A flexible ecosystem service mapping approach to support multiple level governance of joint landscape service provisions

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3rd AIEAA Conference "Between Feeding Earth and Greening Agriculture: Challenges and Opportunities for the Bio-Economy" 25-27 June, 2014 Alghero, Italy

Outline

- Introduction and motivation of this work
- Case study area Märkische Schweiz CLAIM project (EU FP7 - *Supporting the role of the Common agricultural policy in LAndscape valorisation: Improving the knowledge base of the contribution of landscape Management to the rural economy*)
- Probabilistic approach to (joint) ES assessment and mapping
- Cultural landscape service provision and demand
- Dealing with different spatial contexts
- Spatial targeting of interventions to enhance landscape aesthetics
- Conclusions

Motivation of this work and state of the art

Spatial targeting and multi-level governance

- There is an increased awareness, at both theoretical and practical levels, of the role of location in the value of natural resources which has lead to the emergence of new paradigms as, e.g., spatial discounting (Perrings and Hannon, 2000), scale and topology based ecological economics (Jordan and Fortin, 2002), spatial sustainability indicators (van der Berg and Verbruggen, 1999)

- GIS-based spatial analysis has been proved to be an efficient tool to define the most suitable or relevant geographical target areas for policy intervention (van der Horst, 2007) and has become a widespread tool to inform decision making in sustainable land use and natural resources management

- An explicit effort to mainstream spatial thinking and spatial analysis as a key tool in the design of policy intervention is still missing

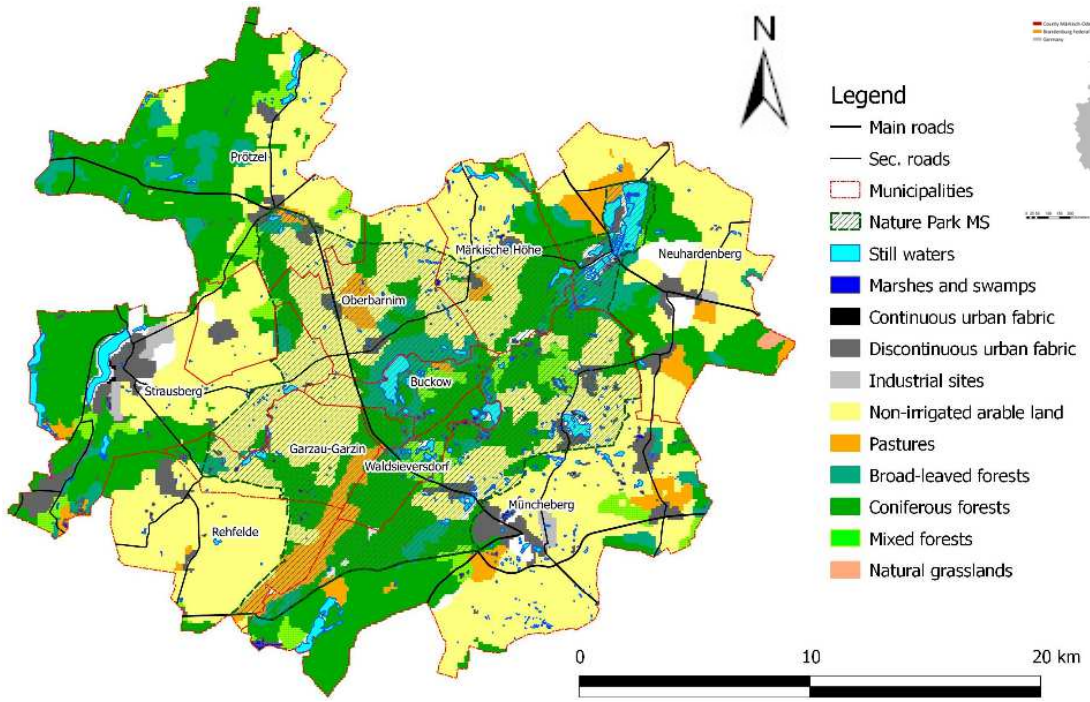
- Efficiency is related to: i) criteria for delineation, ii) choice of boundaries, iii) internal homogeneity of target areas, iv) spatial heterogeneity of costs and benefits, v) spatial context(s) addressed

Motivation of this work and state of the art

Our contribution:

- ❑ A methodological framework which is adaptable and consistent
- ❑ A probabilistic approach to landscape services spatial modelling and assessment based on geostatistical simulations
- ❑ Provides a flexible and generally applicable tool to support mapping and decision making at different levels and in different contexts.
- ❑ Operational value: several services can be treated and mapped simultaneously, different spatial levels can be combined and analysed

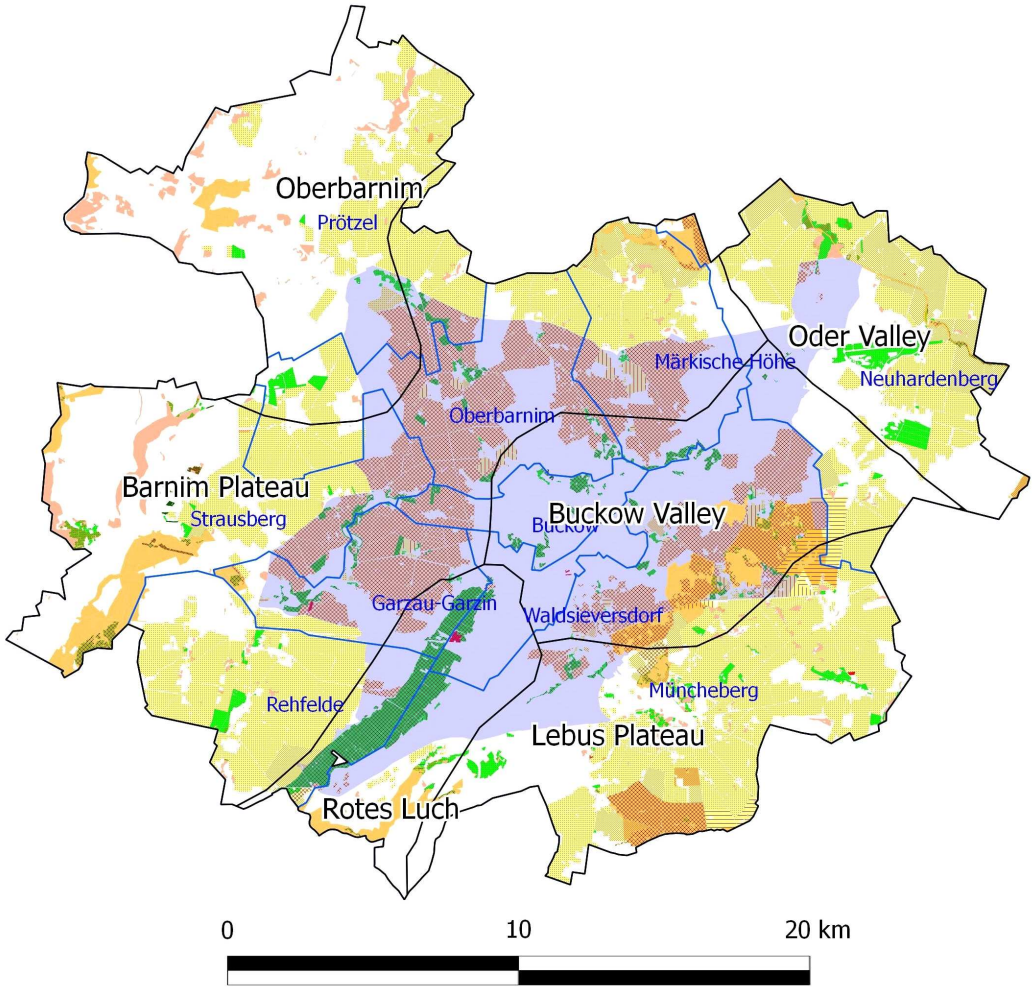
CLAIM case study area Märkische Schweiz



- 576.4 Km²
- Ten municipalities, Pop. 46,523 (May 2012),
- 81 Inh./km² (13 - 384)
- Nature Park MS 204.9 Km²
- Periglacial landscape with very low fertility soils
- Abundance of typical landscape elements
- Crop diversity and extensive grassland management
- Highly appreciation for landscape aestetics
- Landgrabbing and crop intensification

CLAIM case study area Märkische Schweiz

In order to support multi-level governance of joint services provision, landscape service mapping should be flexible in addressing decision-makers' needs and in accounting for different spatial contexts.



