

Mapping ecosystem services

Report on a workshop held on 26th November, 2012 Sheffield Town Hall

Co-organised by the Ecosystems Knowledge Network and Durham Wildlife Trust

Summary

This workshop provided an opportunity for people interested in mapping ecosystem services to learn more about how this is done, the opportunities that it presents and how the challenges involved can be resolved. The 60 participants came from Wildlife Trusts and other charities, local authorities, universities and private consultancies. A morning session involving presentations from three ecosystem service mapping initiatives was followed by an afternoon session to consider applications for how ecosystem service maps can be used.

The workshop presentations and discussions showed that ecosystem service maps are tools for engagement with strong potential to help people evaluate scenarios for the future of land management and understand the impact of development projects. They have a wide array of applications, such as in informing spatial planning and the use of private and public sector funds. Significant opportunities remain for mapping tools to make use of information technologies to allow people in different locations to be involved in building and applying maps.

The presentations from the morning session are available for download at:

<http://ekn.defra.gov.uk/activities/past/mapping-sheffield>

Introduction

Ecosystem services are the functions provided by the natural environment that benefit people. Mapping ecosystem services is an important area of innovation within an ecosystems approach. Tools for producing the ecosystem service maps are underdeveloped throughout the UK. New applications for them are emerging. This workshop was organised to provide an opportunity for people interested in mapping ecosystem services to learn more about how this is done, the opportunities that it presents and how the challenges involved can be resolved.

Presentations of mapping initiatives

Eco-Serv GIS: A WildlifeTrust toolkit for mapping ecosystem services at the county scale

Introduction

Durham Wildlife Trust's Chloe Bellamy and Jonathan Winn, presented the EcoServ-GIS that they have developed. This identifies where areas can provide (supply) ecosystem services, where there is demand for those services, and how many services are being supplied.

Currently, many tools for mapping ecosystem services follow a simple rule-based matrix of habitats. A limitation of this approach is that it does not provide enough information in order to map ecosystem services at a local level. Alternative mapping approaches require large amounts of data to be acquired at expense, or access to datasets that are available only in academia. EcoServ-GIS aims to provide an appropriate balance between complexity and ease of use. The mapping methods within the toolkit use the widest possible range of data that is easily accessible and have been shown in the scientific literature to be linked to ecosystem services supply or demand.

Tool description

EcoServ-GIS makes use of ArcGIS software. Initially, the toolkit produces a detailed habitat base map, using **Ordnance Survey Mastermap** layers, building on the green infrastructure mapping methods developed by the Mersey Forest. Local authority open space surveys and Biodiversity Action Plan data are integrated into this base map to provide a habitat and land use information layer on which the models to map individual services are then built.

The EcoServ-GIS project has developed model rules to map 24 ecosystem services. Ten of these have been implemented so far, including two ecosystem services of particular relevance to the Wildlife Trusts: 'accessible nature experience' and 'wildlife watching'.

An example of mapping the 'accessible nature experience' was presented at the workshop. In order to identify areas with the capacity to deliver this service, all green space with public access was identified and graded by perceived levels of naturalness at a local and landscape scale. Levels of societal demand for accessible nature were then mapped separately, using health scores within the Index of Multiple Deprivation (a government study of deprived areas in UK local authority areas) as well as population densities at two scales:

- 300 metres: this distance, which takes roughly five minutes to walk, was used to identify demand for access to green space. This distance is used by Natural England to define green space that may be considered accessible on foot.
- 3.2 kilometres: Based on a Natural England study which found that the majority of outdoor recreational visits took place within this distance.

EcoServ-GIS highlights where services are being delivered by overlaying the output and showing where the service potential and demand maps match. This provides information on areas which are important to conserve due to their current delivery of an ecosystem service. Additionally, areas can be identified where there is local demand for a service but no ecosystem to deliver it. The toolkit

produces continuous output maps at a 10 metre or 50 metre cell resolution across the whole area of a county.

Applications

EcoServ-GIS was developed to meet the need for a rapid and transferable method by which staff in nature conservation organisations and local authorities can map ecosystem services. It is intended for use in spatial planning at the county level, demonstrating the range of services provided locally. The results can be used for both detailed planning at the site scale as well as landscape scale conservation. The toolkit will be available for all Wildlife Trusts, and is intended for use by organisations that work in partnership with Wildlife Trusts, such as local authorities.

