The amenity value of water sensitive urban infrastructure: A case study of rain gardens

Polyakov, M.*, Iftekhar, S.*, Zhang, F.*, and Fogarty, J.*

*School of Agricultural and Resource Economics, The University of Western Australia, Crawley, WA 6009, Australia

Keywords: economic valuation; water sensitive urban design; spatial hedonic model

Summary of key findings

In this study, we estimate the value of amenity benefits generated by rain gardens constructed on street intersections in Sydney residential suburbs. We use hedonic pricing method to analyse property sales data from 2008 to 2014 and location of rain gardens constructed on 41 Sydney intersections. We found that rain gardens constructed on an intersection increase property values within 50 meters by 6% and within 50 to 100 meters by 4%.

Background and relevance

Water Sensitive Urban Design (WSUD) is a land planning and engineering design approach that integrates the urban water cycle — including water supply, stormwater, groundwater, and wastewater management — into urban design. WSUD as an integrated approach aims to improve water supply and environmental protection. It could include both centralized and decentralized technologies, such as rain gardens. WSUD can provide benefits that are easily quantified, such as additional water supply (Brown and Farrelly 2009); and benefits that are not easily quantified, such as mitigating environmental degradation, improved aesthetic appeal, and the provision of recreational benefits (Morison and Brown 2011). Rain gardens are one such WSUD technology which provides benefits not easily quantifiable.

Rain gardens are shallow-plated depressions in the landscape designed to receive rainwater from surrounding areas (such as roofs, paved areas and roads). They are planted with trees and/or shrubs (often native), and covered with a bark mulch layer or ground cover (Dietz and Clausen 2005). They usually include infiltration trenches and bioretention systems to filter pollution out of water. Compared to traditional landscaping, rain gardens are self-sufficient as they do not rely on domestic water (Maksimović et al. 2015). They can reduce the pollution load entering local waterways, conserve water, and increase local biodiversity. For example, Dietz and Clausen (2005) observed that water retention was very high (> 98%) in rain gardens even though pollutant removal was low. In another experimental study, Schlea (2011) found that the rain gardens reduced inflow volume by 37% and retained the entire runoff volume for 26% of the natural storm events. Similar observations were made by Davis et al. (2001). With widespread implementations, rain gardens could reduce flood frequency (Roy et al. 2008), reduce pollution load and improve microclimate through capturing stormwater close to the source (Maksimović et al. 2015). In a recent report, Leonard et al. (2014) have identified several benefits of rain gardens from a community survey in Adelaide: aesthetically pleasing, mitigates local flooding, traffic calming and attract environmentally conscious home buyers.

While there are estimates of the bio-physical and ecological benefits of rain gardens, information on the economic value of the amenity benefits provided by rain gardens to local residents is lacking. If rain gardens provide amenity benefits to local residents these benefits will be capitalised into the value of houses located near rain gardens. There are not many studies looking at the estimates of willingness to pay for WSUD features, and, in particular, for rain gardens. One of few examples is the study by Bowman et al. (2012) who using a contingent valuation survey in Ames, IA, USA found that the household’s mean maximum willingness to pay of $1396 for a rain garden. However, there are no similar estimates for Australia.

Results

To investigate the possibility that rain gardens provide amenity benefits that are capitalised into house prices, hedonic pricing method is used in this study. Hedonic pricing method uses revealed preference approach and assumes that a residential property is a differentiated good and that its value is a function of the characteristics of a property including structural attributes and neighbourhood, accessibility, or
location specific characteristics (Rosen 1974). Using a sample of property sales with a range of property attributes, hedonic pricing method uses regression analysis to estimate marginal implicit prices of these attributes.

We analysed data on houses sold between January 2008 and September 2014 in Sydney, Australia. From City of Sydney we have collected the exact construction date and location of rain gardens constructed on 41 street intersections in Sydney residential areas, and we have collected information 4,437 house sales across the Sydney City Council from RPData. Thus we are able to accurately identify the marginal implicit prices of rain gardens constructed on the intersection. The marginal values reflect the value local residents place on these features of WSUD.

![Study area and location of the rain.](image)

**Discussion**

This study estimated the amenity value of rain gardens constructed on the street intersections in Sydney residential suburbs. We found that construction of rain gardens are valued by the local residents, which was reflected in the increase of property values within 100 m of the intersections. Based on our initial analysis, the aggregate effect of the construction of rain gardens on average intersection is estimated to be approximately $1.5 million. Further research is needed to compare these
estimates with the results of a stated preference approach and with the cost of intersection reconstruction for integrated benefit assessment of rain gardens.

Acknowledgement

We thank Paul Tatham, City of Sydney, for providing rain gardens data.

References