(i) **landscape units**, i.e. "homogeneous" physiographic and ecological areas within a given landscape for which specific functional properties in terms of services' supply are of local or regional relevance;

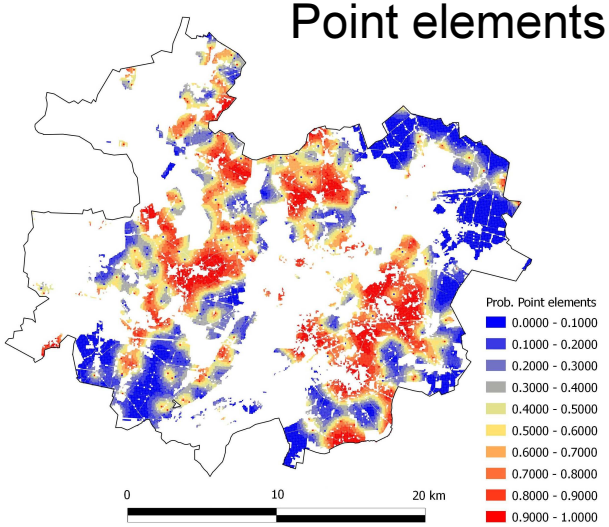
(ii) **administrative units**, e.g. municipalities, provinces or regions, hierarchically linked along a chain of steering power for decision making;

(iii) **land cover or land use classes**, as strongly affecting the potential supply of services within a given landscape;

(iv) **target areas** of specific measures and/or directives, e.g. nature protection, which are designated to result in an increased or decreased efficiency in landscape service supply

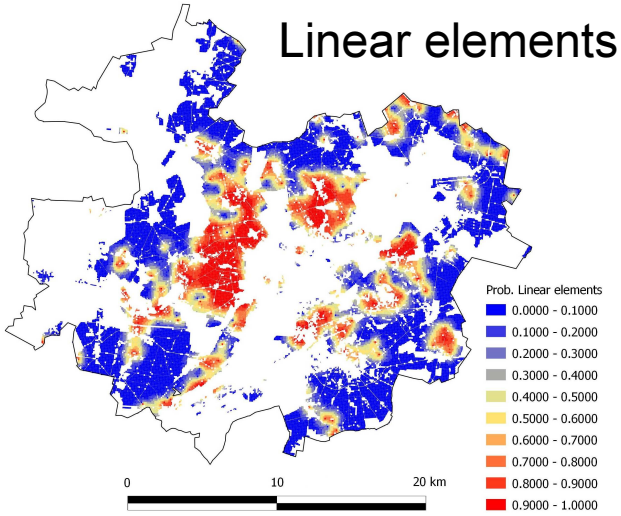
Probabilistic approach to landscape services spatial modelling

Point elements



Probability maps

Linear elements

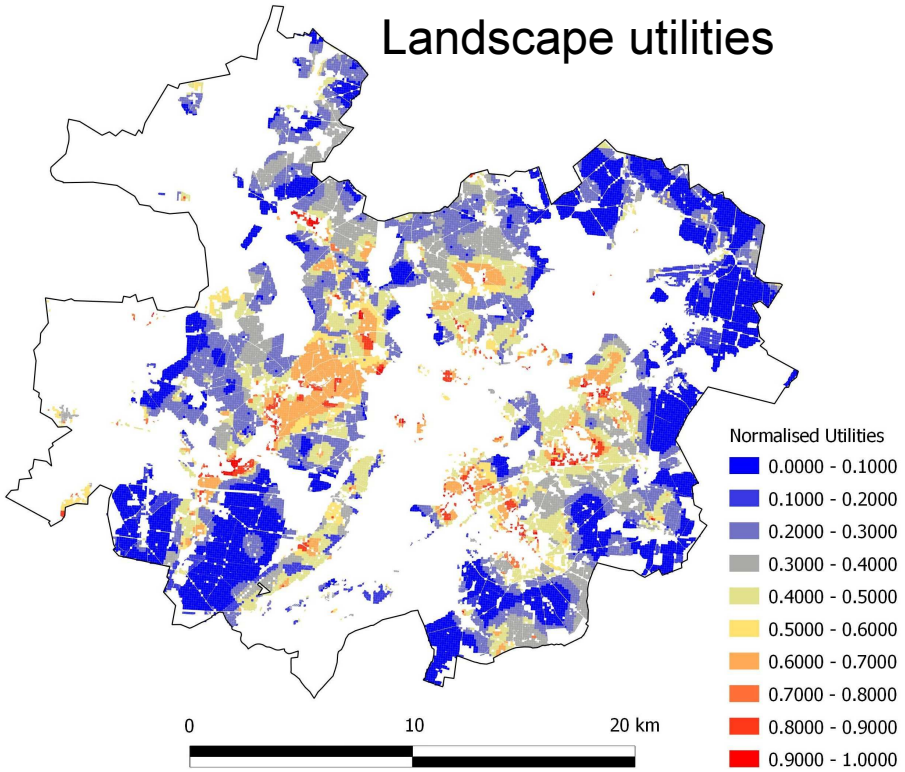


Utility score

Level 1: 0.00
Level 2: 1.18
Level 3: 2.09

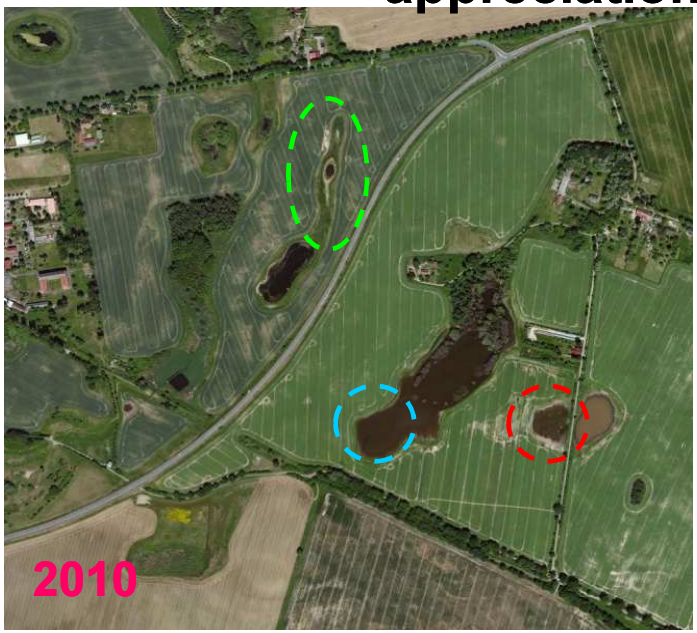
Level 1: 0.00
Level 2: 0.22
Level 3: 1.38

