Gaining Ground: Green Infrastructure Attitudes and Perceptions from Stakeholders in Syracuse, New York

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This research is part of an ULTRA NSF-US Forest service research grant addressing urban ecosystem metabolism in Syracuse, New York. This project explores local stakeholders’ perceptions of green infrastructure (GI) and ecosystems services from both positive and detracting perspectives. Focus groups were used to elicit responses for a thematic analysis. Respondents displayed confusion about what ecosystems services are, as well as what GI is. Implementation barriers include costs (who pays), what the benefits are, unanticipated impacts, and scale of implementation.

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Much has been written recently about green infrastructure (GI) and its potential role in improving the physical environment of older cities in the United States (US), as well as providing health and amenity benefits (Benedict and McMahon, 2006; Center for Neighborhood Technology, 2010; Jaffe, 2011; National Research Council, 2005; Tzoulas et al., 2007; Van Kamp et al., 2003; Wise et al., 2010). The US Environmental Protection Agency (USEPA, 2011) defines green infrastructure as “an array of products, technologies and practices that are natural systems—or engineered systems that mimic natural processes—to enhance overall environmental quality and provide utility services.” This concept evolved from the ecological planning discipline (Benedict and McMahon, 2006). Such GI projects are being used to provide a variety of ecological services for older Rust Belt urban areas. Examples include rain gardens, bioswales, green roofs, constructed wetlands, and permeable pavement (see Figure 1). These GI projects provide ecological services that can be regulatory (water-quality treatment), provision (urban gardens), maintenance (urban biodiversity), and cultural (urban amenities and human health).

Even though GI is being implemented within urban neighborhoods in Chicago, Cincinnati, Milwaukee, New York City, Philadelphia, Portland, and Seattle—there are barriers to successful implementation of such infrastructure at larger scales (Jaffe, 2011; National Research Council, 2008; Traver, 2009). Such barriers may relate to costs and benefits of GI (Jaffe, 2011) or local perception of unwanted or unknown impacts (Smardon, 1989; Traver, 2009). This project seeks to explore the basis for such perceptions for selected urban neighborhoods in Syracuse, New York.

Some Basic Definitions

The following are definitions of key terms that will be used often within this article:

- **Health** is the state of complete physical, mental and social well-being (World Health Organization, 1948).
- **Well-being** is material security, personal freedoms, good social relations, and physical health (Millennium Assessment, 2003).
- **Healthy ecosystems** are free from or resistant to stress and degradation, and maintain their organization, productivity, and autonomy over time (Costanza, 1992; Rapport, Costanza, and McMichael, 1998), but this is not a universally accepted definition.
- **Ecosystem services** are the delivery, provision, protection, or maintenance of goods and benefits that humans obtain from ecosystem functions (De Groot, Wilson, and Boumans, 2002; Millennium Assessment, 2003).
- **Green infrastructure** can be considered as all-natural, seminatural, and artificial networks of multifunctional...
ecological systems within, around, and between urban areas, at all spatial scales (Tzoulas et al., 2007, p. 169).

- *Socioecological systems* are complex integrated systems that emerge through the continuous interaction of human societies and ecosystems (Grimm et al., 2000; Haberl et al., 2006; Redman, Grove, and Kuby, 2004).

**Background and Literature Review**

**Urban Ecosystem Social Science Conceptual Models**

Conceptual frameworks have been developed that link urban ecosystems, human, and ecological health and GI. Social science research models address environmental effects on human mental and physical health. Table 1 includes model theory, the physical environmental aspect, and the related human health aspect. The general summary is that green urban space and biodiversity have value for improving mental and physical health for urban residents. Also, the social models that van Kamp et al. (2003) and Circé (1996) have synthesized for livability and quality of life illustrate the complex interplay of factors affecting quality of life, including personal, social, cultural, community, natural, and built environment, as well as economic factors. So the issue here is how GI improves urban resident physical and mental health, as well as overall quality of life, and whether such values are so recognized.

