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ECTQG2021 in Manchester, keeping the ECTQG Community live in times of challenges.

Welcome to the 22nd European Colloquium on Theoretical and Quantitative Geography, ECTQG 2021 Manchester, organised by a group of researchers based at the Spatial Policy and Analysis Lab of the Manchester Urban Institute, at the University of Manchester.

There is a first time for everything, and due to the Covid-19 pandemic, the Colloquium will have in 2021 its first hybrid edition, taking place mainly online.

Worldwide, academic research has been hit by the imposed lockdowns and by the associated economic crisis. Traditional formats of academic meetings were forced to find new ways to ensure that ideas and innovation kept being discussed and shared by academics from around the world online, avoiding the risk of travel.

ECTQG 2021 Manchester raised to that challenge and has been organised with the sole aim of keeping the ECTQG community live during this very hard period of the pandemic. The Manchester Organising Committee in collaboration with the ECTQG Steering Group, faced challenges linked to uncertainties of travelling and available funds to participate in conferences, associated with a very demanding context in the UK Higher Education sector, with a dramatic increase of academic workload.

The Manchester Organising Committee is extremely happy to be able to bring ECTQG 2021 home to the ECTQG community and beyond, bringing together more than 90 accepted submissions by more than 250 authors from all continents in the world. Three great keynote lectures will be delivered by leading academics in theoretical and quantitative geography and urban analytics, along with a workshop on pedagogy of quantitative methods, six special sessions and twelve parallel sessions, all with strong thematic cohesion and interesting research presentations.

We are also very proud of bringing the European and global communities of researchers in theoretical and quantitative geography and urban analytics back to the United Kingdom, even if mainly virtually, in these times of uncertainty and challenges for the British research community.

We are, however, very sad for not welcoming you all in Manchester and at the Department of Planning and Environmental Management as initially planned. The University of Manchester is the home of Alan Turing. The Department is about to start celebrations of its 70th anniversary in 2022, being home of some historical achievements in the field as well as alma matter of some prestigious colleagues in quantitative geography.

Manchester is definitely a wonderful place to organise ECTQG.

We thank the University of Manchester Spatial Policy and Analysis Lab and Institute for Data Science and Artificial Intelligence, as well as the Urban Analytics Programme of The Alan Turing Institute for their support.

We wish to thank the ECTQG community for their resilience in keeping the interest in participating in ECTQG 2021 despite the challenges of the past two years.

We will meet all of you in the virtual spaces of the ECTQG 2021 Manchester.

The ECTQG 2021 Manchester Organising Committee

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Synergies and trade-offs in ecosystem services' provision: identifying spatial bundling in Sardinia.

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As per the definition by the European Commission, a green infrastructure is “a strategically planned network of natural and semi-natural areas [...] designed and managed to deliver a wide range of ecosystem services”. From a natural scientist’s standpoint, this definition is problematic because human-centred, as residual naturalness in Europe is here thought of as something to be managed and planned to maintain ecosystem services (ES), hence the goods and services provided by nature to humans. Moreover, “a wide range” implies that several ES can be delivered simultaneously; while some ES are often jointly provided and intertwined (Bennet et al., 2009), several studies show that some interrelationships are negative and result in trade-offs (Madureira and Andresen, 2014), especially as regards provisioning ES.

Therefore, by building on spatially explicit assessments of seven ES carried out in previous studies (Lai and Leone, 2017; Floris, 2020; Lai et al., 2020; 2021), this piece of work aims at investigating multifunctionality, i.e., an area’s capacity to provide simultaneously multiple ES, to identify areas of territorial specialization on which planning policies can be grounded. Sardinia, an Italian island, is chosen as a case study because its low residential density, low endowment of infrastructure, and persistence of traditional agricultural and farming practices have preserved a good level of naturalness, which is a prerequisite for the delivery of ES. The scale is that of municipalities, which, in Italy, represent the lowest administrative tier in charge of land-use planning, as land-use and land-cover changes are the most important factors affecting ES provision.

The seven ES here considered are as follows: habitat quality as potential nursery for species (QUHAB); global climate regulation (carbon sequestration and storage: CO2SEQ); local climate regulation (mitigation of land surface temperature REGTEMP); agricultural and forestry productivity (PRODAF); ecosystem-based potential recreation (POTRIC); intrinsic value of biodiversity for present and future generations (INTBIO); landscape quality, reflecting cultural identity and sense of place (QUPAES).

The seven ES were assessed and mapped, and their values normalized in the 0÷1 range; next, the mean normalized value was calculated for each Sardinian municipality (n=377). Following Raudsepp-Hearne et al. (2009), Turner et al. (2014), Queiroz et al. (2015), the analysis comprised three steps:

- for each ES, spatial patterns were analysed by assessing spatial autocorrelation through Moran's I index; hotspots and coldspots of municipalities having statistically significant higher or lower values than their surrounding municipalities were identified through the Getis-Ord G_i^* statistics;
- statistically significant (linear) correlations between each pair of ES were assessed through Pearson's correlation coefficient;
- clusters comprising municipalities having a level of in-group similarity higher than their dissimilarities with respect to municipality not belonging to the group were spatially identified by applying first a principal component analysis (PCA), aimed at reducing redundancies due to the present of correlations, and next a cluster analysis through the k-means algorithm.