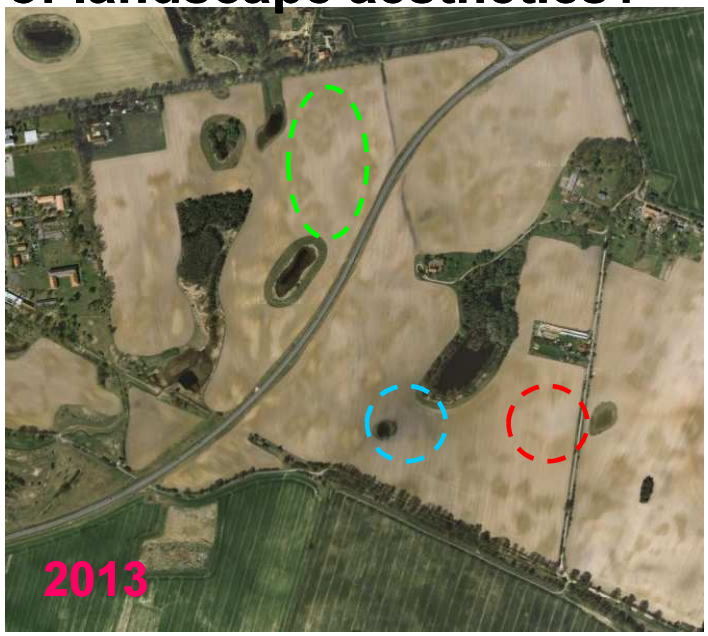
Landscape utilities

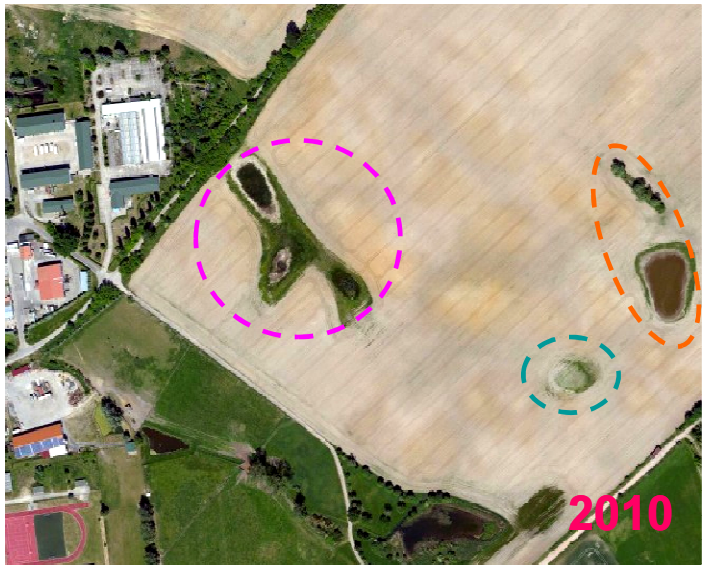


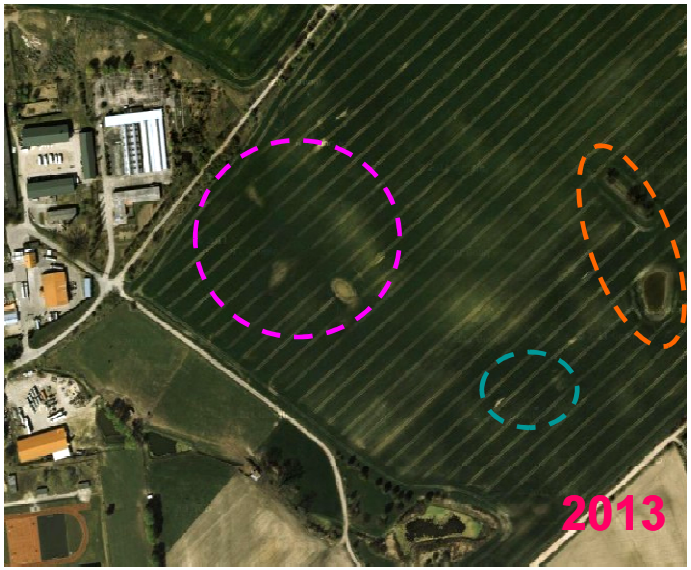
Goal: identify priority areas for local landscape management from an aesthetic perspective (cultural landscape services), e.g. at municipality level taking into account local condition, i.e. sub-landscape units and environmental protection

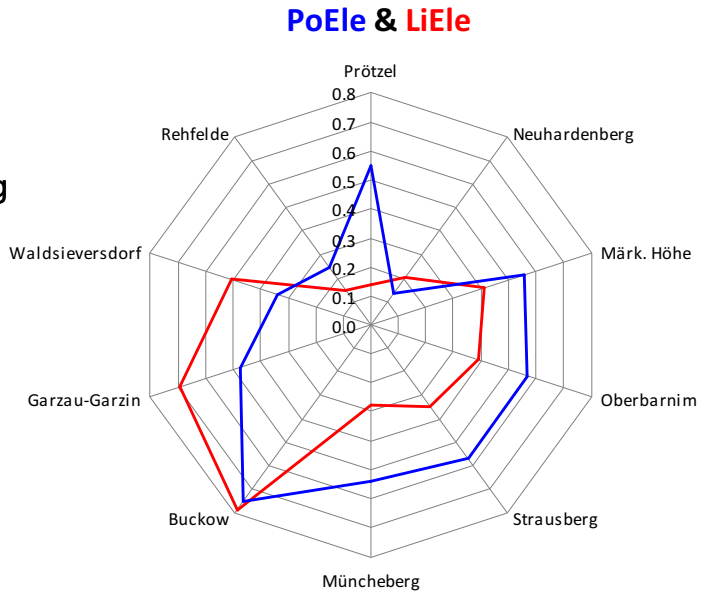
How the removal of landscape elements affect the appreciation of landscape aesthetics?



