planning

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There is now greater interest in the coastal and marine environment than ever before, reflecting appreciation of its current and potential economic, environmental and recreational importance. This includes demand for developments that harness the natural resources of the sea, such as offshore renewables, or in support of economically important industries such as tourism and aquaculture. At the same time, our diverse seascapes are integral to our national identity and our country's rich natural and cultural heritage.

Until recently, our dynamic coasts and seas have been some of the least understood parts of the UK's environment, with a lack of good information about their character and multiple values. By contrast, there are well-developed and recognised techniques, particularly in landscape character assessment, to help us understand the terrestrial landscape and reflect its importance in decision-making and development management. Natural England published its Approach to Seascape Character Assessment (1) as a complementary document to the updated Landscape Character Assessment guidance for England (2014).

This presentation will explore, through the use of case studies (2), how the principles of landscape character assessment have been applied offshore. Examples of national, regional, local and project-scale seascape character assessments will show how information can help guide developments to the right places and inform integrated marine and coastal management. Illustrating how the spatial classifications developed by seascape character assessments (character areas and types) can integrate with their landscape counterparts will also demonstrate how a full picture of character can be gained, reflecting the inseparable relationships that exist between land and sea.

Sally's talk will also explain how the information presented in a seascape character assessment can feed into a wider range of planning and policy-related work, including:

- Guiding the appropriate siting and design of coastal and offshore developments, both at a strategic- and site specific level;
- Identifying how the character and qualities of the seascape shape local (and national) distinctiveness – informing place-based initiatives and an analysis of cultural services; and
- Understanding the forces for change and sensitivities of the coast and adjacent seas, informing co-ordinated planning and management responses.

(1) LDA Design (October 2012) An Approach to Seascape Character Assessment. Natural England Report NECR105.

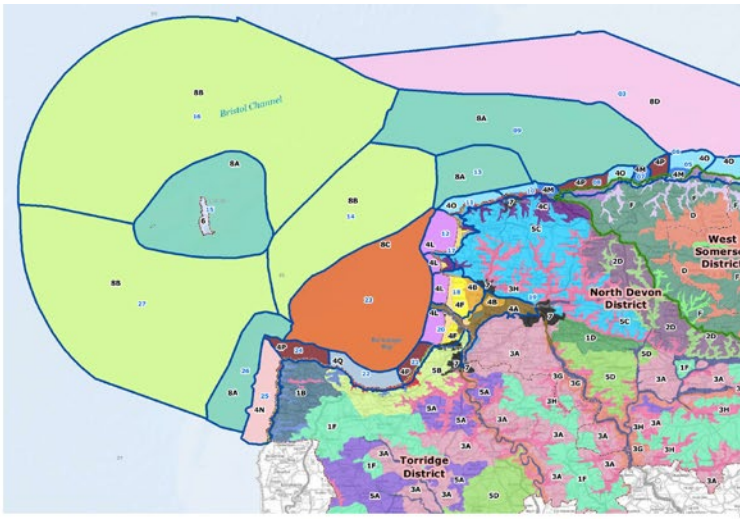
(2) Including:

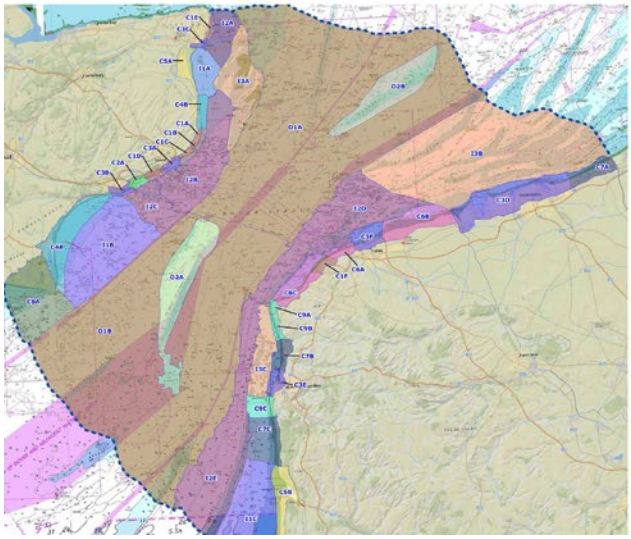
LUC (2014) Seascape Assessment for the South Marine Plan Areas: Technical Report. Produced for the Marine Management Organisation, Project No: 1037.

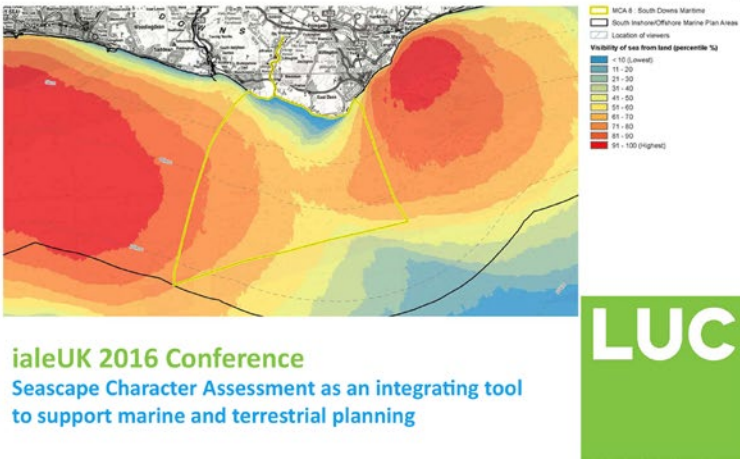
LUC (2015) National Seascape Assessment for Wales. Natural Resources Wales Evidence Report No. 80.

LUC (2015) Seascape Character Assessment for North Devon & Exmoor. National Trust and partners.

White Consultants (2013) Seascape Character Assessment for Pembrokeshire Coast National Park







Historic Landscape Characterisation (HLC) and landscape ecology

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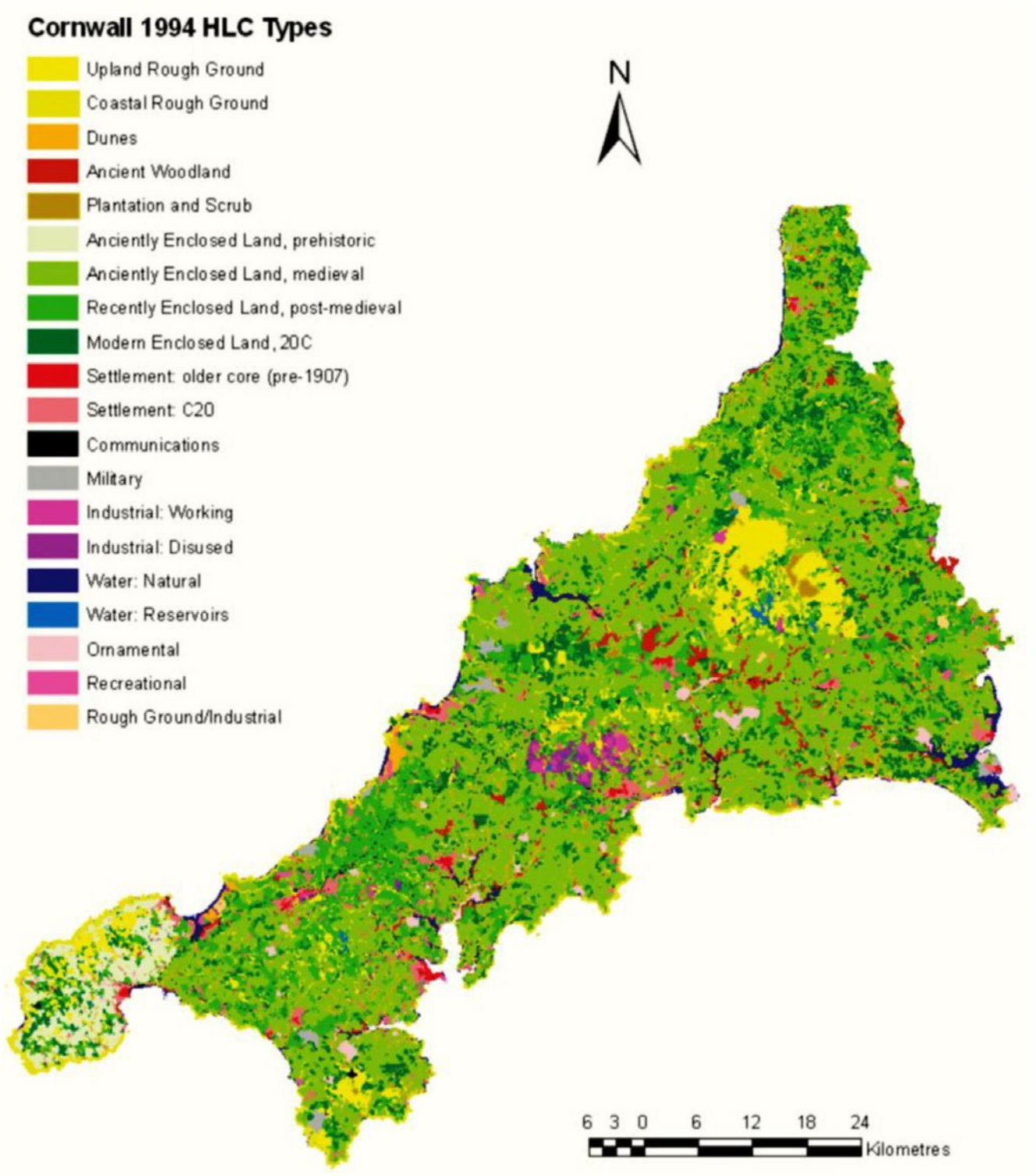
The first HLCs, created a generation ago, in 1993 and 1994, fed understanding of time depth into landscape character assessment (LCA) of Bodmin Moor and Cornwall. With Historic England support, over 99% of England now has HLC (mainly at the county level) and Historic Land-use Assessment (HLA), overseen by Historic Environment Scotland, has been undertaken for all of Scotland. Variations of HLC have also been done in parts of Wales and other countries.