Another useful construct can be derived from the Millennium Ecosystem Assessment (2003), which assesses global ecosystems changes and resultant impacts on human well-
Table 1. Models and theories linking ecosystem and human health

<table>
<thead>
<tr>
<th>Source</th>
<th>Model/theory</th>
<th>Environmental aspects</th>
<th>Human health aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeman (1984)</td>
<td>Environmental effects on mental/physical health</td>
<td>Physical, social, and cultural factors</td>
<td>Nervous system and illness</td>
</tr>
<tr>
<td>Henwood (2002)</td>
<td>Psychosocial stress and health</td>
<td>Poor environment</td>
<td>Chronic anxiety, stress, and high blood pressure</td>
</tr>
<tr>
<td>World Health Organization (1998)</td>
<td>Arch of health</td>
<td>Environmental, cultural, and socioeconomic factors</td>
<td>Working and living conditions, community, lifestyle, and hereditary factors</td>
</tr>
<tr>
<td>Paton, Sengupta, and Hassan (2005)</td>
<td>Healthy living and working model</td>
<td>Environmental, cultural, and socioeconomic factors</td>
<td>Living and working conditions</td>
</tr>
<tr>
<td>Maclntyre (2002)</td>
<td>Basic-needs framework</td>
<td>Natural environment and resources; landscape</td>
<td>Health—all aspects</td>
</tr>
</tbody>
</table>

Adapted from Tzoulas et al (2007).

being (Cairns and Pratt, 1995). This includes a conceptual framework linking ecosystem services and human well-being through socioeconomic factors. Ecosystem services, which are grouped into four categories—provisioning, regulative, supporting, and cultural services—provide for human well-being within five categories—security, access to basic resources, health, good social relations, and freedom of choice.

Perception Studies of Green Infrastructure

There has been a growing, but limited, literature on the roles, functions, resident attitudes, and constraints to GI implementation. North American studies of GI perception include studies in Albuquerque, New Mexico (Abrahams, 2010); Gainesville, Georgia (Johnson, Hartel, and Kuehler, 2008); Los Angeles (Pincetl and Gearin, 2005); and Portland, Oregon (Shandas, Nelson, and Arendes, 2009). Perceived community benefits of GI in these communities include better understanding of ecological systems (Shandas, Nelson, and Arendes, 2009), increased access to urban green space (Abrahams, 2010; Shandas, Nelson, and Arendes, 2009), safe and healthier neighborhoods (Abrahams, 2010; Shandas, Nelson, and Arendes, 2009), informal citizen groups taking action (Shandas, Nelson, and Arendes, 2009), and provision of equity through access to green space for lower-income neighborhoods (Floyd, Gramman, and Saenz, 1993; Johnson, Hartel, and Kuehler, 2008; Pincetl and Gearin, 2005). Studies of GI perception and value from an international perspective include those done for the United Kingdom (Mell, 2010), Denmark (Nielsen and Hansen, 2007; Rusche, 2011), Malaysia (Mansor and Said, 2008; Mansor, Said, and Mohamed, 2008, 2010), Pakistan (Qureshi, Breuste, and Lindley, 2010), and South Africa (Cilliers, 2009). These studies support the following perceived attributes of GI for these communities:

- Green-space access as social equity (Cilliers, 2009; Mell, 2010)
- Green-space accessibility for well-being (Qureshi, Breuste, and Lindley, 2010; Rusche, 2011)
- Perceived crowding and green-space quality (Qureshi, Breuste, and Lindley, 2010)
- Availability of physical recreational activities (Mansor and Said, 2008; Mell, 2010)
- Social well-being and participation (Mansor and Said, 2008)
- Sense of place attachment (Mansor, Said, and Mohamed, 2008)
- Green-space accessibility related to stress reduction and health benefits (Mell, 2010; Nielsen and Hansen, 2007)

