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The Study of Optimization the Structure of Construction Land in High Population Density Urban Region

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Introduction

The manifestation of reconstruction the conurbation spatial construction and the society function are the structure and the application styles of the urban land. Currently, the amenity of environment in the residential areas is becoming a common concern. However, the criteria of the livable environment are a dynamic conception which never stops improving while the standards and conditions of living are being ameliorated. In the urban area, the investigation of the structure optimization of constructive land is essential for the improvement of the environmental amenity and the satisfiability of the residents' requirements. In my project, I wish to approach how to optimize the structure of the constructive land in the high population density area depending on an example of optimization of the post-industrial land in Shenyang, China from 2002 to 2011.

General Situation

Tiexi district is a famous industrial base which is also the core area of Shenyang, northeast of China, with the total area of 39.48km2 (industrial area 22.01km2). In the district of Tiexi, the north industrial and south living area was divided by Jianshe Street, termed "living in the south, working in the north".

The Functional Zoning Map of Tiexi (2002)
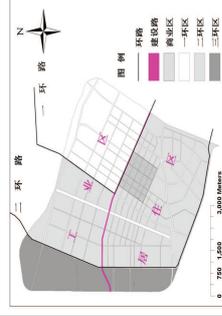
The Application Structure Map of Industrial Land in the Northwest of Tiexi (2002)

The Distribution Map of New Residential Area in the Northwest of Tiexi (2011)
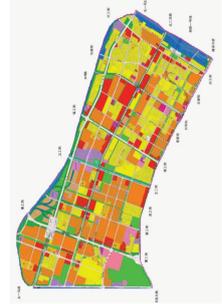
According to the strategy of the Revitalization of the Old Industrial Base of the Northeast which commenced from 2002, the old industrial land area had been divided into multifunctional regions which covering commercial, transportation, national health service, education and residential fields.

Conclusions

The main old industrial area landscape are domestic architecture, highway and green area which has low levels of landscape fragmentation and regular shape. The main change of urban landscape is that the industry architectures have been replaced by the residential architectures and the green area. The new residential architectures are expanded towards the vertical orientation which caused higher population density, scarcity of parking lot and low traffic efficiency.

Strategies

1. *Integration of the green area and the parking space is one of the effective method to optimize the structure of residential area in the high population density cities.*

2. *Development of the high-rise buildings, application of the basements and expanding of the viaducts are another three essential methods to economize the land usage in the high population density cities.*

3. *Avoiding the repeated construction is the fifth criteria of optimization the land usage.*

Pedodiversity with land use diversity comparison between case areas from the developed east and less developed central China

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Abstract

Two typical provincial capitals (Nanjing and Zhengzhou) and two counties (Rugao and Yuanyang) in east (Jiangsu province) and central (Henan province)China were chosen respectively as the developed and less developed comparative cases for pedodiversity and land use diversity correlative analysis by borrowing the recently developed pedodiversity methodology. Land use classification was worked out using remote sensing images in different times (1986-1988, 2000-2001, 2004-2006) for these studied areas before the calculation of the constituent diversity index and spatial distribution diversity index using Shannon entropy in 2km*2km grid scale of the soil and land use pattern were conducted and then a connection index was proposed to evaluate the relationship between soil and land use diversity.

Location of the case areas
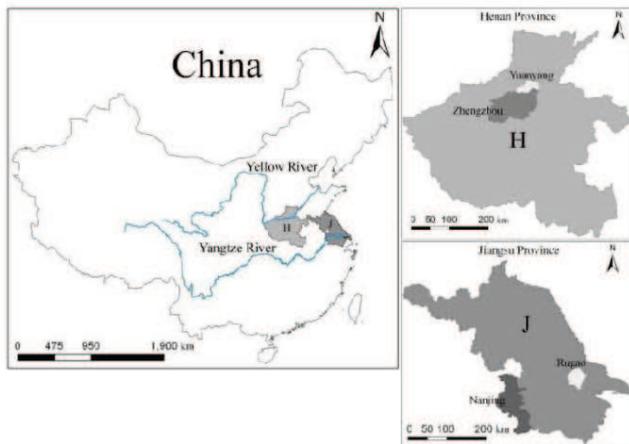
S expresses the number of spatial grids, pi expresses the area ratio of number i spatial grid to the total area of each soil or each land use. In this case, diversity index Yh expresses the spatial distribution diversity, which is the discreteness degree of each soil family or land use type to show the diversity pattern of spatial distribution.
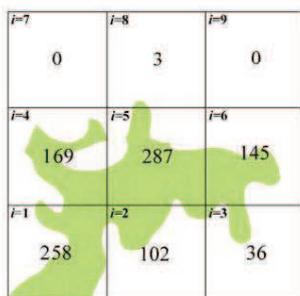
Main Results

Statistics of composition distribution diversity

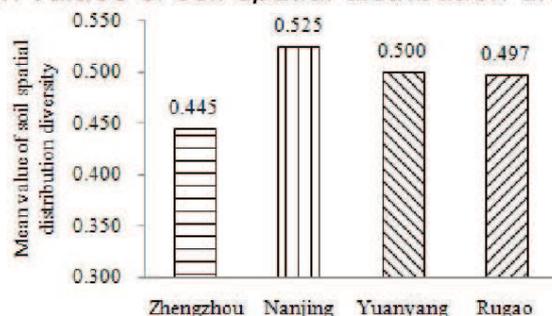| Case area	Soil taxa number	Soil constituent diversity	Land use constituent diversity ①	②	③
Zhengzhou	51	0.779	0.335	0.355	0.405
Nanjing	32	0.738	0.366	0.483	0.545
Yuanyang	14	0.732	0.312	0.277	0.329
Rugao	7	0.582	0.293	0.184	0.180

Data and method

Landsat TM images at different times(1986-1988), (2000-2001) and (2004-2006) are used for overlaying the digital soil vector data taken from the second national soil survey of the selected different scaled case areas as the basic data to conduct the lan use dynamic change and diversity spatial pattern analysis using PC software ArcGIS9.3 and ENVI 4.5.

$$Y_h = \frac{-\sum_{i=1}^{S} p_i \ln p_i}{\ln S}$$

i=7	i=8	i=9
0	3	0
i=4	i=5	i=6
169	287	145
i=1	i=2	i=3
258	102	36

Simulation example of spatial distribution of soil X

Mean values of soil spatial distribution diversity

Using EBONE methodology to map and monitor change in Israel's nature reserves

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INTRODUCTION:

The INPA is the main agency in Israel responsible for nature conservation. By law we must collect all information necessary for conservation
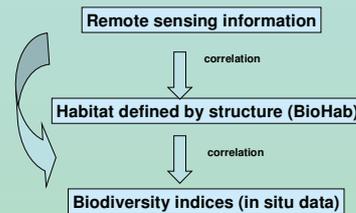
INPA is responsible for 440 nature reserves and 120 national parks. We must know the distribution and abundance of plant and animal species of conservation interest and habitats with conservation value. We do not have the resources cannot map and monitor all species and habitats of interest by ordinary survey. Hence these tasks remain incomplete.

The EBONE approach

EBONE has offered us an approach to enable us to do the necessary mapping and monitoring, using correlation with proxy parameters.

Remote sensing information
correlation
Habitat defined by structure (BioHab)
correlation
Biodiversity indices (in situ data)

MOUNT CARMEL: Classic mediterranean habitat types: forest, maquis, garigue, batha, and agricultural land. Conservation problem: mapping and monitoring habitats over large area <u>EBONE application</u>: habitat classification and monitoring via RS (planned for 2013)

LOCATIONS FOR TEST CASES: We have selected five protected areas in Israel under our management, where we can attempt an implmentation of EBONE mapping and monitoring ideas.These areas serve as pilot studies for improved monitoring for conservation management.

BEERI NATURE RESERVE: an Irano-Turanian Steppe in the Northern Negev. <u>Conservation problem</u>: bunchgrass *Hyparrhenia hirta* expanding and becoming a pest species. <u>EBONE application</u>: mapping and classification of habitats, monitoring changes due to bunchgrass (planned for 2012)

ENOT ZUKIM NATURE RESERVE: A freshwater oasis on the Dead Sea. <u>Conservation problems</u>: invasive *Phragmites australis*, expanding *Tamarisk spp.* driven by fire and water quality/quantity decline. <u>EBONE application</u>: RS monitoring of changing habitats.

ADULLAM NATURE RESERVE: A Mediterranean/desert transition zone maquis. <u>Conservation problem</u>: is the maquis expanding or contracting in this reserve? <u>EBONE application</u>: use RS to map habitats and monitor change.

SAMAR DESERT SAND DUNES RESERVE in the Rift Valley. <u>Conservation problem</u> apparent dieback of Haloxylon persicum. <u>EBONEapplication</u>: remote sensing for quantification and monitoring of H. persicum density.

SUMMARY

Our goals are to co-opt the regional districts of our organization, to become "stakeholders" by a test reserve in each district. From the beginning, we connect with conservation management goals determined by the district biologists. The use of the EBONE-based methods is to help achieve these management goals.

EBONE methods used inside the protected areas are mainly used for
1. Mapping habitats and target species
2. Monitoring changes in habitat areas and types
3. Monitoring changes in target species distributions

We hope this will provide an alternative to extensive In-situ sampling and monitoring of species and habitats (which would be expensive and we probably would not do.)

METHDOLOGY

Methods derived from EBONE:
Orthophoto-based mapping
EBONE structural classification

New methodology added to EBONE for conservation:
Species and community level analysis
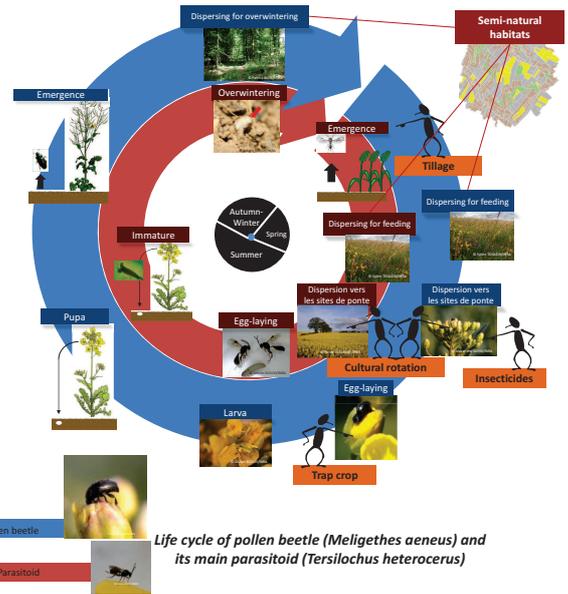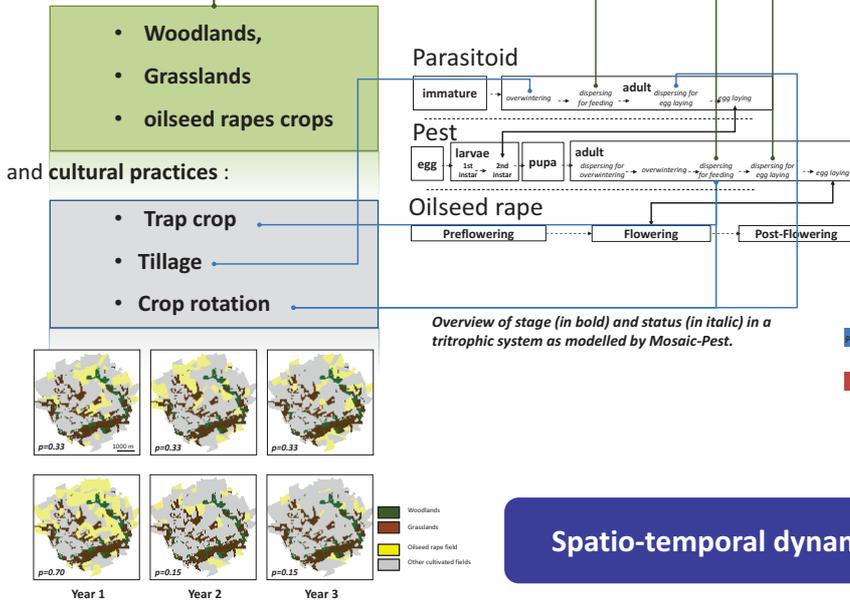Assessing fulfillment of conservation goals (Scenario modeling?)

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Linking agricultural practices and biological regulation at landscape scale using a spatially explicit model

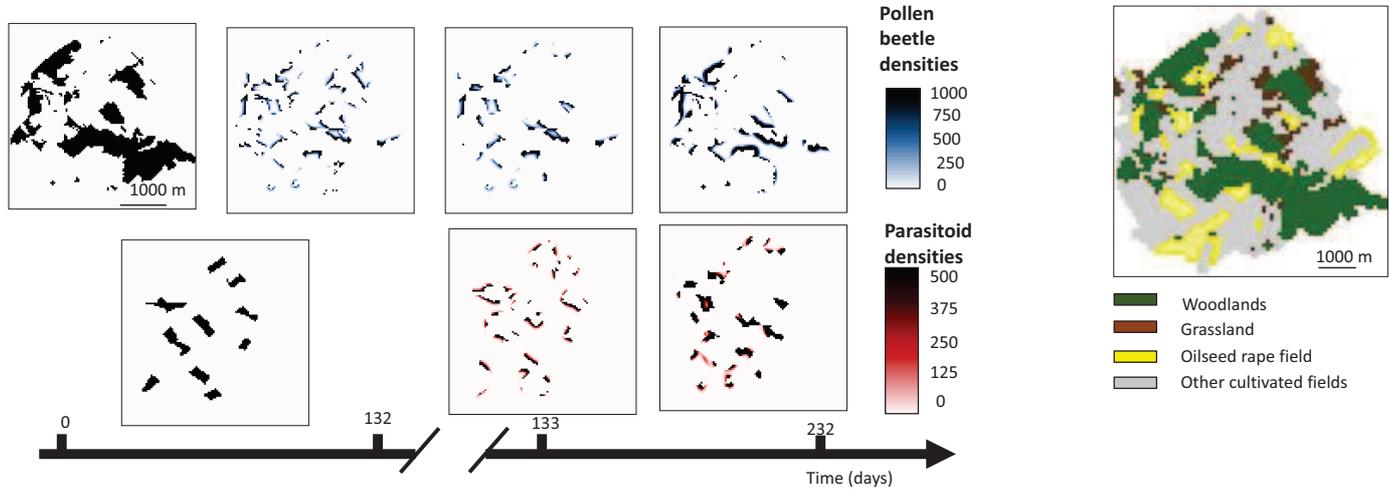**Fabrice Vinatier[1], Muriel Valantin-Morison[2], Philippe Lagacherie[1]**

1 INRA UMR Lisah, Montpellier, 34060, France, 2 INRA UMR Agronomie, Thiverval-Grignon, 78850, France, E-mail: fabrice.vinatier@supagro.inra.fr

Understanding the relations occurring at landscape scale between a pest, its host-plant and its main parasitoid is an important task that necessitates modeling tools to be achieved. We presented here a lattice model that describes the spatio-temporal dynamics of a tri-trophic system in relation with **landscape structure :**

- **Woodlands,**
- **Grasslands**
- **oilseed rapes crops**

and **cultural practices :**

- **Trap crop**
- **Tillage**
- **Crop rotation**

Overview of stage (in bold) and status (in italic) in a tritrophic system as modelled by Mosaic-Pest.

Life cycle of pollen beetle (Meligethes aeneus) and its main parasitoid (Tersilochus heterocerus)

Examples of different crop rotation on a three-year period

Spatio-temporal dynamics depend on landscape composition

Visualisation of the spatial dynamics of the host-parasitoid system issued from a one year simulation with the Mosaic-Pest model

Combined effects of landscape and biological regulation

	df	P-value	SI (%)
Densities of pollen beetles (Poisson model)			
Main effects			
Crop allocation	1	<0.001	0.0
Crop rotation	1	<0.001	0.9
Biological regulation	1	<0.001	15.0
Trap crop	1	<0.001	30.6
Ploughing	1	<0.001	0.01
Map pattern	34	<0.001	47.5
Interaction effects			
Crop allocation × Crop rotation	1	<0.001	0.05
Crop allocation × Biological regulation	1	<0.001	0.06
Crop allocation × Trap crop	1	0.002	0.01
Crop allocation × Ploughing	1	0.006	0.0
Crop allocation × Map pattern	34	<0.001	0.15
Crop rotation × Biological regulation	1	<0.001	3.0
Crop rotation × Trap crop	1	0.001	0.01
Crop rotation × Ploughing	1	0.44	0.0
Crop rotation × Map pattern	34	<0.001	1.6
Biological regulation × Trap crop	1	0.001	0.5
Biological regulation × Ploughing	1	<0.001	0.0
Biological regulation × Map pattern	34	<0.001	2.0
Trap crop × Ploughing	1	0.1	0.01
Trap crop × Map pattern	34	<0.001	0.55
Ploughing × Map pattern	34	0.99	0.0
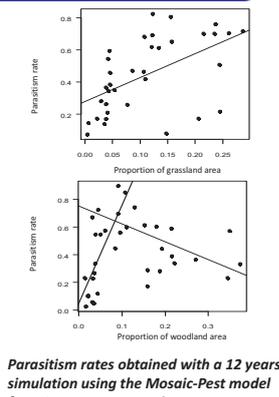
Results of ANOVA analyses testing for the effects of cultural practices, landscape configuration (map pattern), and biological regulation by a parasitoid on the density of pollen beetles per m²

Parasitism rates obtained with a 12 years simulation using the Mosaic-Pest model for a 3-years crop rotation.