Its systematic and comprehensive method and principles meld those of many disciplines to create a generalised spatial representation (usually GIS-based) of our current understanding of a place's development. Concerned with present-day landscape, it emphasises the modern and recent, but it contains within it an understanding of longer-term historical trajectories, originating in medieval and prehistoric times, helping users draw out signs of continuity and change, important qualities for those with an interest in semi-natural Britain. Landscape ecologists find HLC useful, given their discipline's focus on how ecological forms, systems and health are all substantially affected by change and continuity in land use. Involvement of landscape specialists in the earliest, Cornish HLCs helped draw out how historic aspects of place contribute to the aesthetic and the communally appreciated aspects of place. This broadly coincided with radical reviews of how landscape can be valued, codified in the Burra Charter and now in Historic England's Conservation Principles.

HLC's broad-brush approach assigns blocks of land to types, like ancient woodland, marsh, upland and coastal rough ground, various kinds and ages of enclosed farmland, industrial, urban, peri-urban, etc on the basis of attributes that recur where shared history resulted in shared form and character. HLC types are akin to ecologists' broad habitat and community types. Many landscape ecologists will find HLC types useful as they provide more precise chronologies and closer indications of the likely maturity and complexity of ecologies than some of their own terms do.

HLC frames debate and shapes action at high levels in order to encourage intelligent stewardship of the semi-natural and semi-cultural aspects of landscape and place. Practitioners, currently usually in the heritage, natural environment and landscape sectors, work with the European Landscape Convention's definition of landscape, which encourages sensitive ascription of plural values to landscape, and then positive action based on those (1).

(1) Herring, P. (2012) Valuing the whole historic landscape. In: The Routledge Companion to Landscape Studies. Howard, P. et al. (eds). London: Routledge, 166-178.


Cornwall 1994 HLC Types
Upland Rough Ground
Coastal Rough Ground
Dunes
Ancient Woodland
Plantation and Scrub
Anciently Enclosed Land, prehistoric
Anciently Enclosed Land, medieval
Recently Enclosed Land, post-medieval
Modern Enclosed Land, 20C
Settlement: older core (pre-1907)
Settlement: C20
Communications
Military
Industrial: Working
Industrial: Disused
Water: Natural
Water: Reservoirs
Ornamental
Recreational
Rough Ground/Industrial
N
6 3 0 6 12 18 24
Kilometres

Landscape Characterisation - Methods and Applications in Landscape Ecology

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Warwickshire is a top ten destination in Lonely Planet's 'Best in Europe 2016' list, praised for its rural qualities. The County's Landscape Team are well versed in applying landscape characterisation as a spatial framework tool to identify, classify, map and assess landscape pattern and function. The ability to capture differences in landscape is critical for landscape planning; whether it is used to provide objective landscape advice on planning applications, giving evidence at public inquiry or input into Minerals and Waste Plans.

WCC's Landscape Team have been applying and refining the landscape sensitivity methodology developed through The Living Landscapes Project (2000). The overall aim is to enable practitioners to both understand and interpret character and sensitivity of the County's landscapes and to make more informed judgements when considering the capacity of these landscapes to accommodate change. Two study areas were piloted around the urban edge of Stratford upon Avon and Rugby town and led to the inclusion of policy covering 'character areas' within the emerging Local Plans. In 2013 Warwick District Council commissioned a joint Landscape Sensitivity, Ecological and Geological Study to inform their village housing options consultation for the Local Plan. This document is now referenced by development control planners for any planning applications that potentially affect these settlement areas. This has been followed by a similar study for Rugby Borough Council and requests from parish councils for landscape input into the development of their Neighbourhood Plans.

Although funding constraints mean that our data is developing in a piecemeal fashion we are able to start updating our mapping and feed into the Warwickshire, Coventry and Solihull Green Infrastructure Strategy. The Strategy is based on Landscape Character, Landscape Ecology and Accessible Green Space practices. The ecological aspects of the GI Strategy is evidenced on current and accurate Phase 1 habitat data and modelled by the University of York. The Strategy uses average dispersal distances of 1000m and 500m to give each polygon an estimate of functional connectivity. These parameters are used for woodland, grassland and wetland habitat categories. Six Connectivity Maps resulted from this methodology and form the GI Strategy's Biodiversity Priorities:

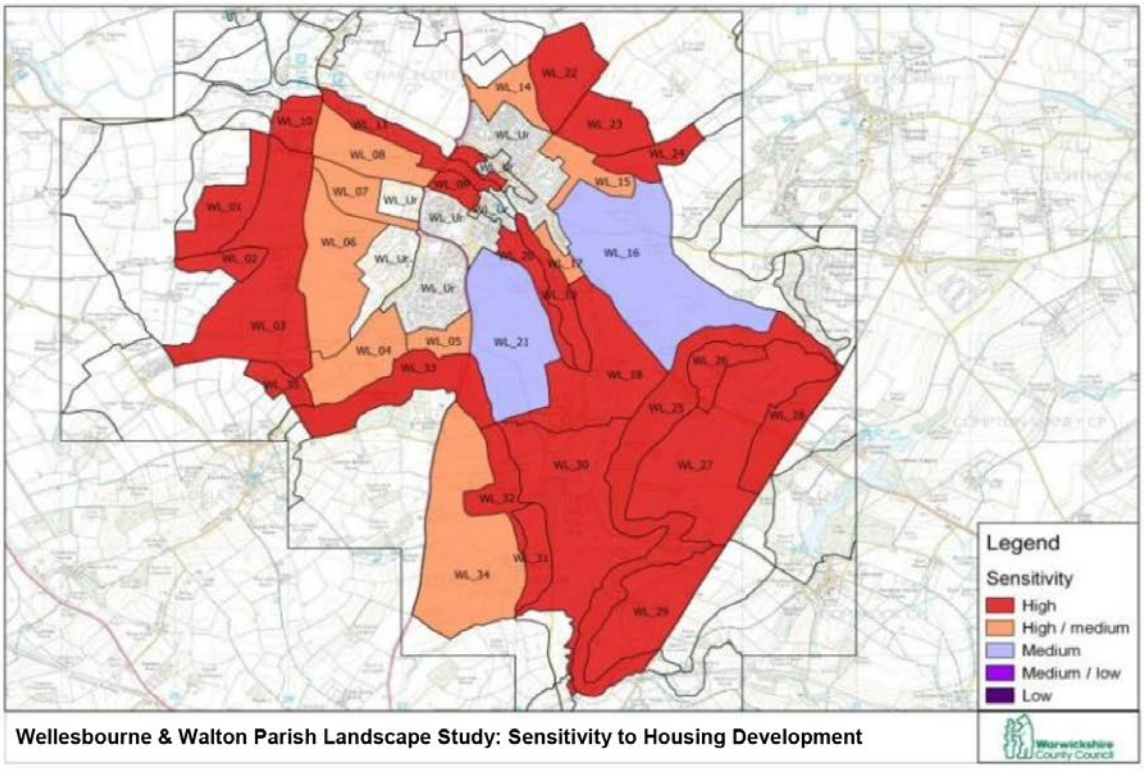
Priority 1) – Connect individual sub-regional GI Biodiversity assets (polygons) to create large functional clusters, and

Priority 2) – Connect the large functional clusters.

