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Discussion Paper

Urban-rural continuum Impact Assessment and sustainable planning tool utility testing in Finland and Scotland -ConTest

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1. Introduction

Mapping and modelling the supply of ecosystem services (ES) are the key components within ES research supporting policy, decision making and land use planning. Ecosystem services are the benefits people obtain form the ecosystems and can be classified to *provisioning services, regulating services, cultural services and supporting services*. Comparing to other ES, cultural ecosystem services are not yet fully integrated decision making and land use planning.

The Recreation Opportunity Spectrum (ROS) was developed in the late 1970s in the USA to assist land managers to overcome management problems associated with the increasing number of visitors to outdoor recreation areas (Ward and Rich 1996). The ROS approach has since been applied in land and resource planning and management of recreation areas. Recently it was integrated in the European PEER Research on Ecosystem Services (PRESS) in a new context in mapping recreational ecosystem service potential and fruition at the European scale (Maes et al. 2012).

The purpose of the ConTest research was to find out if ROS-based methodology could be used as part of impact assessment of land use plans with regard to cultural ecosystem service provision at different scales. Cultural ecosystem services are defined as "non-material benefits people obtain from ecosystems trough spiritual enrichment, cognitive development, refection, recreation and aesthetic experience" (MA, 2003, Chapter 2, p.40). More specifically, the aims of this study were to:

1. apply ROS methodology based thinking in a new context aiming at concretizing ecologically sustainable development in urban-rural continuum regions, and
2. test a spatially explicit model for the assessment of recreation ecosystem service in ongoing planning processes.

In this study the model was downscaled from European to local level using two test cases (TC's), one in Finland and the other in Scotland.

The Finnish TC comprises the planning of a new housing area called Sibbesborg in the municipality of Sipoo which is located next to Helsinki, the capital of Finland. In 2011, the municipality of Sipoo hosted an open international planning competition for a sustainable community in Sibbesborg. The aim of the competition was to submit a plan for a community of up to 100,000 residents. The current population is about 3,000. The competition and its scope were based on the Sipoo 2025 Master Plan and the municipality's expansion strategy, which is a response to the overall development objectives for the Helsinki region, an area that is one of the fastest growing urban

regions within the European Union. The planning area of Sibbesborg is located next to Sipoonkorpi National Park and includes, for example, different types of Natura 2000 areas. The brand of Sibbesborg is visioned to base on local food production and green care services. Trekking routes, riding stables and nature school will all be part of the recreational services of the community (Municipality of Sipoo 2013).

The other TC is the Cairngorms National Park with Britain's highest and most massive mountain range, its biggest native forests, spectacularly clean rivers and lochs, moorland and farmland and a stronghold for Britain's wildlife. The National Park is home to around 16,000 people, living in towns, villages, hamlets, and houses in the countryside. Tourism-related businesses account for about 80 % of the economy, including activities such as skiing, walking, fishing, shooting, and stalking. At least 1.4 million people visit the Cairngorms each year.

Connection and contrasts between the two different case study areas were important in testing the method with regard to the policy context and governance structures.

In these TCs the focus was on the present state of the land use in the planning areas. The ConTest assessment integrated knowledge from local stakeholders with spatial data on areas potentially providing recreational ecosystem services. The involvement of local stakeholders in the process was beneficial for the project as they questioned the approach by providing feedback from a different perspective. Their involvement increased also general understanding of data and methods, and their potential usability in the planning and decision making processes.

2. Characteristics of test cases

This research is demand driven. In Finland, practical land use planners have expressed their need for easily applicable tools for ecosystem service (ES) assessments, land management and impact assessment of land use plans from the ES point of view. The call for such tools is especially high in the case of Sibbesborg where the planning principles rest upon safeguarding natural values and ES in the area and the planning process should be continuously evaluated based on realisation of these principles in practice.