The model demonstrates the importance of landscape composition as well as cultural practices to influence population levels of pollen beetles. It bridges the gap between plot and landscape scales.

The model, very generic, could be applied to various case studies as a virtual laboratory to test effects of landscape composition and cultural practices on a pest, its host-plant and its predators in temperate areas.

Tauw

Simulating commuting waterbirds:
flight paths of birds confronted with landscape objects

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The model Simflux confronts a network of flight paths of relevant bird species with network(s) of infrastructure and landscape elements, e.g. wind turbines, power lines and railways. Here, focus is on Natura 2000-sites (SPAs) and their species (swans, geese, ducks and shorebirds).

Problem: it is difficult to elucidate the complex pattern of foraging and resting sites in the landscape. Yet it is important to understand the effects on nature of a particular landscape element for each SPA separately within this complex network. Complexity results from e.g. the many flight paths between SPA (resting site) and foraging sites outside SPAs by the many relevant bird species.

Model:
Key assumptions:
• Refuging as leading principle for relevant bird species
• Maximal energy expenditure per individual shapes length of network flight paths
• Foraging sites based on species-specific maximum foraging distance (text box 1)
Methods:
• Formulated goals for resting sites (SPAs)
• Count data for foraging sites (expressed in bird days)

Box 1: Examples of maximal foraging distances (km) for selected bird species within and outside breeding season based on a literature review (sources available at request)

Bird species	Within breeding season	Outside breeding season
Bewick's Swan *Cygnus bewickii*	no Natura 2000-goal	12
Greater White-fronted Goose *Anser albifrons*	no Natura 2000-goal	30
Eurasian Wigeon *Anas penelope*	no Natura 2000-goal	1
Purple Heron *Ardea purpurea*	20	no Natura 2000-goal
Eurasian Spoonbill *Platalea leucorodia*	40	15
Great Cormorant *Phalacrocorax carbo*	70	20
Marsh Harrier *Circus aeruginosus*	5	no Natura 2000-goal
Eurasian Curlew *Numenius arquata*	no Natura 2000-goal	15
Lesser Black-backed Gull *Larus fuscus*	30	no Natura 2000-goal
Common Tern *Sterna hirundo*	12	no Natura 2000-goal

Results:
Left: High-risk and low-risk sites for wind turbines
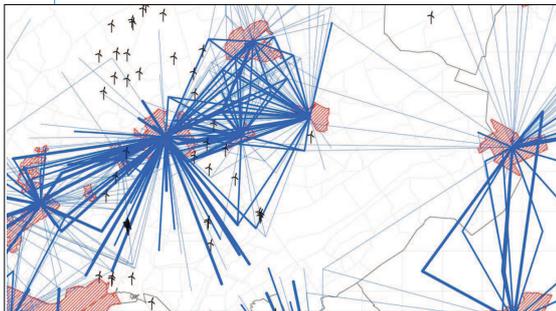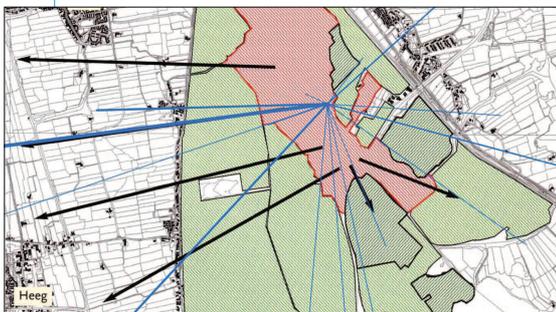
**Right:** Barnacle Geese *Branta leucopsis*

Validation for Pink-footed Goose *Anser brachyrynchus*
Left: Modelled flight paths (blue) compared with observed flight paths (black) for one Dutch SPA (red shaded; background from Kleefstra, Levende Natuur 111: 136-140, 2010)

Right: Modelled flight paths (blue) compared with network of SPAs (dark green) and designated goose foraging sites (brown)
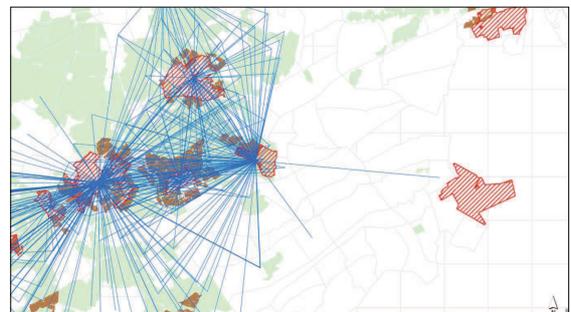
Integrated landscape planning using ecosystem services and converging interests

Jan Van Uyvanck, Ilse Simoens & Geert De Blust (Research Institute for Nature and Forest, Brussels)

Introduction

Landscape planning in areas that are dominated by an intensive agricultural use often fails because of conflicting interests. Most often, economical aspects and free market processes are opposed to landscape aesthetics, biodiversity conservation, recreation, residential comfort and social cohesion.

Methods and results

In the intensively used area of Haspengouw (Figure 1) in the centre of Belgium), we used the concept of ecosystem services to carry and guide the process of landscape planning.

Figure 1 : the intensively used landscape of Haspengouw with arable land and low strain orchards

Stakeholder interviews revealed the area's specific ecosystem services and their meanings to residents, tourists, farmers, conservation and water managers. The stakeholders' interests ranged from the conservation of specific species (e.g. Corn bunting *Emberiza calandra*) to the explicit need of high agricultural production of cereals and fruits (Table 1).

Figure 2 : Yellowhammer, a declining regional species with a stronghold in the study area

Table 1 : Ecosystem service table (adapted from the TEEB study "The Economics of Ecosystems and Biodiversity, 2010) as a base for interviews and appreciation.

Provisioning services	Regulating services	Cultural services
Vegetable food	Influence on water quality	Aesthetic values
Animal food	Influence on air quality	Berries, wild plants and mushrooms for consumption
Regional products	Climate regulation	Hunting game
Construction timber	Water flow regulation	Facilities for children
Biofuel crops	Erosion prevention	Educational functions
	Fertile soils	Soft recreation (hiking, cycling)
	Disease and pest control	Motorised recreation
	Conservation of typical or regional species (Figure 2)	Sports recreation horse riding, mountainbiking)
		Therapeutic effects
		Identity building
		Silence
		Favor social relations
		Living quality
		Spiritual values

Stakeholder interviews revealed the area's specific ecosystem services and their meanings to residents, tourists, farmers, conservation and water managers.

Identifying the important themes and connected ecosystem services

theme 1 : Landscape & Nature
theme 2 : Sustainable Agriculture
theme 3 : Healthy Environment
theme 4 : Social Cohesion & Landscape

Explicitation of the meaning of these ecosystem services and their translation to required landscape qualities and spatial structures

Structure sketch

Nature & Landscape Inventarisation

Existing spatial visions (national, regional, municipal)

Integration and spatial translation to different ambition levels

Spatial Scenarios or Alternative Visions

Landscape Vision

Feedback from stakeholders and choice of scenario

Choice of actions and measures

Landscape Plan

Figure 3 : From stakeholder interview tot landscape plan

Interviews with stakeholders

Relevant ecosystem services and their appreciation; recommendations from stakeholders.

In contrast to classic bottleneck analysis, we searched for converging interests by translating ecosystem services into desired landscape characteristics and structures. Depending on the ambition level, we draw maps in which less or more interests were integrated (Figure 3) ,The focus was on the conservation of farmland bird, flowering road verges, hollow roads and erosion control and reduction of pesticides on the one hand and erosion control and conservation of high agricultural production on the other hand. These maps were used to describe landscape scenarios.

We worked out three scenarios: (1) the "beautiful landscape", integrating living, recreation and management of linear landscape elements; (2) the "living agricultural landscape (see Figure 5) and an ambitious (3) "Landscape in harmony", in which all important ecosystem services were integrated.

Figure 4 : Permanent grasstrips combined with food crops for farmland birds integrates erosion control and bird conservation,
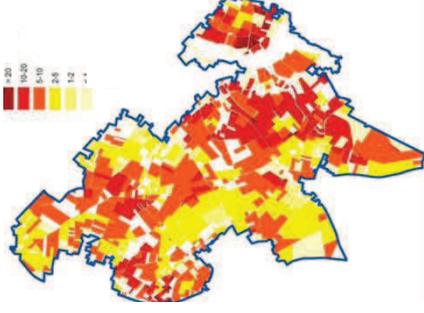
Figure 5b : Breeding farmlandbird territoria

Figure 5a : Actual erosion in the study area (ton/ha/year)

Figure 5d : Structure sketch "Nature and landscape" with focus on linear landscape elements and farmland birds
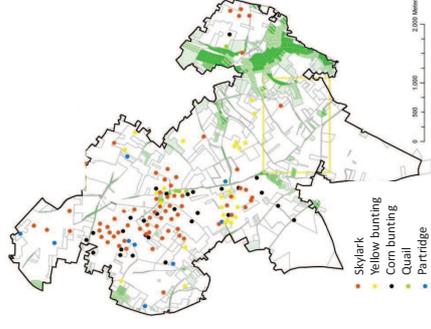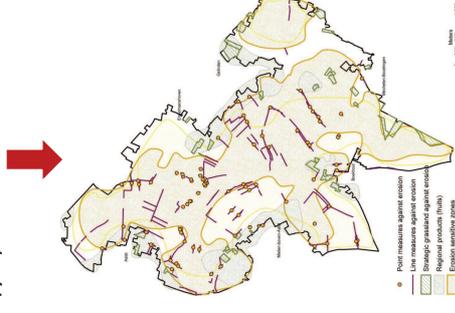
Figure 5c : Structure sketch "Sustainable agriculture " with focus on erosion control and conservation of the agricultural area
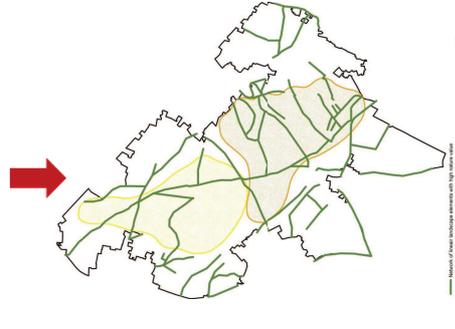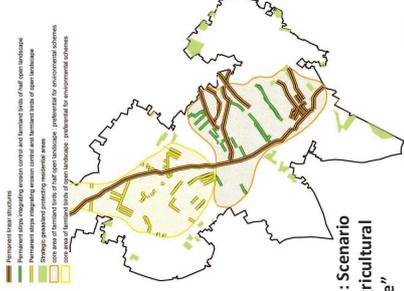
Figure 5e : Scenario "Living agricultural Landscape"

Conclusions

We found that erosion control is an excellent occasion for farmland bird conservation in both open and half open landscapes using different kinds of grassland buffers and woody landscape structures respectively. Buffering hollow roads contributes to erosion, pest control, conservation of species rich grassland communities and landscape experience by tourists and residents.

The ecosystem service approach with different scenarios is a useful tool for integrated landscape planning is rural areas

The use of 1 km square botanical records in the description and evaluation of an urban landscape

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[2]Landcare Associates, 28 Harborne Rd Birmingham B15 3AA   [3]EcoRecord Biological Record Centre, 28 Harborne Rd Birmingham B15 3AA

The Wildlife Trust for Birmingham and the Black Country

Poot near Sneyd Junction, Blexwich

Ranunculus sardous West Park, Wolverhampton

Polystichum setiferum Anson Branch Canal, Walsall

Carex pseudocyperus Park Lime Pits, Rushal Canal, Walsall

1. Introduction

A systematic 15 year survey of the 715 one kilometre squares which make up the Birmingham, Dudley, Sandwell, Walsall and Wolverhampton conurbation (fig. 1) took place between 1995 and 2011 in preparation for a forthcoming flora of Birmingham and the Black Country (B&BC). The data generated consists of 235,834 spontaneous occurrences of 1,434 mappable vascular plant taxa.
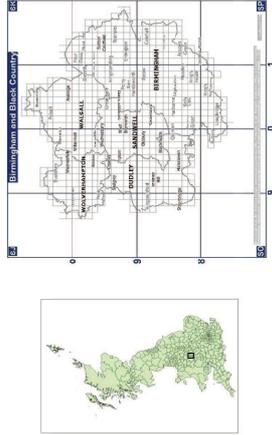
Figure 1: Location of the study area

2. Characterisation of the data set

Urban floras are sometimes dismissed as being dominated by ephemeral populations of garden escapes and other "alien" species. In Table 1 these data are compared with those for the whole of Britain and Ireland in the national atlas (Preston *et al.* 2002).

Table 1 shows that there is a relatively high number of archaeophytes (plants which became naturalised before 1500) in B&BC, which was expected, since they are typically associated with human activity, but the data do not suggest that the conurbation has a substantially greater proportion of neophyte species (plants naturalised since 1500) compared with native species than Britain and Ireland as a whole. This is an interesting result when considering that many, or most, neophytes are likely to have naturalised from use, cultivation or as contaminants of goods, humans and vehicles in urban areas.

Table 1: Comparison of species numbers and origins with the British and Irish flora as a whole

	Native taxa	Archaeophytes	Neophytes	Casuals	Unclassified	Total
Britain and Ireland	1571 (46.8%)	158 (4.7%)	1305 (38.9%)	252 (7.5%)	68 (2.0%)	3354
B&BC	687 (47.9%)	105 (7.3%)	547 (38.1%)	62 (4.3%)	33 (2.3%)	1434
B&BC as a proportion Of Britain and Ireland	(43.7%)	(66.4%)	(41.9%)	(24.6%)	(48.5%)	(42.8%)

3. Distribution of monad records in B&BC

The monad distribution of the 1995-2011 database of vascular plant records in B&BC is shown in Fig. 2. The figure shows considerable variation in overall numbers from monad to monad. The low minimum accepted for the analysis (100 common species per monad) may mean that certain monads were not as thoroughly surveyed as others, and some of the highest scoring monads are in nature reserves (Saltwells, Woodgate Valley, Sandwell Valley, Barrow Hill) where the flora is very well known.
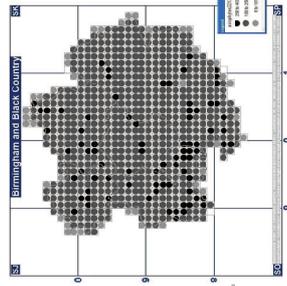

250 to 400 (80)
100 to 250 (694)
0 to 101 (43)

Figure 2: Vascular plant records by monad

4. TWINSPAN analysis of the monad flora data

A multivariate analysis of the monad data was undertaken using WinTWINS 2.3 (Hill & Šmilauer 2005). The use of all the monads in which at least 25% of its area is present within the boundaries of the study area was found to be an acceptable compromise in monad comparability. This involved the analysis of 1432 species in 655 monads.

Fig 3 is a dendrogram showing the division of the 655 monads into three groups together with their TWINSPAN indicator species. The first division cuts off a relatively small group of 129 monads to form Group 1. The seven indicator species for the division are all associated with Group 1. All are native species both in B&BC and in UK. All save one suggest wetland, and two of those, *Lemna minor* and *Sparganium erectum*, are extremely common species of "almost any relatively permanent nutrient-rich waters. *Juncus inflexus*, *Mentha aquatica*, *Angelica sylvestris* and *Rumex conglomeratus* suggest the presence of modestly base-rich, nutrient-intermediate, fairly long-established wetland and *Cynosurus cristatus* suggests relatively long-established grassland.
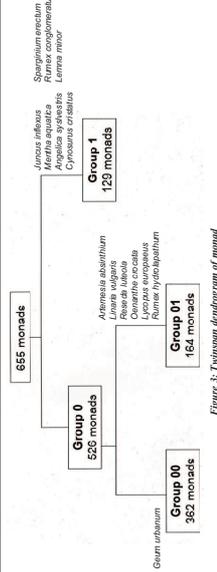

Figure 3: Twinspan dendrogram of monad groupings

The division appears to represent trends towards the presence of a variety of water-rich habitats and also towards the presence more generally of longer-established, semi-natural habitats in Group 1 monads, with the implication that open water and wetland and most other semi-natural habitats are relatively scarce in Group 0 monads.

