

Lifestyle and cultural barriers influence community engagement with green infrastructure

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Abstract

Few studies have focused on value structures, experiences, and cultural diversity as it relates to bioswale planning and implementation. We used ‘Point of Opportunity Interactions’ to understand previously undocumented views of the Cantonese-speaking immigrant community about bioswale design and use for stormwater management in Portland, Oregon, USA.

Approximately half of participants were not aware of bioswale function. Maintenance costs and aesthetics were noted concerns, but parking and safety were not. Lack of outreach materials in the Chinese language(s), evening and weekend work schedules, and preferences for plants were barriers to public participation. Overall, lack of trust for the city and city officials was apparent and hindered outreach engagement. Emphasis on informality and place-based data collection near bioswales as neutral outdoors spaces, proximate to participant residences, facilitated communication with this hard-to-reach population and revealed information that would have gone unknown using traditional outreach strategies.

Keywords

bioswales; Cantonese; green infrastructure; hard-to-reach communities; Point of Opportunity Interactions (POI); stormwater management

Introduction

The global human population is concentrated in urban areas, where relationships among greenspace, human well-being, and climate change are important aspects of urban living (Reyes-Riveros et al. 2021) among which their interrelationships with ecosystem service delivery contribute urban resilience (Staddon et al. 2018). Green infrastructure (GI) is “an interconnected network” of greenspace (Benedict and McMahon 2012, 281) that provides ecosystem services including stormwater management, water purification, urban heat island mitigation, sense of place, and recreation (Coutts and Hahn 2015; Ghofrani 2017). Therefore, GI plays an important role in enhancing urban human-nature connection where limited access to nature exists (Ferguson et al. 2018).

As GI planning and development expands globally, multiple factors influence municipal use of GI solutions (Grabowski et al. 2022), such as maintenance (Heynen et al. 2006), parking availability (Everett et al. 2015), cost (Shandas et al. 2010), public fee acceptance (Keeley et al. 2013), stakeholder collaboration and cross-jurisdictional communication (Keeley et al. 2013), and perceived appropriateness and success of GI in mitigating impacts (Thorne et al. 2018). Reported barriers to GI include language differences (Butler and Adamowski 2015), lack of environmental awareness (Carlet 2015), disinterest in change (Cettner et al. 2014), need for innovation (Matthews et al. 2015), and difficulty with stakeholder transfer of knowledge (Ugolini et al. 2015). Numerous studies have evaluated resident attitudes toward, preferences for, and participation in GI programs (e.g., Baptiste et al. 2015; Pincetl and Gearin 2005; Shandas 2015, Netusil et al 2014), revealing social and cultural concerns contributing to lack of support that hinders planning and implementation (Johns 2018).

Fewer studies have focused on linkages between community value structures and residential experiences with GI (Faehnle et al. 2014; McGarvey 2014), including those related to cultural diversity. Miller and Montalto (2019) observed that underrepresented communities in New York City were less convinced than others among the population that GI could provide tangible benefits or mitigate community structural injustices. Ethnically and racially diverse stakeholder groups have unique expectations from and interactions with greenspaces that evolve in part from experiences with exclusion, marginalization, and/or discrimination of individual preferences (Ferguson et al. 2018). Therefore, unequal access to GI may exacerbate inequalities in greenspace provisioning and vulnerability to existing environmental hazards (Zhu et al. 2019).

The City of Portland, Oregon's (USA) Bureau of Environmental Services (BES 2007) has been installing bioswale facilities since the early 1990s as a strategy for stormwater management under its Green Streets program. Bioswales are a specific type of GI that use vegetation to slow and filter stormwater runoff (USEPA 2017). Bioswales can be planted with different vegetation types (Killmon 2017) and facilitate numerous environmental benefits (Hoang et al. 2016). Early public participation studies about this Portland initiative (Church 2015; Shandas et al. 2010) suggested generally high levels of public awareness and engagement. However, more recent analysis reported less awareness and understanding of bioswales regardless of time since installation (Everett et al. 2016; Everett et al. 2018). Upon closer evaluation of the findings of Everett et al. (2016, 2018) there emerged a unique perspective among a subgroup of participants: the Cantonese-speaking immigrant community in Portland. Here, we report these previously undocumented views, as they highlighted gaps in stakeholder perspectives of GI in municipal and land use planning.

