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Going green? Ex-post valuation of a multipurpose water infrastructure in Northern Italy

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ABSTRACT

A contingent valuation approach is used to estimate how households value different multipurpose infrastructures (conventional or green) for managing flood risk and water pollution. As a case study we consider the Gorla Maggiore water park located in the Lombardy Region, in Northern Italy. The park is a neo-ecosystem including an infrastructure to treat waste water and store excess rain water, built in 2011 on the shore of the Olona River in an area previously used for poplar plantation. This park is the first one of this type built in Italy. A novel aspect of our research is that it not only considers the values people hold for different water ecosystem services (pollution removal, recreative use, wildlife support, flood risk reduction), but also their preferences for how those outcomes are achieved (through conventional or green infrastructures). The results indicate that the type of infrastructure delivering the ecosystem services does have an impact on individuals' preferences for freshwater ecosystem services. Households are willing to pay from 6.3 to 7.1 euros per year for a green infrastructure (compared to a conventional one), with a premium up to 16.5 euros for a surrounding made of a park. By considering the type of infrastructure within the choice model, we gain a richer understanding of the relationship between social welfare and freshwater ecosystem services.

1. Introduction

Green infrastructures "comprise of all natural, semi-natural and artificial networks of multifunctional ecological systems within, around and between urban areas, at all spatial scales" (Tzoulas et al., 2007). Green infrastructures then refer to the living network of green spaces, water and other environmental features in both urban and rural areas. This concept is often used in an urban context to cover benefits provided by trees, parks, gardens, woodlands, rivers and wetlands. There is a long list of potential benefits provided by green infrastructures that the European Environmental Agency (2011) reviewed and classified in ten broad topics: biodiversity/species protection, climate change adaptation, climate change mitigation, water management, food production and security, recreation well-being and health, land values, culture and communities. Recently, the European Commission (2013) has defined green infrastructure as "a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services".

A large literature identifying the benefits to be expected from green infrastructure has developed in the last decades. Among others, Tzoulas et al. (2007) have reviewed the literature on green infrastructure in relationship with ecosystem health, human health and human well-being. Wang et al. (2014) have summarized the literature from different disciplines to synthesize the knowledge on the effects of green infrastructures on the indoor environment and human comfort in urban areas.

Despite the abundant literature in urban planning (Gill et al., 2007; Pugh et al., 2012; Ellis, 2013), published economic analyses focusing on green infrastructures remain still quite limited. Jim and Chen (2006) have used a contingent valuation method to evaluate the recreational amenities of urban green spaces in Guangzhou, China. Using the same valuation approach, López-Mosquera and Sánchez (2011) have shown that a higher environmental and social awareness is associated with a higher willingness to pay for the Monte de San Pedro Natural Park, a peri-urban green space located in Coruña (Spain). In the same vein, Mell et al. (2013) value the

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development of green infrastructure investments (trees) in the urban core of Manchester, UK. Benefits and costs of street trees have been also assessed in Lisbon, Portugal (Soares et al., 2011) and in Portland, US where it has been shown that the number of street trees fronting the property and crown area within 30.5 m of a house positively influence sales price (Donovan and Butry, 2010). Wilker and Rusche (2014) have used a contingent valuation approach to value different types of green infrastructures in Esslingen, Germany. They analyze how the elicited willingness to pay can be integrated in regional planning policies. Use of economic valuation to create public support for green infrastructures is also discussed in Vandermeulen et al. (2011). The perspective of Baptiste et al. (2015) is a little bit different since the authors focus on the factors that influence the public's willingness to implement green infrastructures on private properties.

Our paper aims at contributing to the literature providing economic values for green infrastructures. Our specific focus is on green infrastructures dedicated to water pollution removal and flood risk management. As a case study we consider the Gorla Maggiore water park located in the Lombardy Region, in Northern Italy. This park is a neo-ecosystem including a green infrastructure to treat waste water and store excess rain water, built in 2011 on the shore of the Olona River in an area previously used for poplar plantation. The Gorla Maggiore park is the first one of this type built in Italy. We contribute to the literature on valuation of green infrastructures in three different ways. First, our research considers the values people hold for different water ecosystem services (pollution removal, recreative use, biodiversity, flood risk reduction) and also their preferences for how those outcomes are achieved (through conventional or green infrastructures). By considering the type of infrastructure within the choice model, we gain a richer understanding of the relationship between social welfare and freshwater ecosystem services. Second, we propose the first application of the *attribute-based* contingent valuation approach developed by Moore et al. (2011) to the context of ecosystem services. Third, our valuation study has been conducted ex-post, a few years after the construction of the Gorla Maggiore water park. Since people have already benefited from the services provided by this park, this might reduce the hypothetical concerns usually attributed to using a stated preference approach.