The next division of Group 0 cuts off another relatively small group to form Group 01. The indicators for this group are *Artemisia absinthium*, *Linaria vulgaris*, and *Reseda luteola*, perennial species associated with post-industrial sites in B&BC, or at least areas with less industrial and canal habitats than Group 01 monads, with fewer wetland sites and other old habitats than Group 1 and with more evidence of gardens, allotments and other recently-disturbed areas in B&BC. Group 00 appears to represent suburban B&BC, or at least areas with less industrial and canal habitats than Group 01 monads, with fewer wetland sites and other old habitats than Group 1 and with more evidence of gardens, allotments and other old habitats characteristic of residential areas. The prevalence of woodland species (including some such as *Allium ursinum* and *Mercurialis perennis* showing some affinity with ancient woodlands) may reflect a concentration of some pre-industrial habitats in areas only relatively recently taken for residential purposes. It also suggests that long-established habitats are not entirely confined to Group 1 monads.

The only indicator for the largest Group 00 is *Geum urbanum*, which although essentially a woodland species, is now widely distributed in gardens, allotments and other recently-disturbed areas in B&BC. Group 00 appears to represent suburban B&BC, or at least areas with less industrial and canal habitats than Group 01 monads, with fewer wetland sites and other old habitats than Group 1 and with more evidence of gardens and other habitats characteristic of residential areas.

In summary the botanical records have allowed the division of the monads into three groups according to their predominant land uses. In only 25% of monads (Group 01) is industry shown to be the predominant feature of the flora; hence this might be described as the "industrial" group. In 20% of monads (Group 1) the predominant feature is the natural environment. Group 1 can be described as the "rich semi-natural" group, although the focus on open water and wetland species suggests that there might be other non-wetland natural habitats beyond Group 1. The floras of the remaining 55% of monads forming Group 00 are by definition not predominantly industrial nor predominantly rich semi-natural, and the principal feature seems to be the presence of residential property although some agricultural areas in the periphery of the conurbation are included. Group 00 could be described as the "suburban" group.

The distribution of the three TWINSPAN groups of monads across B&BC is shown in Fig. 4 and forms an interesting description of the conurbation. Not unexpectedly the Group 00 "suburban" monads tend to be in the periphery and the Group 01 "industrial" monads form a central core. The distribution of the Group 1 "rich semi-natural" monads is quite complex, but the group is clearly much more widespread in the Black Country than in Birmingham and much more closely integrated with the industrial core in the Black Country.
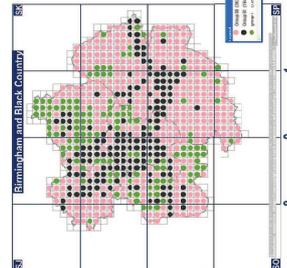

Group 00 (362)
Group 01 (164)
Group 1 (29)

Figure 4: Distribution of the TWINSPAN monad groupings

5. Axiophyte analysis

The BSBI axiophyte project (http://www.bsbi.org.uk/axiophytes.html) defines axiophytes as "the 40% or so of species that arouse interest and praise from botanists when they are seen…..they are indicators of habitat that is considered important for conservation, such as ancient woodlands, clear water and species-rich meadows." Lists of axiophytes provide a powerful technique for determining conservation priorities. Sites with many axiophytes are usually of greater conservation importance than those with fewer. We have explored whether it is possible to characterise monads by the number of axiophytes they contain. A list of 249 species considered important for nature conservation in Birmingham and the Black Country has been drawn up by the authors. Their distribution in Birmingham and Black Country is shown in a coincidence map forming Fig. 5.
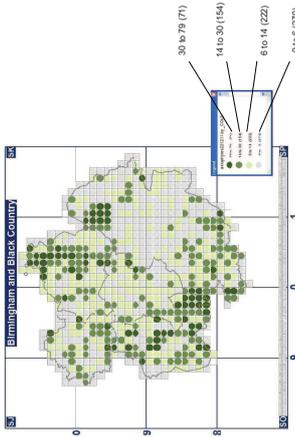

30 to 79 (71)
14 to 30 (154)
6 to 14 (222)
0 to 6 (270)

Figure 5: Coincidence of all axiophytes in B&BC

Figure 5 shows three main foci of axiophyte concentration. The two associated with Sutton Park in North Birmingham, and Halesowen in south-east Dudley represent the survival of pre-industrial landscapes in the conurbation. The third, in Walsall, is a more complex association of squares with pre- and post-industrial histories. There is a more diffuse, largely post-industrial network of high axiophyte diversity across west Dudley and Wolverhampton, and another, weaker one associated with the older suburbs of South Birmingham. There is a conspicuous axiophyte 'desert' reaching north-west from central Birmingham, although a partial link across the conurbation is offered by the raised axiophyte levels in the central Sandwell Country Park.

Figure 6 shows a combination of TWINSPAN and Axiophyte maps of Birmingham and the Black Country which is currently being used in the implementation of the Nature Improvement Area (NIA) status recently awarded to the conurbation through the Birmingham and Black Country Wildlife Trust. It is extremely pertinent in addressing the ideas about improving the English ecological network expressed in the Lawton report (2010) which were the foundation of the NIA initiative.
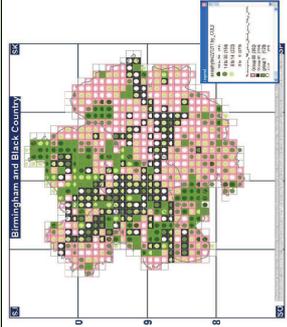

Figure 6: Combination of TWINSPAN groupings and axiophyte coincidences (i.e. merging of figures 4 and 5)

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A Forest of Contradictions
A Study of the Urban forest in Delhi, India

University of Cologne

Overview

- 6% of Delhi's geographical area is forest land, known as the Ridge. Of this, 91.73% is reserved forest and the rest has the status of Protected Forest.

- Containing a biodiversity park, a wildlife sanctuary, a butterfly conservatory as well as many historical landmarks, the Ridge forest is a unique element in a developing megacity where space is acutely contested.

- Evictions from the forest have led to creation of illegal slums around the forest area. These slum dwellers continue to access the forest as a community space and for forest produce.

- Encroachments by Malls, hotels, private bungalows and government agencies.

- As land value escalates, the forest is under ever-increasing pressure.

- The dominant discourse considers the forest value in terms of a 'natural' space and its bio-physical functions-biodiversity, air purification, climate moderation, water table.

- No analysis of the socio-economic and political aspects. Policy does not consider various uses, pressures and stakeholders.

Immense Pressure: A slum at the borders of the Bio-diversity park

Research Objectives

- Examining the largely overlooked economic and socio-political dynamics of the urban forest as an element of the city..

- Gaining an understanding of the impact of current policies on stakeholders and the environment through this lens.

- Assessing and suggesting possible governance frameworks to address problems and gaps in the current arrangement.
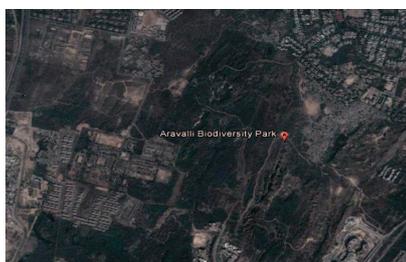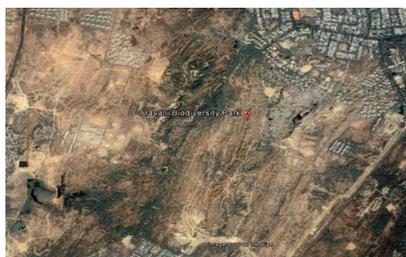
Creating natural spaces- The Aravalli Bio-diversity park in 2000 and 2012

Methodology

- Urban Political Ecology follows the main themes of Co-production of society and environment, power relations, unequal access, negotiation of interests in a given socio-political setup.

- In-depth interviews with policy makers, Forest Department, NGOs, experts, environmentalists, citizens, users of forest produce and space etc.

- Field observations

- Extensive secondary and archival research to trace the discourses and policy around the Ridge.
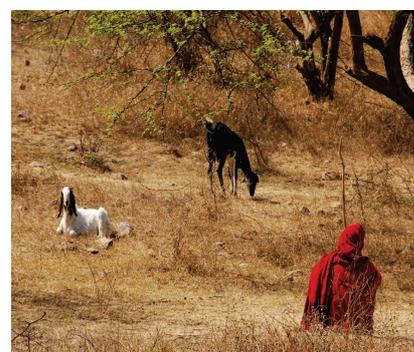
Competing for resources-Above; A protected species of deer (Nilgay), Below; Illegal grazing inside the Wildlife Sanctary

Points for discussion

- The Ridge as a geographical, legal,administrative,ecological, economic, political and cultural space; what is the nature of the interaction and development of these various aspects?

- The discourse in the policy circle is that the forest needs to be protected from the city and not forest as part of the urban dynamic. How can this discourse be broadened to include alternative ideas on the relationship between city and natural sapces?

- What uses are allowed? Who is to be shut out? How can the decissions on prioritising uses be democratised?

- Is it possible to create communaly managed commons in a large mega-city like Delhi?

This is a PhD. Study by Megha Sud (Department of Geography, University of Cologne).
The duration of the study is from October 2011 to October 2014.
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Forest Landscape Restoration: A World of Opportunity

Climate change

Forest landscape restoration has the ability to contribute to climate change adaptation and mitigation. It offers a opportunity to improve the resilience of local people and natural systems and thereby help adapt to climate change. Planting more trees can lock up more carbon, improve the environment and people's lives as well as helping to regulate the climate.

Communities

Engagement with communities through collaborative learning ensures that stakeholders are involved in making informed choices about the type and configuration of forest establishment they wish to see in their landscape. It is essential that communities are given a meaningful role in shaping and benefiting from the management of future forest resources.

Participatory planning

Informed spatial planning and delivery of the FLR approach is key to a landscape approach to habitat and resource management and to selecting land uses and habitats that are ecologically suited to sites. It can also help ensure that restoration projects are located where they can provide most benefit for people and biodiversity.

The Forest Landscape Restoration (FLR)

approach brings people together to identify and put in place a mix of land-use practices that will help restore the functions of forests across a whole landscape, such as a water catchment. It focuses on restoring forest functionality at a landscape level rather than a site level, which translates into gaining the optimal quantity and quality of forest resources necessary for improving and maintaining people's well-being and ecological intergety

The Global Partnership for Forest Landscape Restoration

is a proactive network that unites governments, organisations, communities and individuals with a common goal to restore degraded landscapes. The partnership was initiated with the purpose of catalyzing and reinforcing a network of diverse examples of restoration of forests and degraded lands that deliver benefits to local communities and biodiversity, and fulfill international commitments on forests. Forest Landscape Restoration builds on a number of existing and proven rural development, conservation and natural resource management principles and approaches

Technology: tools and practical applications

Understanding the spatial distribution and function of landscape components can help target where practical conservation can have maximum impact. The use of appropriate technology to support forest landscape restoration can aid the implementation of the landscape approach.

Landscape approach

The landscape approach aims to improve livelihoods and biodiversity by getting the right activities in the right places in order to conserve biodiversity and enhance options for people's livelihoods at the landscape level. It is based round the key principles of landscape ecology:

Ecosystem services

Forest landscape restoration can deliver societal demands for a range of ecosystem services. It shifts the emphasis away from simply maximising tree cover on individual forest sites to optimising the supply of forest benefits within the broader landscape to support the key ecosystem services provided by forests and wooded landscapes.

Biodiversity

Safeguarding biodiversity requires the implementation of policy into practice, existing conservation initiatives would benefit from the FLR approach. The success of FLR projects requires that their outcomes are measured in order that the benefits to biodiversity can be monitored.

Forest habitat networks

The vision is to combine native and planted woodlands to optimise ecological and biodiversity using landscape ecological principles. It is expected that the development of habitat networks will not only benefit biodiversity but also deliver a range of other environmental and social benefits

Global forest restoration potential
- Broad-scale restoration
- Mosaic restoration
- Rain-fed croplands
- Irrigated croplands
- Tropical deforestation 2000-2005

THE GLOBAL PARTNERSHIP ON FOREST LANDSCAPE RESTORATION

Ideas transform Landscape

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Forest Research

How do landscape functions and services differ in different landscape types? Examples from the Czech Republic

CASE STUDIES

Alluvial forested LT (1,036.10 ha) – in wide river valleys (150-300 m above sea level, a.s.l.) with quaternary sediments (loess, sand, and gravel), fluvisols, and a warm to mild climate. Floodplain forests with ash, oak, or elm, as well as wet meadows. Protected areas cover 50 % of the LT.

Hilly agricultural LT (867.86 ha) – in the hilly regions with lower elevations (180-300 m a.s.l.) with calcareous clays and sands, chernozems, and a warm and dry climate. The prevalent land use vineyards or arable land, with dry grasslands and oak or oak-hornbeam woodlands in the protected areas. Protected areas cover 19 % of the LT.

Upland meadow forested LT (1,662.58 ha) – in the uplands with higher elevations (300-780 m a.s.l.) with flysh formations, cambisols, and a mild climate. Oak-hornbeam or beech forests, with mesophile meadows. Protected areas cover 38 % of the LT.

LANDSCAPE TYPES
HILLY AGRICULTURAL
ALLUVIAL FORESTED
UPLAND MEADOW FORESTED
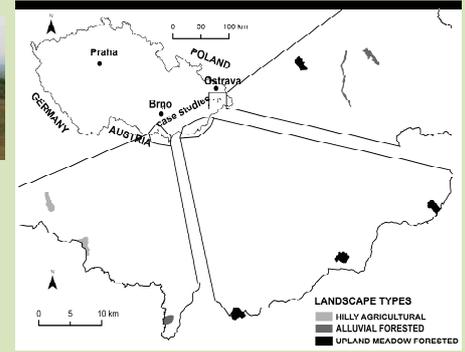
METHODS

- Input data: ortophotos from 2009 with resolution 1 m , biotope mapping layer
- 83 types of land cover classes distinguished, veryfied in the field
- Six functional groups: connecting corridors, dissecting corridors, valuable matrix, disturbed matrix, artificial matrix, stepping stones
- Calculation of landscape functionality based on landscape metrices, five functional categories according to the mean's quintile values: very low, low, medium, high, very high
- 19 landscape functions and services grouped into regulation, habitat, provision, information and carrier functions and services
- Relationship between land cover types and landscape functions and services assessed as types' capacities to provide given landscape function and service; categorized 0-5 (0 – no relevant link between type and function, 5 – very high relevant link)

RESEARCH QUESTIONS

- WHAT ARE THE DIFFERENCES IN LANDSCAPE FUNCTIONALITY AMONG LANDSCAPE TYPES?
- WHICH LANDSCAPE FUNCTIONS AND SERVICES ARE PROVIDED BY DIFFERENT LANDSCAPE TYPES? HOW DO THEY DIFFER FROM EACH OTHER?