Methods

Study Site

Research was conducted in Johnson Creek Watershed in east Portland, Oregon, USA, as a part of a larger, interdisciplinary research effort spanning three continents (Clean Water for All 2014). Johnson Creek Watershed has experienced persistent flooding issues and, therefore, is a long-standing municipal area of interest. Floodplain reclamation and restoration in association with a willing-seller program are among existing GI features (City of Portland 2022). Bioswales have been built among residential developments during the past 20 years, which allowed researchers to select interview sites from an ample area. Socially, east Portland contains a concentration of immigrant and minority populations; some neighborhoods have greater than 25% of households speaking a non-English language (see page 4 of JCWC 2015). Throughout the Johnson Creek Watershed, the most spoken non-English languages are Spanish (10%), Russian (3%), Vietnamese (2%), and Chinese (2%).

Data collection and analysis

Bioswales were selected across a gradient of years since installation (1-2 years, 4-5 years, and 8-9 years prior to research), resulting in a quasi-longitudinal sample. Researchers then conducted Point of Opportunity Interactions (POI) around each selected bioswale (see Everett et al. 2016, 2018 for methodological approach and rationale details). POI involved approaching people at locations close to bioswales (including knocking on doors of adjacent houses) and asking if they had time to talk in their yard, on the street, or at their doorstep. In return, participants were given a small gift card. An advantage of POI was the availability of bioswales as immediate and tangible visual prompts, allowing participants to point out changes and particular characteristics, details which would have been lost if data collection took place

remotely. Before approaching households, researchers observed bioswale condition, physical appearance, and potential changes since installation; thus, becoming familiar with the bioswales as part of the residential context on a street-by-street basis (Davies 2011).

The POI consisted of a semi-structured interview (Wengraf 2001) premised around twelve questions covering four thematic areas, as follows. First, awareness and knowledge of bioswales included: 1) awareness of nearby drainage systems, and 2) understanding the bioswales' main functions. Second, perceived advantages and disadvantages of bioswales, included: 1) advantages and disadvantages of devices, and 2) whether residents made use of or interacted with them, appreciated them, and had preference for more or fewer structures. Third, residents' changes in opinion and behavior following installation included: 1) perceptions of bioswales when first installed and changes over time, 2) impacts on how residents behaved, 3) any changes in residents' relationships with water as a result of installations, 4) awareness and practice of maintenance behaviors for bioswale functioning, and 5) whether residents would be willing to contribute time or money to bioswale maintenance. Finally, perceived wider impact of bioswales on neighborhoods and the community included: 1) perceived effect of bioswales on community relations, 2) opinion as to whether other communities could benefit from similar structures, and 3) perceived impact of bioswales on property values.

Upon contact, participants were informed of the research objectives, possible outcomes, and guided through the consent process. No demographic screening was performed other than to ascertain that participants were at least 18 years old; all participants were considered eligible upon meeting that criterion. Because POIs were conducted impromptu, a semi-structured format allowed for natural flow of conversation and addressed needs of those who were time-pressed or

tired of the engagement. Answering of all questions was voluntary. One member of the research team spoke first-language Cantonese.

Data were recorded on a digital voice-recorder and transcribed verbatim. Data were analysed using Dedoose, a mixed-methods data analysis software, which allows for coding of qualitative data according to emergent themes. Interviews conducted in Cantonese were translated into English prior to coding. For data analysis, transcripts were re-read multiple times to explore and assess responses. Themes were derived using an inductive approach. A quantitative analysis for theme recurrence also was conducted to complement core qualitative analysis (see Everett et al. 2016; Everett et al. 2018).

Results

Across the broader study, data were collected from 41 interactions across nine streets, with 45 total respondents (see Everett et al. 2016; Everett et al. 2018). Most POIs (32 total; 34 respondents) were completed in English. The average time for POI engagement was 26 minutes. The Cantonese-speaking subset included nine interviews with eleven respondents (two POI included pairs of participants). Many Cantonese-speaking participants initially were reluctant to engage because they perceived the researchers as ‘from the City’, but became more interested once assured that efforts were purely academic.

Six specific themes were revealed in the Cantonese-speaking subset of interviews, described as follows.

Understanding of Bioswale Function and Maintenance

Approximately half of Cantonese-speaking participants noted that they did not understand the purpose or functions of bioswales for reasons including unfamiliarity with

the Green Streets Program and/or BES, and lack of knowledge about ecosystem services provided by bioswales.

Of course, I believe these infrastructures should have their effects [towards better water environment]... I haven't got much educational background, as we are from Mainland China. Most of the time, what [the BES] are doing, we don't really know, to be honest. What these infrastructures contribute to the climate and water environment, I do not know too much about that.