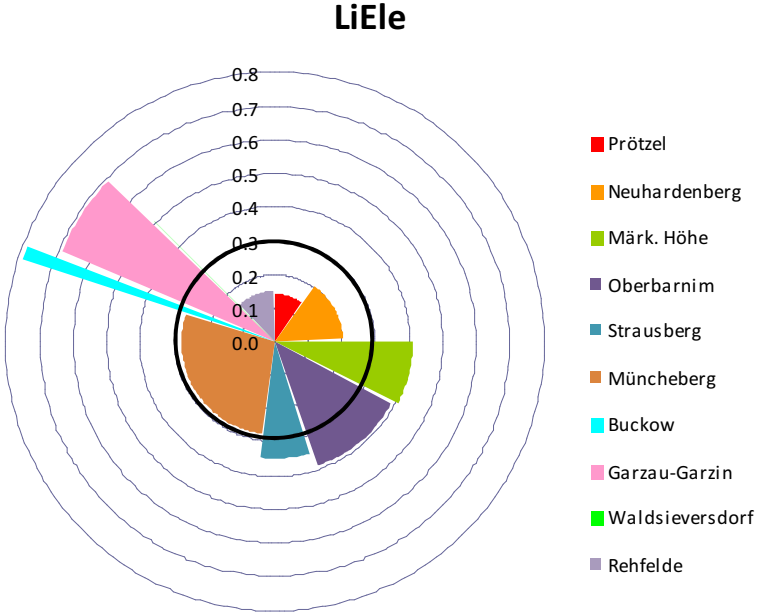


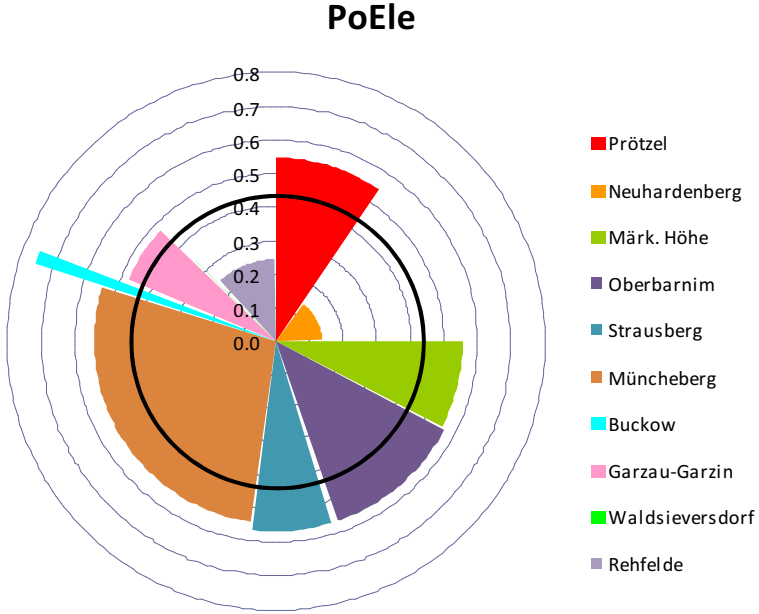




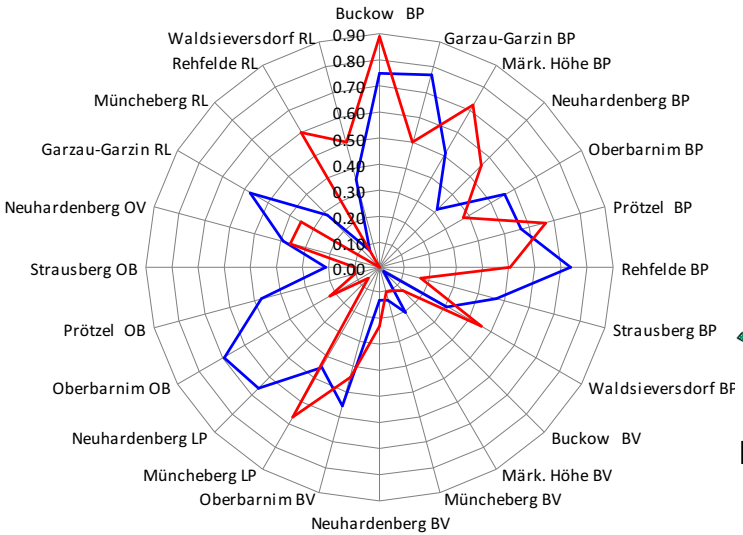


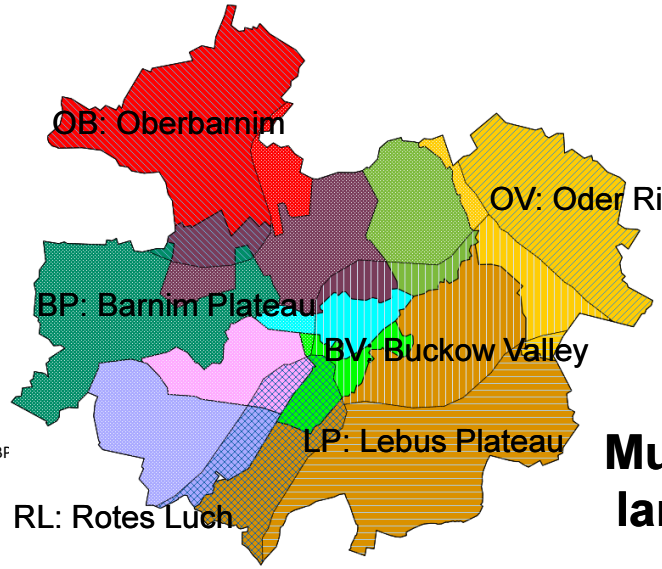
Municipality level





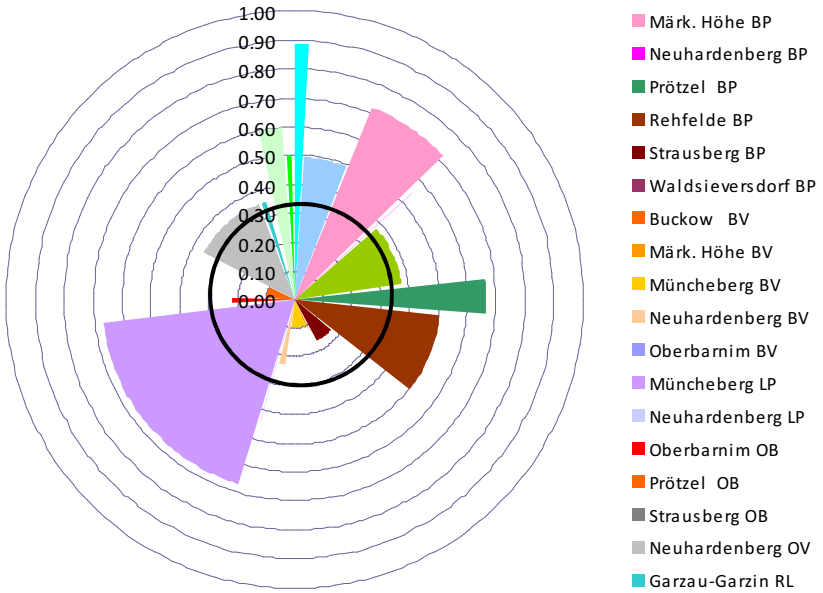
PoEle & LiEle



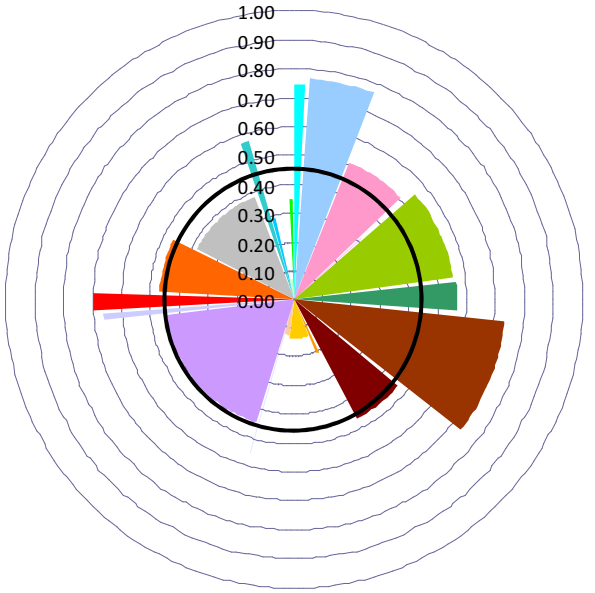


Municipality and landscape level

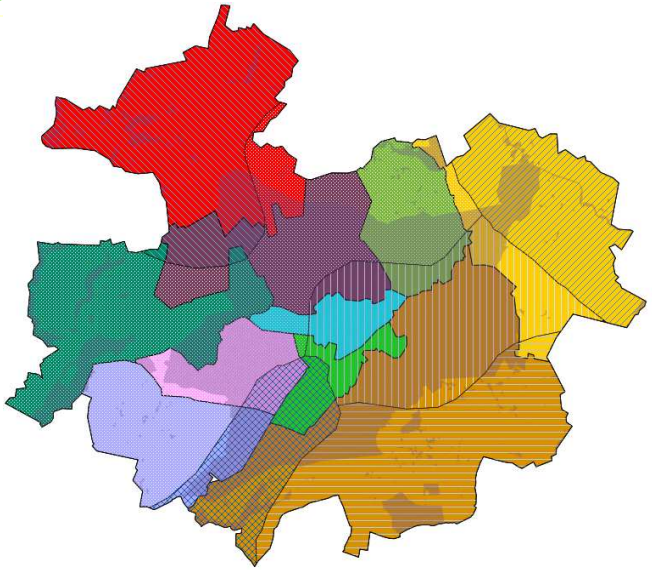
LiEle

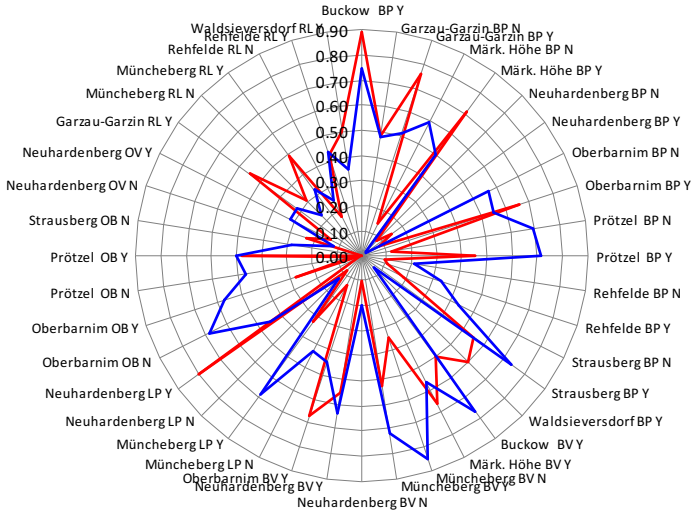


PoEle

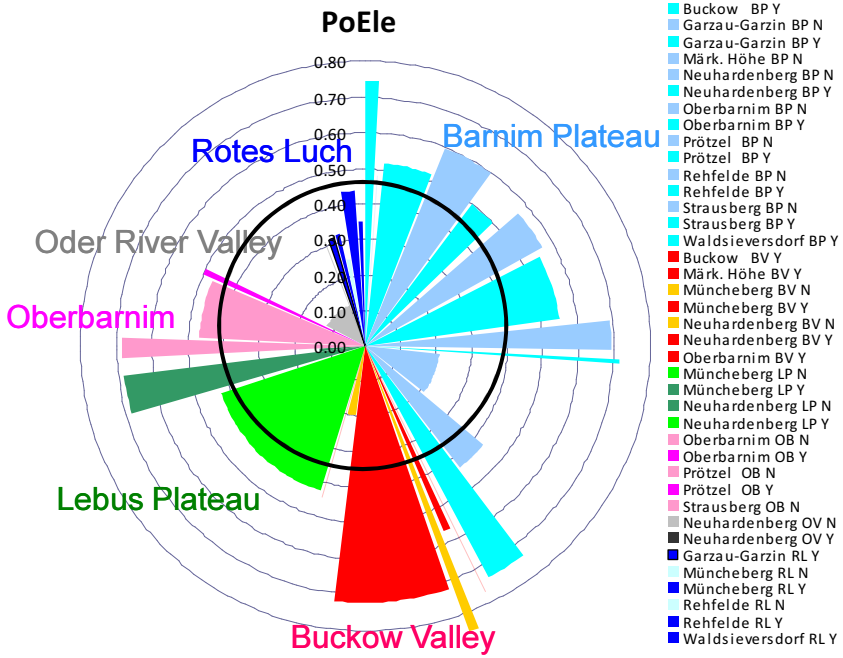


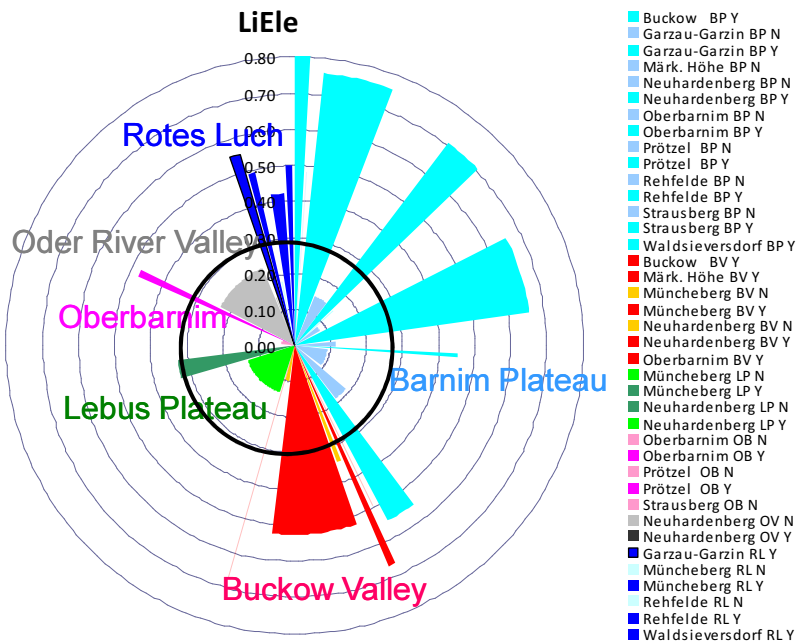
- Buckow BP
- Garzau-Garzin BP
- Märk. Höhe BP
- Neuhardenberg BP
- Prötzel BP
- Rehfelde BP
- Strausberg BP
- Waldsieversdorf BP
- Buckow BV
- Märk. Höhe BV
- Müncheberg BV
- Neuhardenberg BV
- Oberbarnim BV
- Müncheberg LP
- Neuhardenberg LP
