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Research paper

Public aesthetic preferences to inform sustainable wetland management in Victoria, Australia

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HIGHLIGHTS

- Preference statistically differed between dry wetlands, open wetlands and treed wetlands.
- Dry wetlands were neutral, open wetlands slightly liked and treed wetlands moderately liked.
- Aesthetically relevant attributes of wetlands were biophysical and emergent properties.
- Familiarity increased preference for grasslands and wetlands with emergent vegetation.

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ABSTRACT

Wetlands are an important landscape element in the sustainable city, providing valuable ecosystem services that can be harnessed in alternative urban water management systems. To ensure sustainable wetland management, community preferences for wetlands in (sub)urban landscapes must be understood. Thus, public aesthetic preferences were examined for freshwater wetlands in Victoria, Australia. A simple rating methodology was applied, in which wetland images ($N = 70$) were rated for preference and selected connotative perceptual constructs on a 7-point modified Likert scale by participants ($N = 241$) recruited from community groups in Melbourne, Victoria's capital city. Data reduction analyses revealed preference categories and associated dimensions of preference, i.e. aesthetically relevant attributes. Statistical analyses related preference to the perceptual constructs as predictors and to respondents' sociodemographic variables and their familiarity with wetlands. There were five wetland preference categories, with increasing preference from 'brown grasslands', 'green grasslands', 'wetlands with emergent vegetation', 'wetlands with open water' and 'treed wetlands'. Wetland attributes that defined preference were presence of trees, amount of water and perceived wetland health, in turn defined by water quality, vegetation lushness and relative proportions of land and water. Predictors of preference were perceived wetland health, complexity, orderliness and perceived naturalness. Preference for least preferred wetlands increased with respondents' familiarity with wetlands. These results can inform sustainable wetland management, by suggesting how their aesthetic appreciation can be increased through inclusion of aesthetically relevant attributes, when compatible with environmental goals, or provision of site interpretation and education programs to promote familiarity.

1. Introduction

Wetlands are important structural, functional and visible landscape elements in cities around the world. Whether natural or constructed, they can provide valuable supporting, provisioning, regulating and cultural ecosystem services (van Roon, 2012). Through water sensitive urban design in Australia (Wong, 2006), wetland ecosystem services have been harnessed in urban water management systems to treat stormwater passively through natural ecological processes, thereby controlling flow to local waterways and improving water quality, mitigating the urban heat island effect and potentially providing an additional water source to supplement potable supplies. They also enhance local biodiversity, offer opportunities for recreation, and sequester carbon (van Roon, 2012).

In Australia, sustainable management of wetlands is guided by the triple bottom line, considering environmental, economic and social values. Social values should encompass equity and aesthetic, experiential and ethical values, to ensure sustainable landscape design (Musacchio, 2009). An aesthetic component of sustainability

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acknowledges the proposition that landscapes can only be culturally sustainable when they are socially valued and aesthetically preferred (Nassauer, 2004).

Wetlands are often cited as examples of unaesthetic landscapes (Fudge, 2001; Giblett, 1996; Nassauer, 2004), which is an expression of an ecosystem disservice (Lyytimaki & Sipila, 2009). Although some philosophers argue that not all nature has aesthetic value (Fudge, 2001), Berleant (1992) contends that everything, including wetlands, has an aesthetic dimension. This was demonstrated in a recent study of the public perceptions of freshwater wetlands in Victoria, Australia, which revealed their aesthetic value (Dobbie & Green, 2013). Understanding the aesthetic values of wetlands can be important to guide their sustainable management and the design of constructed wetlands to harvest and treat stormwater. Depending on the context, biophysical attributes known to be aesthetically relevant in attractive and preferred wetlands might be manipulated to promote preference, while ensuring that the wetlands fulfil their intended ecological function (Eaton, 2001; Wang, Nassauer, Marans, & Brown, 2012).

Beauty has been defined as aesthetic pleasure derived from experience of the natural landscape, either as an objective environmental quality that exists whether it is seen or not or as a subjective quality that exists only in perception (Lothian, 1999). Smardon (1983) attributed objective beauty to wetlands in his formal aesthetic model for assessment of USA wetlands, as did Dartnell (1996) in a model for the visual assessment of wetlands in Victoria, Australia. However, sustainability relies on wetlands being both attractive and preferred. This involves subjective beauty, a perceived landscape value.