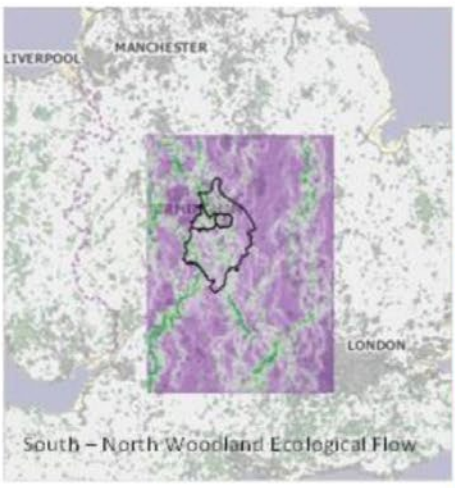
The mapping also identified three strategic area classifications for the sub-region's Defra Biodiversity offsetting Pilot: Strategic Areas; Semi-Strategic Areas, and Non-Strategic Areas.

Now the County looks to bring together its world leading Ecological Landscape Connectivity Modelling, Historic Landscape Character and Landscape mapping to greater inform its field-by-field Ecosystems Services mapping... to give all decision makers at all levels (farmers to planners) the evidence needed to make Warwickshire Europe's No.1 destination of choice.

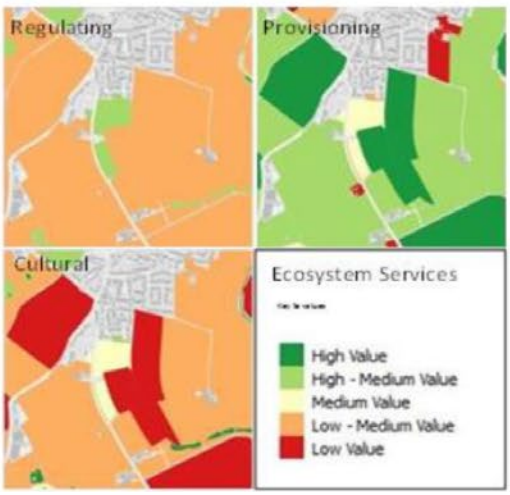
Ecology, Historic Environment and Landscape



Wellesbourne & Walton Parish Landscape Study: Sensitivity to Housing Development



South – North Woodland Ecological Flow



Historic Landscape Character

Rural landscape character: continental, national and regional appraisal

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The increasing interest towards natural and cultural heritage as a result of the interaction between man and nature, as underlined by UNESCO, has encouraged a holistic approach to landscape conservation. Moreover, the indication of the European Landscape Convention to enlarge the perspective from pristine areas to ordinary landscapes, has suggested extending landscape analysis to the full territory. Furthermore, the European Rural Development Policy has urged to improve aspects regarding the economic, environmental and social situation of the EU's rural areas. Accordingly, the new European Agricultural Policy has focused the future rural development on multifunctional farms, supporting a greening economy, nature conservation and agro-ecosystem biodiversity. European countries have carried out rural landscape character assessment independently or adapting it to European and global strategies. In Italy, landscape character assessment has been taken into account in a few studies (e.g. 1). Previously, landscape evaluation and planning has been implemented since the 1980s at both national and regional level, to support international and national legislation (see 2; 3). At national level, the Heritage and Landscape Code (Codice Urbani) required in 2004 the 20 Italian Regions to produce their Landscape Plans. At regional level, the first Italian Landscape Plan was approved in 2006 by the Autonomous Region of Sardinia (RAS). After dividing the island in 51 Local Landscape Areas (LLA), RAS developed a two-step methodology on landscape assessment and planning. Firstly, 27 LLA for the coastal areas with intense development pressure were analysed and regulated, and secondly the remaining 24 LLA with prevalent rural character were considered. In this context, a research on Sardinian rural landscape has been recently carried out, as the first rural landscape character assessment of the entire island (Fig. 1). The Sardinian landscape has been studied, evaluated and classified focussing on its rural character. A unique biocultural diversity has emerged in the rural areas (Fig. 2), together with extended unpopulated rural landscape. Here, agriculture and pastoralism are the main activities (Fig. 3), and traditional culture is still a distinctive element to imprint the landscape. The methodological framework of the research, based on landscape units and types, has produced a first step to the identification of the rural landscape character of Sardinia.

(1) Vogiatzakis, IN. et al. (2006) Landscape typology in the Mediterranean context: a tool for habitat restoration. Journal of Mediterranean Ecology. 7: 23-30.

(2) Pungetti, G. (1996) Landscape in Sardinia: history features policies. Cagliari: CUEC.

(3) Makhzoumi, J. et al. (1999) Ecological landscape design and planning: the Mediterranean context. London: Spon.

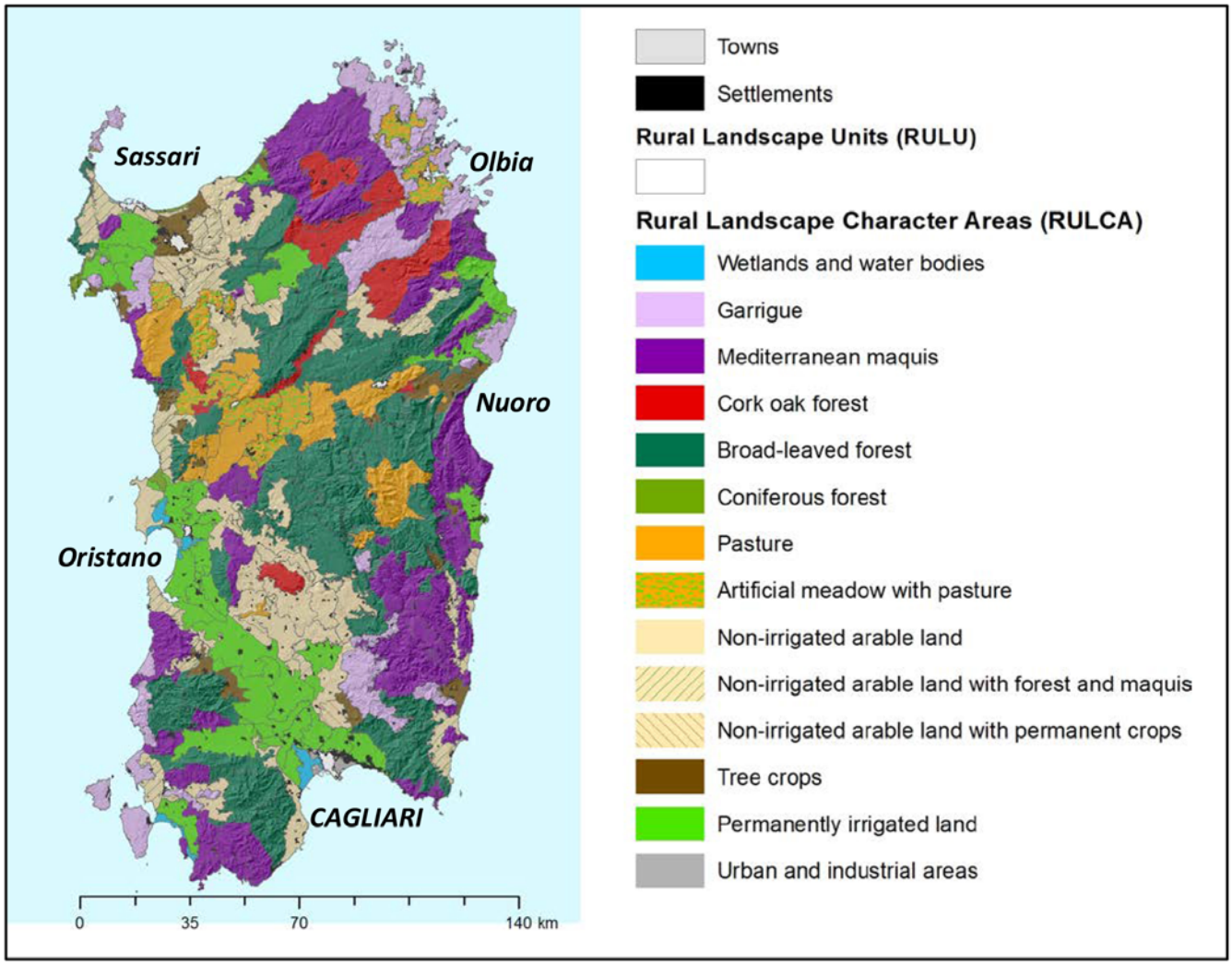

Figure 1 - Rural Landscape Character Areas of Sardinia

Figure 2 – Seascape with maquis on calcareous rocks

Figure 3 – Artificial meadows, pasture and crops with hedgerows

Characterization of European cultural landscapes: accounting for structure, management intensity and value of agricultural and forest landscapes

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Current dynamics in land management have put cultural landscapes under a huge pressure of agricultural intensification and land abandonment. To guide adequate management of these current dynamics, knowledge on the location of different types of cultural landscapes is needed. Spatially explicit European wide characterizations of landscapes are based mostly on biophysical factors such as topography, climate, soil, or land cover, but fail to address the cultural side of landscapes. The objective of this paper was to develop and propose a new European characterization of cultural landscapes that explicitly includes the cultural component embedded in the landscape. We present a characterization of European cultural landscapes based on the prevalence of three dimensions of cultural landscapes commonly identified in the literature: management intensity (1, 2), landscape structure (3, 4), and value and meaning (5, 6). We mapped spatial proxies for each of these dimensions on a European scale at a 1km resolution. We combined previously used proxies with new indicators such as social media usage and registered traditional food products. We integrated the three dimensions into a continuous "cultural landscape index" (Fig. 2 and Fig. 4) and a characterization of agricultural (Fig. 1) and forest landscapes (Fig. 3). The characterization shows the dominant cultural dimension for each landscape (low intensity, fine structure or high value/meaning) and identifies hotspots of cultural landscapes where all three dimensions are

present. These hotspots are mainly found in the Mediterranean, while in eastern and northern Europe cultural landscapes are mostly characterized by one of the dimensions, or coldspots occur. Our characterization of cultural landscapes can help to target the conservation of cultural landscapes, link similar landscapes in different regions and inform policy design on the most important characteristics of cultural landscapes at a regional scale.

