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Improving nature experience in cities: What are people's preferences for vegetated streets?

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ABSTRACT

In the current context of strong urban sprawl, it becomes urgent to find urban approaches that simultaneously promote ecological functions and relationships between people and nature in cities. Streets are omnipresent urban elements that can deliver ecosystem services and facilitate people daily interactions with nature. Promoting vegetation in streets can take different forms which have to be combined with people's preferences. Based on photomontages, we assessed people's perceptions and valuations for herbaceous vegetation types associated to various managements and designs of pavements. Using a combination of a local field survey and a French national online survey, we collected a total of 3609 responses representing a large diversity of socio-demographic characteristics. The results of the field survey confirmed those of the online survey. Although there was variability among people valuations, we found that lowly managed pavements with spontaneous vegetation were in average higher valued than highly managed pavements without vegetation. Pavements with spontaneous vegetation were perceived as less kept than pavements without vegetation, but more beautiful and less boring. We found a consensus of high valuations towards pavements containing vegetation integrated in small design interventions (flowers seeded in foot of wall, design of a meadow strip along the pavement), suggesting that people generally accept vegetation with visible signs of human actions or managements. Socio-demographic characteristics partly explained variabilities in photo valuations. As expected, people frequently connected with nature had the highest preferences for vegetated pavements, spontaneous or integrated in designs. These results show that vegetated streets can become daily biodiversity-friendly urban greenspaces appreciated by urban dwellers. We provide recommendations for promoting vegetation in streets that will be useful for politics, urban designers and managers.

1. Introduction

The current strong urban sprawl causes profound changes in ecological habitats and associated biodiversity (Grimm et al., 2008). However, it is now recognized that nature experience is required for improving urban dweller health and well-being (Botzat et al., 2016; Cox et al., 2017b) and that it can change people attitudes towards pro-environmental behaviors (Soga and Gaston, 2016). In this context, it is necessary that researchers, designers and managers propose urban approaches that simultaneously promote ecological functions and relationships between people and nature (Aronson et al., 2017; Gaston et al., 2013; Soga and Gaston, 2016).

Nature in cities can be promoted at various scales in multiple public or private spaces (Aronson et al., 2017; Beninde et al., 2015). Land sparing and land sharing have been proposed as two spatial approaches located at both opposite ends of a continuum of nature conservation strategies (Lin and Fuller, 2013). Land sparing which consists in introducing large green spaces (e.g. parks) within a compact urban matrix has been shown an adapted strategy for hosting some large animals and uncommon plant species (Caryl et al., 2016; Kendal et al., 2017; Villaseñor et al., 2017) and to develop various people uses including walking, resting or jogging (Palliwoda et al., 2017). However, this approach induces a travel distance between housing and parks which can be a barrier to frequent people use (Soga et al., 2015). Moreover, this approach requires strong political and economic choices in urban planning. Another approach is land sharing where a higher fragmentation of green spaces dispersed through the urban matrix under diversified forms is proposed (e.g. pocket parks Ikin et al., 2013, vegetated streets Säumel et al., 2016, small urban grasslands Kendal et al., 2017). This approach is interesting to promote various biological

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communities associated to different local environmental and management conditions (Kendal et al., 2017) and to increase daily contact with nature (Soga et al., 2016). In addition, this strategy seems particularly relevant in old cities where high urban densities can limit space-consuming projects.

Streets are linear elements omnipresent in the whole urban matrix which are often only viewed as corridors for pedestrian and vehicle traffics. By introducing vegetation, streets can become multi-functional by delivering numerous ecosystem services (Säumel et al., 2016) and represent opportunities to facilitate incidental people daily interactions with nature (e.g looking at vegetation while walking in a street, Cox et al., 2017a). Street vegetation can take different forms according to design and management practices which have to be combined with people's perceptions and preferences to make effective decision-making (Bennett, 2016; Ives and Kendall, 2014; Wallace et al., 2016). In the largest streets and with a relatively high planning budget, planting trees can be an interesting strategy for improving people street valuations (Ng et al., 2015; Todorova et al., 2004). More simply, streets can also encompass a large variety of herbaceous plants, cultivated or spontaneous, by changing management practices or by making small interventions (Weber et al., 2014).