In Scotland, good quality impact assessment tools which can be used as a knowledge exchange with private land owners is viewed as an important aspect of policy making by the Cairngorms National Park Authority (CNPA). Managing land use in the National Park is a complex process due to most of the land being owned by private

individuals or groups or by agencies such as the Forestry Commission. As the CNPA does not directly own land it consequently needs to utilise a mix of regulation and incentivises to achieve its objectives. In addition, one of the goals in Cairngorms test case was to investigate the process of resource management planning to maximise ES delivery within a given area and to highlight the advantages and disadvantages of utilising the concept of ES within that process. The more precise aims of resource management planning in Cairngorms have been set out in the National Parks (Scotland) Act 2000:

1. To conserve and enhance the natural and cultural heritage of the area
2. To promote sustainable use of the natural resources of the area
3. To promote understanding and enjoyment (including enjoyment in the form of recreation) of the special qualities of the area by the public
4. To promote sustainable economic and social development of the area's communities
   (http://cairngorms.co.uk/park-authority/about-us/)

ROS based methodology was initiated by scientists and practical land use managers, but in the ConTest study, it was modified by researchers. In the Finnish TC land use planners were involved in data gathering, data production and evaluation of results. Furthermore, a case study advisory board (CAB) of another research project has participated in discussions of preliminary concepts and presentation of results. The CAB consists of researchers, local land use planners, policy makers and nature area managers (e.g. Finnish Forest Service).

In the Cairngorms TC the research team worked directly with the Director of Conservation and Visitor Experience of the CNPA. The research team has worked also in the past with the CNPA running several related projects and has gained an understanding of the CNPA's needs. This project was welcomed by the CNPA as previous studies have produced data which has proved useful to engaging with local stakeholders e.g. land owners and businesses and encouraging responsible development of recreational activities within the Park which is seen as an important activity of the CNPA.

3. Organisations, methods and test case processes

The TC research was carried out by researchers from the Finnish Environment Institute (SYKE) and the Centre for Ecology and Hydrology (CEH). In addition, the utilisation of the methodology of ESTIMAP to analyse and visualise the ROS-based approach was supported by European Commission's Joint Research Centre (JRC).

3.1 Methods

ROS based method was previously applied for European and national scale assessment of recreational ES (Maes et al. 2012). The model developed in that assessment was afterwards included into a modeling framework called ESTIMAP developed at the Joint Research Centre.

ESTIMAP is a framework developed for an integrated assessment of the capacity of ecosystems to deliver their services (Zulian et al. 2013). The model for assessing nature based outdoor recreational activities (Paracchini et al. 2014) contains three indicators: (1) recreation potential (RP), the recreation potential provided by nature; (2) opportunity spectrum (OS), the gradient of service available according to proximity to population and potential opportunities; and (3) population benefit, the share of local population that can potentially profit from the service (Table 1). In the ConTest project the ESTIMAP methodology was developed and refined further by, for example, taking account of human inputs (HIP) increasing the recreation potential and downscaling it to local and regional levels.

Table 1. ESTIMAP modules of recreation with their respective indicators, units and output formats (modified from Zulian et al. 2014).

Module	Supply or demand	Indicator	Units	Output format
Recreation	Supply	Recreation potential (RP)	Dimensionless indicator	Raster map
	Demand	Recreation Opportunity Spectrum (ROS)	Categories based on RP and proximity	Raster map
		Potential trips	Share of the population which has access to ROS classes (%)	Statistics

3.1.1 Recreation potential (RP)

RP estimates the capacity of nature to provide recreational opportunities. It depends on the following components:

1. Water
   - Presence of and proximity to water bodies, rivers and sea.
2. Natural features influencing the potential recreation provision
   - Any natural feature or characteristic that has a specific positive impact on outdoor recreation potential.
3. Degree of naturalness
   - Modeled through the *"Hemeroby"* concept (Paracchini and Capitani 2011, Steinhardt et al. 1999), that measures the

human influence on landscapes and flora; according to Steinhardt et al. (Steinhardt et al. 1999) "*the degree of hemeroby is a measure of the impacts of all human actions on the ecosystems*".

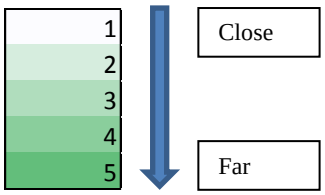
4. Human inputs (HIP) influencing the potential recreation provision
   - Any man-made infrastructure that has a specific positive impact on outdoor recreation potential, for example trails, cooking shelters and piers.

3.1.2 Opportunity spectrum (OS)

The opportunity spectrum represents the relation between the potential provision for recreation and the possibility to reach those opportunities. It is created by overlaying RP with a proximity index. In this context the proximity index represents a general proxy to estimate the relationship between origins (where ideally people live) and a surface of destination (the RP). It overlays two surfaces, one derived from an euclidean distance from roads and one from euclidean distance from urban areas (Paracchini et al. 2014, Zulian et al. 2013) (Table2.)