## RESULTS

HILLY AGRICULTURAL LT
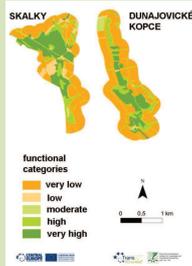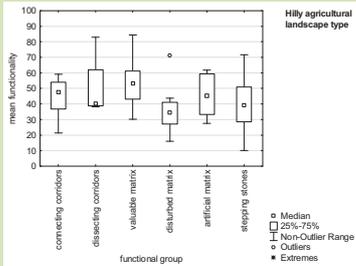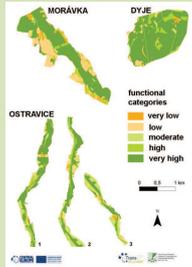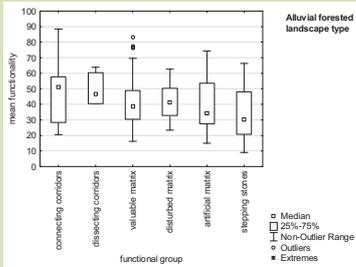

Landscape functionality

- High functionality: valuable matrix (permanent grassland, shrubs)
- Low functionality: disturbed matrix (arable land, vineyards), stepping stones (permanent grassland, small orchards)
- Very small functionality land cover types cover more than 50% of the area

Landscape functions and services

- Higher values for soil formation, soil retention as well as water regulation and nutrient regulation from *regulation* services, refugium from *habitat* services and cultivation from *carrier* services.
- Reflect both rather intensively used rural areas and more valuable landscape elements which were surrounded by these areas.
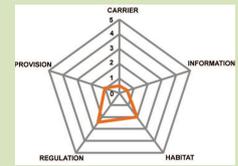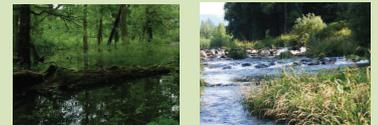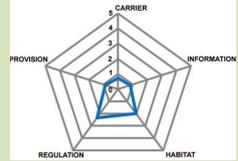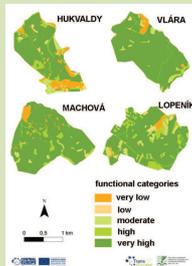

ALLUVIAL FORESTED LT

- The lowest landscape functionality
- High functionality: valuable matrix (forests, meadows), connecting corridors (water courses, linear tree vegetation), dissecting corridors (roads)
- Low functionality: stepping stones (groups of trees, ponds, ruderal vegetation), artifical matrix (settlements)
- High functionality landcover types cover more than 50% of the area, substantial area belongs to moderate class

- The highest values of *carrier* services caused by concentration of interconnected settlements in the river valleys - typical especially for the case studies Ostravice and Morávka.
- Higher *regulation* and *habitat* services provided by remaining floodplain forests together with wet grassland, especially in the Dyje case study
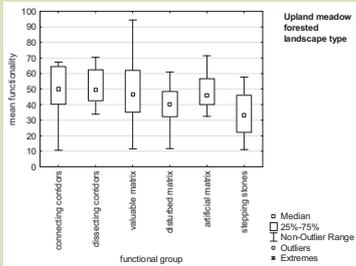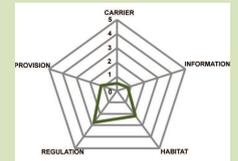

UPLAND MEADOW FORESTED LT

- The highest landscape functionality
- High functionality: valuable matrix (forests, meadows), connecting corridors (water courses, linear tree vegetation), dissecting corridors (roads)
- Low functionality: stepping stones (groups of trees, ponds, ruderal vegetation), disturbed matrix (cultural meadows, arable land)
- High functionality land cover types cover more than 50% of the area

- Highest values for *regulation* (local climate regulation, disturbance prevention, soil formation, soil retention, nutrient regulation), *habitat* (nursery) and *provision* services (raw materials, food)
- caused by predominant oak-hornbeam and beech forests and herb-rich meadows with higher capacities of these services

SUMMARY

- Landscape functionality values reflect the character of the landscape types:
  - Higher functionality mainly in the upland meadow forested landscape type with predominant valuable matrix.
  - Lower mean functionality in alluvial forested landscape type reflects lower values for valuable matrix, stepping stones and artificial matrix.
  - Lower mean functionality in hilly agricultural landscape caused by predominant disturbed matrix.
- Regulation and habitat services dominate in all landscape types.
- Despite different character of landscape types, the spider-web values do not significantly differ from each other.

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The production renewable energy in Switzerland: a spatial analysis of potential conflicts with other landscape services

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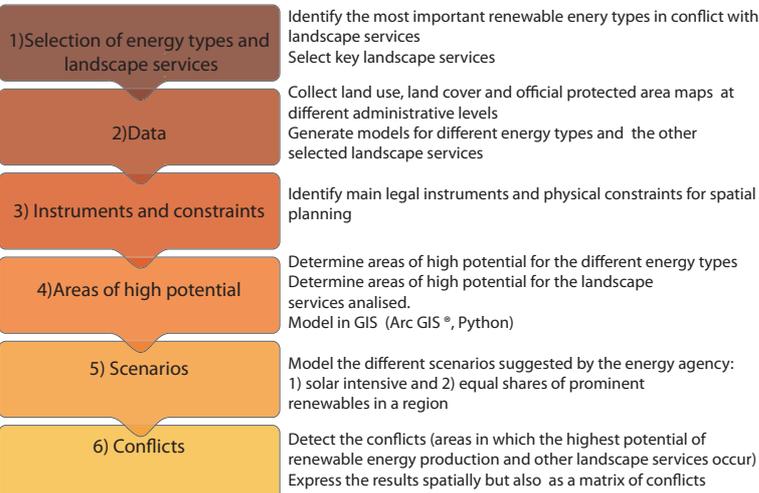
Introduction

Renewable energy production (wind power, hydropower, solar power and biomass) is a landscape service with growing importance and high political relevance.

In March 2008, the Swiss Federal Office of Energy defined a goal of increasing the production of electricity from renewable sources to 5400 GWh by 2030 (SFOE, 2009). However, for this small country, the space is limited and renewable energy production competes with other land uses.

The expansion of energy production will have a strong impact on competing landscape services such as agricultural production, recreation, tourism, biodiversity conservation and aesthetics.

Method

Step	Description
1) Selection of energy types and landscape services	Identify the most important renewable enery types in conflict with landscape services. Select key landscape services
2) Data	Collect land use, land cover and official protected area maps at different administrative levels. Generate models for different energy types and the other selected landscape services
3) Instruments and constraints	Identify main legal instruments and physical constraints for spatial planning
4) Areas of high potential	Determine areas of high potential for the different energy types. Determine areas of high potential for the landscape services analised. Model in GIS (Arc GIS ®, Python)
5) Scenarios	Model the different scenarios suggested by the energy agency: 1) solar intensive and 2) equal shares of prominent renewables in a region
6) Conflicts	Detect the conflicts (areas in which the highest potential of renewable energy production and other landscape services occur). Express the results spatially but also as a matrix of conflicts

Results: Identification of conflcits

Landscape service / Renewable energy	Aesthetics	Tourism/ Nearby Recreation	Cultural Earth	Food production	Fresh water	Soil quality
Wind	👁 🏠	👁 🏠 🌱	👁 🏠			🏠
Solar (roofs, PV field installation, avalanche protection)	👁 🚫 🏠	👁 🚫 🏠	👁 🏠	🌱		🌱
Biomass (Biogas)	👁					
Biomass (wood)	🌱 🏠	🌱 🏠	🌱 🏠			🌱
Hydropowerplant (large and small)	🏠				👁 🏠 🌱	

Noise pollution — Visual blight — Nature conservation — Preservation of the past — Changes to the neighbourhood

Aims

This study has the following aims:

a) Map areas, at the national scale, to evaluate the capacity of the landscape to generate renewable energy

b) Model expected conflicts with other landscape services for different energy production scenarios

Results: Wind turbines

Indicators of potential
- Wind speed >4.5 m/s
- Ground steepness < 20°
- Soil type
- Minimal surface for the installation

Physical constraints
- Settlements
- Rivers and lakes
- Forest
- Unstable soil

No Go: Legal constrains
- National inventories of protected areas:
  - Moorlands,
  - peatbogs and transition peat bog
  - Fens
- National Park (Canton Grisons)
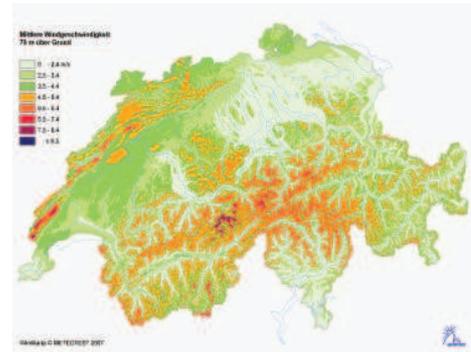- Core areas of nature discovery parks
- UNESCO World Heritage sites

Figure 1. Wind speed map for Switzerland, Source: Meteotest

Go: Expecting conflicts

Federal Inventories:
- Alluvial sites
- Amphibian spawning areas (different protection grade)
- Dry meadows
- Natural Landscape Monuments
- Swiss Heritage Sites
- Swiss Heritage roads
- Prohibited hunting areas
- Wetland
- Bird migration reserves
- Sensitive areas prohibited from hydropower use
- Forest

Cantonal and communal inventories

Conclusion and Discussion

This prototype assessment might play an important role for placing equipment for renewable energy production. This includes the location of hotspots for renewable energy as well as other landscape services at the regional and national scale. Decision makers can benefit from the conflict analysis and minimize landscape conflicts that go along with new installations.
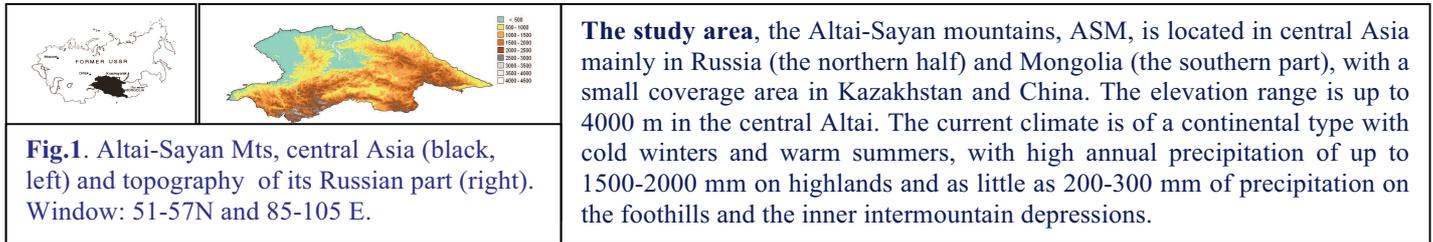
Acknowledgements

CLIMATE CHANGE AND ARIDIZATION OF FOREST TERRITORIES IN THE RUSSIAN PORTION OF THE ALTAI-SAYAN MOUNTAINS IN THE CURRENT CENTURY
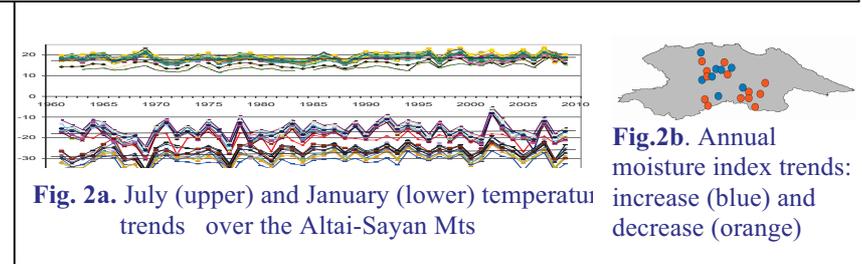
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Fig.1. Altai-Sayan Mts, central Asia (black, left) and topography of its Russian part (right). Window: 51-57N and 85-105 E.

The study area, the Altai-Sayan mountains, ASM, is located in central Asia mainly in Russia (the northern half) and Mongolia (the southern part), with a small coverage area in Kazakhstan and China. The elevation range is up to 4000 m in the central Altai. The current climate is of a continental type with cold winters and warm summers, with high annual precipitation of up to 1500-2000 mm on highlands and as little as 200-300 mm of precipitation on the foothills and the inner intermountain depressions.
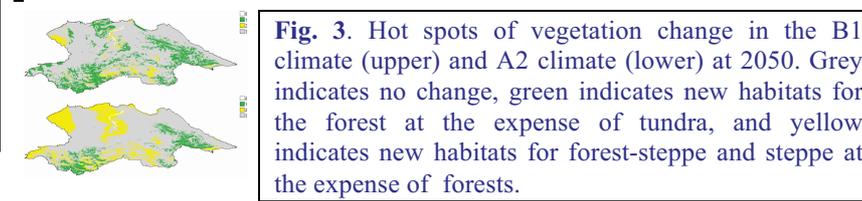
Introduction. Observations and GCMs projections suggest significant temperature increases in Siberia this century that are expected to have profound effects on Siberian vegetation. In the Altai-Sayan Mts, for half a century, from 1960 to 2010, summers have increasingly become 0.7-1.5°C warmer and winters have become 1-2°C warmer in the moist foothills, and both summers and winters have become 1.4-3.2°C and 2-4°C warmer in dry intermountain basins. Moisture increased on windward slopes and decreased in rain-shade intermountain basins (Fig.2 a,b)

Goals were to evaluate possible climate warming effects on forests and agriculture in the Altai-Sayan ecoregion,

Fig. 2a. July (upper) and January (lower) temperature trends over the Altai-Sayan Mts

Fig.2b. Annual moisture index trends: increase (blue) and decrease (orange)

Methods. To simulate vegetation we used our bioclimatic models: an envelope type model for predicting   montane biomes based on three bioclimatic indices (growing degree days, base 5°C, GDD, characterising plant requirements for warmth; negative degree days, base 0°C, characterizing plants' tolerance to cold; and an annual moisture index, AMI, characterizing plants' drought resistance) and regression type models for predicting crop yields based on growing season indices (GDD and AMI) . Climate data from more than 200 weather stations across the study area were used to map current climate. Future bioclimatic indices for the year 2050 were calculated using climatic anomalies from the climate change scenarios A2 (harsh) and B1(moderate) of the Hadley Center (IPCC, 2007).

Results. In the contemporary climate, 25% of the ASM area is covered by non-forest vegetation tundra and grasslands (forest-steppe and steppe) and 75% - by coniferous forests (taiga). In the warmed B1 and A2 climates at 2050, our simulations indicated that tundra would nearly disappear, forests would cover only half a territory and another half would be covered by forest-steppe and steppe. (Fig. 3).

Fig. 3. Hot spots of vegetation change in the B1 climate (upper) and A2 climate (lower) at 2050. Grey indicates no change, green indicates new habitats for the forest at the expense of tundra, and yellow indicates new habitats for forest-steppe and steppe at the expense of forests.
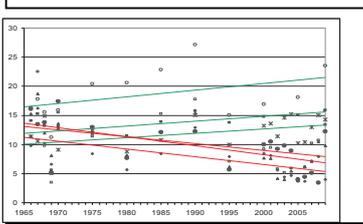
Humans have traditionally cultivated steppe and forest-steppe on suitable soils for agriculture. We analyzed potential effects of climate change on agriculture that may be introduced in new forest-steppe and steppe habitats predicted in ASM
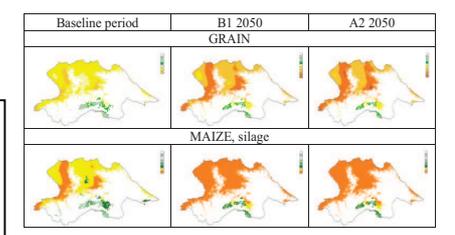

Fig. 4. Trends of grain crops, centner ha^{-1} , for 1966-2009 in the forest-steppe zone (green) and steppe zone (red). With warming, production increases under sufficient moisture in forest-steppe and reduces as the climate becomes dryer in steppe.

Table. Ag-region area (%) suitable/ not suitable by heat and by moisture

Climate	1960 -90	B1 2050	A2 2050
Cold/**not** suitable	48	19	16
Optimum suitable	**49**	**75**	**78**
Dry/ **not** sutable	2.5	5.0	5.7

Baseline period	B1 2050	A2 2050
GRAIN		
MAIZE, silage		

Fig. 5. Crop yields (centner ha^{-1}) predicted for grain and maize silage in the future B1 and A2 climate at 2050

Conclusions. Due to our predictions for the forests to shift upslope in a warmer climate and to be replaced by forest-steppe and steppe in lowlands we believe that agriculture in traditionally cold Siberia may benefit from warming. Future Siberian climatic resourses could provide the potential for a great variety of crops to grow that previously did not exist on these lands. From 50% to 75-80% of the ASM area was predicted to be   climatically suitable for agriculture but limited at higher elevations for crop advance and soil potential. Nonexistant today crops may be introduced in the warmer but dry lowlands and foothills that would necessitate irrigation. Climatic factors control crop distribution and production (R2 = 0.43-0.68). Agriculture in ASM would likely benefit under climate warming. Crop production may increase twofold. Adaptation measures would sustain and promote food security over the study and adjacent areas.

Exploring woodland biodiversity within an agricultural matrix - a landscape scale approach

Jess L. Neumann   email j.l.neumann@pgr.rdg.ac.uk

1. Introduction

Today, much of lowland England is characterized by fragments of native woodland within a much larger agricultural matrix; a result of intensive farming and landscape modification.

Demand for agriculture, urban development and industry is projected to increase, with native woodland remaining at the forefront of threatened semi-natural habitats as species continue to decline.

Spotted flycatcher – 59% decline since 1994

There is need to understand species response at the *landscape scale* at a time when land managers and organisations are actively seeking guidance on the most effective ways to preserve wildlife within farming systems, without compromising on economic productivity [1,2].

2. Methods

Species data were collected from the centre of 50 woodland sites across Hants, Wilts and Dorset.

Data type	Woodland birds	Carabids
No. of sites	29	34
Date	April – May '11	May – Aug '11
Method	10 min point counts	Pitfall trapping
Visits/ days	2 visits	28 sample days
Results	778 birds 43 species	1180 beetles 39 species

A 2 x 2 km tetrad was defined around each sample woodland from which landscape variables, soil and topographic values were calculated using a GIS.