The subjective character of landscape perception was modelled by Zube, Sell, and Taylor (1982) and more recently by Gobster, Nassauer, Daniel, and Fry (2007), who suggest that an aesthetic experience arises from the transaction of multiple nested environmental and human phenomena. The predominant environmental phenomenon comprising the perceptible realm is described as landscape patterns, in which water and vegetation and their spatial configuration enhance preference (e.g. Kaplan & Kaplan, 1989; White et al., 2010). Preference can be expected to vary, however, with various human phenomena, such as knowledge, cultural context and ethical values. Western cultural attitudes that might prejudice wetland preference relate to control and safety, neatness and care (Nassauer, 2004; Syme, Beven, & Sumner, 1993). So, too, might the cultural concepts of naturalness and health, which are assessed on the appearance of a landscape but might bear little resemblance to the scientific concept of ecological function (Nassauer, 1995). Naturalness enhances landscape preference (Kaplan & Kaplan, 1989), although what is perceived as natural can change with landscape category (Mausner, 1996). A percipient's knowledge, acquired formally through education or informally through experiences, might also influence preference (Gobster et al., 2007). So, too, might familiarity (Stamps, 1999), and whether the transaction is casual or purposeful (DeLucio & Mugica, 1994).

There is little research comparing preference between different types of wetlands explicitly, and none in Australia. Some early North American studies suggest that wetlands can be highly preferred, although the wetlands were often combined with other landscape types, confounding the preference results for the wetlands themselves (Palmer, 1983; Palmer & Zube, 1976). However, relative preference varied with waterscape category (Hammitt, 1983; Herzog, 1985; Kaplan & Kaplan, 1989). Other studies of preference and associated attitudes towards wetlands or similar stormwater management structures revealed generally favourable results (Baxter, Mulamoottil, & Gregor, 1985; Kaplan & Austin, 2004; Kaplowitz & Lupi, 2012; Wang et al., 2012).

In the absence of empirical data, prediction of preference might be useful in urban wetland management. Preference for different types of wetlands has been predicted in terms of information processing theory, in which preference is related to the wetland's spatial configuration, expressed by coherence, legibility, complexity and mystery (Kaplan & Kaplan, 1989; Kaplan, Kaplan, & Ryan, 1998). Studies of waterscape preference in the USA revealed the influence of some of these variables (Herzog, 1985; Lee, 1983; Nasar, 1987).

Theoretical models, based on a small set of variables related to spatial configuration, might not reflect the richness of human aesthetic responses to landscapes (Gobster & Chenoweth, 1989) and thus be inadequate to describe preference for wetlands, which is likely to be multidimensional (Litton, 1979). Kaplan, Kaplan, and Brown (1989) and Gobster and Chenoweth (1989) suggest that different predictor variables apply in different environments, depending on the particular aesthetic qualities and content, and need to be determined empirically. Alternatively, constructs salient in the perception of an environment have been used to describe waterscape preference (Fenton, 1988; Nasar, 1987; Palmer, 1983; Pomeroy, Green, & Fitzgibbon, 1983). These perceptual constructs structure landscape meaning and might be more relevant to a preferential judgement of wetlands than supplied variables derived from theory.

Despite this body of work, there are critical gaps in the literature on wetland preference. There are no preference studies of Australian wetlands, and other studies compare wetlands within a single type, e.g. bog, or with other waterscapes or terrestrial landscapes, not with other wetlands. Specifically, preference between different wetland types has not been studied using methodological and analytical techniques to reveal preference categories and associated aesthetically relevant attributes of wetlands. Possible predictors of wetland preference related to their perception, rather than to theory, have also not been studied, nor the influence of sociodemographic attributes or familiarity.

Thus, this paper presents the results of the first study of public preference for freshwater wetlands in Victoria, Australia, and its relationship with salient connotative perceptual constructs as possible predictors and sociodemographic attributes and familiarity of percipients. This information can then inform the management and design of wetlands, including education programmes, to ensure optimal delivery of ecosystem services by wetlands, including ecological and aesthetic values.

2. Methods

2.1. Rating scales

Preference and selected connotative perceptual constructs were rated on a 7-point modified Likert scale. To clarify the intent of each scale mark, gradations of assessment were labelled with the adverbs 'strongly', 'moderately' and 'slightly', with 'neutral' describing the midpoint.

Connotative constructs with the greatest frequency of occurrence in the perceptual categorisation of Victorian freshwater wetlands (Dobbie & Green, 2013) were selected to construct the rating scales. These constructs—'orderly', 'open', 'healthy', 'natural', 'attractive' and 'varied'—were operationalised using Kasmar's lexicon of environmental descriptors (Kasmar, 1988). Although 'defined' was amongst the most frequently used constructs, it was not included as it was used inconsistently and ambiguously in descriptions of wetlands. 'Orderly', 'attractive' and 'complex' were amongst the final group of 66 environmental descriptors in Kasmar's lexicon, developed empirically for architectural spaces. Additional descriptors, for 'open', 'healthy' and 'natural', were selected from earlier stages of the lexicon's development. The final set of operationalised constructs