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Organizing urban ecosystem services through environmental stewardship governance in New York City

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HIGHLIGHTS

- We analyze survey data to identify the most connected bridge organizations that govern ecosystem services in New York City.
- We interview organization leaders to understand how their group's bridging role formed.
- Bridge organizations play an integral and increasing role in the management of urban ecosystem services in New York City.
- An initial condition of heterarchic relations was essential to the development of bridge organizations in New York City.
- The bi-modal role played by bridge organizations is integral to the governance of ecosystem services in New York City.

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ABSTRACT

How do stewardship groups contribute to the management of urban ecosystem services? In this paper, we integrate the research on environmental stewardship with the social–ecological systems literature to explain how stewardship groups serve as bridge organizations between public agencies and civic organizations, working across scales and sectors to build the flexible and multi-scaled capacity needed to manage complex urban ecosystems. Analyzing data collected from a survey of stewardship groups in New York City, combined with open-ended semi-structured interviews with representatives from the most connected civic "hub" organizations, we use a mixed-method approach to understand the specific activities of bridge organizations in the process of preserving local ecosystem services. This paper concludes that the role of bridge organizations in the management of urban ecosystem services in New York City is increasing, that these groups have a specific bi-modal role in the network, and that an initial presence of heterarchic organizational relations was crucial in their development. The paper ends with a discussion of the implications of these results.

1. Introduction

Local environmental stewardship groups have increasingly linked site-based efforts to sustain urban ecosystem services with governance processes concerned with preserving quality-of-life in cities. As a result, contemporary urban environmental stewardship (UES) involves work to conserve, manage, monitor, restore, advocate for, and educate the public about a wide range of issues related to sustaining the local environment (for more details on this definition of stewardship see Fisher, Campbell & Svendsen, 2007). Urban Environmental Stewardship groups serve as direct managers of small parks and gardens, street trees, wetlands, and other sites that provide ecosystem services including air and water filtration; micro-climate regulation; drainage; and recreational/cultural benefits (Barthel, 2006; Bolund & Hunhammar, 1999; Boyer & Polasky, 2004). They also form a crucial component of the urban environmental governance structure by networking their activities with other local groups and citywide advocates and agencies. While stewardship networks have increased in size and complexity in many cities in recent decades, a number of authors point out that environmental governance structures continue to lack the capacity for coordinating the management of ecosystem services across multiple scales, as well as adapting stewardship activities flexibly to changing ecological conditions (see Cashore, 2002; Ernstson, Barthel, Andersson, & Borgstrom, 2010; Newman & Dale, 2005, 2007; Ostrom & Schlager, 1996; Pickett et al., 2008).

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In this paper, we explore the ways that certain UES groups contribute to the management of urban ecosystem services by serving as "bridge organizations" that work across sectors and geographic scales. Specifically, we present the findings from a network survey of urban stewardship groups. These results are combined with a series of open-ended semi-structured interviews with the most connected civic organizational brokers to understand how and why UES groups take on the role of bridge organizations within urban settings. This paper has three sections. First, we briefly review the literature on UES and social–ecological systems, paying particular attention to the role of brokerage organizations described within these relatively fragmented lines of inquiry. Second, we outline our data and methods, which explains our mixed-methods approach for identifying bridge organizations and why New York City provides an ideal case for understanding our research question. Third, we present our findings and discuss how they help us understand stewardship better.

2. Urban environmental stewardship and social–ecological systems

In recent years, extensive research has been conducted to understand UES, looking at the preservation of gardens, parks, watersheds and other sites (e.g. Fisher et al., 2007; Fisher, Campbell & Svendsen, 2012; Grove, Burch & Pickett, 2005; Svendsen & Campbell, 2008). One of the reasons for this growth is that urban stewardship sites are seen as a source of human health and well-being (see Campbell & Weisen, 2009). As such, UES is a community-based social activity that aims to enhance quality-of-life in cities with the underlying assumption that doing so will improve the social–ecological functioning of specific urban areas (see Barthel, Folke, & Colding, 2010; Cox & Bower, 1998; Shandas & Messer, 2008; Svendsen, 2009). Civic groups around the United States have sought to strengthen stewardship actions by working along with and outside of government agencies and the private business sector (e.g. Andrews & Edwards, 2005; John, 1994; Sirianni, 2006; Sirianni & Friedland, 2001; Svendsen & Campbell, 2008). As a result, a diversity of civic groups are taking action to manage ecosystems, protect human and ecosystem health, and educate broader publics through what has come to be known as "civic innovation" (Boyte, 1999, 2004; Sirianni & Friedland, 2001).