Table 2. Thresholds for the estimation of the proximity index in the ConTest case studies.

		Distance from roads (m)			
		<50	50-150	150-300	>300
Distance from urban fabric (m)	<300	1	2	2	4
	300-500	2	2	2	4
	500-750	3	3	3	4
	750-1000	3	4	4	4
	>1000	4	4	4	5



3.2 Test case process

Study areas were selected in the question formulation phase of the project based on their characteristics. Both TCs represent urban-rural continuums where planners were keen to work with the research team to explore the potential utility of the approach. The focus of the Finnish test case is on the Sibbesborg planning area, but due to the nature of recreational ES the area that was actually analysed included a 10 km buffer zone round the edge of the local master plan area. People travel variable distances for the purpose of recreation and do not remain within the borders of a restricted planning area. A buffer of above mentioned size has been recommended for the studies related to assessing the sustainability of city regions in Finland (Söderman et al. 2012). In the Cairngorms the whole national park was delimited as the study area as this is the planning unit relevant to the CNPA.

In both TC's the classification of the cultural ES followed the Common International Classification of Ecosystem Services (CICES, http://cices.eu/, Haines-Young & Potschin 2013) version 4.3 developed for the national environmental accounting system being developed under the coordination of the European Environment Agency (EEA).

A wide variety of spatial data was used to analyse the spatial variation of recreation potential in TC areas (Tables 3 and 4). Data was gathered mainly by using the existing datasets of the research institutes, but also knowledge from local stakeholders and land use planners together with local spatial data on areas recreation services was used. Data requirements included sufficient spatial accuracy and comprehensive extent in the study area. Public Participation GIS survey on recreation habits and values given to specific spots by the current residents of the area was carried out in the Finnish TC. Results were used as guidance to find out, for example, where the important recreational areas are and how far people are willing to travel to recreate.

Table 3. Datasets used to estimate the recreation potential in Sibbesborg

Component	Sub-component	Data source
Water	Proximity to Lakes	©Finnish Environment Institute
	Proximity to Seashore	©Finnish Environment Institute
	Proximity to Big rivers	©Finnish Environment Institute
	Proximity to Small rivers	©Finnish Environment Institute
Features Influencing the Potential recreation provision	National parks	©Finnish Environment Institute
	Protected areas (union of all types of designated protected areas and nature conservation programme areas), except national parks and protected bird areas	©Finnish Environment Institute ©Finnish Forest Survey (Metsähallitus) ©Uusimaa Regional Council
	Designated protected bird areas and other valuable bird areas	©Finnish Environment Institute
	Traditional agricultural biotopes (different from High Nature Value Farmlands)	©Finnish Environment Institute
	Green urban areas	©Municipality of Sipoo
Degree of naturalness	Corine land cover 2006	©Finnish Environment Institute
	Regionally significant landscapes	©Finnish Environment Institute

Human inputs influencing the potential recreation provision	Beaches and picnic places	©Municipality of Sipoo
	Camping facilities	©Finnish Environment Institute
	Cooking places/fire places	©Finnish Environment Institute
	Horseback riding	©Municipality of Sipoo
	Golf courses	©Municipality of Sipoo
	Shelters / cabins	©Finnish Environment Institute
	Bird watching towers	©Municipality of Sipoo
	Fitness and recreation trails	©Municipality of Sipoo
	Skiing tracks	http://www.mski.fi/sipoo/
	Green houses	©Municipality of Sipoo

Table 4. Datasets used to estimate the recreation potential in Cairngorms National Park

Component	Sub-component	Data source
Water	Proximity to lakes	©Open street map
	Proximity to rivers	©Open street map
Features influencing the potential recreation provision	Special Protection Area (SPA) designated under the Birds Directive.	©Scottish natural heritage
	Conservation areas (Ramsar)	©Scottish natural heritage
	Special Area of Conservation (SAC) designated under the Habitats Directive.	©Scottish natural heritage
	National Nature Reserves (NNR) in Scotland.	©Scottish natural heritage
	Scottish natural heritage (NSA)	©Scottish natural heritage
	Natura 2000 sites	©EEA
Degree of naturalness	CORINE Land Cover 2006	©EEA
	Ancient wood	©Scottish natural heritage
	HNV farmland	©EEA
Human input influencing potential recreation provision	Nature centre	Based on google research and local knowledge
	Visitors centre	
	Watching towers	
	Paths + paths with infrastructures	©Open street maps; http://www.walkhighlands.co.uk/cairngorms/kingussie.shtml, http://braemarscotland.co.uk/things-to-do/walking/

4. Results and discussion

The ROS presents nine categories of service. They match three levels of provision (low, medium and high) and three degrees of proximity (from close to remote). Figure 1 shows the results for Sibbesborg and Figure 2 the results for the Cairngorms.