Hedgerows
1. Low; intact
2. Low; defunct
3. Med; intact
4. Med; defunct
5. Mature; intact
6. Mature; defunct
7.Tree line

Tetrad
Sample point
Scrub
Dec. wood
Mix. wood
Con. wood

Urban
Water
Imp. grass
Arable

Structure and composition variables included:
• Sum area of each habitat type
• No. of wood patches and their configuration
• No. of water bodies
• Presence of road / rail links
• Hedgerow length, type and connectivity

Species response tested using ANOVA and GLM. Significant results determined by p value < 0.05

3. Analysis of results

1 way ANOVA indicates that soil and topographic conditions are homogenous across all sites ($p > 0.05$).

GLM: Beetle richness – R-Sq (Adj) = 85.5%
Woodland type /configuration : significant
Connected hedges : some significance
Hedge types 3 & 5 : significant as population sinks
Road/rail fragmentation : significantly detrimental
Heterogeneity beneficial including imp. grassland

GLM: Bird richness – R-Sq (Adj) = 24.3%
Heterogeneity of habitats is key [2]
Urban & imp. grass: significant - foraging opportunity
Hedges for connectivity not essential but beneficial as additional habitats
Roads and rail: non significant - flight capability

Pterostichus niger

4. Conclusions

Taxonomic groups don't respond uniformly due to varied species requirements and morphological differences e.g. mobility [2,3].

Landscapes are best viewed as functioning networks which include the matrix; not separate components.

Heterogeneity in a landscape is significantly beneficial. This has policy implications regarding the implementation and benefits of landscape-scale conservation including agri-environment schemes and woodland grants.

[1] Barbaro et al., (2007) J. Biogeog, **34**, 652-664
[2] Dauber et al., (2003), Agriculture, Ecosystems and Environment, **98**, 321-329
[3] Aviron et al., (2005), Agriculture, Ecosystems and Environment, **108**, 205-217

"On patches of ecosystems and mosaics of norms; towards a landscape ecology of regulatory and governance institutions".

Jose Muñoz-Rojas Morenes[1]; Marc Gonzalez-Puente[2]; Felipe Cortines-Garcia[3].
[1]The James Hutton Institute. [2] Universitat Autonoma de Barcelona [3] Agrinatura, Paris.
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I. Introduction; aims and objectives.

➢ Landscape ecology has, to date, showed limited interest on the spatial patterns of the sets of overlapping institutions, policies, regulations and norms that ultimately determine the dynamics of land uses and landscapes, and therefore, of ecosystem services.

➢ In order to fulfil this gap, the spatially explicit assessment of the coherence and effectiveness of existing regulatory and governance frameworks and regimes for land-use and landscape change need to be critically addressed.

➢ This shall provide with novel strategies to better cope with the potential synergies, conflicts and impacts of diverse land use options, and with the spatial and scalar miss-matches that take place within and amongst individual social and ecological sub-systems.

II. Unravelling regulatory and governance frameworks; complex, multi-level, polycentric, panarchic; the example of Scottish forestry.
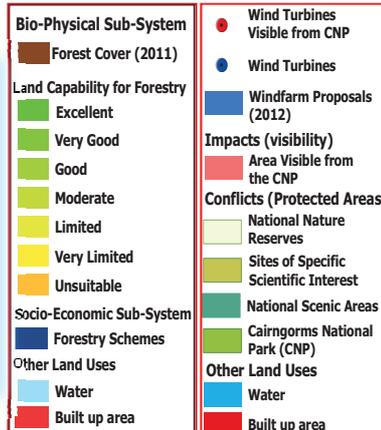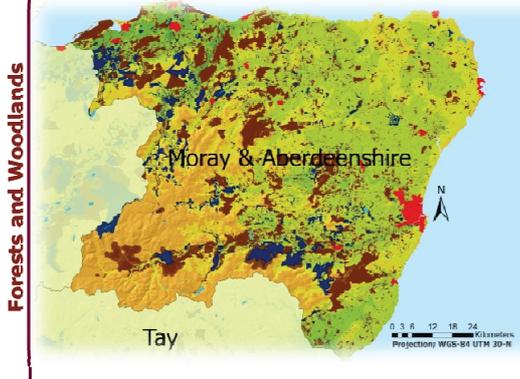

Land-use National.

Forestry National.

Strategic; guidelines, inventories & national schemes.

Implementation; local & regional schemes, plans and projects.

III. Spatial analysis; spatial and socio-ecological conflicts, impacts and miss-matches.

Forests and Woodlands

Forestry socio-ecological miss-matches in the Moray & Aberdeenshire Forest District

Bio-Physical Sub-System
Forest Cover (2011)

Land Capability for Forestry
Excellent
Very Good
Good
Moderate
Limited
Very Limited
Unsuitable

Socio-Economic Sub-System
Forestry Schemes

Other Land Uses
Water
Built up area

Wind Turbines Visible from CNP
Wind Turbines
Windfarm Proposals (2012)

Impacts (visibility)
Area Visible from the CNP

Conflicts (Protected Areas)
National Nature Reserves
Sites of Specific Scientific Interest
National Scenic Areas
Cairngorms National Park (CNP)

Other Land Uses
Water
Built up area

Spatial conflicts and impacts of wind energy in the Cairngorms National Park
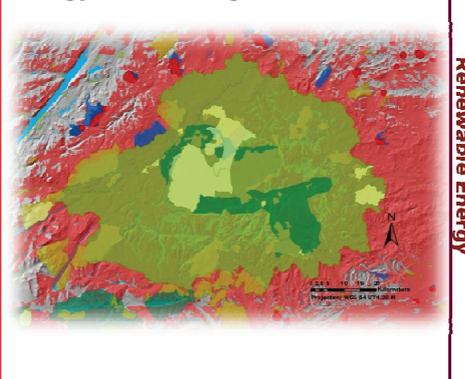
Renewable Energy

IV. Ecosystem Services; conflicts, synergies and uncertainty; renewable energies versus forestry.

Ecosystem functions	Ecosystem goods and services	Scottish planning policy 6	Renewables action plan	SNH's policy on renewable energies	Strategic locational guidance onshore winfarms (SNH)	2020 Route map for renewable energies	Scottish Forestry Strategy	Strategic Plan for the National Forest state	Forest Plans: Scottish Forestry grant Schemes	Forest Plans: Rural development Contracts
Regulation Functions										
Soil retention	Maintenance of arable land	0	0	0	0	0	0	0	0	0
	Prevention of damage by erosion/siltation	-	-	-	-	-	+	+	+	+
Soil formation	Maintenance of productivity on arable land	0	0	0	0	0	0	0	0	0
	Maintenance of natural productive soils	-	-	-	-	-	+	+	+	+
Nutrient regulation	Maintenance of healthy soils and productive ecosystems	-	-	-	-	-	+	+	+	+

V. Final reflections.

➢ Regulatory and governance frameworks and regimes that drive land-use and landscape change in Scotland are characterized by their complex, cross-scalar, cross-level interactions, and by spatial and socio-ecological miss-matches that might be clearly identified.

➢ A spatially explicit methodology was developed and tested over selected forestry and wind-energy case studies across Scotland, and potential conflicts, synergies and impacts were effectively identified and located with promising results for planners and decision makers.

➢ Finally, the translation of regulatory and planning objectives into concrete Ecosystem Functions and Services helped link the empirical spatial model with the objective of multi-functional land use that is presently advocated throughout European and Scottish rural policy.

Planning for multifunctional landscapes of Russian Black sea coast

Ksenia A. Merekalova, Anastasia P. Eremeeva, Viktor M. Matasov, Pavel M. Shilov, Ksenia A. Sokolova

Lomonosov Moscow State University, Faculty of Geography, Moscow, Russia; *E-mail: merekalova@yandex.ru*

The tasks of the study: 1) to create a broad scale landscape map of the study area; 2) to evaluate the suitability of landscape units for different land use, i.e. agriculture, forestry, constructional engineering and recreation.

Study area is located in Krasnodar region in Russia on the Black sea shore. It is low mountainous territory with deciduous forests and subtropical climate.

Sample plots 2012
Sample plots 2004 "Orlenok"
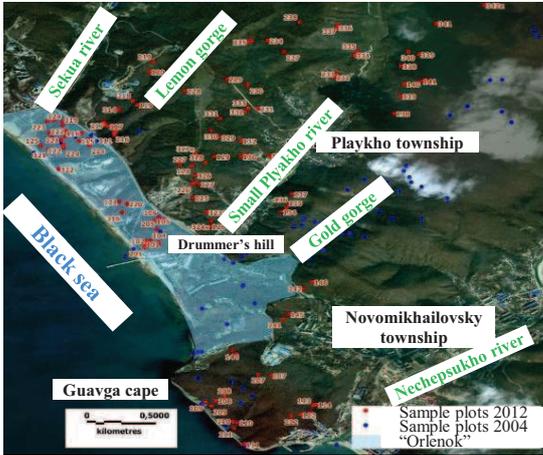
Landscape mapping based on
1) topographic map in scale 1:25000 and derived digital elevation model (DEM);
2) remote sensing data;
3) field landscape descriptions (about 200 sampling plots)

Composed landscape map envelopes the area of more than 10 km2 and includes about 80 types of landscape units.
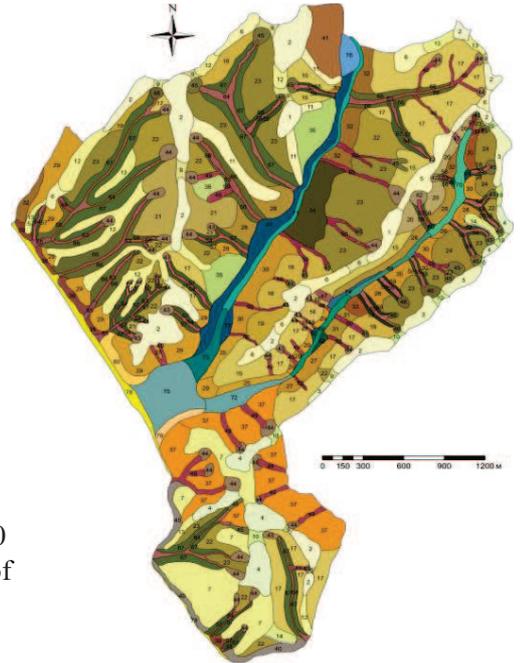
Morphometrical characteristics

DEM
SLOPE DEGREE

metres
degrees

PLAN CURVATURE
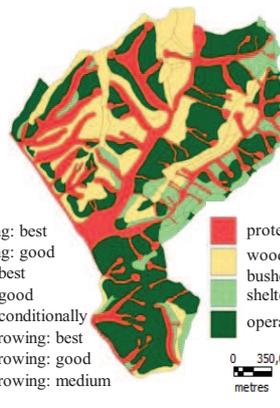PROFILE CURVATURE
SLOPE ASPECT
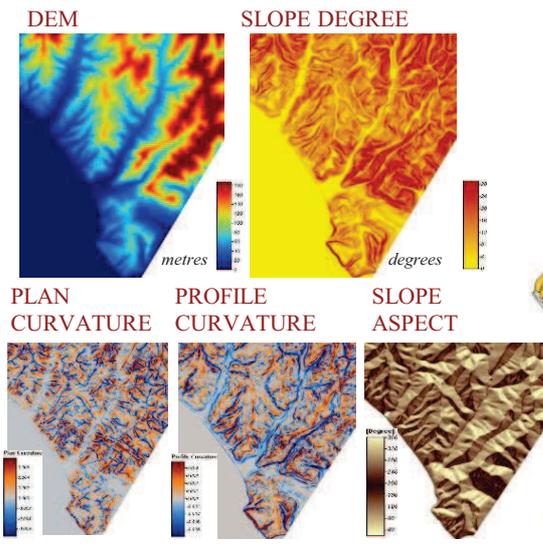
Valuation of landscape suitability for different land use

Mean values of landscape components characteristics were calculated for each landscape unit. Every landscape unit was evaluated according to strict criteria of its suitability for different types of land use.
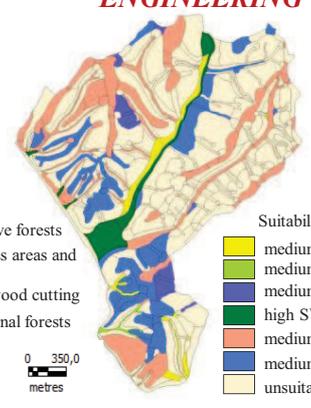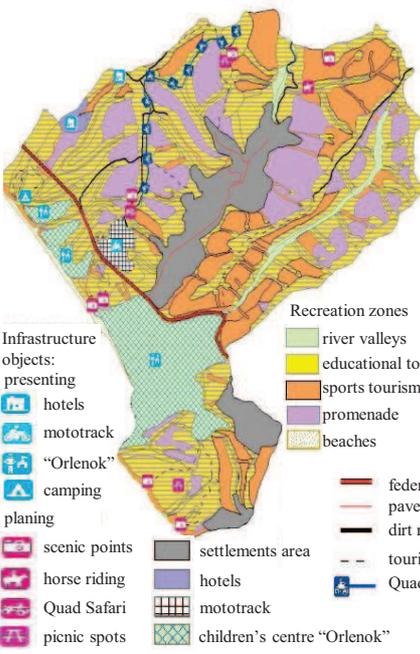
AGRICULTURE

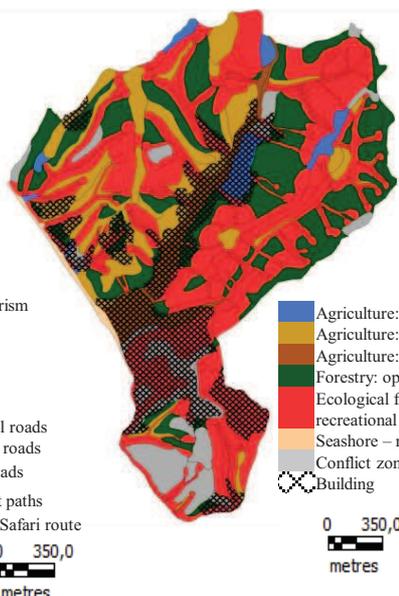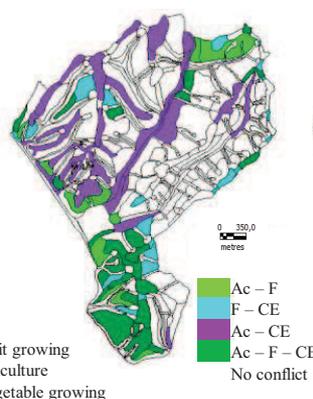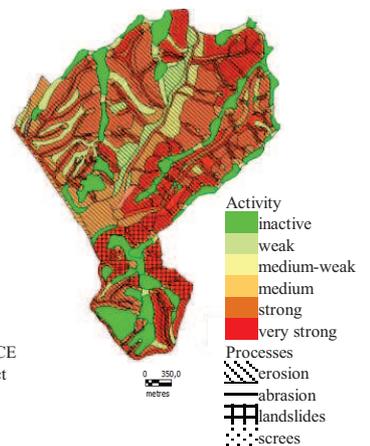fruit growing: best
fruit growing: good
viticulture: best
viticulture: good
viticulture: conditionally
vegetable growing: best
vegetable growing: good
vegetable growing: medium
walnut

FORESTRY

protective forests
woodless areas and bushes
shelterwood cutting
operational forests

CONSTRACTIONAL ENGINEERING

Suitability
medium SE
medium W
medium NE
high SW
medium SW
medium NW
unsuitable

RECREATION

Infrastructure objects: presenting
hotels
mototrack
"Orlenok"
camping

planing
scenic points
horse riding
Quad Safari
picnic spots

Recreation zones
river valleys
educational tourism
sports tourism
promenade
beaches

federal roads
paved roads
dirt roads
tourist paths
Quad Safari route

settlements area
hotels
mototrack
children's centre "Orlenok"

INTEGRAL SCHEME OF LANDSCAPE PLANNING

Agriculture: fruit growing
Agriculture: viticulture
Agriculture: vegetable growing
Forestry: operational forests
Ecological framework with recreational activity
Seashore – recreation priority
Conflict zones
Building

CONFLICT ZONES IN LAND USE

Ac – F
F – CE
Ac – CE
Ac – F – CE
No conflict

EXOGENOUS PROCESSES ACTIVITY

Activity
inactive
weak
medium-weak
medium
strong
very strong

Processes
erosion
abrasion
landslides
screes

Results

By superposition and joint analysis of the applied maps we detected "conflict zones" in land use and developed integral scheme of landscape planning of the territory.