One resident learned about bioswale benefits from more civic-involved members of the Cantonese-speaking community:

I've heard from people, this green street program is used to manage flood water, to block the stormwater effects on my house, so they plant the grass for doing the same stuff and also for other purposes which I don't know too much about it.

However, another resident expressed concern regarding bioswale grass that had grown too long and needed maintenance.

It may be good. But it would be better if they could send more people to manage. I don't really know which is better. Is it better to absorb more water with long grass? Other than absorbing rain, does it have any other function?

Another respondent expressed concerns about the wild grasses providing habitat for mosquitoes.

But, if the grasses are so high, I am worried it will [encourage] mosquitoes. I don't know. Will it have more mosquitos in the summertime? Or can they send more people to cut the grass? But, are they deliberately letting the grass be so long to have better water absorption? Is this the purpose?

Environmental Benefits

Participants who had knowledge about the bioswales' intended environmental benefits noted flood prevention, water purification, and less frequently, heat mitigation. For example, one participant noted:

Good, it's quite good. That means we will not get flooded. It drains immediately to the swale after raining and also it purifies [stormwater] to be very clean, so it's very good in my mind.

Understanding of water purification and stormwater pollution were noted by two residents.

Yes, these kind of facilities should be able to absorb and reserve water, and have some better usage ... of water. I think the soil and plants may be able to purify the collected water [stormwater], then also may reserve the water, if I am correct...

It may also let some pollutants be purified [from the collected stormwater].

Several participants reflected on the role of bioswales in the context of the Green Streets program:

Interviewer: *Do you know what the purpose of doing this [the Green Streets project] is by the city?*

Interviewee 1: *Rainwater [Stormwater] drainage and flood prevention.*

Interviewer: *Do you think you or your family will understand more about the blue-green concept from this project [Green Streets]?*

Interviewee 1: *We should. For example, flood prevention or drought, etc., so I think it will have some good effect from the project.*

Interviewee 2: *Advantage is water can be drained and [the] soil cleans the dirty water.*

Interviewer: *Do you think it [the Green Streets project] can help the City to deal with climate change in the future?*

Interviewee 1: *Yes I think so – also, creating more greenspaces, I believe it may help to clean our air too.*

Although researchers explained the benefit of heat mitigation frequently, only one respondent noted the role of wild grasses in heat mitigation:

Wild grass can reduce heat. If there's no grass, when the sun shines directly to the soil, it will be very hot.

Multiple participants viewed bioswales as a potential green community gathering spot:

Interviewer: *Do you think there's any change to the whole street by doing this project?*

Good effect on the community?

Interviewee 1: *I feel it has. As least, it is good in the aspect of creating more greenspaces for this community.*

Interviewer: *Yes. Do you think it can help the neighbors or the whole community?*

Interviewee 1: *Yes, absolutely!*

Interviewee 2: *All of us will also come out to view and chat.*

Aesthetics

Cantonese-speaking participants placed value in bioswale aesthetics. Several regarded wild grasses as ugly or untidy, and associated their visual appearance with a lack of maintenance:

Too ugly! Can't it be planted some nicer flowers?

Yes, it looks very ugly in my opinion.

Support! If they can plant some nice flowers, I will support. If wild grass, it's ugly.

...it looks too chaotic.

... it looks too weedy.

However, one participant did not mind the grass:

Interviewer: *That means wild grass is a disadvantage?*

Interviewee: *It's no problem with wild grass. It even doesn't matter without watering.*

But, it is just because there are some people who like to plant grass.

Interviewer: *That means beauty is an advantage [of the bioswale]?*

Interviewee: *Yes.*

Cantonese-speaking participants also provided specific comments regarding the trees planted in bioswales. One remarked about the height of a tree within the bioswale in front of their residence.

If they can plant the tree which is not higher than the door, that would be better. I am not very satisfied with such a high tree. But I am satisfied with making the environment more green.

Two Cantonese-speaking participants suggested replacement of bioswale trees with more visually appealing and utilitarian trees, such as edible fruit trees.

I don't have any suggestions. But, if this tree can be replaced by a fruit tree, that would be great as we can pick the fruit sometimes... And also, allow us to plant some flowers. If the government doesn't want to plant, I don't mind planting them by myself.

If this tree could be replaced with a fruit tree, it would be good. If not, a cherry tree is better than this as a cherry tree looks nicer. I just only have problem with the tree.