Urban environmental stewardship has become a driver of civic innovation as practitioners seek out new ways to manage diverse ecosystem services (see Carpenter et al., 2009, p. 1310 on the need to study such systems). In fact, the growth of UES potentially contradicts recent literature on environmental organizing and civic participation. Specifically, research has found that participation in civic associations is declining (Putnam, 1995, 1996, 2000; but see Fischer, 2005; Paxton, 1999, 2002; Rotolo, 1999) and that current urban environmental movements are place-based and fragmented (Gottleib, 1993; Harvey, 1999). However, as urban stewardship involves a combination of public agencies operating at the citywide, regional, and state scales along with many civil society actors including formal non-profit organizations, informal community groups, and individual volunteers operating in ecological regions, across cities, and in specific neighborhoods, UES may very well contradict the work of these scholars.

As a result of the intertwined social and ecological dimensions of stewardship, urban sites and the ecosystem services they support have agency within social networks. Civic activism often arises in response to changing ecological conditions in stewarded areas, especially as urban ecosystem services noticeably decline. The literature on social–ecological systems (SES) has explored this relationship. In particular, the SES perspective holds that "ecological systems are intricately linked to and affected by one or more social systems" and that "some relationships between people are mediated through interactions with biophysical and non-human biological units" (Anderies, Janssen & Ostrom, 2004, Section 2). While the SES literature remains diverse in its perspectives (see Berkes & Folke, 1998), most authors in this area consider the growth and innovation in urban environmental stewardship to reflect the co-constitutive demands of human and natural systems.

One focus of the SES literature is upon understanding the types of social systems that most effectively preserve and manage urban ecosystem services. As Folke outlines, this effort has involved applying the notions of resilience and complexity to the analysis of SES (2006; see also Berkes, Colding & Folke, 2003). Resilience studies developed initially in the field of ecology to describe the ability of natural systems to bounce back from environmental perturbation. Since then, researchers have extended the resilience concept to the study of how social systems develop the capacity to respond to environmental disturbances by innovating and adapting to emerging ecological conditions (e.g. Anderies, Janssen & Ostrom, 2004; Crona & Hubacek, 2010; Ernstson et al., 2010; Krasny & Tidball, 2009; Prell, Hubacek & Reed, 2009). A contrasting but complementary approach to resilience within the SES literature looks at vulnerability in systems that are "unable to cope with adverse effects" (Adger, 2006, p. 269).

The extent to which an SES exhibits resilience is, in part, determined by the capacity of social institutions to respond to non-linear ecological changes resulting from complex ecosystem processes. As a result, complexity has been developed within the literature as an important quality of an SES. The complex systems approach is the foundation of much of the new literature on climate, sustainability, ecological economics, and environmental planning and management (see Berkes, Colding & Folke, 2003 for a full discussion). Complex systems thinking applied to the management of environmental problems generally holds that resilience is achieved through an increased capacity to develop new non-linear, non-hierarchic relationships amongst and between social and ecological systems (e.g. Ernstson et al., 2010). As Pickett, Cadenasso, and Grove (2005) argue, complex conditions exist in the spatial, organizational, and temporal dimensions of an SES requiring analyses that work across traditional disciplinary boundaries in order to develop tools for managing complexity.

Generally, the need to manage complexity in networks has led the SES, and other closely related literatures to focus on the need for institutional arrangements that work across multiple scales and flexibly respond to changing environmental conditions (e.g. Crona & Hubacek, 2010; Ernstson et al., 2010; Prell, Hubacek & Reed, 2009). These literatures have found that flexible policymaking processes that work through multi-sector and multi-scale brokers are required (see also Goulder & Kennedy, 1997; Liu et al., 2007). Urban environmental stewardship, when viewed as a set of individual actions to preserve ecological conditions *and* as a governance activity that requires coordination across civic, public, and private sectors offers one perspective on how and why such brokers form. In effect, the UES system is an arena within which the "'adaptive dance' between resilience and change" occurs (Olsson, Folke, & Berkes, 2004, p. 87).