(1) Bignal, EM. et al. (1996) Low-Intensity Farming Systems in the Conservation of the Countryside. Journal of Applied Ecology. 33(3): 413-24.

(2) Plieninger, T. et al. (2006) Traditional land-use and nature conservation in European rural landscapes. Environmental Science & Policy. 9(4): 317-21.

(3) Van der Zanden, EH. et al. (2015) A typology of the diversity in composition, spatial structure and management intensity of European agricultural landscapes. Landscape and Urban Planning.

(4) Van der Zanden, EH. et al. (2013) Modelling the spatial distribution of linear landscape elements in Europe. Ecological Indicators. 27: 125-36.

(5) Rössler, M. (2006) World Heritage cultural landscapes: A UNESCO flagship programme 1992 – 2006. Landscape Research. 31(4): 333-53.

(6) Plieninger, T. et al. (2015) Exploring ecosystem-change and society through a landscape lens: recent progress in European landscape research. Ecology and Society. 20(2).

Agriculture characterization

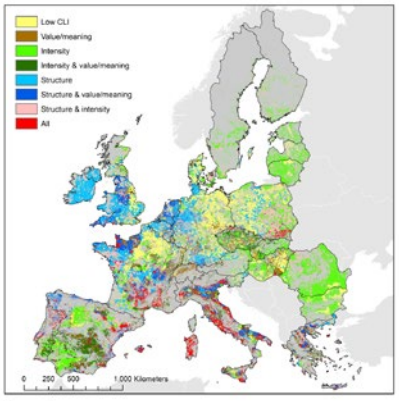

Figure 1

Agriculture cultural landscape index

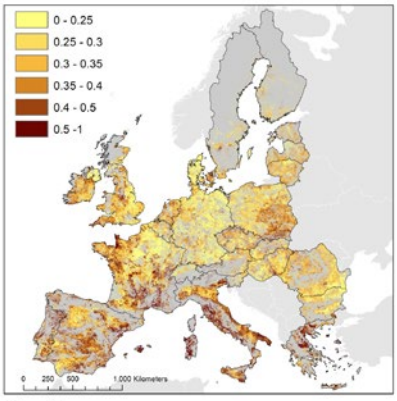

Figure 2

Forest characterization

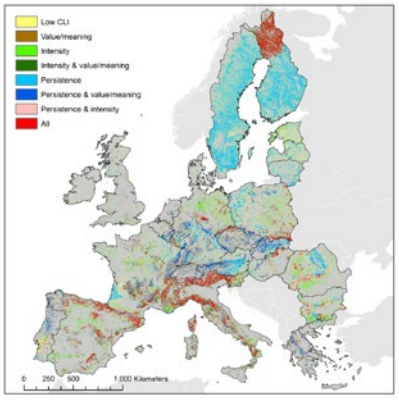

Figure 3

Forest cultural landscape index

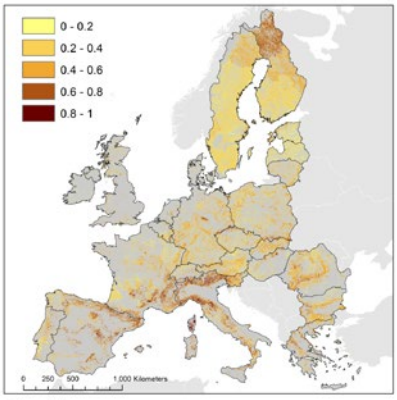

Figure 4

Systems, Habitats or Places? Evaluating the potential role of Landscape Character Assessment in operationalising the ecosystems approach

Authors and Affiliations:

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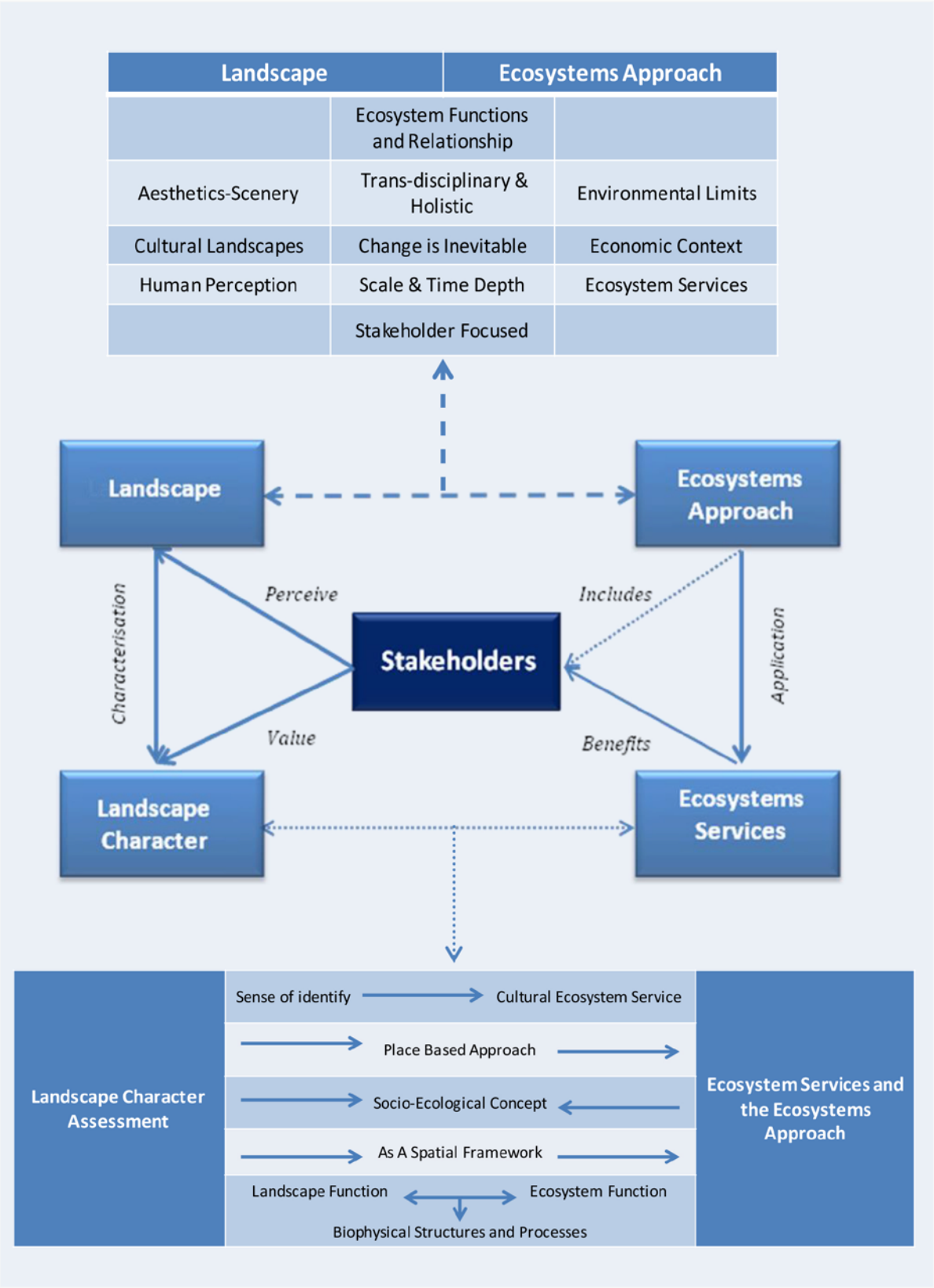
A key challenge for policy and practice is to understand how the ecosystems approach can be rolled out on a national scale in planning, management and decision making and translated into a widely accepted, accountable and democratic planning and negotiating process. At present the ecosystems approach is beginning to be implemented largely through a habitat or a system based framework. Yet, the ecosystems approach is also about socio-ecological connections, the inclusion of people in ecosystems. Arguably any framework used to apply the ecosystems approach needs to not only be environmentally coherent but also meaningful to local communities and central government, to be widely accepted and rolled out. Potschin and Haines-Young (1) conceptualise not only habitats and systems-based approaches but also place-based approaches, as a potential medium through which we can move beyond process-response units and acknowledge the wider social context. This presentation examines the potential role of Landscape Character Assessment as a place-based approach to operationalising the ecosystems approach. The discussion is based on empirical fieldwork, a series of interviews carried out with landscape and conservation practitioners, and four cases studies of emerging practice. The presentation discusses the overlap between concept of landscape and ecosystems-approach, the potential role of Landscape Character Assessment as a spatial framework for the ecosystem approach, and the overlap between character, pattern and function as a means to manage and operationalise the ecosystem approach through landscape character.