The maps will help to direct the work of the Wildlife Trust's **Living Landscapes Programme** by identifying areas of land that deliver a wide range of ecosystem services and will also inform responses to local planning issues such as green belt reviews. By running the toolkit for different land use options as a form of scenarios testing EcoServ-GIS will also be of use in assessing the impact of planned housing development or strategic housing allocation reviews (see Tom Butlin's presentation for an example of such use). Groups such as Biodiversity Action Partnerships and Local Nature Partnerships will also benefit from the output.

Due to the complexities of data format and availability across the UK, English data sets have been used for the first stage of EcoServ-GIS. However, when developing the model rules, the range of situations and habitats across the UK have been considered and future releases will allow a local digital Phase 1 habitat survey or the **Landcover Map 2007** to be used as alternative input datasets.

To use EcoServ-GIS, organisations need ArcGIS Version 10 (Desktop advanced/ArcInfo license), ArcGIS Spatial Analyst extension, GIS expertise and time to gather the data sets. The organisation or partnership will also require a contractor license with the local authority in order to utilise the **Ordnance Survey Mastermap** layer.

Durham Wildlife Trust plans to make the toolkit and user guide available in early 2013. Organisations wishing to use the toolkit should contact their **local Wildlife Trust**.

A planned further development of EcoServ-GIS will aim to expand the range of services mapped and to integrate more marine services. It is also intended to further test the toolkit in other counties, and trial its applicability in 'real world' spatial planning scenarios.

For more information, please contact Chloe Bellamy on cbellamy@durhamwt.co.uk

Polyscape and its use in stakeholder negotiation

Tim Pagella from Bangor University presented the Polyscape tool, which he developed with Bethanna Jackson (now at Victoria University of Wellington, New Zealand). The Polyscape tool was developed as part of research into flood risk management in the Pontbren river catchment in Mid-Wales. The starting point for this project was the farmers of Pontbren, who joined together to plant 130,000 trees to provide improved shelter for their livestock. Polyscape looked at where the potential for tree planting was most likely to provide multiple benefits in terms of ecosystem services.

The tool was designed to increase engagement with local farmers and landowners, using their knowledge to 'ground truth' existing data maps. Tim Pagella highlighted that the process of making ecosystem service maps is as important as the output produced; it gives stakeholders a platform to debate issues on a relatively equal footing.

Tim Pagella explained that many approaches to mapping ecosystem services focus on the places where ecosystem services arise (such as woodland). They then map the synergies and trade-offs between these services. Polyscape has broadened this to look at the spatial dimensions of ecosystem services, mapping them from where they arise to where they are received.

In his presentation, Tim Pagella highlighted the need for better mapping of how ecosystem service provision changes over time. This is vital for helping people understand scenarios for the future and make informed decisions using maps.

For more information, please contact Tim Pagella: afse0c@bangor.ac.uk

Examples of applying and using ecosystem service maps developed by the Mersey Forest

Tom Butlin from the Mersey Forest outlined how ecosystem service maps can be used in planning and design of individual developments. They can help to target investment and generate funding. The Mersey Forest has developed a mapping method, endorsed by the Ordnance Survey, which provides data for 28 ecosystem services. It has been applied to many different landscapes from large rural areas such as Ayrshire through to urban development sites such as Everton Park in Liverpool.

In 2010, Liverpool City Council and the Liverpool Primary Care Trust (PCT) commissioned The Mersey Forest to produce a Green Infrastructure strategy. The maps produced as part of this strategy helped to identify overlapping areas where ecosystem services provide health benefits, and where there was a high demand for those benefits. This work informed the PCT decision to allocate £300,000 to 38 Green Infrastructure projects to deliver health benefits. The projects included a garden designed by, and for, refugees on a formerly derelict site. The health outcomes are being evaluated by the University of Essex.

The Mersey Forest has also developed an online Green Infrastructure tool called **Site Informer**. This gives local authorities and other organisations access to information on existing Green Infrastructure, the services it provides and the demand for those services. This is a way to give people access to data if they don't have GIS software or the skills to use it. Liverpool City Council is currently using this tool to help with their Strategic Housing Land Availability Assessment.

The mapping method developed by the Mersey Forest has also helped to demonstrate the economic benefits of incorporating Green Infrastructure into developments. Therefore, when a multi-billion pound scheme to



Developer's illustration of the Wirral Waters Project (Birkenhead Docks), subject of an ecosystem service mapping project that led to the establishment of a Community Environment Fund.

redevelop Birkenhead Docks was proposed, the Green Infrastructure Valuation toolkit (for which the mapping can be an input) showed that £2 million of Green Infrastructure investment (a small fraction of the total budget) and a small annual maintenance budget would deliver £30 million in benefits over five years. As a result of this analysis, the developers established a Community Environment Fund. They are paying one per cent of all of their capital investment in redevelopment projects in the Mersey Belt into this fund on an ongoing basis.