2.1. Focusing on bridge organizations

Bodin, Crona, and Ernstson (2006) argued for the need to understand better the brokerage role in social ecological systems. They describe the broker as an organization that "gains access to many pieces of group-specific information captured inside the different groups, which allows the broker to synthesize a large knowledge pool. . . [and know] which groups or individuals to connect, how to connect them, and when" (2006, "Roles and Structural Positions in Natural Resource Management"). The authors' focus on the role of

brokers in social–ecological systems arose in response to Newman and Dale's call for the need to differentiate between the two types of ties identified in the literature on social capital (see Putnam, 2000). They include "bridging ties," which connect groups to external resources and open up new possibilities for action, and "bonding ties," which enforce conformity amongst groups within a portion of the network (see particularly 2005 and 2007). Brokerage groups, as described within the sociological literature, can play both roles (e.g. Burt, 2007; Marsden, 1982; Merton, 1968).

Numerous organizations that perform bridging and bonding roles in stewardship networks have been analyzed in the social–ecological systems and urban environmental stewardship literatures. For example, in their study of a small municipal ecosystem management organization in southern Sweden, Hahn, Olsson, Folke, Johansson (2006) analyze a stewardship group that works with volunteers, as well as municipal agencies, to create multi-scaled and adaptive responses to changing local ecosystem conditions. Arguing that this type of organization has been successful precisely because it has connected local stewards with external resources and coordinated activities across scales through *ad hoc* projects with government agencies, they find that the bridge role played by the organization helps to make local institutions more responsive to changing ecological conditions and thus ensures a more resilient social–ecological system. Similarly, Bodin et al. argue that a social network that is flexible and conducive to co-management of natural resources at multiple scales should contain several groups with "internal trust and trust among them, linked together by motivated brokers who are interested in using their structural positions to initiate and maintain adaptive co-management" (2006, "Concluding Remarks", paragraph 1).

Ernstson et al. (2010) also highlight the role of brokers in creating the flexible and adaptive qualities needed for a resilient social–ecological system. They focus on the role of "midscale managers" that incorporate new information into the network of organizations in a city in order to help local stewards flexibly respond to changing knowledge and ecological conditions. They also examine the role of "scale-crossing brokers" that unite the work of small-scale ecosystem service managers with citywide and landscape-wide actors in order to create multi-scaled management practices. Ernstson and associates find balances "between centralization (for effective collective action) and decentralized modularity (for distributed diversity of autonomous and localized knowledge generation in preparation for change)" (2010, p. 5). In other words, the meso-level brokers that they analyze both centralize the functions of a subset of local stewards and allow for decentralized innovative practices by connecting local autonomous groups with higher-scale resources and knowledge.

In this paper, we seek to understand how the meso-level brokerage functions described in the conceptual and empirical literature on SES work in the context of the urban environmental stewardship networks of New York City. We analyze selected civic groups, which we label *bridge organizations*. Many of the groups we select started out engaged in local organizing and eventually began to centralize the work of many small organizations while connecting resources across scales and sectors. We seek in this study to understand better how and why some groups perform this bridge function in the context of local environmental stewardship and what effect they have upon the management of urban ecosystem services.

3. Case selection and research methods

This study explores how bridge organizations function within the environmental stewardship network of New York City. As a highly urbanized area with strong development pressures and a dense civil society, New York City is a particularly interesting case to examine relative to the problem of building adequate environmental governance structures. By the mid-19th century, the city had rapidly developed into a major metropolis and a dense civic sector formed to advocate for quality-of-life issues such as tenants' rights, labor rights, community development, public art, urban design, and environmental protection (e.g. Cordero-Guzman, 2007).