Except for the autocorrelation analysis, which was performed in GeoDa, version 1.6.7, all the other steps were performed using ArcGIS®ESRI, version 10.7.

Figure 1 provides an overview of the assessment of each ES at the municipal level; the autocorrelation analysis, carried out with the queen contiguity conceptualization, shows evidence of spatial agglomeration ($I > 0$) statistically significant and decreasing up to the fifth level of contiguity for all of the ES but for QUHAB, for which only the first two levels show evidence of autocorrelation. The results of the hotspot and coldspot analysis are shown in Figure 2, left-hand side, and highlight that some parts of the island can be either hotspots or coldspots, depending on the ES at stake.

The Pearson coefficients (here not reported for the sake of space) show that 16 out of the 21 ES pairs are significant linearly correlated; negative correlations always concern PRODAF and CO2SEQ, which therefore compete with other ES.

Since the seven ES are mutually correlated, the territory can be conceived of as a provider of bundles of ES, and the PCA is helpful to reduce redundancies. The PCA shows that approximately 93% of the variance can be explained through four new axes, or around 97% through five axes, which represent as many combinations of the seven ES. Therefore, the k-means algorithm was run seeking out for five clusters, whose spatial distribution is shown in Figure 2, right-hand side, together with the spider diagrams that provide the mean value of each ES in each group.

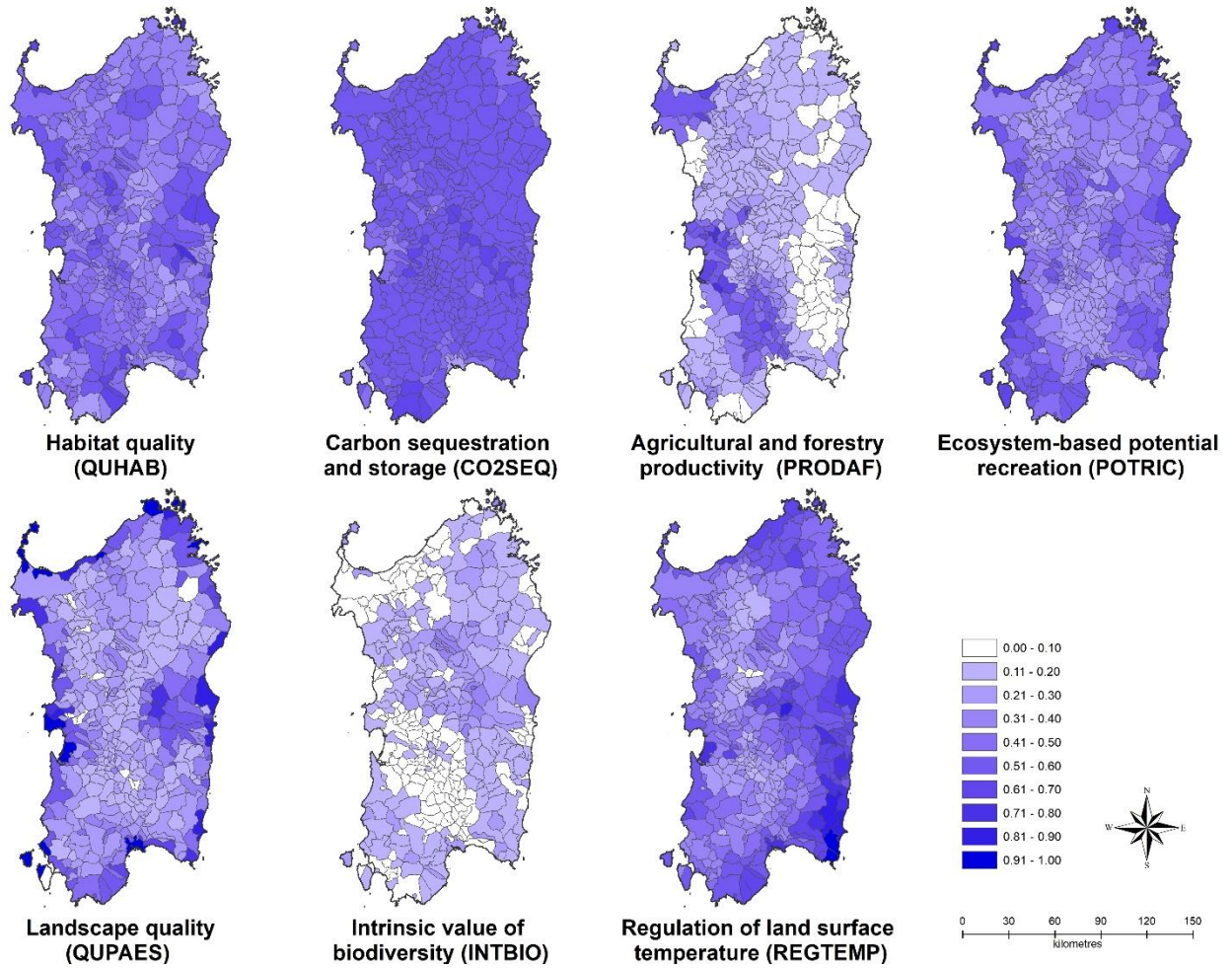


Figure 1: Mean ES normalized values at the municipal level.