Assessing the Impact of Land-use Change on Biodiversity and other Ecosystem Services

Andrew Mead (Biometrician, School of Life Sciences)

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Land-use Change

- Currently of great political interest
- Impacts of Climate Change
  - Different/modified crops; effects on pests, diseases, weeds; species interactions
- Focus on environmental stewardship
  - Food security v. environment; economic incentives
- Demands for renewable energy generation

Measuring Impacts

- Biodiversity – multiple definitions, spatial and temporal variation
- Ecosystem Services – De Groot (2006) definitions
  - Regulating functions – climate, water, carbon, …
  - Habitat functions – spatial conditions to maintain biodiversity
  - Provisioning functions – production of biomass (food, energy, …)
  - Cultural functions – recreation, education, …
  - Carrier functions – providing a suitable infrastructure
- Multiple criteria to consider, with spatial and temporal interactions

From land-use
To ecosystem services

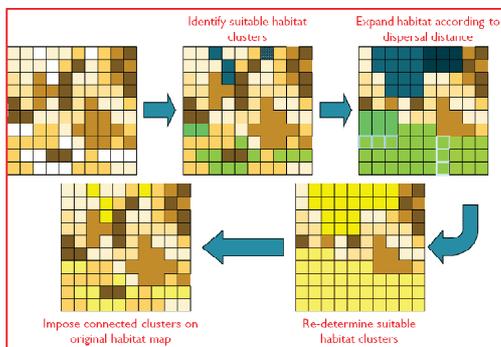From ecosystem services
To environmental footprint
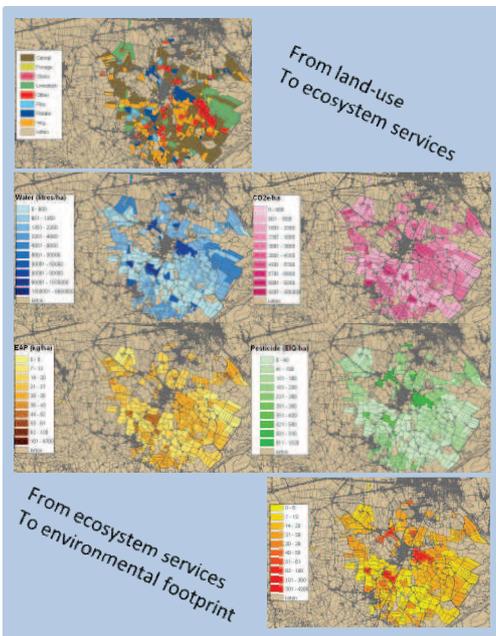
Biodiversity and Landscape Heterogeneity

- Biodiversity often "measured" in terms of densities of target species
- Usually sparse data on particular species (presence only, convenience samples)
- Generally assumed relationship between biodiversity and heterogeneity (Tews *et al*, 2004)
  - More variable landscape = more biodiversity (species richness)
- Measurement of heterogeneity based on adjacency matrix for "pixelated" map (Dramstad *et al*, 2001)
  - Counts neighbours for each land classification
  - Weighted for distance of neighbours (reciprocal of distance)
  - Weighted for similarity of habitats
  - Trace, eigenvalues, or matrix sum as indices of landscape heterogeneity
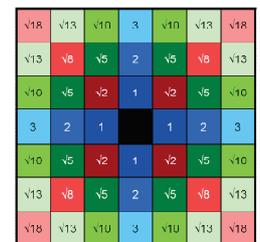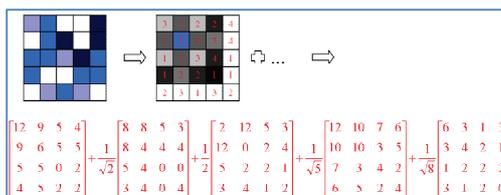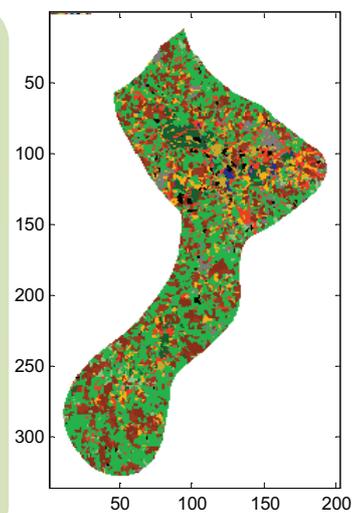
Combining Ecosystem Service Values

- Simple combination of ecosystem services as a weighted sum – subjective value depending on priorities of stakeholder
- Want to understand spatial associations and dependencies – need more than an aggregation
- Knowledge should allow "optimal" spatial planning of land-use
  - May also need to consider economics, …
- Current development of approaches for implementation of increased renewable energy generation
  - Multivariate and spatial statistics
  - Map-based output using GIS to over-lay multiple ecosystem service/land-use layers

Identify suitable habitat clusters

Expand habitat according to dispersal distance

Impose connected clusters on original habitat map

Re-determine suitable habitat clusters

Habitat Connectivity

- Increased heterogeneity = increased habitat fragmentation
- Assess habitat connectivity
  - Measure of potential for movement of species within the landscape
  - Summarise as proportion connectedness for a species
- Combine for multiple species
- Combine with heterogeneity

Measuring Landscape Characteristics

- Investigating other metrics – FRAGSTATS package – measuring composition and configuration
  - area metrics, patch density and size, edge characteristics, shape metrics, neighbour metrics, diversity metrics (standard ecological tools), contagion and interspersion (spatial aggregation of habitats including lacunarity), core area metrics
- Assess relationships with measures of species biodiversity, taking account of spatial scale

Using participant observation methodology to analyse quality of public spaces in rural villages
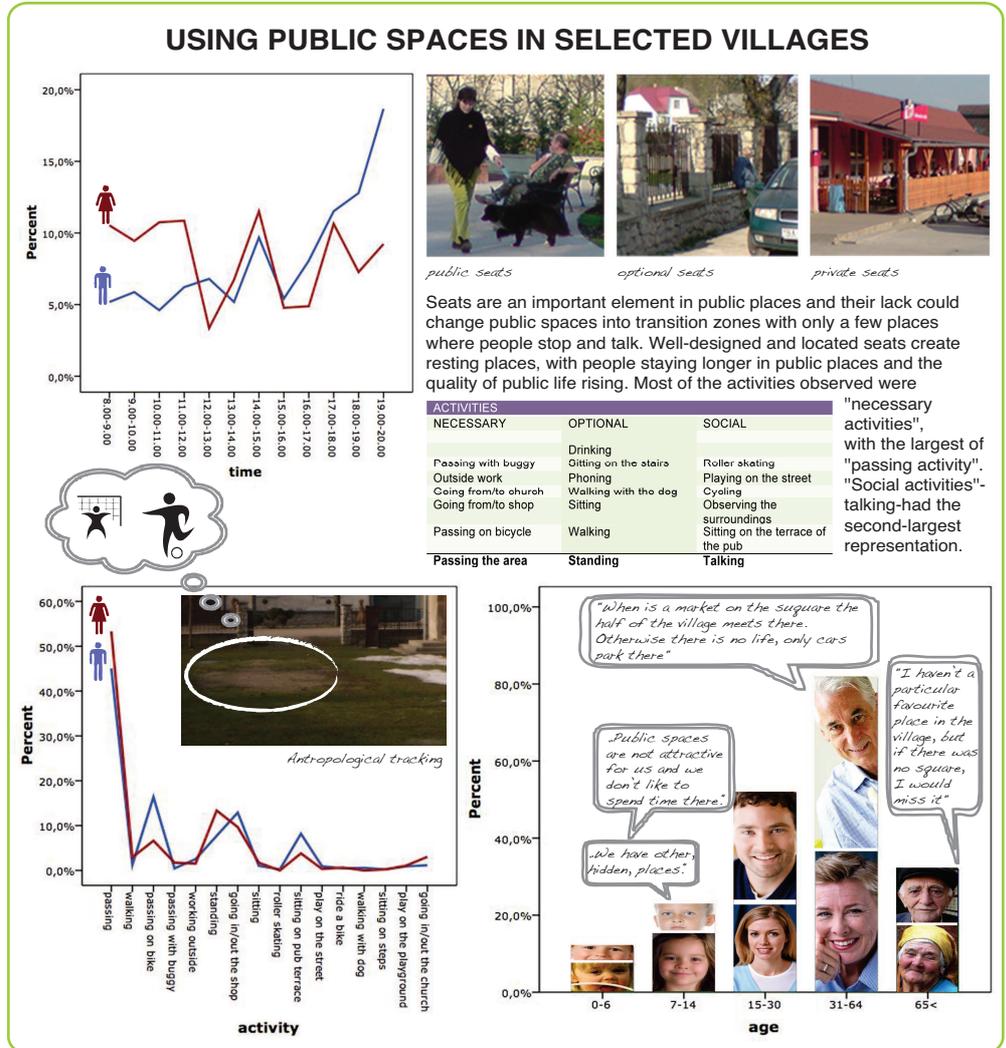
Barbora Lipovská

INTRODUCTION

As Spradley (1972) suggested, in contrast to animal behaviour, human behaviour has meaning to the actor, and that meaning can be discovered. If our purpose is to design places that support people's needs and activities, our analyses should be aimed at analysing human behaviour. The observation approach has been widely used amongst planners and designers and it has become a significant basis for urban design. By observing what people do, rather than just listening to what they say, Whyte (1980) and Gehl (1996) were able to put an end to some of the deep-seated and destructive myths about what people want from their cities and public spaces.

Aim

Public life observations of rural public spaces seeks:
● to evaluate the quality and use of selected public spaces
● to determine how and by whom selected public spaces are used.
● to uncover the reasons why people use or don't use the public space

USING PUBLIC SPACES IN SELECTED VILLAGES

public seats   *optional seats*   *private seats*

Seats are an important element in public places and their lack could change public spaces into transition zones with only a few places where people stop and talk. Well-designed and located seats create resting places, with people staying longer in public places and the quality of public life rising. Most of the activities observed were "necessary activities", with the largest of "passing activity". "Social activities"-talking-had the second-largest representation.

ACTIVITIES		
NECESSARY	OPTIONAL	SOCIAL
	Drinking	
Passing with buggy	Sitting on the stairs	Roller skating
Outside work	Phoning	Playing on the street
Going from/to church	Walking with the dog	Cycling
Going from/to shop	Sitting	Observing the surroundings
Passing on bicycle	Walking	Sitting on the terrace of the pub
Passing the area	**Standing**	**Talking**

Antropological tracking

"When is a market on the squuare the half of the village meets there. Otherwise there is no life, only cars park there"

"I haven't a particular favourite place in the village, but if there was no square, I would miss it"

"Public spaces are not attractive for us and we don't like to spend time there"

"We have other hidden places".

METHOD OF OBSERVATION

Three different villages in different parts of West Slovakia were selected and 17central public spaces were observed.
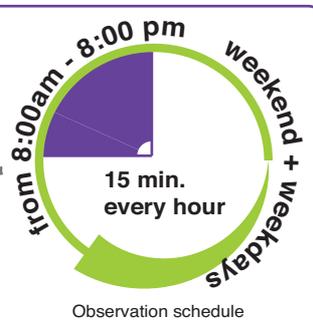
Participant observation and semi-structured interviews with selected citizens were conducted. During the observation the following were recorded: – age, gender, activities – observation notes – antropological tracking (The evidence of the presence of people on public space)

Observation form

from 8:00am - 8:00 pm
weekend + weekdays
15 min. every hour
Observation schedule

Conclusion

We necessarily affect not just the aesthetic and ecological situation but the social quality of public space. The participant observation method discussed here is a way to analyse public spaces in villages, it is a dialogue between community and designer, that leads to design of:
● The future use of public spaces
● Location of roads and paved areas and their surface character
● The number, shape and location of rest areas and their equipment
● Location of green areas
● Monitoring quality of public space
● Indicating the principles of future improvement

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BIRMINGHAM CITY University

Spatiotemporal analysis of the landscape patterns in a riparian corridor of W. Greece

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**Institute for Environmental Research and sustainable Development, National Observatory of Athens, Athens, Greece

INTRODUCTION

Mediterranean landscape are characterized by a long lasting history of intensive land use. Last decades alterations occurred rapidly as a result of socio-economical changes.

Ecological and environmental impacts are more visible in riparian zones, that are among the most fragile ecosystems in the world.

Human activities (constructions of dams, impoundments, dikes and canals, water and mineral extraction) modify continuously the hydrology and geomorphology of these areas.

Intensification of agriculture, urbanization and touristic activities degrade habitats and induce land cover changes.

Site description

Louros River is located in the Epirus region, western Greece. The Louros drains an area of about 925 km[2]. It springs from Mount Tomaros (1,972 m), flows south for over 80 km before discharges into the bay of Salaora main ecological importance in the Ambracian Gulf.

Legend

1.Artificial surfaces
- 111 Urban Fabric
- 122 Road

2. Agricultural areas
- 211 Non irrigated
- 212 Permanently irrigated
- 222 Fruit trees
- 223 Olive groves

3. Forests and semi natural areas
- 311 Broad leaf forest
- 314 Coniferous forest
- 321 Sclerophylous vegetation
- 323 Natural grassland
- 331 Sclerophylous vegetation
- 333 Beaches, dunes and sand plains

4. Wetlands
- 411 Inland marshes
- 421 Salt marshes

5. Water bodies
- 511 Water courses
- 512 Water Bodies
- 521 Coastal lagoons

Fig. 1.Land cover/land use maps produced by image segmentation and photo interpretation of the aerial remote sensing imagery.

MATERIALS AND METHODS

A data set of black and white aerial imagery data acquired from the Hellenic Army Geographical Survey (HAGS) , georeferenced and digitized for the years 1945,1971,1997 and 2006 within a geographic information system were used in order to detect land cover data of the area . The digitalization procedure was carried out manually. The definitions of classes based on the Level 3 of the CORINE Land Cover nomenclature system with a higher level of detail (Legend). A series of non – redundant landscape metrics was calculated to analyze landscape structure and spatial heterogeneity in the study area, using the landscape structure analysis programme FRAGSTATS.

Table 1. It represents the values in ha of area per each class during the consideration period of time.

Level 1	Area 1945	Area 1971	Area 1997	Area 2006
1. Artificial surfaces	42.14	131.54	186.44	217.85
2. Agricultural areas	770.80	772.52	814.27	734.69
3. Forests and semi natural areas	1461.17	1201.23	1237.60	1180.41
4. Wetlands	295.67	471.53	347.74	429.79
5. Water bodies	138.45	131.41	122.18	145.50
Total	2708.23	2708.23	2708.23	2708.23

RESULTS

- A high increase is observed in Artificial surfaces (trout farm, human settlements).
- In natural areas the sand plains are limited.
- Fragmentation of the rural landscape with the development of hedges in order to mark the boundaries of the fields.
- The land consolidation, the drainage and irrigation projects in conjunction with intensification of agriculture lead in the increase of irrigated arable land.
- High developed stabilized forest communities developed along the River floodplain after the construction of dam (1956).
- The overall tendency towards the intensification of agriculture in the lower valley affected the riparian buffer corridor which have became more limited and fragmented .

DISCUSSION

It is obvious that the main changes are located in the lower and the higher part of the valley. Large amount of wetlands change use because of the drainage in the 1950-1960 for the acquisition of new arable land. The land consolidation, the drainage and irrigation projects in conjunction with intensification of agriculture lead in the increase of arable land. The negative effect of these interventions have changed the river beds, with the construction alignment, digging channels, raised embankments, etc., have led to degradation to wetland habitats and the loss of valuable ecosystems.

Table 2. Landscape metrics for the entire landscape (Landscape level) and for the LCLU types (class level) between 1945 and 2006.

	NumP				MPS			
	1945	1971	1997	2006	1945	1971	1997	2006
1. Artificial surfaces	32	171	434	254	1.32	0.77	0.43	0.85
2. Agricultural areas	144	373	688	415	5.35	2.07	1.18	1.68
3. Forests and semi natural areas	515	621	865	629	2.84	1.93	1.46	0.52
4. Wetlands	26	115	254	151	11.37	4.1	1.27	2.85
5. Water bodies	48	76	100	90	2.88	1.73	1.22	1.62

Selected references
• Papastergiadou, E. S., Retalis, A., Apostolakis, A., & Georgiadis, T. (2008). Environmental monitoring of spatio-temporal changes using remote sensing and GIS in a Mediterranean Wetland of Northern Greece. Water Resources Management, 22(5), 579-594
• Rodríguez-González PM, Ferreira, M.T.& Ramil-Rego, P. (2004) Northern Ibero-Atlantic wetland woods vegetation types and within-stand structure. Forest Ecology and Management, 203, 261-272.

Is the cattle farming intensification the better choice to reduce environmental pressure on Brazilian areas?

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Abstract: Intensification of pasture management has been subsidized by the Brazilian government as a means of reducing deforestation. We used a mathematical model in fuzzy language to check if an intensification policy of the Brazilian government could reduce cattle farming impact on these areas. Our results indicate intensification does not solve the deforestation problem in the Amazon and the Brazilian Pantanal.