The mapping method also helped to ensure that more Green Infrastructure was incorporated into the master plan for Liverpool Knowledge Quarter, an earlier redevelopment project.

The mapping method and Green Infrastructure Valuation Toolkit are freely available to all – see http://www.merseyforest.org.uk/files/The_Value_of_Mapping_Green_Infrastructure_pdf.pdf and <http://bit.ly/givaluationtoolkit> respectively.

For more information, please contact Tom Butlin: tom.butlin@merseyforest.org.uk

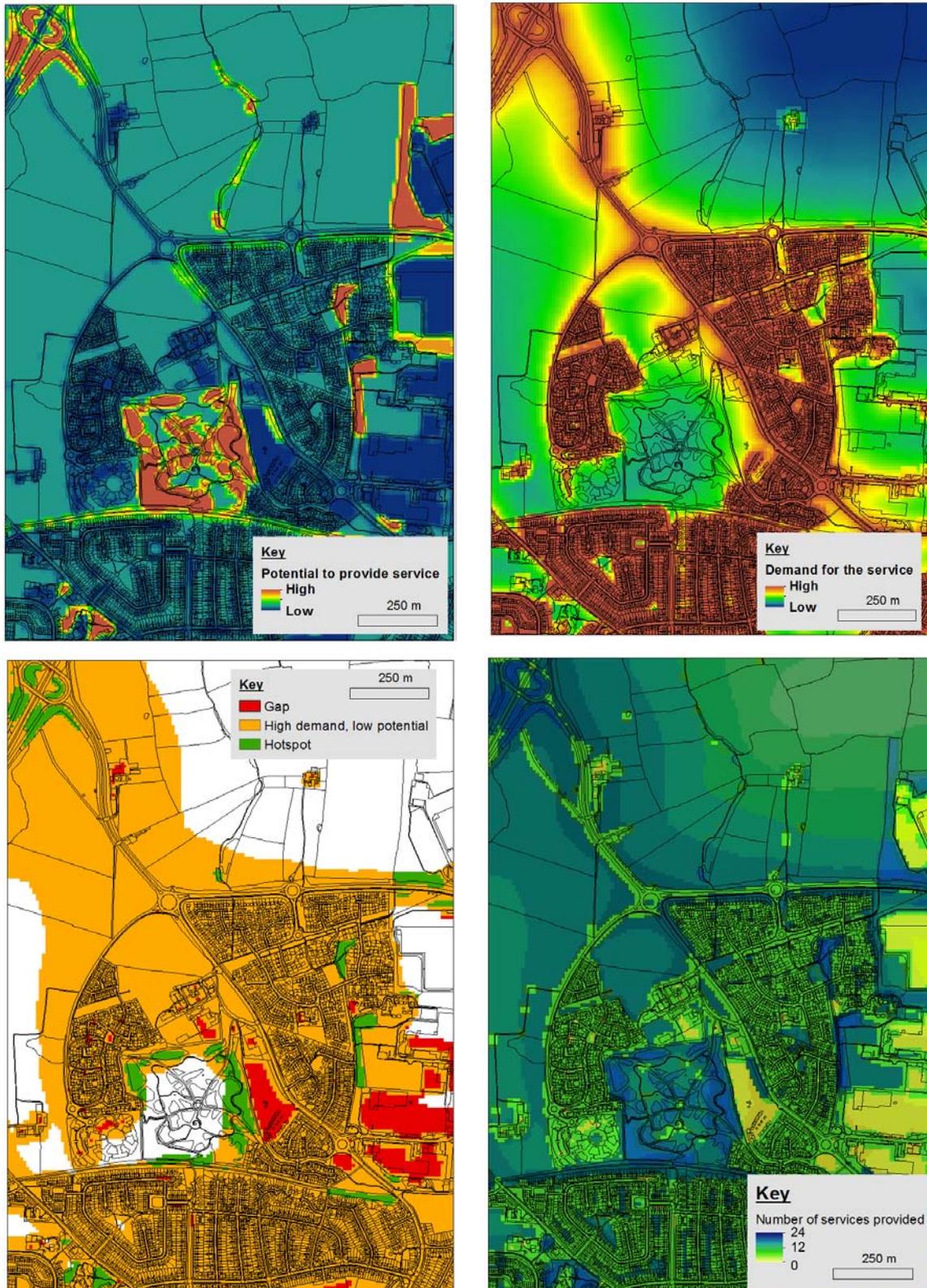
Participant learning within the workshop

