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Research Paper

Go greener, feel better? The positive effects of biodiversity on the well-being of individuals visiting urban and peri-urban green areas

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HIGHLIGHTS

- We assess benefits and well-being deriving from visiting urban and peri-urban green areas.
- We examine how biodiversity of urban and peri-urban green areas affects well-being.
- Biodiversity positively affects well-being, especially for urban green areas.
- Length of visit to green areas and biodiversity predict well-being through the mediation of perceived restorativeness.
- Urban green spaces rich in biodiversity can enhance well-being and promote sustainable lifestyles.

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ABSTRACT

The literature on human experience in green environments had widely showed the positive outcomes of getting in contact with nature. This study addresses the issue of whether urban residents' evaluations of urban and peri-urban natural settings and the positive outcomes deriving from contact with such settings vary as a function of their biodiversity. A field study assessed benefits and subjective well-being reported by urban residents visiting four different typologies of green spaces, selected on the basis of urban forestry expert criteria according to a 2×2 factorial design. The biodiversity level (low vs. high) was crossed with the setting location (urban vs. peri-urban) as follows: urban squares with green elements, urban parks, pinewood forest plantations, and peri-urban natural protected areas. A questionnaire including measures of length and frequency of visits, perceived restorativeness, and self-reported benefits of the visit to the green spaces was administered in situ to 569 residents of four Italian medium-to-large size cities: Bari, Florence, Rome and Padua. Results showed the positive role of biodiversity upon perceived restorative properties and self-reported benefits for urban and peri-urban green spaces. Consistently with the hypotheses reported herein, a mediation role of perceived restorativeness in the relation between experience of natural settings (i.e. higher level of biodiversity) and self-reported benefits was found. The design and management implications of the findings are discussed.

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1. Introduction

Research on restorative environments reveals that natural settings are, more consistently than others, capable of promoting psychological well-being by reducing psychophysical stress, inducing positive emotions, and facilitating the renewal of cognitive resources (Hartig, 2004). Many studies on psychological restoration in nature refer to evolutionary explanations, such as the *Biophilia Hypothesis* assuming that human beings evolved in natural environments and developed an innate tendency to respond positively to natural settings (e.g., Wilson, 1984, 1999). This positive response also includes psychological restoration, as conceived by different authors in terms of stress reduction (Ulrich, 1983) and recovery of directed attention (Kaplan & Kaplan, 1989; see also Kaplan, 1995, for an integrative framework).

Empirical evidence has frequently been provided in support of theories on stress reduction (e.g., Hartig, Mang, & Evans, 1991; Ulrich et al., 1991) and attention restoration derived from natural settings (e.g., Berman, Jonides, & Kaplan, 2008; Berto, 2005; Laumann, Gärling, & Stormark, 2003; Staats, Kievet, & Hartig, 2003; Tennessen & Cimprich, 1995). Yet, it is important to understand whether different kinds of natural settings can have different restorative effects. Furthermore, it is worth investigating the possible psychological mediators and moderators of the positive outcomes of contact with nature. Addressing relevant issues in this field of research can therefore help answer questions such as: Is the level of biodiversity (*sensu* ecological and landscape diversity) of a green setting related to its (actual or perceived) capacity to induce positive psychological states and benefits? Does this relation change across green spaces located in different parts of the urban system (e.g., urban vs. peri-urban settings)? Which modalities of interaction with nature can moderate the psychological benefits of an individual? What are the intervening mechanisms in this relation?