The remaining of the paper is organized as follows. Section 2 describes our case study in Italy and Section 3 is devoted to presenting the design of the contingent valuation survey and its administration. The results of the econometric model are reported in Section 4, and Section 5 concludes the paper.

2. The Gorla Maggiore water park

The municipality of Gorla Maggiore (located in the Lombardy Region, in Northern Italy, Fig. 1) operates a typical combined sewer system designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe network. Most of the time, the combined sewer system transports all the sewage to the wastewater treatment plant of Olgiate Olona (located about 7 km downstream Gorla Maggiore), where it is treated and then discharged in the Olona River. During periods of heavy rainfall, however, the water volume can exceed the capacity of the combined sewer system and creates an overflow that is discharged directly into the Olona River. Overflows contain not only storm water but also untreated human and industrial waste, toxic materials and debris, and can contribute to local flooding. These events are frequent in Gorla Maggiore where just between March and August 2014, 70 overflows episodes were registered (Masi et al., 2015). To address this issue, the Lombardy Regional Authority has reinforced a law (R.R.n.3 from 24 March 2006), compliant with the EU Water Framework Directive, that forces all municipalities to

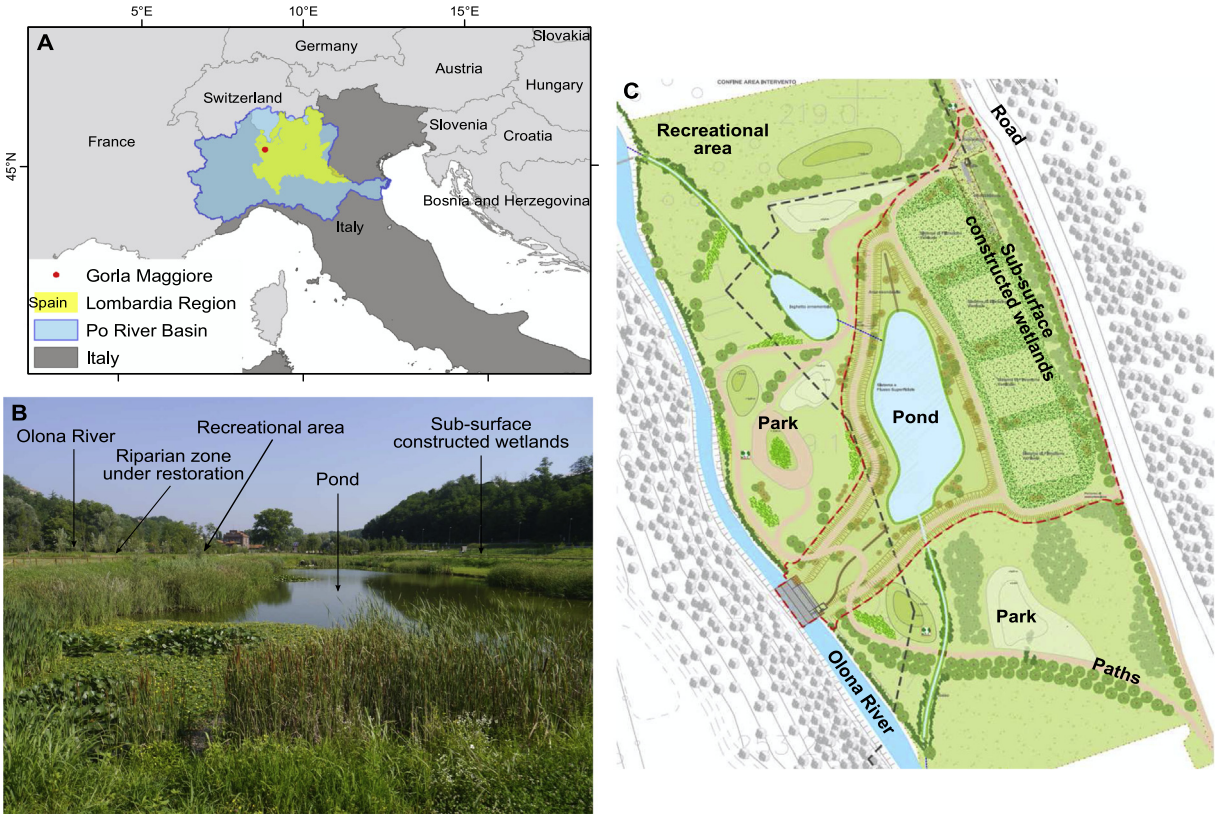

Fig. 1. Location and characteristics of the Gorla Maggiore water park.