In the second half of the workshop, participants had the opportunity to examine different types of ecosystem service maps and discuss how they could be applied. They focused on a hypothetical situation in an urban area where noise was a problem. Participants were presented with the following in sequence (Figure 1):

- A map showing only the ecosystem service potential of the area (in terms of the capacity of the environment to buffer noise).
- A map showing demand for that service (based on how noisy the area was, and how many people were likely to be affected by it).
- A map that overlaid the potential and demand maps to show the gaps (areas where there was high demand but no potential), improvement zones (areas of high demand and low potential) and hotspots (areas of high demand and high potential).
- A map focused on multi-service delivery, showing how many services could be delivered across an area.

They were also shown an aerial photograph of the area. Participants were asked to consider what each map showed, how they related to each other, which maps were most useful for their work, how the maps might differ depending on whether cultural, provisioning or regulating services were illustrated, what action could be taken in the gaps, improvement zones and hotspots, and what should be done in areas with low demand but high potential.

Figure 1 – Maps examined by the discussion groups



Learning points from this session were:

- Ecosystem service maps don't provide definitive 'answers'; the results of any mapping exercise should always be questioned and never taken at face value. For this reason, they are best considered as tools for engagement.
- All terms used in relation to ecosystem service maps should be carefully explained as they can be interpreted in many different ways. Examples are ecosystem service 'potential', 'need' and 'demand'.
- Ecosystem service maps have strong potential to help people evaluate scenarios and understand the impact of built development.
- Maps are a useful education tool to help with the application of an ecosystems approach in a particular geographical area.

A further interactive session focused on the limitations to creating and using ecosystem service maps, along with how these may be resolved. Participants used Ketso mind-maps (www.ketso.com) to record their own experiences or ideas for using an ecosystems approach. On separate 'branches' of the mind-map, they explored best practices, challenges, transferable core principles and how to better enable projects to use an ecosystems approach.

Limitation with mapping	Ways forward identified by participants
<ul style="list-style-type: none"> ● Projects seeking to develop ecosystem service maps in a particular area are not always aware of which data exist. 	<ul style="list-style-type: none"> ● More practical demonstrations of data use (such as occurred in the workshop).
<ul style="list-style-type: none"> ● Lack of time to develop tools and the cost involved in doing so. Includes limitations on data availability [for use in maps developed by organisations outside academia]. 	<ul style="list-style-type: none"> ● Greater use of partnership working between public, academic and third sector organisations.
<ul style="list-style-type: none"> ● Communication of key concepts and technical knowledge. 	<ul style="list-style-type: none"> ● Develop consistent methodologies between mapping initiatives. ● Development of interactive mapping technologies using online forums, 'crowd sourcing', 'cloud computing', and online data sharing. ● Need regular focus group meetings ● Development of online training on ecosystem service mapping

Limitation with mapping	Ways forward identified by participants
<ul style="list-style-type: none">● Difficulty in explaining ecosystem service maps to stakeholders, and helping to inform interpretation of them.	<ul style="list-style-type: none">● Make full use of information technologies, such as interactive PDFs, to present maps more clearly to users.
<ul style="list-style-type: none">● Different stakeholders look at maps with different priorities.	<ul style="list-style-type: none">● Develop tools that stakeholders can contribute to, for example marine mapping tools include Marine Map and SeaSketch. These have data layers that different stakeholders can access from different locations.
<ul style="list-style-type: none">● There is lots of choice but it remains difficult to choose what is most appropriate for a particular context.	<ul style="list-style-type: none">● The project by Natural England may help to address this (see below).

There is clearly much work in progress to find ways of mapping ecosystem services and support the application of an ecosystems approach. During the workshop in Sheffield, Nick Dales from Natural England described a project that his organisation has initiated to collate all the ecosystem services mapping projects currently underway. It is hoped that this will draw in work from throughout the UK and abroad. The tool will be updated as initiatives arise and when existing projects are updated.

Annexes

Presentations and recordings from the day will be available as separate files for viewing or download at:

ekn.defra.gov.uk/activities/past/mapping-sheffield

About the Ecosystems Knowledge Network

The Ecosystems Knowledge Network is a resource for anyone wanting to share knowledge or learn about the practical benefits of an ecosystems approach to both people and nature. An ecosystems approach is a holistic and inclusive approach to looking after the natural environment. For further information about the Network or to register your interest in joining, please visit ekn.defra.gov.uk.

You can also contact the Network Co-ordinator by email at ekn@naturalcapitalinitiative.org.uk or telephone **0333 240 6990**.