- Oberbarnim OB
- Prötzel OB
- Strausberg OB
- Neuhardenberg OV
- Garzau-Garzin RL
- Müncheberg RL
- Rehfelde RL
- Waldsieversdorf RL





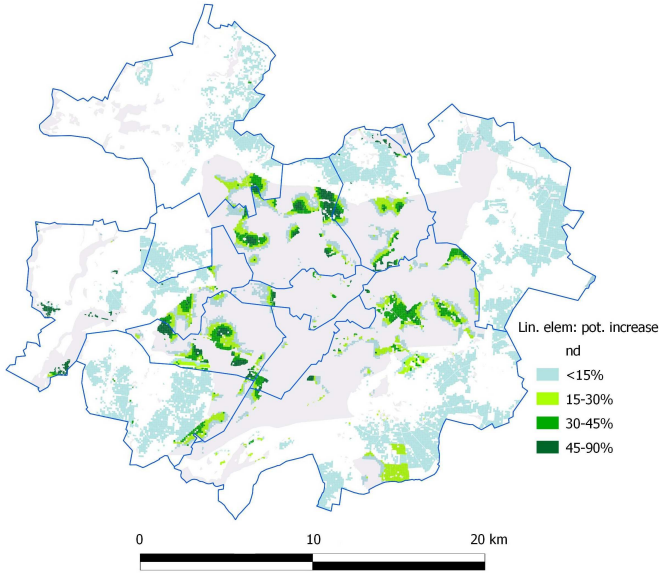
Municipality landscape and management level

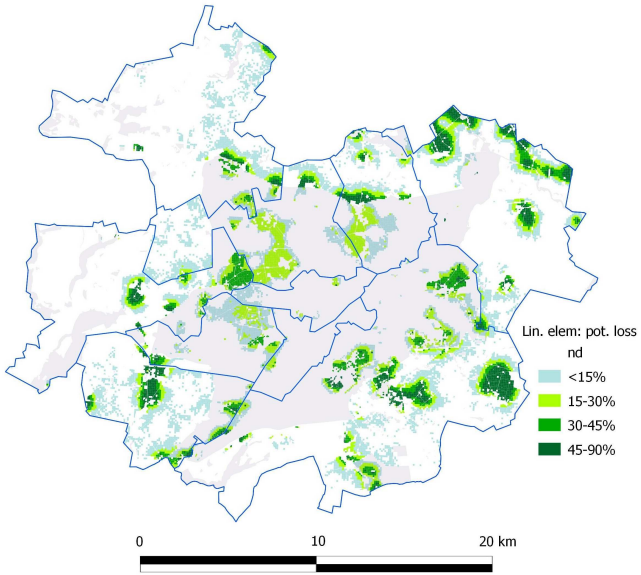




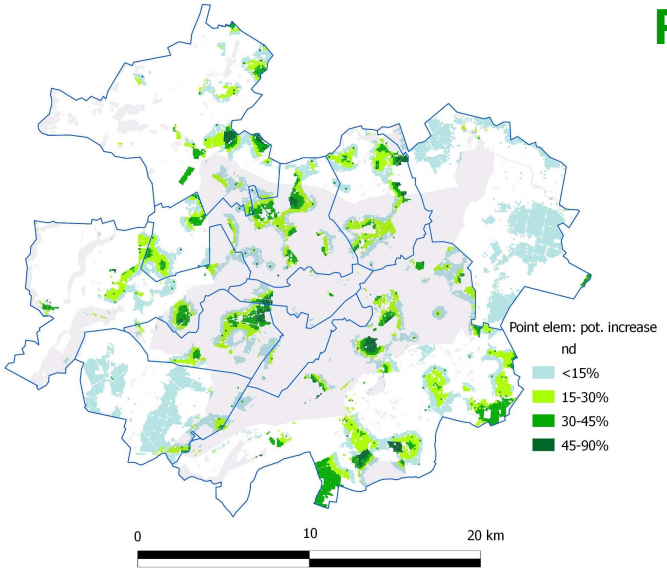
Targeting potential changes in landscape elements

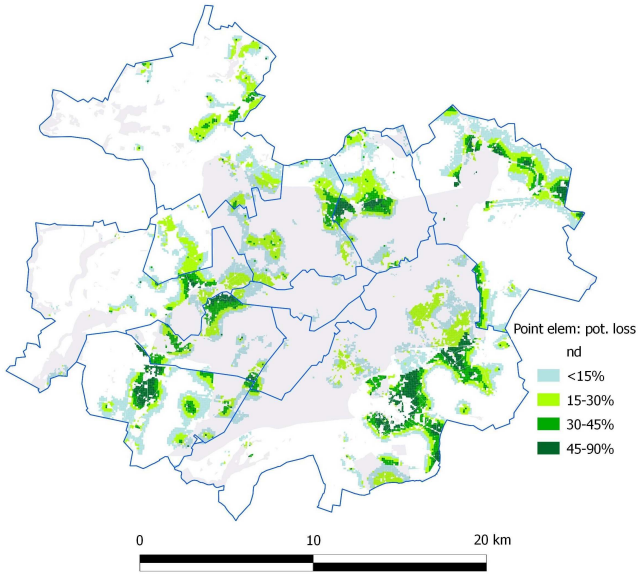
Linear elements





Point elements





Potential increase $\Delta i_{(x,y)}$

$$\Delta i_{(x,y)} = Pt_{jkl} - P_{(x,y)jkl}$$

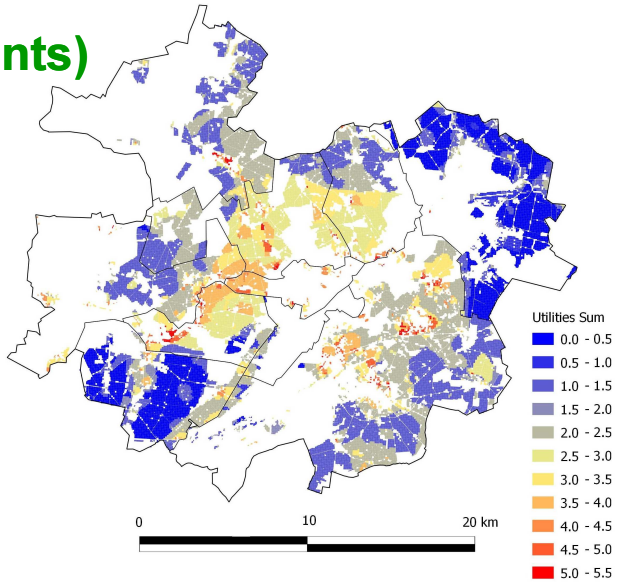
Pt_{jkl} **probability target threshold** set for the j^{th} municipality, with the k^{th} landscape unit, under the l^{th} management option based on observed estimated distributions