There is often confusion as to what the terms open space, green space, and green infrastructure mean, as well as who benefits and how (Kaplan, Austin, and Kaplan, 2004; Nassauer, 1992; Smardon, 1988). The specific issue to be addressed here is how to evaluate the values and functions of GI measures of urban runoff reduction. Jaffe (2011) suggests on the basis of the recently completed Illinois EPA study (Jaffe et al., 2010) “that green infrastructure strategies are cost effective when compared to conventional stormwater management approaches, even when evaluated in terms of their direct costs and savings over their useful lives” (p. 357). He further asserts that there are methodological problems in assessing indirect benefits and values,
such as ecological services—and that direct measurement of costs and benefits of GI is better.

However, if we were to address the range of potential barriers to GI implementation—then further knowledge of how stakeholders perceive GI functions and values as well as perceptual barriers would be useful. According to Traver (2009) and the National Research Council study (2005)—there are three major barriers to urban storm-water runoff related GI, institutional, technological and perceptual barriers. Traver (2009) states that there are misconceptions regarding GI and low impact design, especially related to disease vector habitat for mosquito populations. Other perceptual barriers to GI implementation mentioned in other studies include

- Cost to the resident property owner (LaBadie, 2010; Shandas, Nelson, and Arendes, 2009)
- Disconnect between urban dwellers and their environment (LaBadie, 2010)
- Lack of support for waterway impoundments (LaBadie, 2010)
- Lack of political will to adopt GI (LaBadie, 2010)
- Skepticism from engineers and developers about GI technology (LaBadie, 2010)
- Lack of knowledge on how to design, construct, fund, and maintain GI (LaBadie, 2010; Shandas, Nelson, and Arendes, 2009)
- Lack of knowledge on how GI operates in local climatic conditions (LaBadie, 2010)

Specifically in the Portland Oregon study (Shandas, Nelson, and Arendes, 2009) respondents were more likely to help maintain GI facilities if they were

- Younger
- Involved in other environmental projects and youth groups
- Perceived a high-quality neighborhood association and low access to parks and other open space
- Considered the neighborhood lacking in greenery
- Had greater involvement with community meetings

Understanding urban residents’ perception and attitudes toward ecological services and GI introduction in their neighborhoods will be key to decision making for any such implementation program. Palmer (1984) and Smardon (1988) have previously defined Syracuse neighborhoods and found distinct differences in city residents’ attitudes about urban trees and other vegetation—both positive and negative. Baptiste and Lane (2009) indicates that public perceptions, beliefs, and concerns, as well as incentive structure preferences toward storm-water GI alternatives, are spatially and economically distributed. Related research in Syracuse reveals variations in preference for bioswale design among low-income Hispanic members of the community. Our research will expand on this work by including a broader socioeconomic spectrum of neighborhoods. By developing the methodology to profile such perception and attitudes—at neighborhood-block scales—we will be facilitating the decision-making support structure and physical model development for GI alternatives.

The overall objective of this study was to explore via focus groups and surveys—the perceived constraints and benefits of residents living within the West Side study area in Syracuse. The specific objective reported here are focus-group results about benefits and constraints to implementation of Green Infrastructure (GI) in Syracuse. Also we explored resident’s perceptions of ecosystem services, perceptions of quality of life, and preferences toward implementation of GI technologies.

**METHODS**

Study Area

The city (City of Syracuse), and three local neighborhoods (Downtown, Near Westside, and Strathmore) comprise the study area (Figure 2). The neighborhoods also are part of a sewershed whose effluent causes numerous combined sewer overflows (CSOs) each year that contaminate the major creek, Onondaga Creek, running through the City of Syracuse. Downtown has a 49.3% non-White population, with 28.8% over age 25 without a high school equivalent education and an average annual household income of around $10,000. Near Westside has a 62.8% non-White population, with 49.7% non-high school educated and an average household income of around $14,000. The Strathmore neighborhood has a 17.3% non-white population, with 7.3% non-high school educated and an average household income greater than $40,000.

