Factors influencing greenways use: Definition of a method for estimation in the Italian context

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ABSTRACT

The aim of this research is to assess the relationships between the number of users detected along some Italian greenways and the characteristics of the territory crossed in order to define a model capable of estimating the number of potential users of a greenway before it is realized.

We have gathered monthly users data of 7 Italian greenways. For each greenway, we also analyzed the variables influencing its use (characteristics of the greenways, population, landscape, climate and season).

Using the most significant variables, we have developed three different linear regression models (I: all 13 counters; II: sub sample of 10 mountain counters; III: sub sample of 9 homogeneous mountain counters) having as the dependent variable the monthly users number, in order to assess the combination more able to describe the studied phenomenon.

The three models have a significant χ^2, meaning that the regressors are jointly significantly different from zero, thus the set of our explanatory variables plays a role in estimating greenways monthly potential users.

The use of a greenway is influenced mainly by the population level of education, the tourists number, the richness of historical and architectural resources, the degree of accessibility of the trail and by the month of the year. The population aged under 15 and over 64, the degree of urbanization influence negatively the use.

Although additional researches are needed, the model defined may have potential application in the forecasting studies to estimate existing or proposed greenways use. However, because different regions have different climates, socio-demographic characteristics and landscapes, further research are needed to extend, test and validate the model.

1. Introduction

The issue of non-motorized mobility in the last decades has seen increasing attention at the international level. In Italy, we assisted at the creation of hundreds of kilometers of trails dedicated to cycling and walking, many of which meet the greenway definition of the European Greenways Association: "*Communication routes reserved exclusively for non-motorized journeys, developed in an integrated manner which enhances both the environment and quality of life of the surrounding area. These routes should meet satisfactory standards of width, gradient, and surface condition to ensure that they are both user-friendly and low-risk for users of all abilities. In this respect, canal towpaths and disused railway lines are a highly suitable resource for the development of greenways*" (EGWA, 2002).

More generally, greenways can be planned at different scales and for multiple purposes (ecological, recreational, cultural, non-motorized mobility) (Fabos, 1995).

There is a significant literature on greenway planning and design from all around the world. Various methodologies and studies on greenway planning have been conducted in Italy (Rovelli et al., 2004; Senes et al., 2010; Toccolini et al., 2006). However, it is surprising that, despite the increasing interest in non-motorized transport (at social, political, and academic level), little attention has been paid to cycling and walking compared with other modes of transportation (Heinen et al., 2010). This is a great gap for two reasons. Firstly, because the characteristics and determinants of non-motorized transport are very specific. For example, the weather as well as physical effort greatly influence non-motorized transport when compared to car and public transport use (Heinen et al., 2010). Secondly, because in the modern society cycling and walking represent an important part of multimodal travel behavior, and combine with other modes of transport in daily life

Table 1
Classification of the variables found in the literature.