In this study, we assessed people's perceptions and valuations for herbaceous vegetation types associated to various managements and designs of street pavements. For that purpose, we conducted two surveys (one local in the field and one online at national scale) were people had to grade photomontages reflecting various management and design scenarios. Following previous studies which found that people generally prefer green infrastructures compared to mineral infrastructures (Botzat et al., 2016; Fischer et al., 2018; White and Gatersleben, 2011), we tested the hypothesis that street pavements with some vegetation are more preferred than pavements highly managed with no vegetation. We also examined the relationships between the valuations of our respondents and their socio-demographic characteristics.

2. Material and methods

2.1. Photomontages and valuation measures

We based our questionnaire on a visual method by producing photomontages representing different pavement vegetation types associated to various management practices and interventions (Fig. 1). We first constructed three photomontages to compare people valuations among a highly managed pavement without vegetation ('Asphalt High manag.') and two types of lowly managed pavements harboring spontaneous vegetation ('Asphalt Low manag.' and 'Sand Low manag.'). The represented vegetation on these photos reflects vegetation structure and composition that spontaneously grow on pavements as observed in France (Bonthoux et al. in revision). Represented dominant species are *Erigeron* sp. for 'Asphalt Low manag.' and *Trifolium repens* (L.) for 'Sand Low manag.' (Fig. 1). We then added two photomontages to assess people valuations for vegetation included in small designs. We first represented a vegetation strip at the foot of the wall ('Asphalt Flower') with sowed species which are often used in French cities for their colored flowers (e.g. *Iberis sempervirens* (L.), *Eschscholzia californica* (Cham.)). This type of intervention is possible in existing old pavements by using cracks or by removing a small asphalt strip along the wall. We also proposed an intervention consisting in the creation of a grassland strip between the pedestrian path and the road ('Sand Grassland'). All these photomontages reflect vegetation structure present in late spring – early summer which is the period in which vegetation differences between pavement situations is the highest and in which people are frequently outside and experience vegetated pavements. Finally, we assessed whether people's preferences depend on the visual context by incorporating the five pavement photomontages in open and closed neighborhood visual contexts (Fig. 1).

We used two measures to assess valuations and perceptions of each pavement vegetation type. First, the ten photos were presented individually in a random order to respondents which had to grade them between 1 (do not like at all) and 10 (like a lot). Second, to measure perceptions, respondents had to answer whether they found that the five pavement types (pavement without the neighborhood visual context, Appendix Fig. 4) were associated or not (i.e. yes or no response) to seven criteria: beautiful, boring, kept, useful for nature, natural, wild, valuable for the city image. Finally, we collected information about socio-demographic variables that could influence people valuations for pavement vegetation including age, gender, qualification level, job or studies in the environmental field or not, frequency of outdoor activities, house or apartment housing and practice of gardening (Table 1). We also asked the city name of residence to know whether respondents live in rural or urban areas (by informing the number of city inhabitants) and in which French region (by informing longitude and latitude, Table 1).

2.2. Surveys

A combination of field and online surveys including the same photomontages and collected information was realized between April and June 2017. Comparison of these two types of survey was used to check the robustness of our results and limit methodological biases.

Field face-to-face surveys were performed in the agglomeration of Blois (105 000 inhabitants) which is located in central France. Surveys were conducted in the inner Blois city and in several small villages in the agglomeration. This survey approach permitted us to optimize the age gradient range by interviewing teenagers and elderly persons who were only slightly addressed by the online survey. It also allowed to interview people not interested in the subject. The online survey was used to increase our response sample size. This latter approach can show results consistent with traditional sampling approaches and allows to obtain a cheap, fast and large collection of responses (Brickman Bhutta, 2012; Gosling et al., 2004; Riva et al., 2003). To disseminate the online survey and optimize the respondents variability we sent a web link to students, professors and administrative personnel of several universities with various specialties including environmental field (e.g. ecology, landscape architecture) and other disciplinary areas (e.g. mathematics, physics, computer science). We also posted the link on different social networks and employed a snowballing approach by asking to forward the survey to other networks.

2.3. Analyses

Grades associated to the ten photomontages were highly correlated between both field and online surveys (Spearman rank correlation Rho = 0.81, n = 10, Appendix Table 1). We thus pooled both dataset before analyses in order to improve the robustness of results.

We first compared means of grades associated to the ten photos using t-tests. We also calculated coefficients of variation to investigate the level of grade variability. To analyze the relationships between the five pavement types and people perceptions we performed a multiple component analysis (MCA) on the response (yes-no) * seven criteria matrix, including in the same matrix the responses for the five