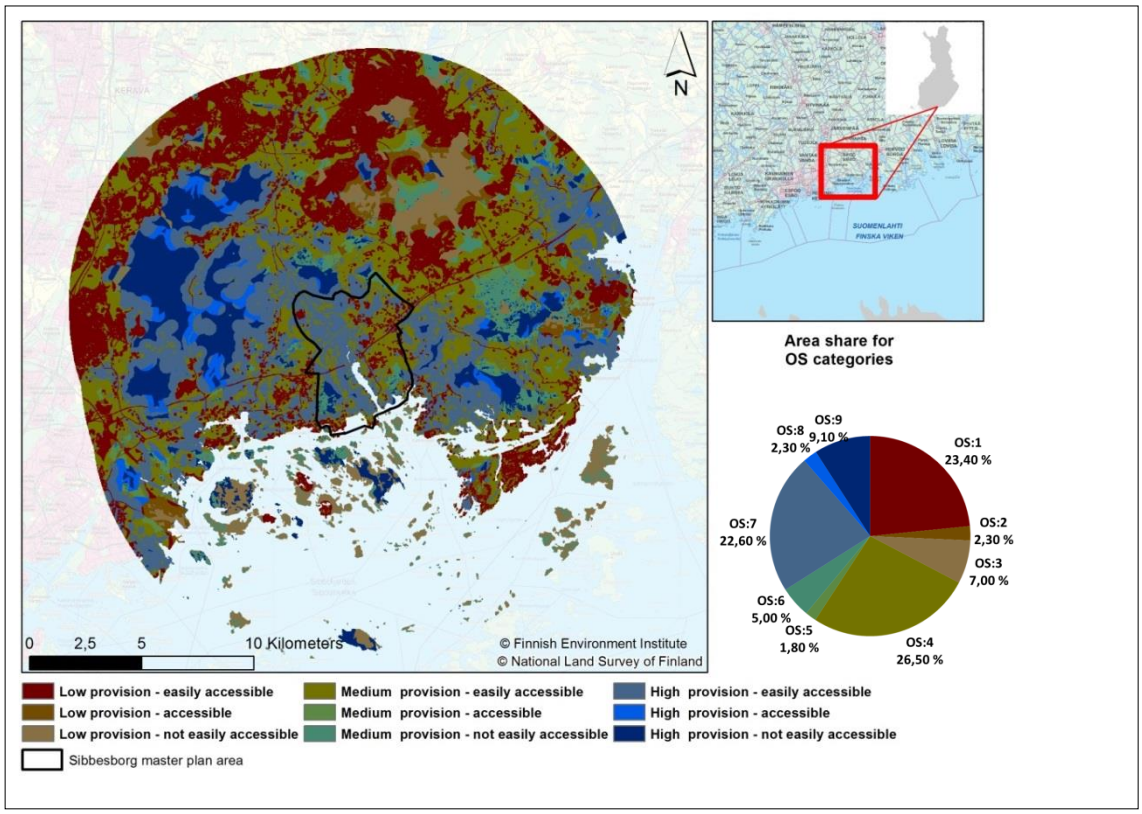


Figure 1: Recreation opportunity spectrum for Sibbesborg.