(1) Potschin, M. et al. (2013) Landscape and the place-based analysis of Ecosystem Services. Landscape Ecology. 28: 1053-1065.

Conceptual framework for exploring links between the relationship between Landscape Character Assessment and the Ecosystems Approach



(Source: Morrison (2012) An evaluation of the potential role of Landscape Character Assessment in the application of the Ecosystems Approach, MSc unpublished Dissertation)

Characterising Urban Landscapes for Ecosystem Services Assessment

Authors and Affiliations:
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Urban landscapes are complex and heterogeneous at fine scales, and their characterisation involves many unique considerations. In assessing the ecosystem services that can be provided by urban green spaces, the use of appropriate scales is vital to ensure accurate and meaningful assessments. Even when scaled appropriately, methods for assessing the spatial character of the landscape can be difficult to interpret. We present research on the impact of spatial scale in input data when modelling ecosystem services with the InVEST framework in Bedford, Luton and Milton Keynes, UK (Fig. 1a); and on the characterisation of urban green space using landscape metrics calculated in Fragstats.

The spatial scale of model input data (i.e. land use/land cover and terrain) was found to exert considerable influence on the results of ecosystem service models for carbon storage (Fig. 1b), sediment erosion (as the inverse of its prevention as a service; Fig. 1c) and pollination (Fig. 1d). Modelling at a relatively fine spatial scale (5m) produced generally more favourable results for ecosystem service provision than modelling at a coarser scale (25m): carbon storage was estimated at an average of 9.32 kg m-2 in the 5m analysis vs. 7.17 kg m-2 in the 25m analysis; sediment erosion was estimated at 6.4 Mg km-2 year-1 when modelled at 5m resolution vs. 18.1 Mg km-2 year-1 at 25m resolution. The increased detail of high-resolution datasets is believed to more accurately represent the complex urban mosaic of vegetated and artificial surfaces. As such, these results indicate that the resolution of commonly available input datasets may be insufficient for accurately modelling ecosystem services in urban environments.

Additionally, the complexity of urban settings confounds the use of landscape metrics to characterise different forms of urban greenspace; however some generalisations can be made with respect to patch size, configuration and fragmentation, and these relationships can in turn be linked to ecosystem service provision (Table 1). The most heavily built-up forms (city centres and industrial estates) were typified by small and fragmented patch structure with low carbon storage and pollinator abundance, but also low soil loss due to paved surfaces. By contrast, woodlands and parks exhibited large, well-connected green areas capable of storing more carbon and supporting more pollinators, but with a greater risk of soil erosion. Larger green patches appeared to provide more carbon storage and pollinator abundance per area, but increased erosion risk as well (Table 2).

Care should be taken when assessing complex urban landscapes to select data appropriate to the scale of inquiry and to be aware of the potential for discrepancies to result in under- or over-estimates of ecosystem service provision. Different urban forms and patches can then be characterised according to their exhibited landscape metrics and relative potential for ecosystem service provision.

(1) Potschin, M. et al. (2013) Landscape and the place-based analysis of Ecosystem Services. Landscape Ecology. 28: 1053-1065.

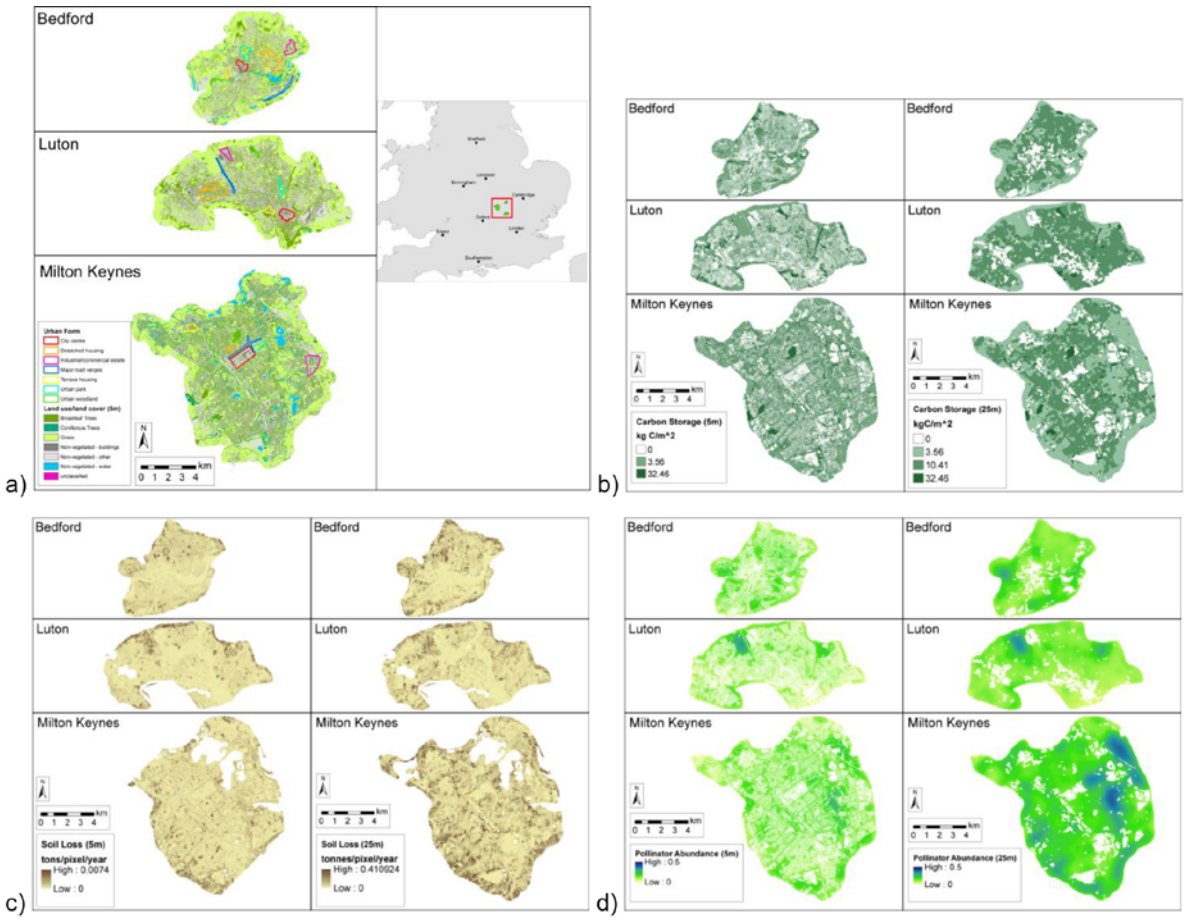

Figure 1: Study area (a) and modelled carbon storage (b), sediment erosion (c), and pollination provision (d) at two spatial scales. Source: Grafius et al. (2016) 'The impact of land use/land cover scale on modelling urban ecosystem services.' Landscape Ecology.

Table 1: Mean values for modelled ecosystem services in green space samples of seven urban forms.

Urban Form *Units*	**Mean carbon storage** *(kg m^{-2})*	**Mean soil loss** *(Kg $pixel^{-1}$ $year^{-1}$)*	**Mean pollinator abundance index**
Urban woodland	28	0.1	0.200
Urban park	12.5	0.371	0.213
Major road verges	13.2	0.144	0.144
Detached housing	10.3	0.092	0.149
Terrace housing	7	0.028	0.095
Industrial/commercial estate	4.2	0.078	0.068
City centre	3.7	0.024	0.064

Table 2: Mean values for modelled ecosystem services by green patch size (5m resolution).