Introduction

There are three systems of cattle breeding in Brazil [1]:

•Extensive: represents 80% of bovine meat production using only grazing as protein and energetic source.

•Semi-Intensive: the dietary base is also grazing, but animals receive protein and energetic supplements during the dry period.

•Intensive: animals are confined, do not graze but receive large amounts of protein-richfoods.

A program from the Brazilian government encourages farmers to intensify bovine cattle farming. The Senate approved in 2003 a credit line for cattle farmers to change from extensive to intensive breeding regime in order to increase productivity, reducing grazing areas and, consequently decreasing deforestation [2].

We developed a mathematical model that incorporates fuzzy set theory in order to check if the cattle farming intensification is the better choice to reduce environmental pressure on Brazilian areas and if government made the right decision creating a credit line to support intensification.We chose fuzzy logic because this problem involves imprecision and *Fuzzy* logic provides the development of genetic algorithms, which are able to represent uncertainty inherent in data.

Methodology

We developed a mathematical model in fuzzy language. It was composed of three components: cattle component, politic/economic component, and sustainability component.
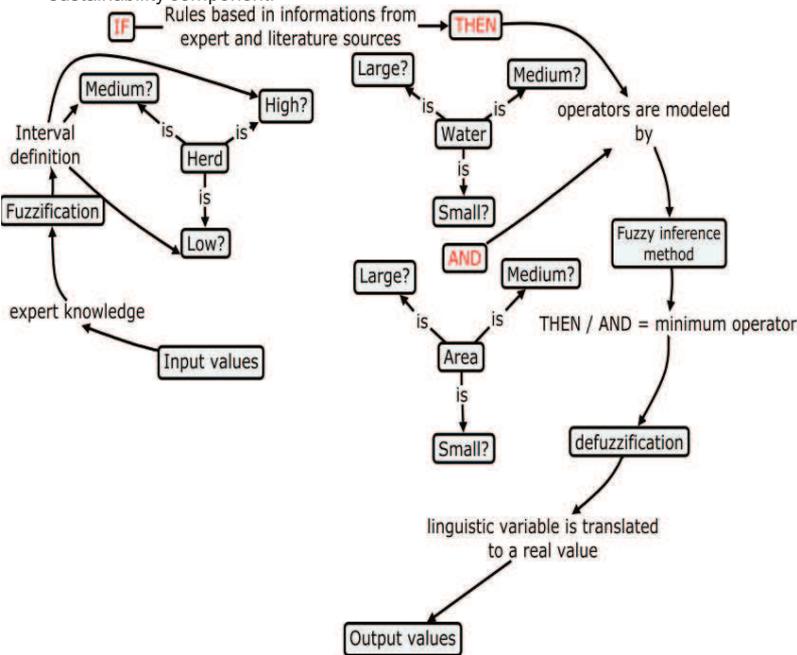
Figure 1: Structure of fuzzy rule-based system. (Cattle component)
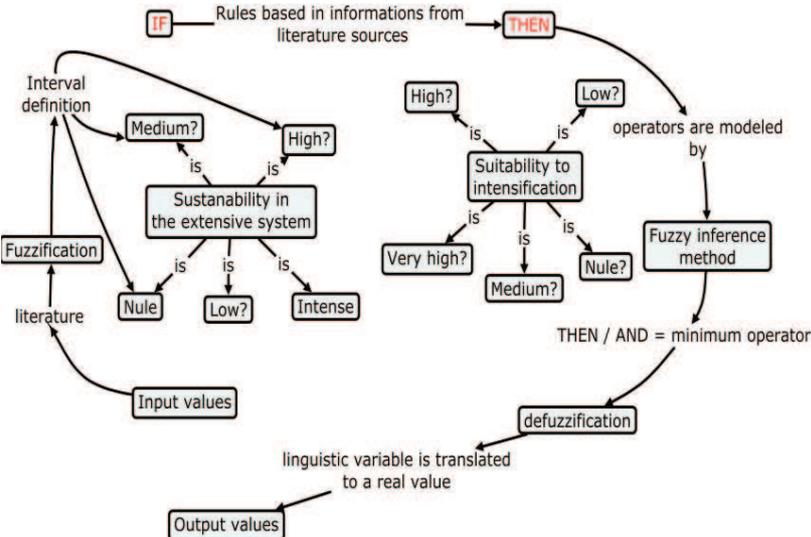
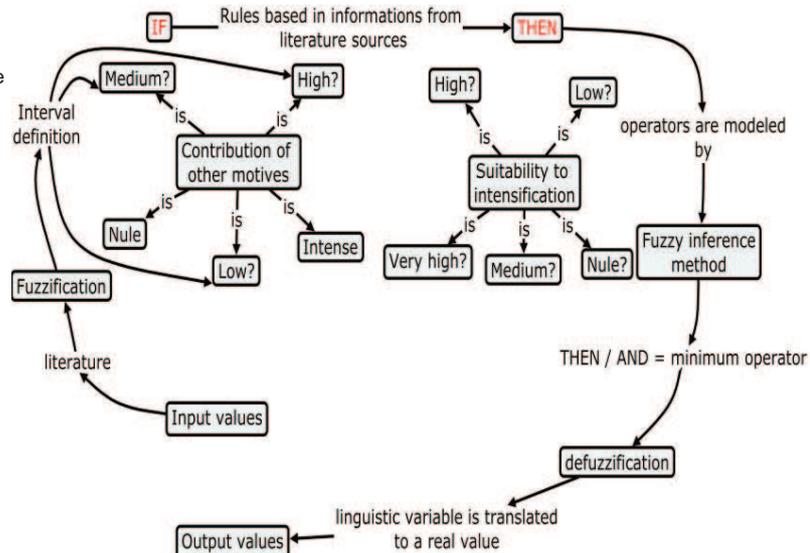**Figure 2:** Structure of fuzzy rule-based system. (Politic\Economic component)

Figure 3: Structure of fuzzy rule-based system. (Sustainability component)
Simulations was run to the Pantanal (Corumbá, MatoGrosso do Sul, southwestern Brazil) and Legal Amazon (São Félix do Xingu, Pará, northern Brazil). These areas were chosen because they are located in areas of biodiversity and conservation importance.

Results and Discussion

Table 1: Suitability of each component to intensification (Corumbá)

	Cattle component (grazing area)	Cattle component (water)	Politic/Economic component	Sustainability component
Suitability to Intensive system	0.953	0.085	0.876	0.12
Suitability to Semi-Intensive	0.788	0.140	0.876	0.12

In the cattle component (grazing area) and politic/economic component, intensification seems to reduce the environmental impact of grazing areas in the Pantanal. However, these data cannot correspond to reality when we look to the water output and third component. In accordance with [3] , beef cattle production is usually considered to have a strong negative environmental impact on the regions where it is practiced, however in the case of the Pantanal, the opposite happened, where extensive beef cattle production guaranteed, and continues to guarantee, the conservation of the ecosystem. Removing cattle can increase risk from fire as grasses grow taller and dry dead foliage accumulates.

Table 2: Suitability of each component to intensification (São Felix do Xingu)

	Cattle component (grazing area)	Cattle component (water)	Politic/Economic component	Sustainability component
Suitability to Intensive system	0.873	0.000	0.118	0.975
Suitability to Semi-Intensive	0.368	0.146	0.118	0.975

In São Felix do Xingu, the low politic/economic component value indicates that contribution of other motives is bigger than beef production to expanding pasture (low suitability for intensification). Therefore, intensification does not solve the problem of deforestation in the Amazon. The purchase of properties to create grazing areas is more related to real estate speculation than cattle farming. Grazing implantation, even in bad situations, is more profitable than having it for forest only [4]. In accordance with [5] ,Deforestation for cattle pasture is considered an "improvement" for the purpose of establishing and maintaining land title.

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[2][in portuguese]http://www.senado.gov.br.Acessed in 04 April 2011.

[3] Abreu, U.G.P et al.,2010. Cattle ranching, conservation and transhumance in the Brazilian Pantanal. Pastoralism 1: 99-114

[4] Fearnside,P.M.,2002. Can pasture intensification discourage deforestation in the Amazon and Pantanal regions of Brazil? In: Deforestation and land use in the Amazon of C.H Wood & R.Porro(eds.). University Press of Florida, Gainesville, pp 299- 314

[5] Fearnside, P.M,.2005. Deforestation in Brazilian Amazonia: History, rates and consequence. Conservation Biology 19(3):680-688.

Landscape ecology: linking environment and society

Effects of habitat change on plants, pollinators and interaction networks - A review

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1 - Introduction

Habitat change is a major threat to biodiversity

... and to species interactions

Information on species interactions can be used to assess habitat quality

Conservation of interactions may be important for species maintenance

OBJECTIVE

To review the effects of habitat change on

Interaction networks

Plants   Pollinators
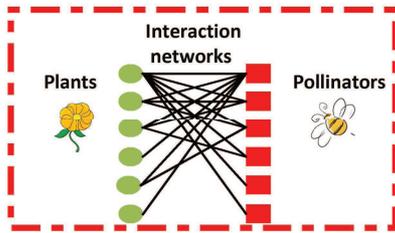
2 - Procedures

May 2011 literature survey using all combinations of the words "pollination, pollinators, landscape, habitat loss and network"
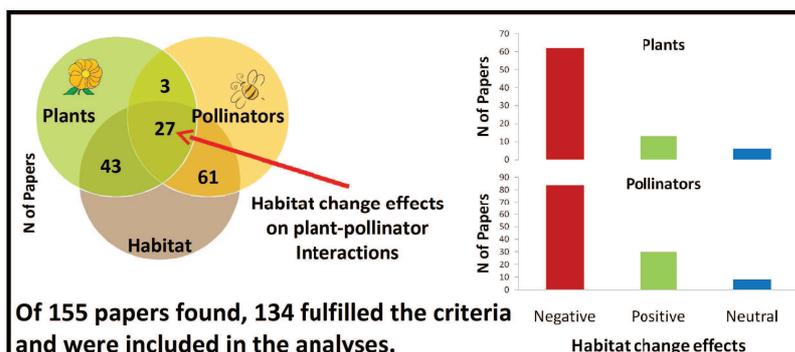
4 - Overview

Plants

Habitat change affects plant sexual reproduction

... plant population density

... may change plant reproductive strategies

... and reduces plant reproductive success

Pollinators

Habitat change reduces pollinator diversity and abundance

...due to increased habitat isolation

... and reduction of floral resources and nesting areas

Interaction Networks

Only one paper analyzed habitat change effects on plant-pollinator networks: Hagen & Kraemer 2010 Biol. Cons. 143

They show that structurally diverse landscapes containing a mosaic of forest, forest edge and farmland in Kenya contain more floral resources, higher pollinator diversity and larger plant-pollinator networks than in continuous forest or agriculture.

Agriculture intensification affects plant–pollinator interactions
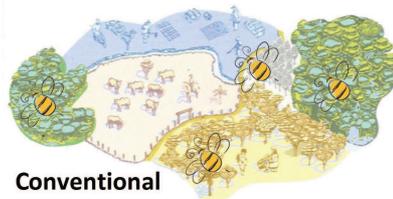
Conventional agricultural landscape
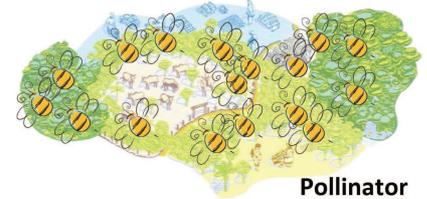
Pollinator friendly landscape

Designed pollinator-friendly landscapes may have positive effects on pollinator diversity and plant reproductive success

3 - Results

Plants 3 Pollinators

27

43   61

Habitat

Habitat change effects on plant-pollinator Interactions

Plants

Pollinators

Negative   Positive   Neutral
Habitat change effects

N of Papers

Of 155 papers found, 134 fulfilled the criteria and were included in the analyses.

5 - Conclusions

1. Habitat change reduces pollinator diversity and affects plant sexual reproduction

2. There is a lack of studies on how habitat change affects plant-pollinator networks

3. An integrated landscape approach may benefit pollinators, plants and their interactions

FORESTED PERIURBAN AREAS: SIMPLY PLANTATIONS OR AN OCCASION TO INCREASE LANDSCAPE COMPLEXITY?

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INTRODUCTION and AIMS

Most part of Lombardy Po plain is occupied by urbanisation and intensive farming, which are causing a loss of natural and seminatural habitats. Continuous urbanisation, infrastructure development and expansion of crops are the major causes of loss of habitats.

That's the reason why recreation in periurban areas of spontaneous habitats is becoming in these latest years fundamental to increase landscape complexity and improve fruition near big cities.

In Lombardy Region, in the last 35 years municipal and regional administrations promoted afforestation projects using spontaneous trees and shrubs (e.g. *Quercus robur, Carpinus betuulus, Cornus mas, Crataegus monogyna*), with different techniques of plantation and management.

Aim of our study is to assess if and when forest plantations allow the growing of spontaneous forest herbs as indicators of woods naturalization.

- points of survey
- Lombardy Region
- Province investigated
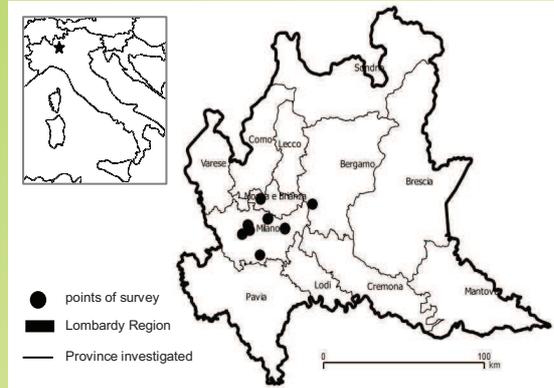
STUDY AREA and METHODS

We developed our study sampling 22 plots in forest plantations with different years of plantations (from 1977 to 2005), distributed in several provinces of the Lombardy Region (Milano, Monza e Brianza, Bergamo). We used phytosociological relevés according to Braun-Blanquet method. We also elaborated 9 spontaneous woods taken from literature (in similar study area) as comparison. During the survey we took also the following parameters to assess the outcome of the plantation and of the following forest management: presence of death trees or shrubs, distance between planted species, height of trees and shrubs.

RESULTS

Cluster analysis separates recent forestations (8 years old average) from old ones (22 years old average) because of the presence of several forest herb species, such as *Ranunculus ficaria, Vinca minor, Polygonatum multiflorum*, with the contemporary absence of herbs common in meadows and in recent forestations (e.g. *Poa pratensis, Potentilla reptans, Bromus sterilis*).

As a major result we observed the good conservation of the planted wooden species, with few death trees and shrubs (<15%). Moreover, periodic management by local administration and presence of citizens that reach forest plantations for recreation are the confirmation that these new woods absolve also a social function.

1987 – Monza e Brianza

2009 - Milano

Several examples of plantations. Different height and covering of trees depend on the year of plantation.

Forest herbs common in old forestations and natural woods

Forest herbs common in natural woods

"Forest" herbs common in bad conserved woods

Meadow herbs common in recent forestations

	Natural woods	Old forestations	Recent forestations

SPECES — YEAR OF PLANTATION

- Hedera helix L.
- Vinca minor L.
- Sambucus nigra L.
- Ranunculus ficaria L.
- Anemone nemorosa L.
- Polygonatum multiflorum (L.) All.
- Scilla bifolia L.
- Geranium nodosum L.
- Viola reichenbachiana Jordan ex B.
- Luzula nivea (L.) Lam. et DC.
- Adoxa moschatellina L.
- Athyrium filix-foemina (L.) Roth.
- Dryopteris filix-mas (L.) Scott
- Lamiastrum galeobdolon (L.) Ehr.
- Melica uniflora Retz
- Leucojum vernum L.
- Aristolochia pallida Willd.
- Symphytum tuberosum L.
- Primula vulgaris Hudson
- Carex brizoides L.
- Holcus mollis L.
- Melica nutans L.
- Duchesnea indica Foeke
- Geum urbanum L.
- Lamium maculatum L.
- Viola alba Besser
- Poa trivialis L.
- Poa pratensis L.
- Potentilla reptans L.
- Bromus sterilis L.
- Arrhenatherum elatius (L.) Presl
- Holcus lanatus L.
- Dactylis glomerata L.
- Torilis arvensis (Hudson) Link
- Trifolium repens L.
- Veronica hederifolia L.

CONCLUSIONS

We think that our work contributes to assess if the new forest plantations i) are useful to increase landscape complexity and habitats heterogeneity, ii) are becoming similar to the spontaneous ones, iii) can absolve more than an ecological function.