Engagement with the City

Cantonese-speaking participants expressed feelings of detachment and hesitancy to voice opinions on bioswales. Several viewed bioswales as something done *by the City to* their streets.

Interviewer: *Have you responded to them [the City of Portland]?*

Interviewee: *No. We're shy.*

Two others shared this view:

I don't really know. It's not our business, so we don't want to be a bother.

We don't know ... it's done by the City, not us.

Confusion and frustration also existed regarding the City's intensive and unconsented use of residential water. Despite similar experiences expressed by multiple participants, concerns had not been voiced to the City.

Yes, but why do they need to use our water?

Yes, there is the tap outside. So, they used our water.

But they always use it and it lasts a long time. If they could use their own water, that would be much better. It's because they are not using less amount.

Barriers to dialogue between the City and Cantonese-speaking participants included a perceived lack of culturally informed educational outreach about Green Streets:

I don't really know if they [the City of Portland] have ever sent related information.

Whether or not, I don't remember if we have been sent such information or not.

Another respondent expressed similar concerns regarding a lack of information from the City:

Interviewer: *Has the City told you what this is [the project and bioswale]?*

Interviewee: *No. They only said they plant the grass to prevent something....*

Financial concerns also existed. There was willingness to support the City's bioswale installation and maintenance if it did not cost participants money.

To Chinese people, if it needs money, people of course won't support. If it doesn't need money, they will have no problem to do what they like. We don't need to pay management

fees. Let us say, for some people, they need to pay a management fee, if there is any need to change or repair, they need to pay an extra fee. Chinese people are very busy. For paying land tax, people will complain if the grass hasn't been managed. For those who don't need to pay land tax, they won't complain. Most may just say to water the grass. ... If you need to ask for money from people, of course they are not willing to. There's no point to pay a few more dollars every month, nobody will be willing to.

Language

Issues with language were mentioned often. As a group, the Cantonese-speaking participants were recent immigrants with limited English language skills.

My English is not too good and I don't have much spare attention and also don't have much educational background to understand this stuff. So, I don't really know what is going on.

Reflections about inaccessibility of English-only information was common among participants:

Interviewer: *Does the government communicate well with you about this project? Have they told you or distributed to you any leaflets in Chinese?*

Interviewee: *Not using Chinese.*

Two other Cantonese-speaking residents shared this view:

[The government] should have sent us some letters about the program by the council. But, it is all in English, not in Chinese, so it is difficult for us to read. Most of our Chinese neighborhoods can't read if it is just in English.

... Most of the elderly don't know too much about the English language. And also, most of them are working in kitchens [in Chinese restaurants], they may not read this kind of thing. They may need to boost up our education on such projects.

Timing

Cantonese-speaking participants tended to work evenings and weekends in restaurants, suggesting potential unavailability during city outreach and maintenance activities.

Interviewer: *Does anybody from the government come to cut/clear the grass?*

Interviewee: *I don't really know. It's because I have long working hours from 7:00 am and come home around 8:00 pm. So, I don't know... I work seven days a week.*

Interviewer: *Do they distribute some leaflets to let you know what they are doing?*

Interviewee: *Yes. But I need to work, so I'm not always at home.*

Discussion

Similar to interviews conducted in English (see Everett et al. (2016, 2018), approximately half of Cantonese-speaking participants were unaware of bioswale function, although some noted conceptual linkage with the Green Streets program. Concerns about maintenance costs and aesthetics, regardless of environmental benefits, were consistent with findings reported elsewhere. Everett et al. (2016) reported that residents perceived plants negatively when they were large, looked unkempt, or resembled weeds. Meenar et al. (2020) also found that residents formed opinions based on plant aesthetics. Cantonese-speaking participants specifically noted aversion to grasses. Expressed focus on bioswale tree aesthetics and favor for cherry trees, the spring flowering and fragrance of which are cultural icons where such trees exist, was unique to the Cantonese-speaking participants in terms of both location and type of tree. Cantonese-speaking participants also uniquely expressed two particular interests for GI presence -- edible

plants and potential gathering and meeting spots -- both of which might fill important cultural and social roles in the neighborhood (Mateo-Babiano and Ieda 2007, Schetke et al. 2016). Such findings support recent trends of defining “environment” based on characteristics and context of one’s local surroundings (e.g., “the place you work... live... play” (Heynen et al. 2006; p. 6).