In recent years, environmental stewardship has become a central part of the ongoing efforts to maintain quality-of-life in New York City that began in the 19th Century. For example, stewardship of local ecosystem services plays prominently in Mayor Michael Bloomberg's recent long-term sustainability planning initiative known as PlaNYC 2030, for which a number of civic groups advised. Because of the unique density of civic organizations working on stewardship in New York City, it is likely that governance structures differ here from other U.S. cities. Yet, as Sandstrom and Rova find, dense networks of heterogeneous groups working to preserve the local environment should help to "promote a common view of the ecosystem as well as appropriate management actions" (2010, as quoted in Crona & Hubacek, 2010). As such, New York City is a good case for examining whether these dense networks enable effective management of ecosystem services. It is also a good case for comparison with other "global cities" that have dense civil society networks (e.g. Sassen, 2001).

3.1. Sampling frame

The first phase of the project was devoted to enumerating the population for sampling. Building on the extant research on local environmentalism discussed above, this study focuses on civil society organizations, including both formal nonprofits and informal community groups that serve any of the following stewardship functions: conserving, managing, monitoring, advocating for, or educating their friends, neighbors, or public officials about the local environment (full details of the sampling frame are available in Fisher et al., 2012). These groups are often concerned with restoration of specific ecosystem services such as water filtration, management of air quality, or plant pollination. To develop the citywide sample of civic stewardship groups, all of the public agencies and nonprofits that work at the city-wide or borough-wide scale (there are five boroughs in the City of New York) on issues related to the environment and natural resource management were approached with a request to utilize their lists of organizational partners. Using multiple sources to compile our list of organizations ensured that there were no potential biases in our data based on any particular source (see particularly Brulle, Turner, Carmichael, & Jenkins, 2007). A snowball sampling method was also used, whereby each of these large-scale data providers was asked to suggest additional potential data providers within the city, until we reached saturation. This approach was applied to capture the core network of stewardship groups that are connected to the citywide environmental and natural resource management community.

Once the individual databases were gathered, we applied several exclusion criteria in constructing the sampling frame: (1) location: groups outside of the five boroughs of New York City were removed, although we did include groups located in New York City whose reach was regional, national, or international; (2) organization status: individuals without a group affiliation were removed; (3) complete addresses: groups with incomplete mailing information were removed from the sample as we could not gather data from them and (4) civil society and public sector actors: we excluded all private businesses, public agencies, and quasi-governmental entities such as local community boards. Quasi-governmental groups are not included because they largely function in New York City as an extension of municipal government. Starting with an initial *N* of

4788 groups, the application of these criteria resulted in a final *N* of 2767 groups.

3.2. Organizational survey

Next, we conducted a citywide survey that was sent to all 2767 groups identified by the data providers. In addition to building on the assessment tool from the multi-city pilot (see Svendsen & Campbell, 2005), the survey was pre-tested in one neighborhood in New York City. After alterations based on pre-test results, the final survey was comprised of twenty questions, most of which were in a closed-ended format. The questions asked about the organizations' stewardship activities, capacity, geography, networks, and their organizational characteristics.

The citywide survey was administered over a period of six months from July to December 2007 via online and U.S. mail using a standardized recruitment text. Whenever possible, was the preferred method of contact. All organizations received up to three reminders at intervals of two weeks via email, and one postcard reminder after one month via U.S. mail. All organizations with a valid phone number in the database received follow-up phone call reminders over the course of the six months. In addition, a description of the study was included in local newsletters and list serves. Overall, 572 groups participated in the survey, representing a response rate of 20.7%. This response rate is within the common range for mail-in and Internet surveys of organizations (for a full discussion, see Hager, Wilson, Pollak, & Rooney, 2003).

Although within the expected range for such a study, the roughly 20% response rate precludes the possibility of doing a full network analysis of the data. As Rothenberg points out is often the case with network data, the survey responses are a "non-random, non probabilistic sample that may or may not be representative, and whose statistical properties are unknown" (1995, p. 106). For such a sample, random graph models that infer the properties of a network cannot be applied effectively (e.g. Frank, 1980). As such, we do not perform a structural analysis of the organizational network. Rather, we use network analytic tools to understand trends in the data and to identify likely bridge organizations in the stewardship system of New York City. These organizations were then interviewed to understand their role in the network. The combination of qualitative interviews and quantitative network analysis allowed us to identify and understand how the bridge role operates within the urban environmental stewardship network of New York City.