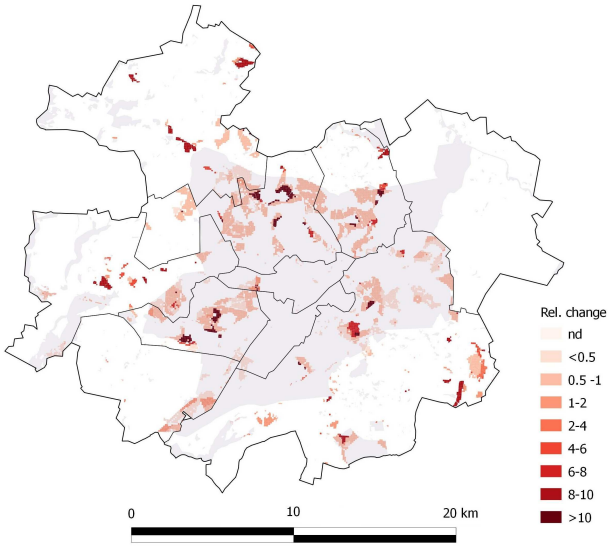
Potential decrease $\Delta d_{(x,y)}$

$$\Delta d_{(x,y)} = P_{(x,y)jkl} - Pt_{jkl}$$

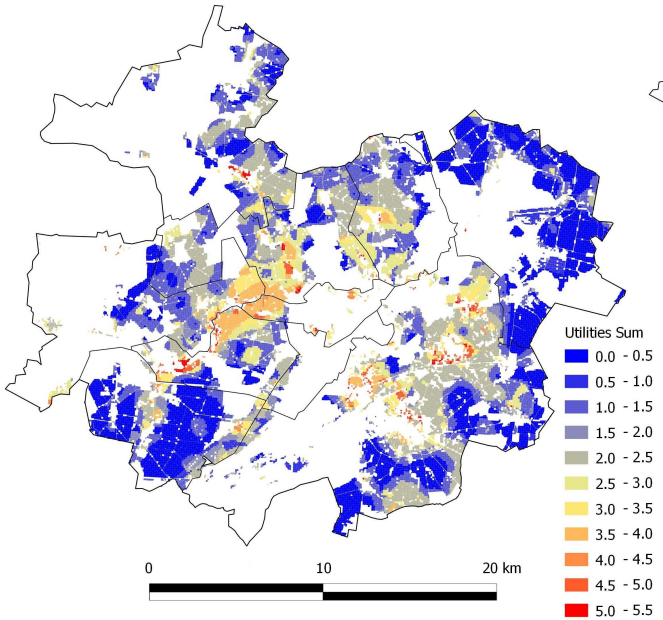
Targeting potential changes in aesthetic preferences

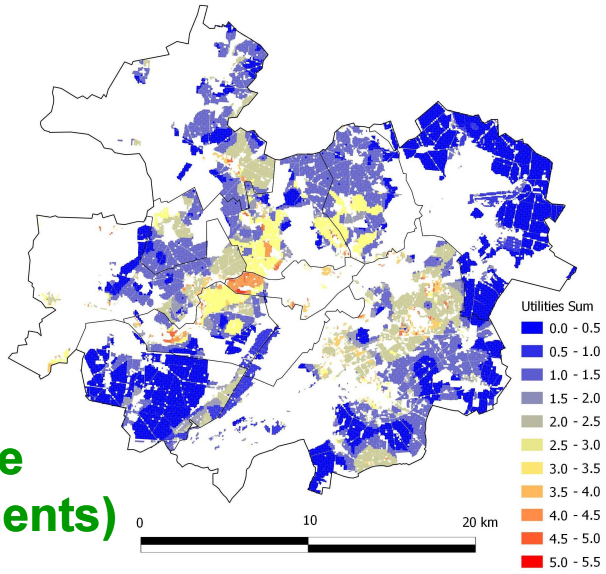
Potential increase (point and linear elements)