Patch Size *(ha)*	**Mean carbon storage** *(kg m^{-2})*	**Mean soil loss** *(Kg $pixel^{-1}$ $year^{-1}$)*	**Mean pollinator abundance index**
0.0025 - 0.5	8.53	0.000077	0.1287
0.5 - 1	12.63	0.000133	0.1699
1 - 5	14.03	0.000170	0.1782
5 - 10	14.44	0.000204	0.1857
10 - 100	14.85	0.000225	0.1890
100 - 500	13.07	0.000227	0.1900

Challenges for assessment and practical application of cultural ecosystem services in decision making, as illustrated by the Swedish mountain landscape

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As with ecosystem services (ES) in general, the number of publications on cultural ES (CES) has grown rapidly in recent years (1). However, there are concerns that the diverse ways in which CES are being investigated is hindering effective research and decision-making (2). This study aimed to: undertake a literature review of CES to highlight the range of approaches; use the Swedish mountain landscape, the Sami people and reindeer husbandry to illustrate challenges for practical application of the CES concept; and discuss implications for consideration of CES in decision making.

The ES cascade model (3) was used to focus the review. In 142 papers reviewed, 294 terms were identified for individual CES, which variously corresponded to all levels of the cascade model; with almost half not relating to any level. Further detailed review of 53 studies highlighted that the lack of rigour in identifying CES impeded their development of methods for determining: ecosystem elements that underpin CES; beneficiaries of CES and how they value benefits delivered; and how CES vary in space and time.

Many studies did not determine links between CES and ecosystems or attributed them to various elements of ecosystems, including biotic, abiotic or even anthropogenic components. Swedish policy documents typify this lack of clarity, as they often vaguely refer to the "mountain ecosystem" as providing CES. Most studies also did not identify beneficiaries of CES. The Swedish mountain landscape illustrates that distinguishing individuals' from groups' needs can be tricky. The impact of many of the studies' spatial resolution and extent on assessment of CES was difficult to determine without identified links to ecosystems or beneficiaries. They also rarely considered temporal issues. However, the Swedish mountain landscape exemplifies the need to consider spatial (Fig. 1) and temporal scales.

We propose a range of questions linked to the ES cascade model that may help researchers and decision-makers to reflect when considering CES. The answers in any specific situation may aid prioritisation of policy development or implementation with regard to the potentially competing needs of different beneficiaries and how landscapes should be managed, where, when and by whom.

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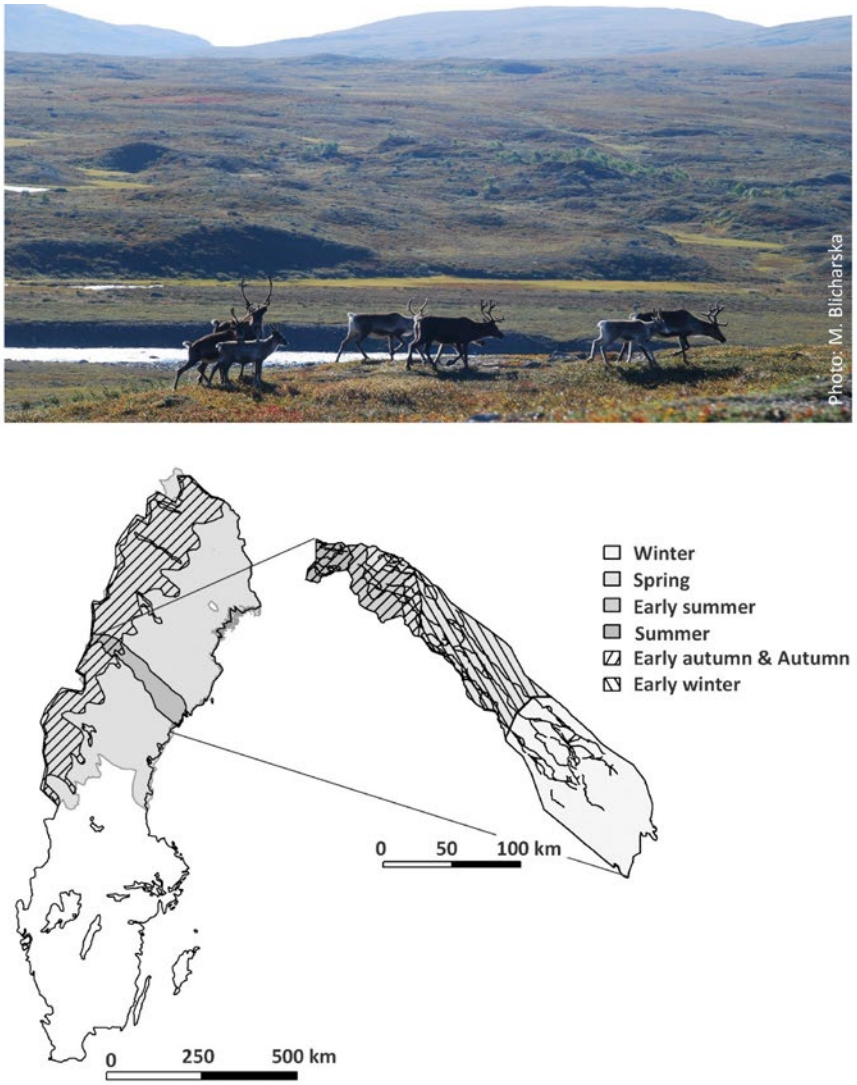

Figure 1. One of the challenges for the CES concept's practical application, illustrated by the Swedish mountain landscape, is the need to consider spatial scale. The large map shows the Reindeer Husbandry Area enclosing all 51 reindeer-herding communities (grey area), and the Alpine Biogeographical Region (hatched). The detailed map shows Vilhelmina North reindeer-herding community separated into seasonal-grazing lands (see legend). Reindeer, a key provider of important CES in the mountain region, migrate annually between the winter-grazing land in the eastern forests and the summer-grazing land in the western alpine region. Hence, evaluation of CES delivered by reindeer needs to consider the availability of all seasonal grazing lands.

Fri 9 Sept pm - Landscapes of the future: change and vision

The Future Use of Landscape Character Assessment

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"predicting the future is like trying to drive down a country road at night with no lights while looking out the back window".

Peter Drucker

The presentation considers the future of landscape character assessment (LCA) over the next ten years. It covers changes in LCA to date, current issues with application, current trends and how these may shape the future of LCA.

The development of LCA in the 1970's established that all landscapes matter, that numerical analysis demonstrating why one landscape was better than another was unhelpful and that a distinction was needed between characterisation and evaluation. Over the last 45 years LCA has evolved as a result of the rise of GIS and computer analysis, the desire to integrate other assessments such as historic, ecological and perception studies, and the development of ecosystem services. Back in the 1970's there were few LCAs and now the whole of UK is covered by an LCA at some scale or another, and the use of LCA is enshrined in planning policy.

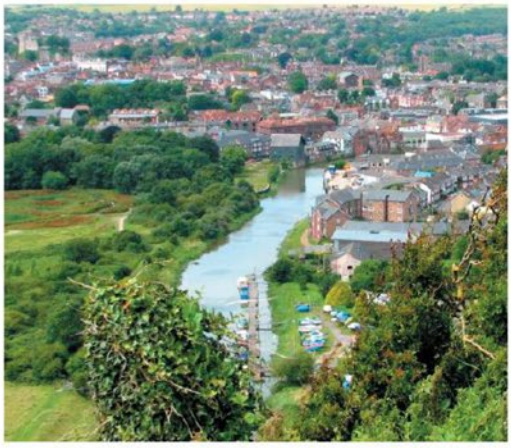
LCA has therefore come of age in the UK and much of Europe is following close behind. LCA is key in planning and decision making but is sometimes wrongly used and this demonstrates some of its weaknesses - addressing them will, in part, shape the future of LCA. But the future development and application of LCA will also be shaped by current trends and new demands including:

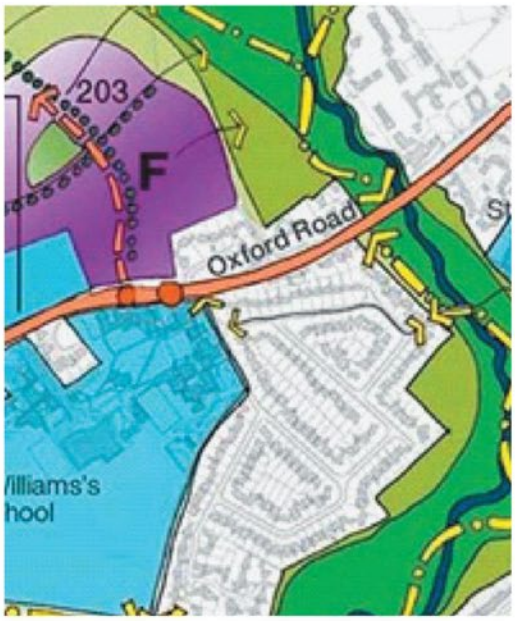
- Changes in funding streams as a result of austerity measures alongside the de-skilling of our local authorities and government bodies due to cut backs;
- Uncertainty regarding agri-environment schemes and climate change and desire to restore functionality of habitat and ecosystems;
- Planning policy reform and pressure for development/incremental change;
- New technologies and the influence of social media;

