

Ecosystem services and green infrastructure planning: a method for the Metropolitan City of Cagliari (Italy)

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Introduction

Green infrastructure (GI) is considered a suitable solution to help mitigating landscape fragmentation and increasing disaster resilience. So, landscape planning and management can introduce GI-based solutions into a variety of plans with the purpose of supplying a wide range of ecosystem services (ESs). We propose and apply a method for assessing the effectiveness of GI in the Metropolitan City of Cagliari (MCC), Italy. We assess the ability of GI to provide MCC with a set of ESs that enhance the resilience of local landscapes to address the effects of climate change. The approach demonstrated outstanding viability, with the selected GI for the MCC proving to be extremely effective.

Methodology

N	Phase
1	Localization of existent potential main and minor areas
2	Selection of target ecosystem services
3	Selection of indicators of ES delivery capacity
4	First ecosystem services delivery capacity assessment

N	ES selected	Code	Indicator
3	Maintenance of species and habitats	2.2.2.3	Protection of areas of value for biodiversity Protection of forests
5	Heat island effect mitigation through vegetation	2.2.6.2	Heat island effect mitigation index

Indicator	Equation	Data requirements
Protection of areas of value for biodiversity	$I_1 = 1 - \frac{w_1 * A_1 + w_2 * A_2}{A_{Tot}}$	A_1 : surface extension (in km ²) of type 1 areas. A_2 : surface extension (in km ²) of type 2 areas. w_1 : weight attributed to type 1 areas (1.00). w_2 : weight attributed to type 2 areas (0.70) A_{Tot} : total surface extension (in km ²)
Protection of forests	$I_2 = 1 - \frac{w_3 * A_3 + w_4 * A_4}{A_{Tot}}$	A_3 : surface extension (in km ²) of type 3 areas. A_4 : surface extension (in km ²) of type 4 areas (forests and shrub inside Natura 2000 network). w_3 : weight attributed to type 3 areas (1.00). w_4 : weight attributed to type 4 areas (0.70).
Heat island effect mitigation index	$I_3 = \frac{A_5}{A_{Tot}} \times 100\%$	A_5 : surface extension (in km ²) of type 5 areas (where NDVI > 0.4289) NDVI: Normalised difference vegetation index.

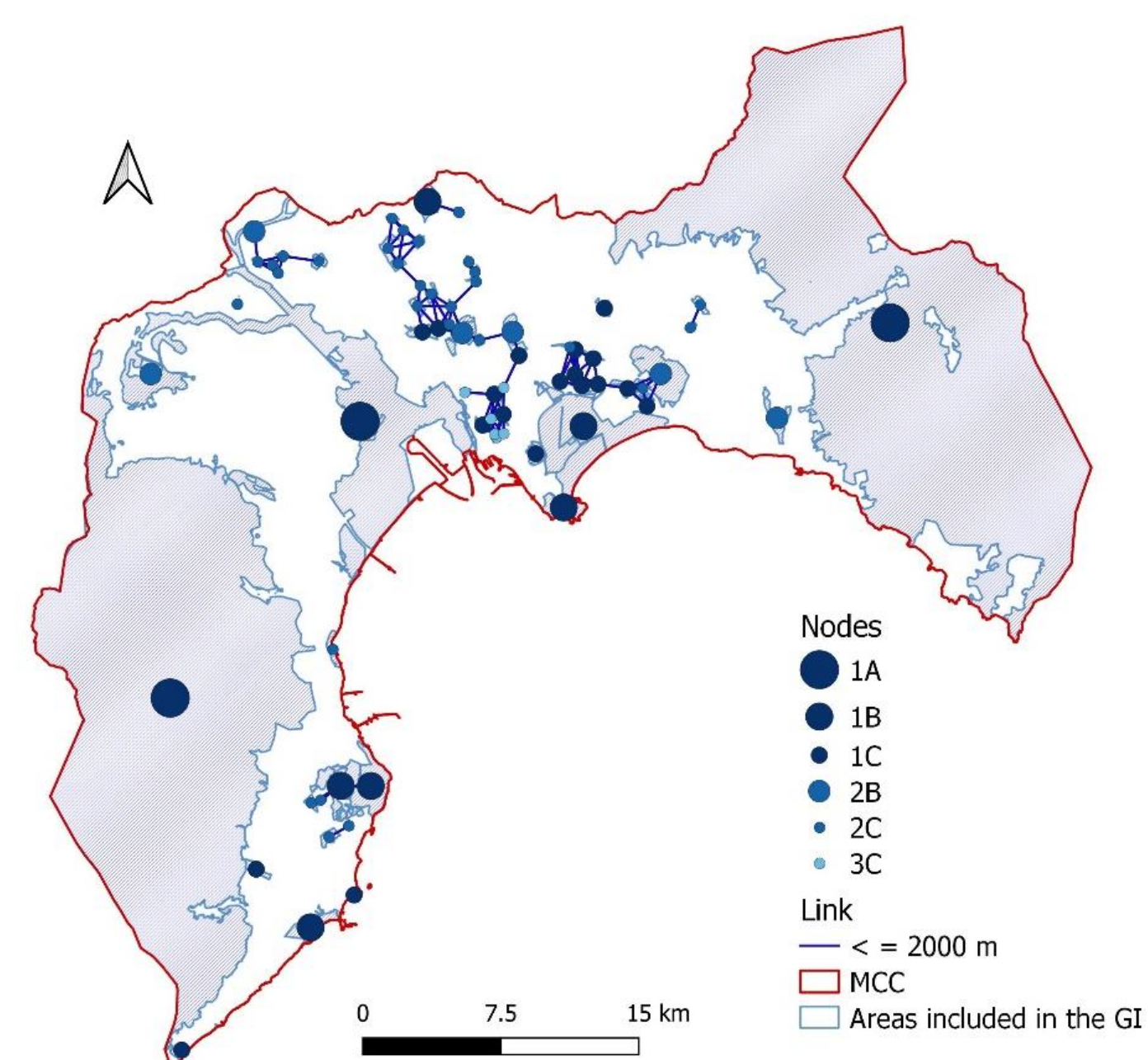
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Results and conclusions

Identification of candidate areas for a GI in the Metropolitan City of Cagliari



Assessing the ES delivery capacity

ES potential delivery assessed	Code	Indicator	Study area	
			GI	MCC
Maintenance of species and habitats	I_1	Protection of areas of value for biodiversity	0.59	0.73
	I_2	Protection of forests	0.28	0.56
Heat island effect mitigation through vegetation	I_3	Heat island effect mitigation index	20%	10%

Many GI layouts can be conceived for the MCC, but the method experimented supports decision makers in selecting the most adaptive one. The study is site-specific: ESs have been selected, with reference to this type of contexts. In this respect, this exercise can be repeated for other types of contexts with the necessary integrations concerning the selection of more proper adaptive ESs. Another key issue is the operative and institutional character of this experimentation.