To address preferences and governance related to GI, we investigated the perceptions, attitudes, and values of urban
Residents in the neighborhoods with regard to: (a) ecosystem services, (b) connections of ecosystem services and quality of life, and (c) drivers affecting potential implementation of new GI technologies. We also will—at a later stage—investigate how city and county decision makers, businesses, and community organizations perceive the same aforementioned issues and both sets of information can be integrated into a collaborative modeling approach for GI implementation. This initial work was accomplished by convening initial focus groups to determine how stakeholders (broadly defined) perceive “natural ecosystem processes and services” within the general West Side of Syracuse which contained the three microneighborhoods: the Near Westside, Downtown, and Strathmore. These stakeholder sessions investigated the range of attitudes, values, perceptions, conceptions, and concerns related to ecosystem services by using standard focus-group methods (Greenbaum, 1988; Krueger, 1994; Morgan, 1988). Ecosystem services will be defined by urban vegetation and other GI mechanisms illustrated in Figure 1 that serve as carbon sinks, mitigate air quality, modify microclimate, and reduce urban runoff. The results of these focused groups are presented within this article.

Our participants for the focus groups were largely drawn from existing community contact bases in the three neighborhoods and subsequent snowballing technique. We took care to ensure that the participants represented a range of interests wherever possible—efforts were made to use community leaders and those individuals with strong ties to our project-area neighborhoods in order to ensure an appropriate representation.

We arranged for the two focus-group meetings (10 and 6 subjects) to be held at the Syracuse Center of Excellence, a relatively central location in the city, which would be an attractive incentive for participants to visit. Both sessions were held from approximately 4 to 6 p.m. to accommodate people’s schedules. The meeting space was open, and participants and facilitators sat at a roundtable. We began each session with a short presentation that introduced the project, ourselves, and a few key concepts. We had the participants each contribute by going around the table so each person had the opportunity for his or her voice to be heard. Summaries of main points discussed are described in the next section. While a session elicited distinct responses due to the varied dynamics of the participants, this is an overall description of responses as derived by thematic content analysis from the audio tape recordings of the two focus-group sessions.

Focus-Group Summary Results

We gathered two focus groups in the summer of 2010 to assess public conceptualization of ecological/ecosystem services and GI, and to vet the survey instrument to be used in the project area’s three microneighborhoods this fall. The following is the thematic summary given each of the questions that were posed to the two focus-group sessions.

Q1. What do you know about ecological services?

Overall, there is substantial public ignorance regarding ecological services; most participants—six of 16—had not heard of them, though four made some connection to the term. At least one participant mistook ES as something “bureaucratic,” and others assumed it meant something that is human-created and managed.

Q2. How do you think about your neighborhood and its ecosystem?

These answers varied based on the neighborhoods in which the participants lived. Most of the responses were associated with participants’ perceptions of environmental prob-
lems in their respective neighborhoods. Some of the issues raised included air quality, water and runoff (including Onondaga Creek and CSO treatment), access to services, walkability, getting people to care about their neighborhoods, tree-planting challenges, etc. There seemed to be a gap in respondents’ understanding of the function of urban ecosystems, which should be explored more thoroughly to clarify the connections between urban ecosystem function and GI.

The top four attributes that respondents associated with urban ecosystems were

- Opportunities for recreational activities, including walking and gardening
- Neighbors maintaining their property, leading to neighborhood calm and building community spirit
- Walkable neighborhoods
- Proximity to green space, parks, and community gardens

Other comments contributed by respondents concerned

- Urban ecosystem educational opportunities
- Presence or absence of large trees providing shade
- Presence or absence of urban wildlife
- Lack of local resident involvement
- Protection of new urban vegetation from vandalism
- Leaving a legacy for future generations

Q3. What do you think about green infrastructure?