Green Network Opportunities Mapping in Glasgow & the Clyde Valley

Background

The important ecological and social functions provided by the network of greenspaces in and around our towns and cities are recognised within Government publications, e.g. the Natural Environment White Paper and Scottish Biodiversity Strategy Review and promoted in planning policy, e.g. National Planning Framework 2. In a period of austerity, the challenge for planning authorities is how to strategically target resources to best enhance green networks for people and biodiversity by embedding green networks within development plans.

Methodology

An approach was undertaken within the Glasgow & the Clyde Valley (GCV) region of Central Scotland to target where effort and resources will give the greatest return on investment, improve network connectivity, and help to address social deprivation.

Taking previously modelled habitat networks and networks for people, a second level of (heuristic) analysis was applied, utilising a series of assessment criteria This identified and ranked opportunities at a regional, strategic level where interventions would have the greatest positive impact on connecting habitats and enhancing access to open space. The steps involved:

1. Identifying the questions planners wanted answering (What do we need to Know?)
2. Assembling and interrogating the relevant datasets (GIS Layers)
3. Calculating a score to enable identification of those areas with the greatest opportunities to enhance the green network (Raster Calculation Process)

What do we need to know?

- **Where are there opportunities to improve the existing Green Network resource?**

- **Where are the priority areas to expand the Green Network?**

- **Where are the major areas of land use change and social need?**

Spatial representation

GIS Layer 1
- Greenspace typology mapping
- Core Path network

GIS Layer 2
- Habitat network opportunities

GIS Layer 3
- Access network opportunities

GIS Layer 4
- Flagship regeneration & community growth areas
- Scottish Index of Multiple Deprivation

GIS Layer 1
Where are there opportunities to improve the existing Green Network resource?

Background datasets
- Greenspace typology mapping (Greenspace Scotland, 2011)
- Core path mapping (supplied by GCV local authorities)

GIS Layer 2
Where are the priority areas to expand the Green Network for habitat networks?

Background datasets
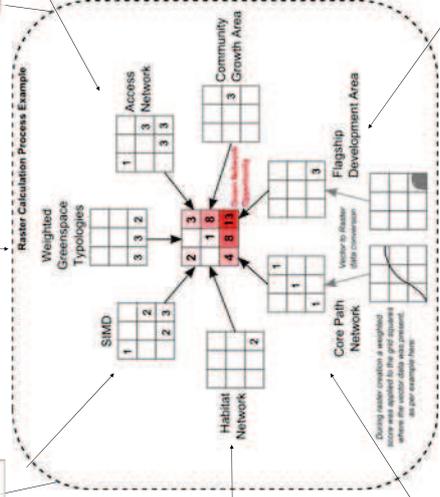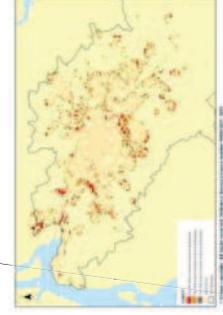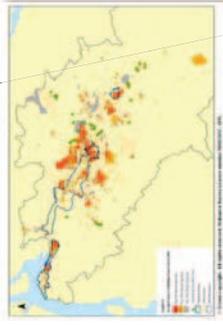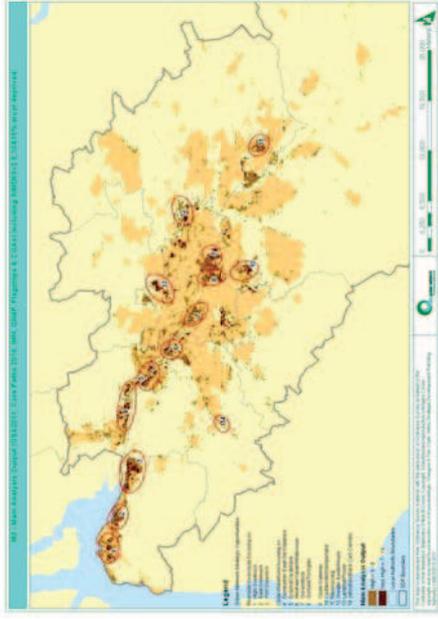- GCV Integrated Habitat Networks model

Method:
- Divide GCV region into 100m diameter hexagonal cells
- Iteratively analyse each cell for its potential to enlarge habitat networks using 'hard' and 'soft' criteria
- Clip output to urban areas
- Identify top 5%, 10% and 15% of cells and apply scores

GIS Layer 3
Where are the priority areas to connect those communities currently disconnected?

Background datasets
- GCV Networks for People Model

Method:
- Divide GCV region into 100m diameter cells
- Iteratively analyse each cell for its potential to increase access to greenspace using 'hard' and 'soft' criteria
- Identify top 5%, 10% and 15% of cells and apply scores

GIS Layer 4
Where are the major areas of land use change and social need?

Background datasets
- Flagship regeneration areas
- Community Growth Areas
- Scottish Index of Multiple Deprivation

Method:
- Identify regeneration and growth areas and apply score
- Identify top 5%, 10% and 15% of SIMD areas and apply scores

Conclusion

The methodology and resultant output (Figure 2) was developed as an integral component of the Green Network Opportunities Mapping for the GCV Strategic Development Plan. The methodology is now being applied at the local authority scale for Main Issues Reports and Local Development Plans.

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Forest Research

gcv green network

Assessing the impact of land-use change on biodiversity: method development and application

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THE UNIVERSITY OF WARWICK

Introduction

- Land use is a key determinant of landscape structure, influencing functional connectivity and permeability for species dispersal.
- Landscape structure metrics widely used as biodiversity indicators.
- This relationship is not fully understood and requires further validation.
- Measuring and understanding the impact of changes in landscape structure on biodiversity is essential for sustainable land management and biodiversity conservation.

Aim

- To quantify landscape characteristics.
- Model the relationship between landscape and biodiversity.

Objectives

- Develop methods for measuring landscape structure, permeability and biodiversity.
- Predict the impact of changes in land-use and landscape structure on biodiversity.

Moving Window Analysis

Landscape data:
- Land Cover Map (LCM) 2000.
- Resolution of 25m.
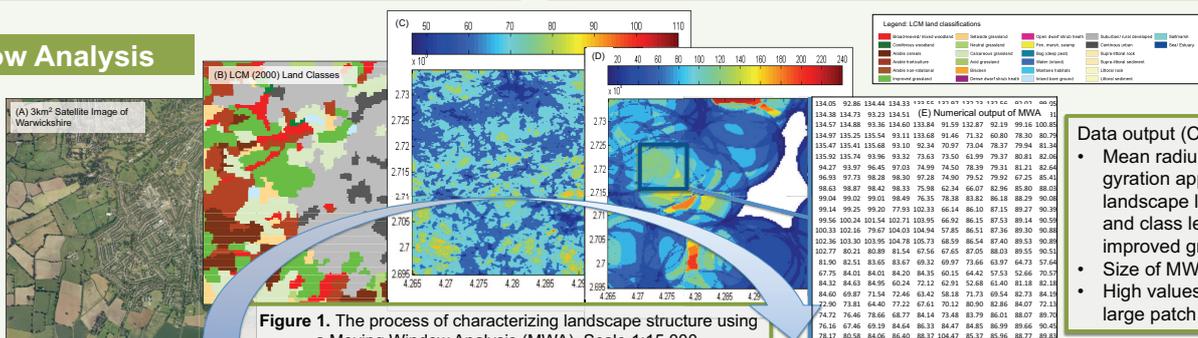- Classifies 26 broad habitats (B) from satellite imagery (A).

Figure 1. The process of characterizing landscape structure using a Moving Window Analysis (MWA). Scale 1:15,000.

Data output (C-E):
- Mean radius of gyration applied at landscape level (C) and class level (D) to improved grassland
- Size of MWA: 500m
- High values indicate large patch extent

Measuring Landscape Structure

Landscape Metrics
- Correlation analysis identified redundancies between 100 metrics, applied to 30 landscapes using the software FRAGSTATS.
- 20 **key metrics** were selected from a Principal Component Analysis.

Moving Window Analysis (MWA)
- Circular MWA with radius of 500m, 1km and 2km applied to the LCM data (Figure 1).
- Size of MWA determined by **dispersal distances** for generic species associated with broad habitat types, identified by Catchpole et al., 2006.
- Size of MWA facilitates:
  - Comparisons between **differing sized landscapes**, and
  - Analysis of individual landscapes at differing **spatial scales**.

Output of MWA
- Results obtained for key metrics:
  - At landscape level and for each class type (Figure 1: C-E)
  - At three spatial scales of analysis
  - An output of **1560 metric maps** for Warwickshire alone!

Current work
- **Combining and summarizing** this information (Figure 1: E) at a spatial scale relevant to biodiversity assessments.
- This analysis will then be applied to Warwickshire **Phase 1 Habitat Data**.

Measuring Biodiversity

Data and Spatial Scale
- Butterfly records for Warwickshire obtained from:
  - UK Butterfly Monitoring Scheme (UKBMS), and
  - Warwickshire County Council (WKCC).
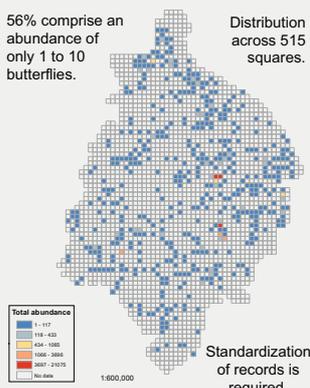- Temporal coverage: 1990-2000. • Average scale: 1km^2

56% comprise an abundance of only 1 to 10 butterflies.

Distribution across 515 squares.

Standardization of records is required.

Figure 2. Distribution of total butterfly abundance across Warwickshire for years 1990-2000.

Butterfly Abundance
- Skewed towards **low abundance** frequencies (Figure 2).

Standardized by:
- total number of surveying weeks
- total number of years

Additional removal of:
- records of just one week per year
- squares with just one year of data.

Total abundance of 67608 across 66 squares.

Butterflies and landscape characteristics
- Hierarchical cluster analysis grouped squares similar in their composition of LCM land cover at 95% similarity level (Figure 3).
- Butterfly presence significantly **depends on compositional group** (X^2_{33} = 680.48, p <0.001).
- A logistic regression model identified **nine significant variables** for predicting butterfly presence/ absence ($D_{9,2417}$ = 17.96, X^2 <0.001);
  - number of land cover classes, • water,
  - arable horticulture, • arable non rotational,
  - arable cereals, • set-a-side grassland,
  - broad-leaved woodland, • suburban/ rural,
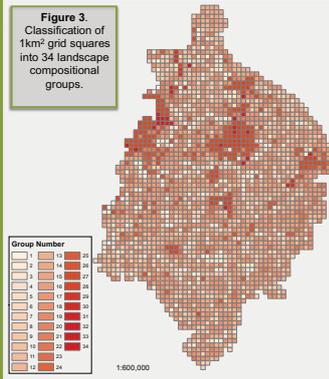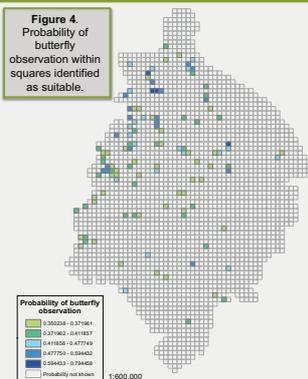 - landscape Simpsons Diversity Index.

Figure 3. Classification of 1km^2 grid squares into 34 landscape compositional groups.

Figure 4. Probability of butterfly observation within squares identified as suitable.

Future work
- Fitted values from logistic model combined with compositional groups facilitates identification of sites suitable for supporting butterflies (Figure 4) and the calculation of **pseudo- absences**.
- Incorporate **species detectability** and **Site Index values** produced by UKBMS to address uncertainty and temporal gaps in data set.
- Relate biodiversity assessments to MWA output for key landscape metrics.

Reference: **Catchpole, R.** 2006. Planning for biodiversity - opportunity mapping and habitat networks in practice: a technical guide. English Nature Research Reports.
FRAGSTATS: McGarigal, K., SA Cushman, and E Ene. 2012. FRAGSTATS v4: Spatial Pattern Analysis Program for Categorical and Continuous Maps. Computer software program produced by the authors at the University of Massachusetts, Amherst.

Tauw

A GIS-based landscape-ecological model to evaluate bat distribution

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Aim
Predicting the potential occurrence and landscape use of the nine most common bat species in the Netherlands.

Box 1: Characteristics of nine common bat species of the Netherlands
Species-specific roost type (b=building; t=tree), maximum foraging distance from roosts (km) and gap distance (m) are basic assumptions for the model.

Species		Roost type	Maximum foraging distance	Gap distance
Daubenton's bat	*Myotis daubentonii*	b	3	25
Pond bat	*Myotis dasycneme*	b	10	50
Natterer's bat	*Myotis nattereri*	b	2	25
Whiskered bat	*Myotis mystacinus*	b, t	3	25
Noctule	*Nyctalus noctula*	b	10	500
Common pipistrelle	*Pipistrellus pipistrellus*	b	3	50
Nathusius' pipistrelle	*Pipistrellus nathusii*	b, t	3	100
Serotine bat	*Eptesicus serotinus*	b	5	75
Brown long-eared bat	*Plecotus auritus*	b, t	1,5	25

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Box 2: Function of landscape elements by bat species
- *Roosts*
  Roost type differs per species and per season, roosts are either in trees or in buildings
- *Flight paths*
  Usage by species differs from highly specific (e.g. only linear water bodies > 3 meters in Pond bat), to complete independence of landscape elements (e.g. Noctule)
- *Foraging sites*
  Species-specific, based on legend unit of 1:10,000 map and size
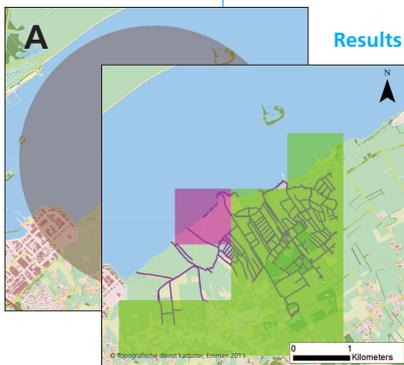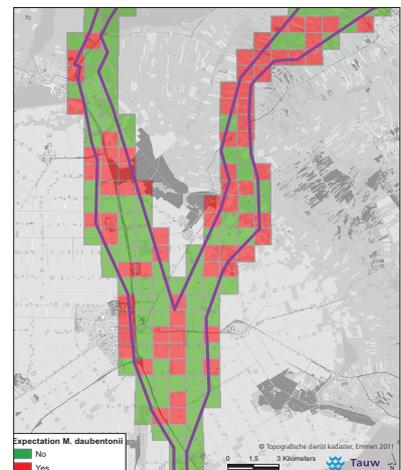

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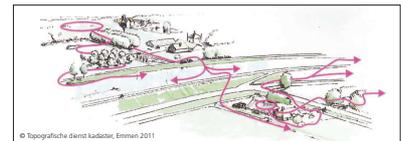
Model
Key assumptions:

- Grid cells are assigned 0 (absence) or 1 (presence) for each function
- Model is based on habitat data only, not on distributional data
- Species-specific usage of landscape elements
- Flight paths are calculated per species for those combinations of roost and foraging site that are within the maximum foraging distance of that species
- Strict forest species are only assigned to grid squares with interconnected forests to reflect their colonization ability
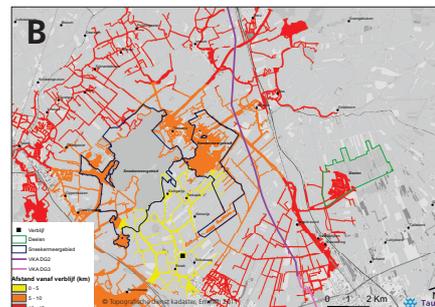
Method:
- Desk study used 2,000 1-kilometer grid cells in the northeastern Netherlands
- Desk study is calibrated by field research in 100 1-kilometer grid squares

Expectation M. daubentonii
No
Yes

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Results

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Left: A: Model output for Daubenton's bat. Can potential foraging sites in the highlighted 1-km grid be reached from potential roost sites? Answer: yes, there are sufficient flight paths to reach the foraging site from potential roost sites in their surroundings.

Verblijf
Deelen
Sneekermeergebied
VKA DG2
VKA DG3
Afstand vanaf verblijf (km)
0 - 5
5 - 10
10 - 15

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black square: Investigated roost
purple line: Investigated development

Natura 2000-sites:
dark blue Sneekermeergebied
green The Deelen

Flight distance from roost:
yellow 5 km
orange 10 km
red 15 km

Right: B: Model output for Pond bat. Does a specific development (purple line) affect the flight path between a roost under study (black square left below) and two protected foraging Natura 2000-sites in the north-eastern Netherlands? Answer: yes, for the Deelen (right; green), no for Sneekermeergebied (left; dark blue).

Key goals for future work:
- Apply the model to urban areas
- Apply the model to other (bat) species
- Extend the model to other parts of the Netherlands and Europe