Category	Variable	References
Socio-economic variables, related to social, economic and demographic characteristics of the population and/or the users of the trails	Age	Dill and Voros, 2007; Furuseth and Altman, 1991; Handy et al., 2010; Hunt and Abraham, 2007; Moudon et al., 2005; Parkin et al., 2008; Turner et al., 1997; Wardman et al., 2007; Zacharias, 2005.
	Income	Dill and Carr, 2003; Dill and Voros, 2007; Furuseth and Altman, 1991; Guo et al., 2007; Parkin et al., 2008; Plaut, 2005; Schwanen and Mokhtarian, 2005; Stinson and Bhat, 2003; Turner et al., 1997; Zacharias, 2005.
	Education level	Furuseth and Altman, 1991; Handy et al., 2010.
	Gender	Böcker et al., 2015; Cervero and Duncan, 2003; Dill and Voros, 2007; Furuseth and Altman, 1991; Garrard et al., 2008; Moudon et al., 2005; Parkin et al., 2008; Plaut, 2005; Rietveld and Daniel, 2004; Rodríguez and Joo, 2004; Ryley, 2006; Scheiner, 2010; Wardman et al., 2007.
Environmental and land-use variables, related to the physical characteristics of the environment near the greenway	Land use	Cervero and Duncan, 2003; Clayton and Musselwhite, 2013; Coutts, 2008; Dill and Voros, 2007; Jones et al., 2010; McCahill and Garrick, 2008; Milakis and Athanasopoulos, 2014; Pikora et al., 2003; Pucher and Buehler, 2006; Rodríguez and Joo, 2004; Turner et al., 1997.
	Population density	Baltes, 1996; Boarnet et al., 2008; Chatman, 2009; Dill and Voros, 2007; Greenwald and Boarnet, 2001; Guo et al., 2007; McCahill and Garrick, 2008; Parkin et al., 2008; Turner et al., 1997; Zahran et al., 2008.
	Proximity to downtown	Bush, 2011; Coutts, 2008; Coutts, 2009; Dill and Voros, 2007; Milakis and Athanasopoulos, 2014.
	Scenery and natural areas	Chon and Shafer, 2009; Coutts, 2008; Milakis and Athanasopoulos, 2014; Pettengill et al., 2012; Shafer et al., 2000.
	Gradient	Cervero and Duncan, 2003; Hunt and Abraham, 2007; Milakis and Athanasopoulos, 2014; Moudon et al., 2005; Parkin et al., 2008; Rietveld and Daniel, 2004; Rodríguez and Joo, 2004; Stinson and Bhat, 2003.
Weather	Rain	Böcker et al., 2015; Dill and Carr, 2003; Nankervis, 1999; Niemeier, 1996; Parkin et al., 2008; Spencer et al., 2013.
	Temperature	Baltes, 1996; Bergström and Magnussen, 2003; Böcker et al., 2015; Bush, 2011; Nankervis, 1999; Niemeier, 1996; Parkin et al., 2008; Ploner and Brandenburg, 2003; Spencer et al., 2013.
	Wind	Böcker et al., 2015; Helbich et al., 2014; Spencer et al., 2013.
Temporal variables	Time of day	Bush, 2011; FHWA, 1999; Niemeier, 1996.
	Season	Stinson and Bhat, 2004; Niemeier, 1996; Ploner and Brandenburg, 2003; Guo et al., 2007.
Accessibility variables	Parking	Stinson and Bhat, 2003.
	Street connectivity	Bhat et al., 2005; Dill and Voros, 2007; Milakis and Athanasopoulos, 2014.
	Proximity to a freeway	Dill and Voros, 2007.
	Proximity to metro/railway station	Milakis and Athanasopoulos, 2014.
Alternative mobility	Household automobile availability	Dill and Carr, 2003; Dill and Voros, 2007; Guo et al., 2007; Parkin et al., 2008; Plaut, 2005; Pucher and Buehler, 2006; Scheiner, 2010; Stinson and Bhat, 2003, 2004.
	Trip distance, travel time	Hunt and Abraham, 2007; Parkin et al., 2007; Stinson and Bhat, 2003, 2004; Timperio et al., 2006.
	Cost of other means of transportation	Pucher and Buehler, 2006; Rietveld and Daniel, 2004.
Traffic variables	Motor vehicle volume	McCahill and Garrick, 2008; Stinson and Bhat, 2003.
	Traffic speed	Milakis and Athanasopoulos, 2014.
Psychological variables		Dill and Voros, 2007; Gatersleben and Appleton, 2007; Rietveld and Daniel, 2004; Stinson and Bhat, 2004.
Variables related to the infrastructures (trails, bike-paths and greenways) themselves	Proximity to bicycle network	Krizek and Johnson, 2006.
	Amount of infrastructures nearby	Dill and Carr, 2003; Jones et al., 2010; Moudon et al., 2005; Pucher and Buehler, 2006
	Pavement	Stinson and Bhat, 2003.
	Facility type	Dill and Gliebe, 2008; FHWA, 1999; Hunt and Abraham, 2007; Stinson and Bhat, 2003
	Continuity of cycling facilities	Stinson and Bhat, 2003.

(Olafsson et al., 2016).

In relation to greenway planning, there is a notable lack of specific literature on 'greenway users' and on the factors influencing their choices (Bush, 2011). Only a few studies are available (Bush, 2011; Coutts, 2008; Coutts, 2009; Coutts and Miles, 2011; Eizaguirre-Iribar et al., 2016; Mundet and Coenders, 2010; Pettengill et al., 2012; Price et al., 2012; Reed et al., 2011; Shafer et al., 2000) in the last 15 years, following the pioneering study for Indianapolis (Lindsey, 1999).

The growing interest and social demand for greenways, often collides with the scarcity of public funds putting a problem of choice among different alternative uses of public money. Consequently, it emerges an increasing need to evaluate each project in terms of its potential benefits (not only economic) and costs for local communities and its capacity to be attractive for users. In this sense, the preliminary evaluation of the number and characteristics of users potentially interested in a new infrastructure should be a crucial phase in the planning and design processes, and a necessary step to perform a cost-benefit analysis of the project. Furthermore, a correct estimation of potential users could be useful also to improve or to extend existing infrastructures.

Different methodologies could be adopted for the estimation of non-motorized users (Porter et al., 1999), falling within two broad