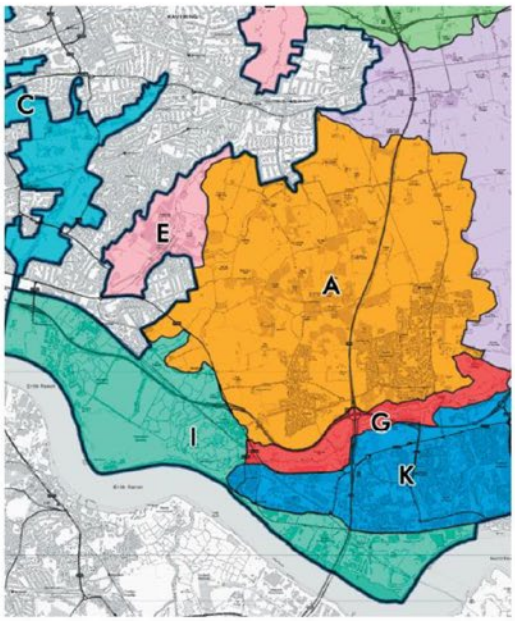
In future the application and use of LCA will inevitably change such that there is likely to be:

- A need for updating and simplification as a springboard to specialist studies;
- More local or project based assessments - e.g. neighbourhood plans or upland management;
- A need for stronger focus on evaluation to protect special places/qualities where there is unprecedented pressure - environmental quality of green belt, assessing the value of undesignated landscapes;
- Synergy with new technologies to improve recording/monitoring and community engagement and prediction;

Predicting the future is difficult, but keeping a sense of a direction is perhaps easier. LCA helps us to articulate what matters and why and is a tool to reach informed decisions and balance conflicting pressures - this, one hopes, will remain its core function.Nevertheless we should be careful not to add more and more data to LCA such that we 'overcomplicate the obvious', nor to regard it as providing us with all the answers in terms of appropriate landscape change - for that we need to hold on to creative thinking, retaining an openness to establish new landscapes, particularly where this enables good use of land and social/environmental well being.







What do we want future landscapes to look like?

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The world has changed rapidly in the last few decades, with profound changes in the ways we use land to support a growing, and increasingly affluent and urban population. As we head towards a global population of more than 9 billion people, we have entered a critical decision space, a window of opportunity over the next few decades within which it is still possible to avert a move beyond the planet's sustainability limit. The successful transition towards a global society that can live within the planet's boundaries is widely seen as the greatest challenge humanity has ever faced.

More people will require more space and more resources, which will have to be provided by a finite land surface facing added pressures from our changing climate. Land use change is inevitable and managing this change sustainably will become a major challenge. A major first step towards achieving the future we want is to understand better what type of world we would like to live in – and what landscape can support this future world.

Here we present three visioning studies using different participatory techniques to describe desired future landscapes.

The VOLANTE project worked with 69 stakeholder in 6 workshops to develop three contrasting visions for sustainable European land use in 2040 (Fig. 1). These visions are described in detail in the VOLANTE Roadmap towards Sustainable Land Resource Management in Europe (1).

In parallel a crowd sourcing experiment was designed to ask young people about their future lives and their use of the land, to infer implications for future landscapes (2; Fig. 2). In total, 1131 responses from 29 countries were received. Results show a strong desire for change, and for more sustainable lifestyles which will have major consequences for the way our landscapes look and function.

The web experiment was recently adapted to an analogue interview format for socio-cultural ecosystem services valuation, called STREAMLINE (3). A landscapescale approach is used to undertand how people interact and value landscapes. Early feedback from a study in the Inner Forth suggest STREAMLINE can form a valuable tool for community engagement/public participation in landscape management and governance.

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(2) Metzger, MJ. et al. (2016) How does Europe want to live in 2040? Citizen visions and their consequences for European land use. Regional Environmental Change in review.

(3) www.streamline-research.com Accessed 17 June 2016.

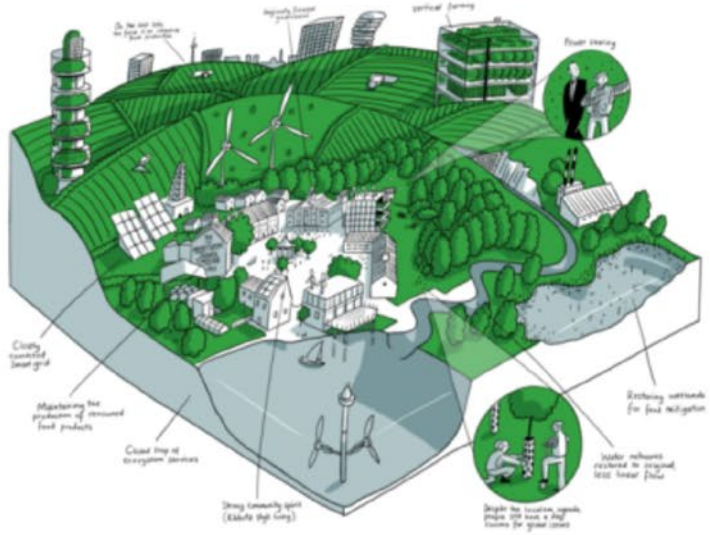

Figure 1. Rich picture describing the VOLANTE vision 'Best Land in Europe'.

Figure 2. Screenshot of the crowd sourcing experiment

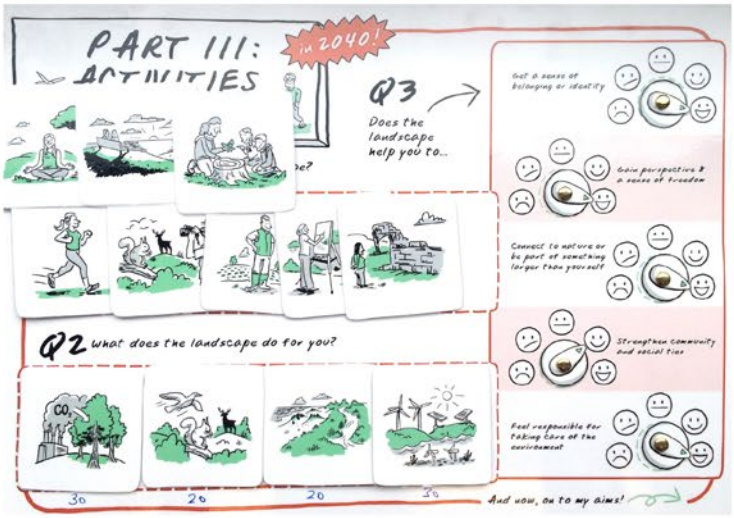

Figure 3. Example of a STREAMLINE canvas, where participants explain how they benefit from the landscape

Downscaling upland land-use change scenarios

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Land use and management practices in the uplands have a major impact on our river biodiversity and ecosystems. The uplands can be characterised as a mosaic of catchment units, which form an ideal model to demonstrate how potential future land-use change may impact on river ecosystems. Predicting how upland landscapes are likely to change with increasing social, economic and climatic pressures, is a key step towards the sustainable management of these natural assets, and the services they provide. Four scenarios; intensification, managed extensification, business-as-usual and abandonment, shown in Fig. 1, were developed as part of the DURESS project (1). They were then downscaled to sub-catchment scale, to begin predicting the impacts of land-use change on river ecosystems. This research explores the impact of future changes in land use on land-cover distribution in upland catchments across the UK.

The Duress scenarios (as described in Prosser et al (2014) (2)), combined knowledge on existing land use with expert-elicited knowledge on likely changes in policy and economic drivers to form a set of change rules. These rule bases underpin the matrices that predict future land-cover change under a range of land ownership, nature designation and agricultural quality criteria. The minimum and maximum change matrices were applied to 128 study catchments in upland Wales, for which the likelihood of the change (probability) and the percentage of land-cover change were calculated.

To understand the spatial character of this change, a maximum entropy model was applied to spatially allocate the maximum percentage change at both a Wales and sub-catchment scale. Fig. 2 shows the national results for the intensification and managed extensification scenario. Focusing on the major changes, the intensification scenario depicts an increase in arable land cover whilst the managed extensification scenario depicts an increase in semi natural grasslands and broadleaved woodland.

The scenarios are very timely as they can help inform policy action post 2020. The current Common Agricultural Policy (CAP) lasts until 2020, and Brexit will trigger new thinking on the policy options for supporting the UK uplands. From 2020 onwards it is likely that a new scheme (or schemes) will be in place. As the future shape of these schemes is uncertain, this work provides the opportunity to input into their development, revealing the potential implications of future management decisions on the uplands. This work also highlighted that further stakeholder dialogue could be integrated to refine the change matrices and allocation rules, giving them the capability to adjust to the local context.

(1) http://nerc-duress.org/Accessed 31 August 2016.

(2) Prosser, H. et al. (2014) Upland Scenarios: what will the future look like? Duress Project report card, Cardiff University.