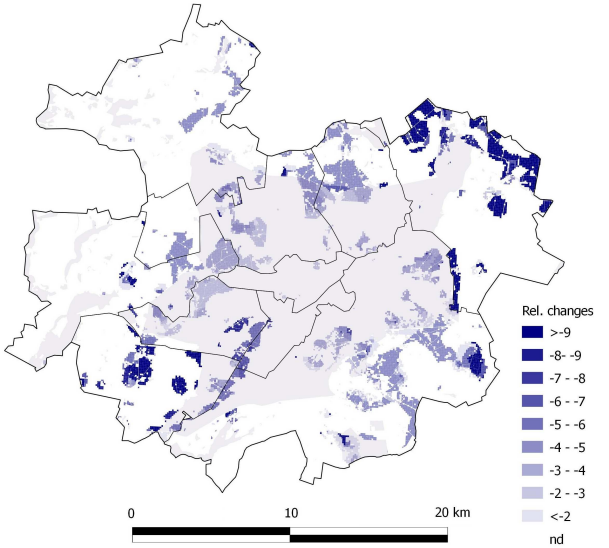




Actual



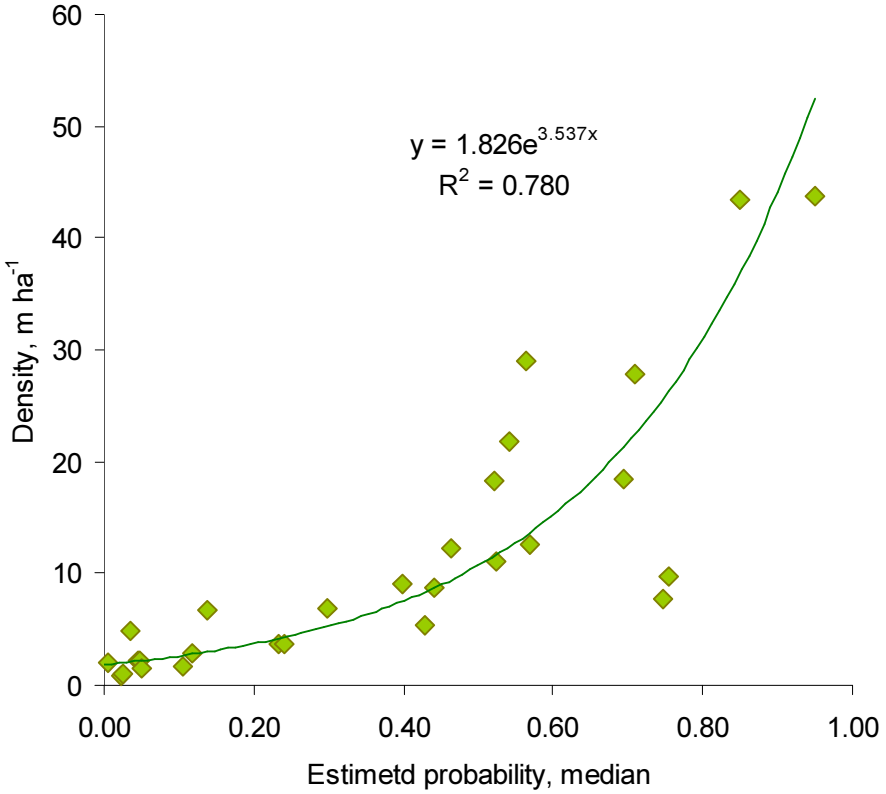


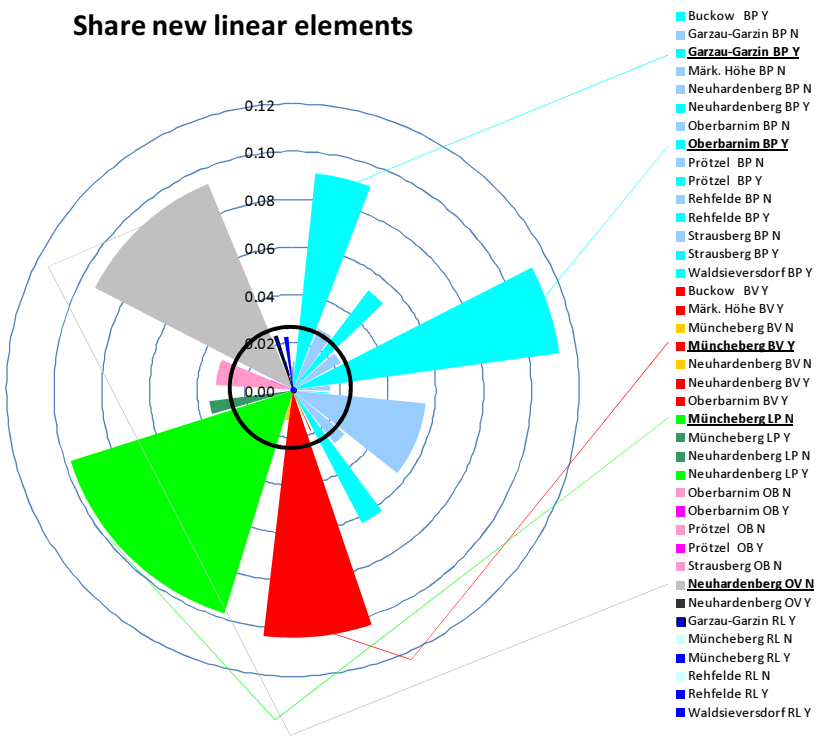


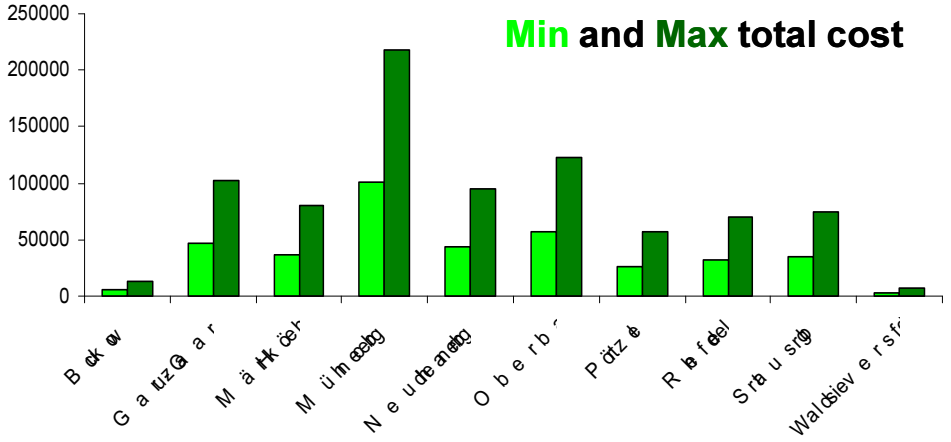
Potential decrease (point and linear elements)

Targeting potential changes in aesthetic preferences

Increase linear elements to p50







Estimated total length new elements: 43,170 m

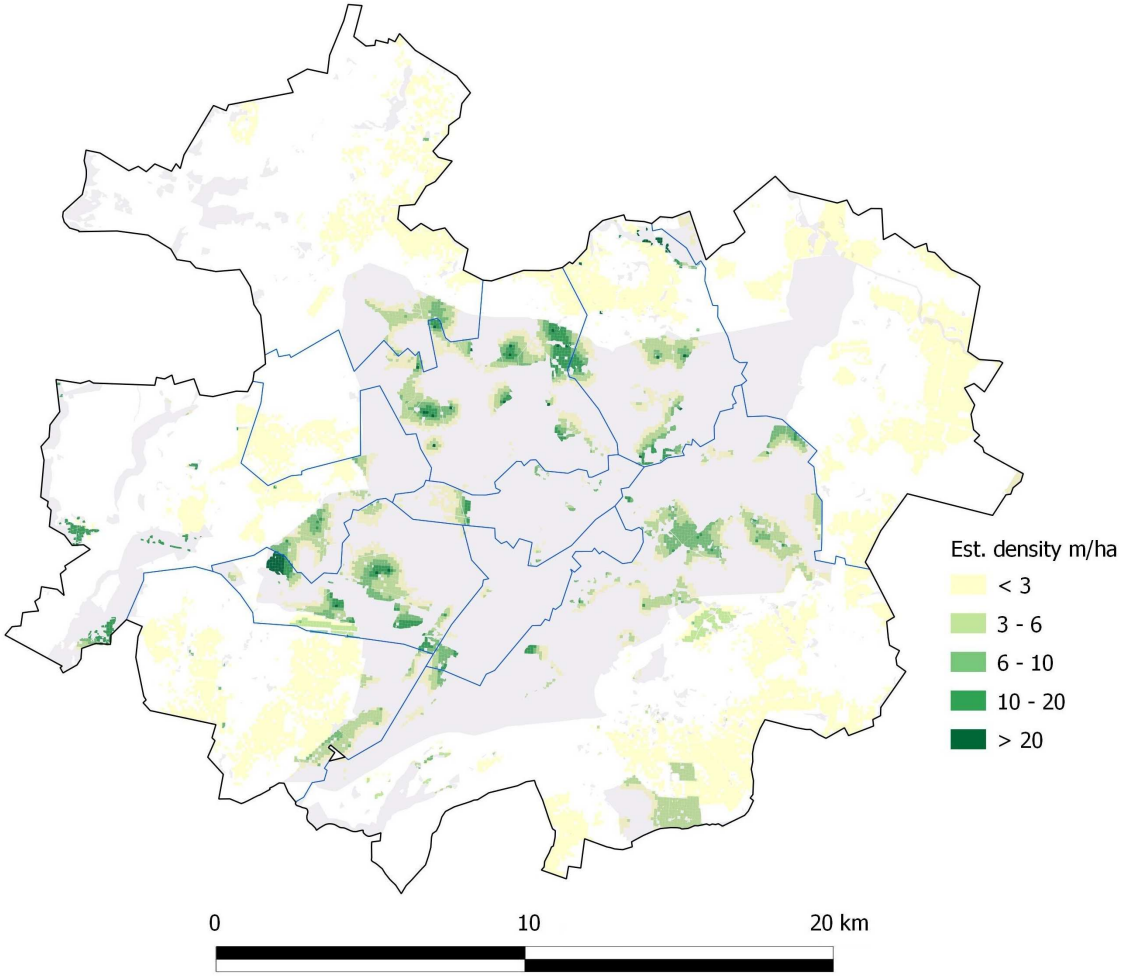
Estimated avg. cost per unit area: 15-32 Euro/ha

Estimated total cost*: 388,525 - 841,801 Euro

* source: Deutscher Verband fur Landschaftpflege (DVL) e V. (2006)

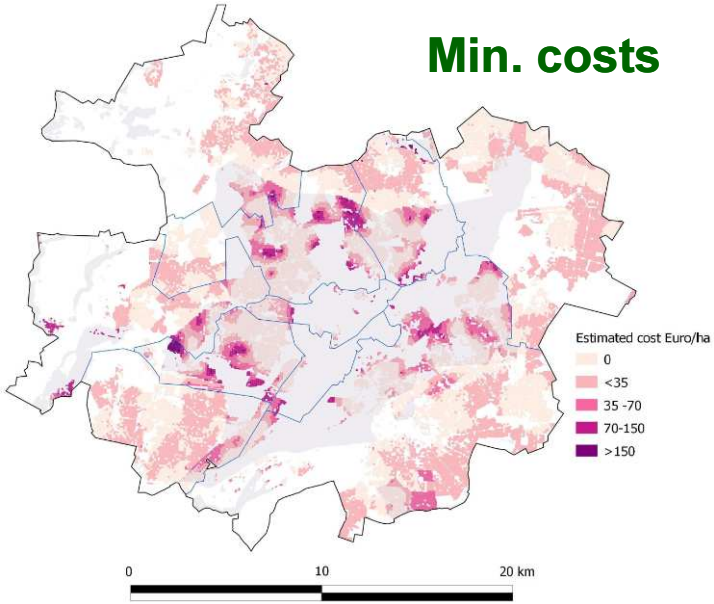
Targeting potential changes in aesthetic preferences