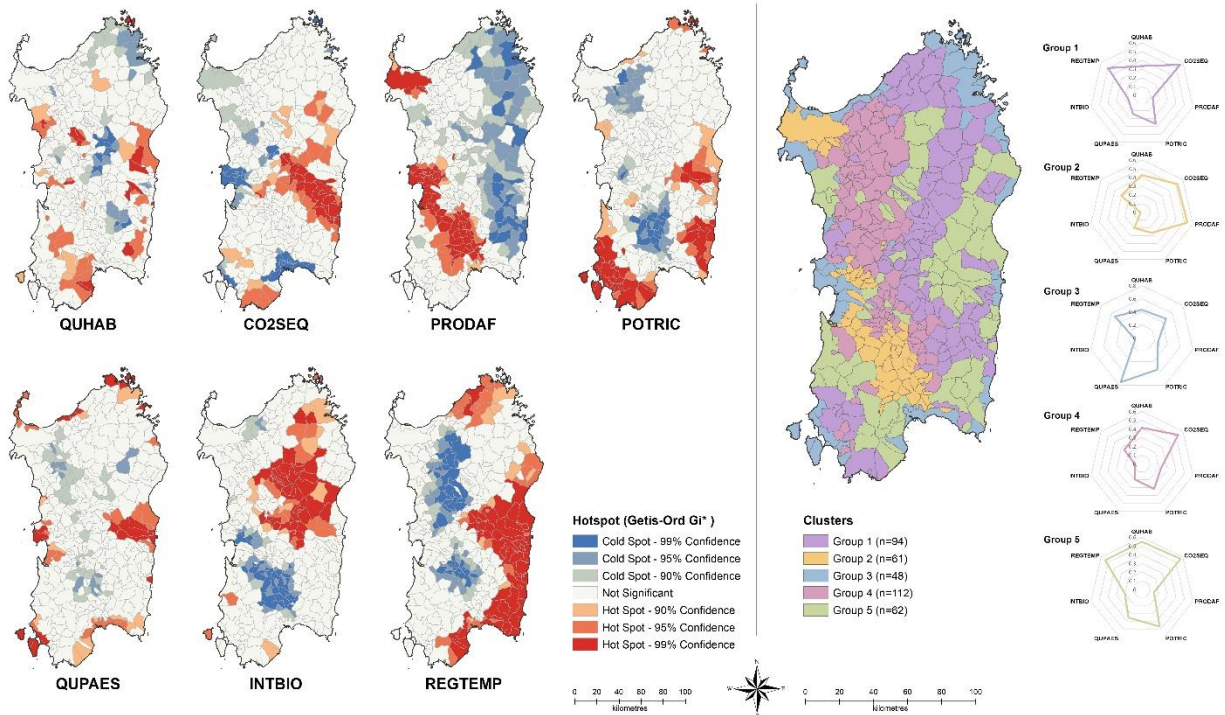


Figure 2: Hotspots and coldspots of mean ES values, municipal level (left), and results from the cluster analysis (right)

As Figure 2 shows, five municipal cluster can be identified; municipalities in each cluster share common features in terms of bundles of ES provided, and they also share some distinctive environmental and socio-economic characteristics. Group 3, where QUPAES and POTRIC dominate, comprises almost exclusively coastal municipalities, whose economies rely on tourism and whose urbanization levels are generally higher than the rest of the island's ones. Group 2, having high values of both PRODAF and CO2SEQ, corresponds to the island's main plains, hosting intensive agriculture and farming that yield comparatively high incomes with respect to Sardinian standards. Groups 1 and 4, both showing high values of CO2SEQ, differ as regards PRODAF (low in 1 and high in 4) and REGTEMP (high in 4 and low in 1); while they both comprise inner and sparsely populated municipalities, they differ as for the morphology, which is gentler in group 4, and the vegetation, which in group 4 is richer in steppe and other herbaceous vegetation and pastures. Finally, group 5 comprises municipalities having high values (in the upper quartile) of all ES except PRODAF; it includes mountain areas, whose landscapes are marked by maquis and forests, the greatest providers of ES in Sardinia.

In conclusion, the analysis of bundles of ES provision at the municipal levels unveils spatial patterns reflecting both ecological and socio-economic patterns. A case can therefore be made for the existence of a territorial specialization (Queiroz et al., 2015) that should be accounted for within land use plans, whose actions can either enhance or degrade the provision of some ES. Awareness should be raised on the fact that actions aiming at enhancing some ES (first and foremost, agricultural productivity) are often detrimental to the maintenance of other ES, such as regulation and cultural ones (Martín-López et al., 2012), and such trade-offs need careful ex-ante assessments in plan-making processes. Future research directions point to the inclusion of a larger number of ES, through which the sensitivity and stability of the clusters could be better assessed, and the inclusion of socio-economic control variables.

Acknowledgments

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