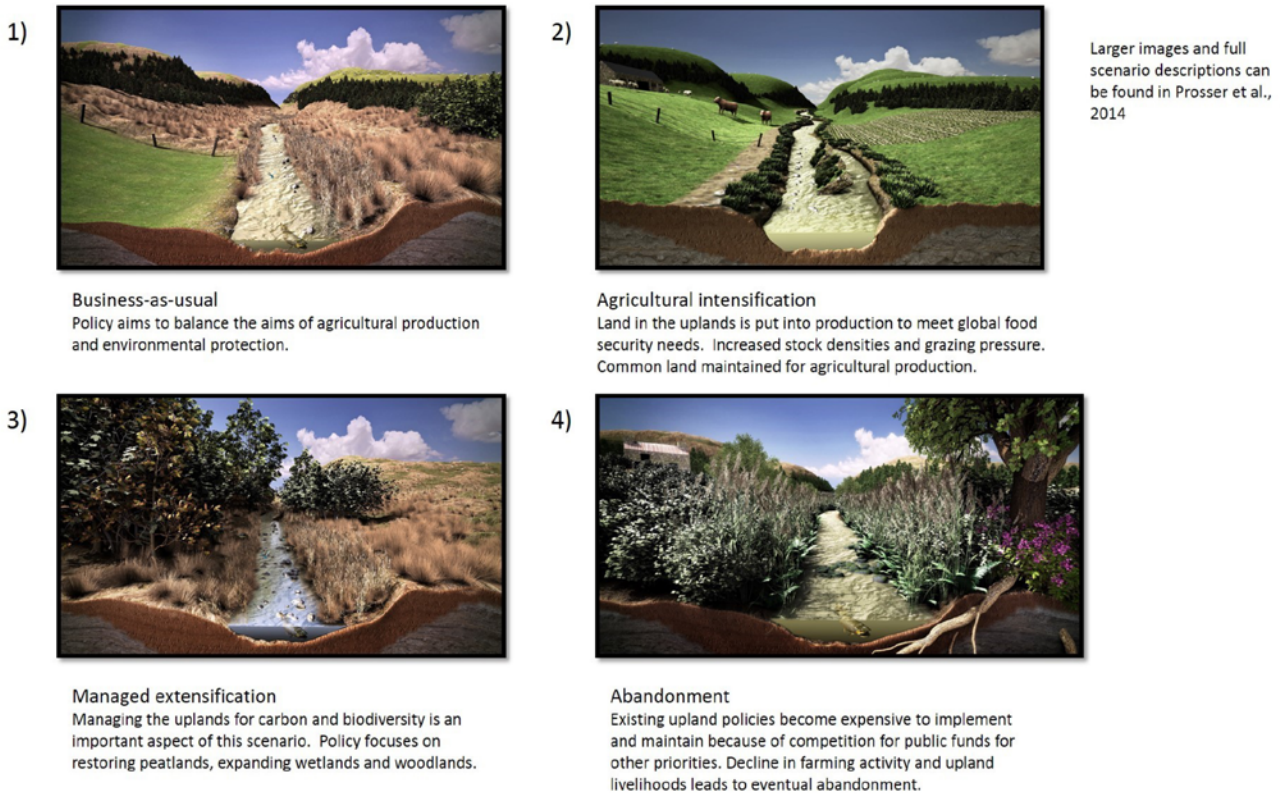

Figure 1: Visuals of the four DURESS scenarios (Prosser et al., 2014)

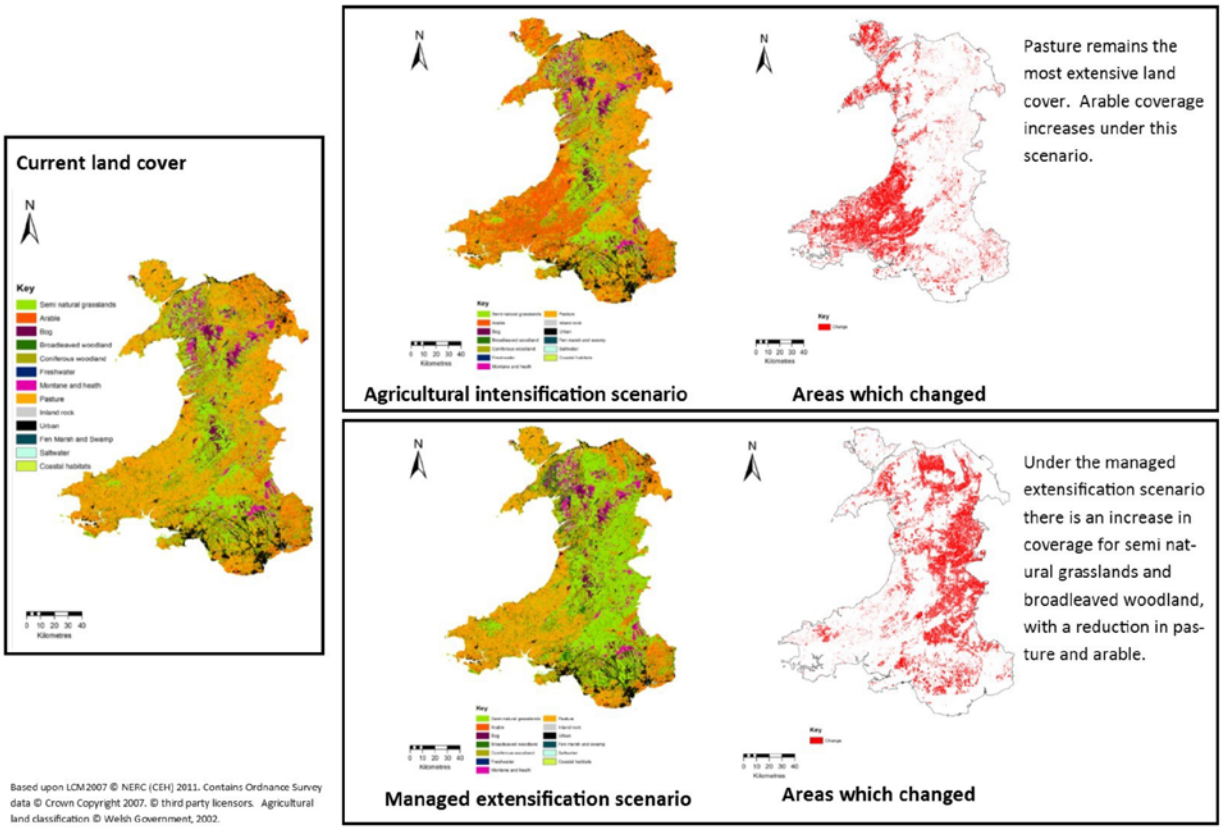

Figure 2: Projecting land-use change across upland Wales for the agricultural intensification and managed extensification scenarios

Character & Condition: the Role of Landscape Character Assessment for the Future of Landscapes

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Landscapes are dynamic, the product of a complex interaction between forces for change operating across time and space. Across historic timescales relatively slow change has, in Europe at least, produced the diversity of cultural patterns that are measured and mapped using a wide variety of LCA (Landscape Character Assessment) techniques (1). More recently, the pressures from a globalising world and the impacts of, for example, climate change, biodiversity loss, increased flooding etc., are changing our perception of the role and value of landscapes. It is therefore surprising that whilst there continues to be considerable discussion of the approaches and methods of Landscape Character Assessment (LCA), concrete and widely disseminated examples of its use as a spatial 'landscape' framework for managing and guiding such rapid change are few. Whilst there, for example, have been significant advances in the development of techniques to map ecosystem goods and services (2), few have used LCA as the spatial framework within which to map the type and extent of services many of which operate at explicitly landscape scales (3).

The paper revisits the concept of 'character' and 'condition' and explains how these key concepts can be used both to classify landscapes into a range of types and to evaluate their condition. The visual delineation of landscape types based on digital mapped information about the natural (soils, land cover, geology and topography) and cultural (settlement, land cover, field patterns etc.) dimensions of landscape remains an effective method and is vital to improve our understanding of the forces that have shaped landscapes over time. In combination with fieldwork, this process of characterisation determines the character of a landscape. By contrast, determining condition requires an analysis of the often complex composition and configuration of the natural and cultural elements that comprise a landscape, a process that is increasingly accomplished using quantitative techniques..

(1) Warnock, S. et al. (2015) Landscape characterisation: the living landscapes approach in the UK. Landscape Research. 40: 261–278.

(2) Haines-Young, RH. et al. (2010) The links between biodiversity, ecosystem services and human well-being. In: Ecosystem ecology: a new synthesis. Raffaelli, D.G. et al. (eds). Cambridge University Press, Cambridge, pp. 110–139.

(3) Maes, J. et al. (2012) Mapping ecosystem services for policy support and decision making in the European Union. Ecosystem Services. 1: 31–39.