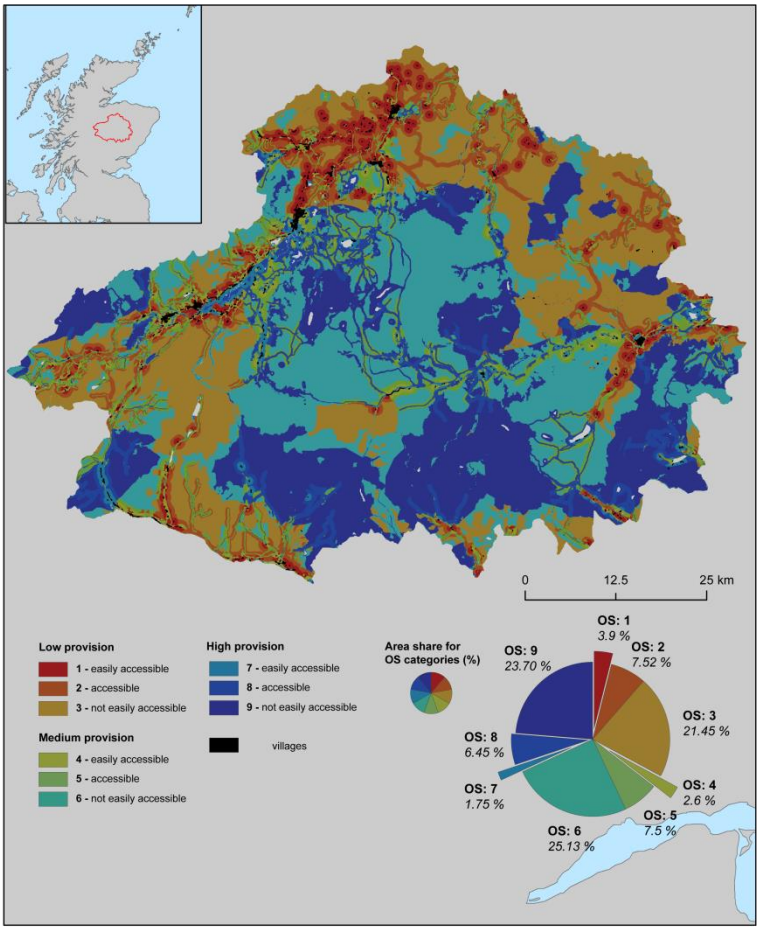


Figure 2:Recreation opportunity spectrum for Cairngorms National Park.

The conclusion of these TC's relates to the usefulness of the ROS concept in impact assessment in land use planning and management. Existence and value of other cultural ES beyond recreation were identified, but because of the data restrictions only the recreational aspect was assessed in both TCs of this research.

In the Finnish TC the evaluation of the results for ROS-based assessment was done with the land use planners of the study area (see Annex 1). The approach was seen as a systematic way to analyze the land use and it's potential. The resulting maps were informative and illustrative and accurate enough to be used at different scales. This strategy could provide potential help in land use planning and management because of its capability to include a lot of useful data. It enables more precise analysis of the planning area with a spatial resolution of 25 meters but also gives a comprehensive image of the area when zooming out to buffer area. Results supported some decisions made on the green infrastructure and urban environment in drafting the Sibbesborg local master plan. Land use planners

identified – as expected - that many places provide variety of recreation potential (e.g. the core areas of recreation). However, some areas with high recreation potential did not stand out as strong as it was expected. The high recreation potential close to major roads was seen problematic due to the traffic noise and pollution which decrease the recreation potential in reality. The current version of the ROS model does not take into account the features that decrease the recreation potential.

In the Scottish TC, the results of the preliminary maps were well received by representatives of the CNPA (see Annex 1). They understood the potential of this approach to aid planning and implementation and could identify places which were colour coded as they would expect but also noticed that some areas were not as expected. They were keen to engage and improve the algorithms to better reflect the local situation. For example water features used for recreation at lower elevations were considered to be accurately represented; however, water bodies which were relatively close in distance to main roads but high in the mountains were classed as easily accessible but were not in fact. The inclusion of elevation data could be utilised to better reflect the situation.

5. Future perspectives

In this project only the current land use was analysed. In order to carry out a real impact assessment by applying the ROS-based assessment of recreational ES, actual land use plans with different options should also be assessed. Assessing both the current and projected future land use would enable the assessment of change in recreational ES provision potential along with land use change. Furthermore, extending the methodology to include all cultural ES and modifying the model to include more of the factors influencing the ES potential provisioning, for example, noise, pollution, elevation would give more information of the area to the planners compared to traditional land use planning in which usually only some of the cultural ES (mainly recreation opportunities or aesthetics in terms of visual quality) are taken into account.

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Annex I: Interviewees and times of interviews of the Sibbesborg and Caringorms National Park test cases

TC 1: Sibbesborg, Finland: 31 of March 2014
Kaisa Yli-Jama, Head of Master Planning, Municipality of Sipoo
Laura Hietakorpi, Architect, WSP Finland Ltd (consultancy in Sibbesborg local master planning)

TC 2: Cairngorms National Park, Scotland: March 2014
Hamish Trent, Head of Land Management & Conservation in Cairngorms National Park Authority
Gavin Miles, Strategic Policy and Improvement Manager at Cairngorms National Park Authority

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