The purpose of this study is threefold:

(i) to assess the impact of biodiversity and location of green areas on the restorative effects perceived by its users. It is hypothesized that the biodiversity level and peri-urban location positively affect self-reported benefits, well-being and perceived restorativeness. A second hypothesis maintains that the location of green areas moderates the effects of biodiversity; i.e., the relation between biodiversity level and self-reported benefits, well-being and perceived restorativeness should be stronger for urban compared to peri-urban green areas: while peri-urban green experience is appreciated per-se, urban green experience is more positive when green spaces have a higher richness in biodiversity;

(ii) to investigate the role of experience variables on restorative effects (by referring to the activities performed in the green areas and the duration of the visits). With reference to the types of activities performed, and in accordance with the studies on social interaction in restorative environments, it has been speculated that environment-oriented as opposed to socially oriented activities in restorative environments increase the perception of restorative properties and self-reported benefits. Concerning the amount of exposure to natural settings, and in accordance with previous studies on length and frequency of visits (e.g., Lafortezza, Carrus, Sanesi, & Davies, 2009) it is presumed that the longer the visit to green areas, the greater the self-reported benefits and well-being as well as the perceived sense of restorativeness; and

(iii) to assess the role of perceived restorativeness as a psychological mechanism in the relation between contact with nature and psychological restoration. We expected the perceived restorativeness to mediate the relation between exposure to nature and self-reported benefits and well-being, as well as the relation between biodiversity level and self-reported benefits and well-being.

1.1. Biodiversity, preference and perceived restorativeness

In the study of restorative environments, nature has often been considered as an undifferentiated typology, in contrast to built environments. Yet, less attention has been devoted to analyzing the restorative potential of different types of natural environments. In the last decade, many have suggested the positive role of biodiversity in the promotion of human health in present day urbanized society (e.g., Brown & Grant, 2005). Fuller, Irvine, Devine-Wright, Warren, and Gaston (2007) have found that biodiversity increase the psychological benefits associated to the "green" experience. This result is still compatible with an evolutionary perspective, as biodiversity plays a fundamental role in life support and ecosystem continuity (e.g., Wilson, 1999). If we consider the implications of the Biophilia Hypothesis in the context of daily life situations, not only should we expect a systematic preference for natural compared to built settings, but we might also argue about the plausibility of a positive link between features such as biodiversity richness and human appreciation of green spaces. These positive evaluations should also be reflected in a greater capacity of settings with higher biodiversity levels (vs. settings with lower biodiversity levels) to induce positive outcomes.

The empirical evidence accumulated to date does not allow to imply such a straightforward relation; in fact, the relation among factors such as biodiversity richness, preference and psychological restoration remains controversial. On one hand, evolutionary accounts such as the Biophilia Hypothesis and findings from studies on landscape preference and restorative environments converge in suggesting that the natural quality of a setting is positively linked to the preferences expressed by its users (or viewers). Indeed, recent evidence suggests that a linear, albeit low-to-moderate, relation exists between actual and perceived natural quality, perceived restorativeness, and preference for green spaces (e.g., Carrus et al., 2013; Scopelliti et al., 2012). Likewise, Kurz and Baudains (2012), found a very slight preference for high-habitat-providing private gardens.

On the other hand, natural settings can induce negative feelings among their users (e.g., Bixler & Floyd, 1997; Burgess, Harrison, & Limb, 1988; Henwood & Pidgeon, 2001; Williams & Cary, 2002) and urban dwellers might express ambivalent attitudes towards urban green spaces (e.g., Bonnes, Passafaro, & Carrus, 2011; Carrus, Passafaro, & Bonnes, 2004).

A study by Qiu, Lindberg, and Nielsen (2013), found for example no relation relation between biodiversity and preference, although people correctly perceive differences in biodiversity in urban green spaces. Another recent study by Johansson, Gyllin, Witzell, and Kuller, 2014 also shows that human appraisal of biodiversity richness is controversial. These authors combined physiological and psychological measures (e.g., qEEG, self-reported emotions, preferences, attitudes) to assess human response to different levels of biodiversity in forest settings. The findings revealed a pattern of positive appraisal for intermediate levels of biodiversity richness, compared to low or high levels.

Studies directly investigating the relation of biodiversity with well-being also did not found compelling evidence. An empirical work by Dallimer et al. (2012) for example found no evidence for a consistent relationship between actual species richness of green areas and visitors' psychological well-being, while a positive relation emerged with perceived biodiversity richness.