Most participants at this point clearly connected GI to storm-water runoff and management concerns, and linked it to other existing projects about which they had heard—rain barrels in particular. There are clear concerns with respect to installation, follow-through, and overall participation of relevant actors. There were several mentions of vacant lots and abandoned houses as spaces to consider. GI needs to be considered in the broader context of the community—how can this be linked to improve the area overall and put people to work? These responses give us a clear inroad to link GI to quality of life for residents within inner-city neighborhoods.
Finally, there were a few responses that made it clear that GI was also mistaken as bureaucratic and falling under the responsibility of governments rather than individuals.

Q4. What might influence your decision to install green infrastructure in/around your home or neighborhood?

Monetary barriers dominated this set of responses, such as up-front individual costs versus long-term and community-wide benefits. Incentives such as grant opportunities and county/city demonstration projects were suggested. Linking to a lack of understanding of ecological services in general, participants believe that residents are unlikely to understand the importance of GI in its broader context.

Site selection and long-term management were important logistical concerns as expressed by focus-group members. Perhaps the most substantial barrier perceived by participants comes from the fact that the majority of city residents are renters and thus less likely to have any control over property decisions, so may find it harder to understand the urgency of GI.

Discussion

Most of the focus-group participants seemed somewhat confused about what ecological services are and what ecological services are provided to what groups. The USEPA (2009) is currently investigating ecological services derived from water resources and is sending out a national questionnaire to ask researchers and urban managers whether they have experience in assessing ecological services derived from GI. In the meantime, investigators such as Jaffe (2011) maintain that assessing direct benefits is the way to go.

What is more revealing is what we get when we ask focus-group participants about their neighborhoods as urban ecosystems. The most important aspect, as most frequently mentioned, is walkable accessibility to urban green space and how their neighbors maintain their personal property or community green spaces. These same attributes or qualities are supported by the results of studies in Fort Worth, Texas (Abrahams, 2010), Gainesville, Georgia (Johnson, Hartel, and Kuehler, 2008) and Los Angeles (Pincetl and Gearin, 2005), as well as the results of studies in Pakistan (Qureshi, Breuste, and Lindley, 2010), Denmark (Rusche, 2011), and the United Kingdom (Mell, 2010). The other strong underlying theme from the focus groups is the perceived need to develop awareness and reconnection of nature to residents, especially disadvantaged groups and urban youth. This same perception is supported by the results of studies in Albuquerque, New Mexico (LaBadie, 2010), Los Angeles (Pincetl and Gearin, 2005), and Portland, Oregon (Shandas, Nelson, and Arendes, 2009), as well as work in Malaysia (Mansor and Said, 2008). This separation of urban youth from nature is also the theme of Richard Louv’s (2008) work as expressed in his book Last Child in the Woods. The importance of urban minorities’ disconnect from access to green space is reinforced by the work of Floyd, Gramman, and Saenz (1993), Heynen (2006), and Kuo (2001). This is important for the reduction of exposure to environmental hazards that are usually associated with the urban populations, which are predominantly minority. Access to green space has the potential for reducing health impacts and lack of environmental benefit that are usually dominant in urban areas (Dunn, 2010; Snider, 2002).

When we asked the focus-group respondents what they knew about GI, most responded with comments about specific kinds of projects; for example, rain barrels, green roofs, and solar arrays. Many participants raised issues about the need for proper siting of GI projects, the need for appropriate home-owner guidance and assistance for GI maintenance, and the need to make the broader connection to neighborhood economic revitalization and quality of life. Such issues are also supported by studies in Albuquerque (LaBadie, 2010) and Portland (Shandas, Nelson, and Arendes, 2009). Putting GI in a larger context of neighborhood revitalization and providing social equity were reinforced by the result of studies in Gainesville (Johnson, Hartel, and Kuehler, 2008) and Los Angeles (Pincetl and Gearin, 2005), as well by the results of studies in South Africa (Cilliers, 2009) and the United Kingdom (Mell, 2010).