Increase linear elements to p50

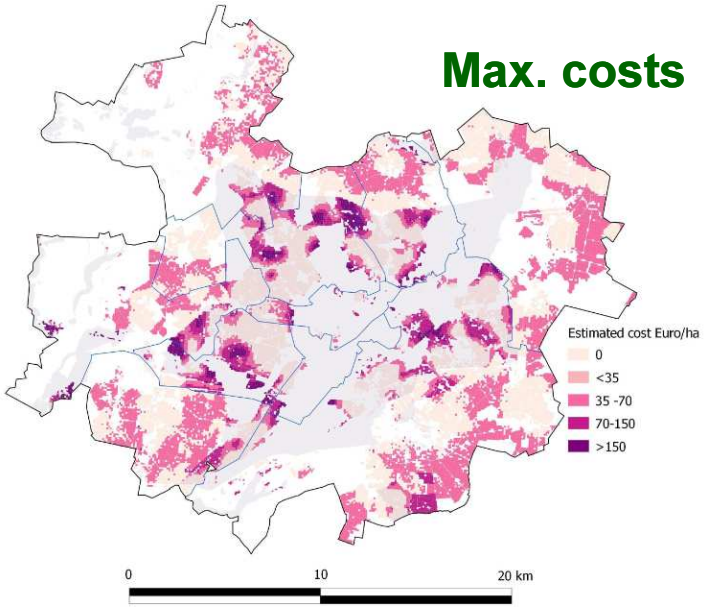


New linear elements density, m/ha

Min. costs

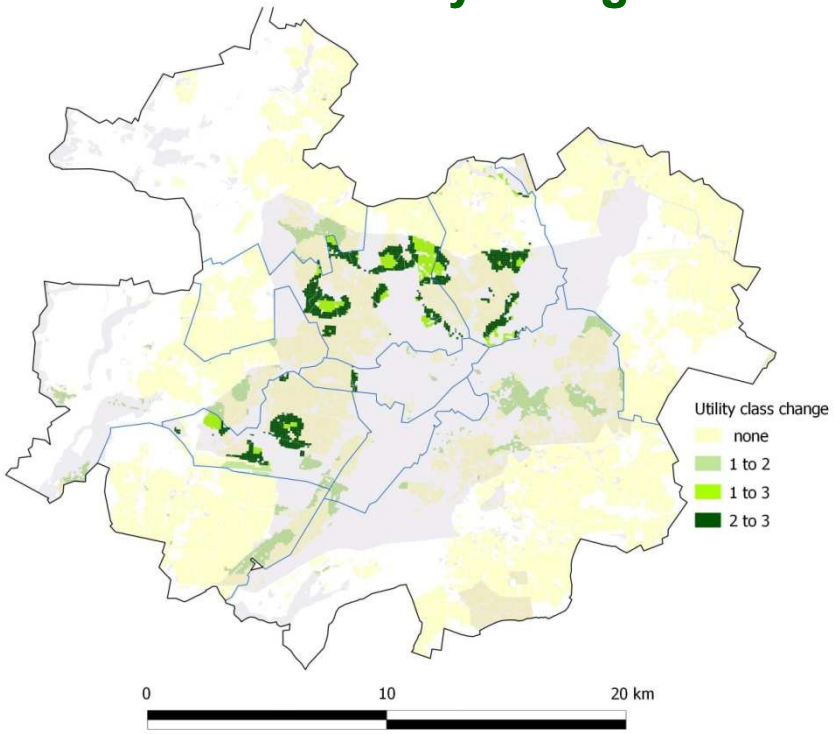


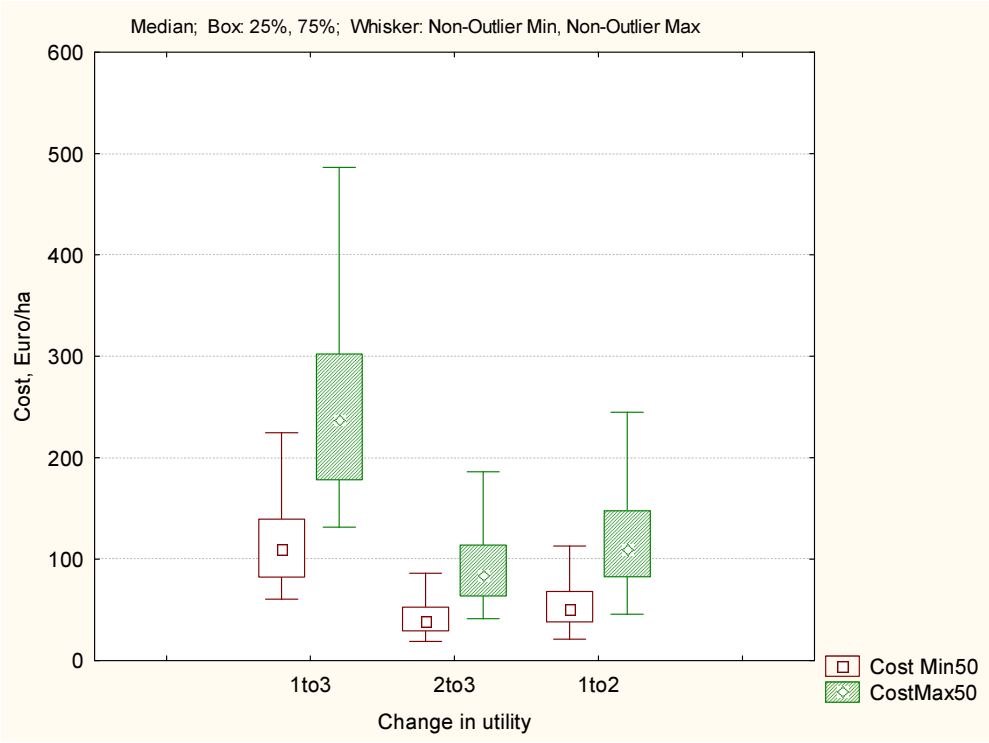
Max. costs

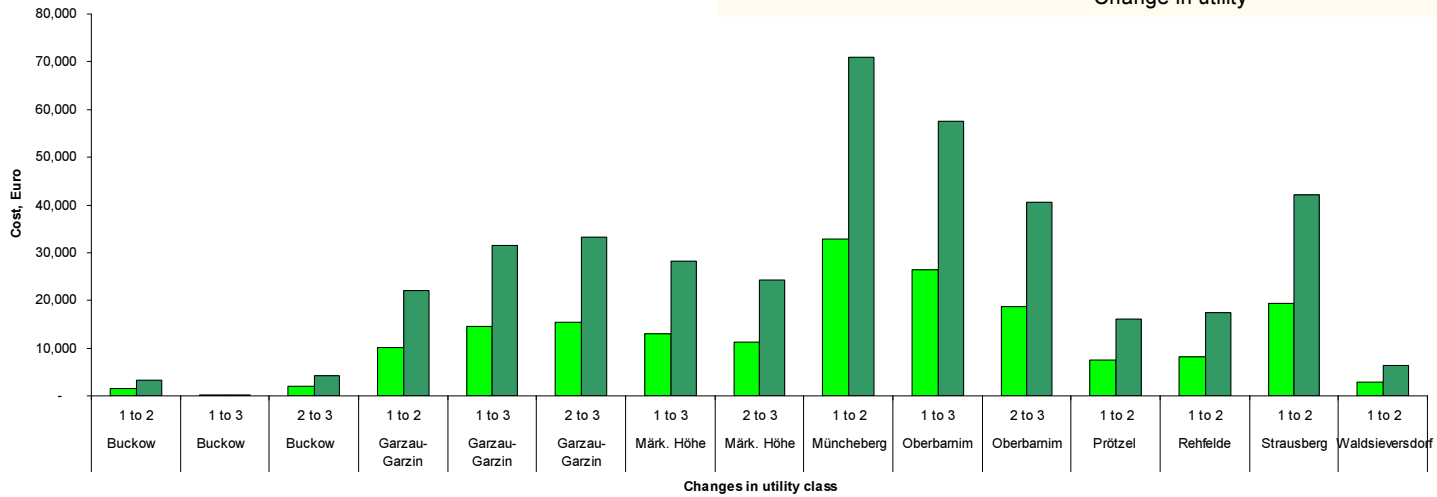


Targeting potential changes in aesthetic preferences

Utility changes after increase in linear elements to p50







Conclusions

- As the valorization of landscape amenities can result in indirect benefits and interactions with the demand of other services (i.e second order effects), landscape actors should take them into account
- The presented approach, taking explicitly into account spatial heterogeneity, can support the identification of target areas to improve cultural services provision linked to aesthetic appreciacion, or to identifies area of prioritary protection of landscape elements in the agricultural landscape in order to prevent their (further) removal
- This can in turn results into more locally effective policy instruments to be put into practice
- The delination of homogenous zones within the study area can support the definition of realistic local target thresholds
- A limitation is due to the current unavailability of a monetary evaluation of landscape preferences, but as elements probabilities can be linked to elements densities in the different subzones, target probability can be quantified and assessed in monetary terms

…thanks for your attention!