In contrast, commonly noted concerns about GI such as parking availability (e.g., Jayakaran et al. 2020), and physical safety (e.g. Venkataramanan et al. 2020) were not reported. We speculated that fewer Cantonese-speaking participants own vehicles, have fewer cars per household, are home at times when more street parking is available, and/or rely on public transportation. Although such reasoning was beyond the scope of our analysis, this disparity of perspective demonstrates the importance of inclusion.

Shandas et al. (2010) and Church (2015) suggested that outreach by the City of Portland improved civic capacity to support GI projects; our results contrasted those findings. First, language was a key barrier, as reported elsewhere (Lovell and Taylor 2013). Cantonese-speaking participants expressed desire for information in Chinese language(s), the absence of which prohibited efficacy of distributed materials, response to calls for participation, ability to communicate about maintenance, and disinterest in opportunity to learn more. Second, participants suggested potential feelings of ‘outsiderness’ (e.g., Mullings 1999). Their refusal of invitations to attend GI-related meetings supported other findings that have cautioned against treating Anglo-European ethnic outreach practices as standard (Klocker and Head 2013). Third, Cantonese-speaking participants reported working long hours, evenings, and weekends in the restaurant sector. Community planning remains disadvantageous to those unable to or unaware of how to participate (Heckert and Rosan 2016). Meynen and Doornbos (2004) suggested arranging meetings to accommodate inflexible schedules. Therefore, engaging potentially

marginalized stakeholders early in the planning process would reveal nuances to facilitate participation and build trust (Butler and Adamowski 2015; Staddon et al. 2018).

Even if Cantonese-speaking participants felt inclined to engage in municipal outreach invitations, a sense of distrust and power dynamic between participants and ‘the City’ was apparent. For example, annoyance about the City’s use of residential water revealed a previously unreported disconnect between the City and residents (*n.b.* researchers did not attempt to verify use of residential water to maintain bioswales). Shifting the dynamic to participant comfort in conversation was enabled by researchers reassuring participants (in Cantonese) that they were not from ‘the City’; thus shifting the research dynamic towards ‘acquiescent friendship’ rather than ‘authoritative professional’ (Hazel and Clark 2013, p. 308). The research team also emphasized their ‘outsider’ and ‘junior’ statuses (two UK academics, one Chinese and the other a wheelchair user, and a US PhD student, using first names rather than titles, and casual and good-humored conversation). Thus, no matter how City staff behave, they may not be perceived or received in a nonauthoritative way -- a power dynamic exists.

Conversing in more neutral outdoors spaces also was felt to ease initial concerns of authority (e.g., Kerstetter 2012). Researchers were able to meet participants ‘where they were’ -- on their street and near their residence -- where participants could feel safe and supported (Wagner 2013). Ability to look directly at bioswales allowed for culturally relevant visioning of space use (e.g., gathering place) and removed need for participants to travel. It also allowed for real-time clarification of perspectives and vocabulary, useful information for developing outreach resources (e.g., Clarke et al. 2015) for those unfamiliar with English GI terminology (see effort by Buendía-Castro 2019). In-person interactions, particularly a door-to-door outreach strategy, also were important for raising awareness and fostering trust in GI by residents in New

York City (Simons 2017). Such an approach also allows for observance of *which* citizens have been engaged versus not, as noted by others (Wagenet and Pfeffer 2007).

Collectively, the Cantonese-speaking participants fit the classification of ‘hard-to-reach’ (Shaghghi et al. 2011) for these reasons: most spoke little or no English, cultural differences meant they did not engage with city officials or those appearing to act on behalf of the City, and worked non-traditional schedules. As a methodological limitation with all sample-based research, respondents were self-selected and findings do not include views of non-respondents; the research team were told ‘no’ by people of all backgrounds. However, keeping engagement time to a minimum and taking the research *to* participants (Cinderby 2010) allowed for valuable insights and engage voices that otherwise might not have been heard.

Conclusion

Point of Opportunity Interactions (POI) facilitated conversations about bioswales with the ‘hard-to-reach’ Cantonese-speaking population in Portland. Some concerns reflected those of English-speaking participants, yet many nuances were exposed about barriers to engagement that focused on language, scheduling, and cultural preferences. Lack of trust of city officials and reasons thereof revealed a constraining power dynamic. Our approach allowed for reflexive, wider-reaching, and empathetic conversations around disability, vulnerability, and infrastructure that addressed research objectives and captured insights that otherwise might have gone unheard.

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