The barriers that were stressed by participants in Syracuse parallel those seen in the wider literature, such as that regarding Albuquerque (LaBadie, 2010) and Portland (Shandas, Nelson, and Arendes, 2009). These issues included monetary cost versus incentives, appropriate installation and maintenance, extent of community involvement in the process, and tensions between renter’s willingness and landlord’s autonomy. Some of the issues raised in the GI literature are not so much at play in Syracuse:

- There is support for waterway improvements given the city’s and county’s roles in the Onondaga Lake Cleanup as mandated by non-point-source water-quality improvement and reduction of CSO loadings plus the Onondaga Creek Conceptual Revitalization Plan (Onondaga Environmental Institute, 2009).
• There is now political will to address CSO load reduction via GI on the Near Westside sewersheds, which is illustrated by the county’s Save the Rain campaign.
• There is reduced skepticism from engineers and planners regarding GI technology, as now there is a coordinated effort to develop 50 GI projects in Onondaga County in the next two years.

However, there is still the issue of neighborhood resident perceptions in regard to receptivity to GI projects on their property or on their street. Some older activist stakeholders expressed frustration in regard to educating or engaging local residents in GI projects, such as planting and maintaining trees. Other focus-group participants are concerned with “not reinventing the wheel,” and using practical versus experimental GI technology plus good siting and design practice. In other words they express risk-adverse perspectives on GI implementation (see Thaler, 1980).

So the disconnect of urban residents with their environment, their apathy, their lack of involvement in neighborhood maintenance, and youth vandalism may militate against community support for GI strategies. On the other hand, some respondents noted new GI-related projects as examples of what can be done, grassroots youth activities, neighborhood revitalization and job creation projects, plus other community-building activities. Some respondents were especially positive about multipurpose GI projects like the Meadowbrook retention basin, which is a wetland that was constructed on the West Side of Syracuse. This project, created in 1976 and rebuilt in 2000–2001, is acknowledged as a historically successful GI project with substantial community benefits and is also an example of endowment value for future use and enjoyment.

Conclusions: Moving Forward

Green infrastructure has become an important policy initiative in many cities, both in the US and internationally, and has been used to address a variety of environmental and social concerns ranging from providing access to open spaces in urban neighborhoods to acting as a form of storm-water control. This article has presented a case study of Syracuse, which is currently adopting GI primarily as a solution to CSOs but also seeks to garner additional benefits (Peng 2011; Peng, Baptiste, and Speer, 2010).

The results from the focus groups provided the research team with feedback that went into the design of a more detailed questionnaire to be administered to the three microneighborhoods illustrated in Figure 2. The results of this survey will be reported in a subsequent article as part of a larger, multistage project that seeks to capture more in-depth analysis of Syracuse residents regarding GI implementation.

From the focus groups, we already know about specific barriers to GI implementation that need to be addressed. The first major barrier is the home-owner financial cost of implementing property-owner GI projects. Onondaga County is implementing some 50 GI projects on the Near Westside of Syracuse, but individual property owners would still have to fund and implement their own projects. New York City has just passed a tax abatement incentive program for property owners in who implement GI projects (Jones, 2009). Such a program could be legislated statewide or in other local jurisdictions. Data from rain-barrel adoption in Chicago (Ando and Freitas, 2009) indicated that there were more problems with rental property adoption.

The second barrier issue is developing educational programs that address GI benefits, maintenance issues, and how GI technology specifically works with local climatic conditions. This is supported by the results of the study of rain-barrel adoption in Chicago (Ando and Freitas, 2009), as well as by results of studies in Albuquerque (LaBadie, 2010) and Portland (Shandas, Nelson, and Arendes, 2009).

The final issue is how to package GI implementation programs as part of grassroots activity and as part of sustainability and neighborhood regeneration (LaBadie, 2010; Shandas, Nelson, and Arendes, 2009). As in other communities such as Gainesville (Johnson, Hartel, and Kuehler, 2008) and Los Angeles (Pincetl and Gearin 2005), such efforts can also be used to provide greater social equity through development of multipurpose GI projects that are accessible to low-income residents.

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