3.2.1. Organizational network data

The network question in the survey asked respondents to provide the names of the top three groups with which they collaborate (alters) in four different categories: government agencies, private businesses, civic groups, and schools. In asking about the top three groups with which respondents collaborate the most, this question is biased toward close ties of the respondents. While this question limits the scope of understanding that can be gained about the overall network, it does offer a "representative sample of the social environment around respondents" (Marsden, 1990, p. 438; see also Scott, 2000; Wellman, 1979). As well, with regard to studies focused on the role of brokers in a network, Burt finds that, "Brokerage benefits are dramatically concentrated in the immediate network. . . [and, as a result] brokerage can be measured with designs in which data are limited to an immediate network" (2007, p. 119). Therefore our sample contains data that are well suited to discover which groups may be playing a brokerage role.

The responses to the network questions were cleaned in order to prepare for analysis by standardizing names of identified groups and recoding responses according to two criteria: (1) all responses that did not identify a unique organizational partner were labeled "general" and removed from the dataset; (2) all responses that were incorrectly answered were re-assigned (e.g. if a respondent provided the name of an alter as a civic partner that should have been considered a government partner). From the 572 respondents to the survey, there were 316 valid, unique civic organizational respondents that provided network data, from which we generated a civic-to-civic network that included 704 civic organizations overall (the respondents identified an additional 388 civic groups as alters that did not participate in the survey). As we only have incoming ties for non-respondents in the network, our findings are limited to identification of likely bridge organizations from within the 316 respondents to the civic network questions.

3.3. Identifying bridge organizations

We identify bridge organizations as those civic groups that were at least two standard deviations above the mean on two separate measures of centrality: number of in-degree ties and betweenness. The number of in-degree ties (in-centrality) refers to the number of times that an organization was identified as a partner by another organization. Thus it is a measure of local centrality, which shows the "the relative prominence of a focal point in its neighborhood" (Scott, 2000, p. 82). That is, this measure identifies organizations that have the most direct connections with other organizations, and thus have the largest sphere of influence in their activities.

Betweenness measures "the extent to which a particular point lies 'between' the various other points in the graph" (Scott, 2000, p. 89). Betweenness recognizes that the structural position of an organization may make it a crucial connector among various otherwise disconnected parts of the network, which may be the case even if the organization is not connected to many other groups. With this measure, the group's structural position, rather than its popularity, makes it an important connector. Betweenness has been used by a number of authors within the social–ecological systems and sociological literatures to identify organizations that perform a brokerage role (e.g. Bodin & Crona, 2009; Burt, 2007).

We use both in-centrality and betweenness to determine likely bridge organizations because we seek to identify organizations that are not only in a structural position to broker across many organizations, but also have a strong local "neighborhood" of groups whose functions they serve to organize. The bridge organizations identified here are well suited to deliver both resources and information across the network *and* to centralize the actions of clusters of organizations. Thus, bridge organizations in social–ecological systems as we understand them require high betweenness and high in-centrality.

In general, the organizations we identify through this process interact with many other organizations and are in a position to carry information and resources across the network. Because the results would alter somewhat with the addition of more network data, we do not assume our network analytic findings to be a definitive means for identifying bridge organizations. Rather, we use the combined centrality measures to select organizations for follow-up interviews. The qualitative component of this study aims to confirm if these groups are, in fact, bridge organizations. We explore whether, how, and why these groups perform roles associated with bridge organizations and in what ways their actions aid in the management of urban ecosystem services. Although this method offers a systematic sample for our interviews, it is worth noting that we likely do not identify all bridge organizations in the UES network of New York City.

3.4. Open-ended semi-structured interviews

Open-ended semi-structured interviews were conducted with representatives of all 13 organizations that were at least two standard deviations above the mean for both in-centrality and

Table 1
Organizations with two standard deviations or above in both degree and betweenness centrality.

Organization Name	In-degree ties	Betweenness
Green Guerillas	25	21,461.168
Grow NYC	21	27,954.521
Brooklyn Botanic Garden	19	29,263.561
Just Food	17	8308.938
Trust for Public Land	12	7145.731
New York Cares	12	8534.704
New York Restoration Project	9	5830.046
Trees New York	9	5939.013
American Littoral Society	9	5733.399
Citizens Committee for New York City	8	6459.121
Park Slope Civic Council	8	7060.734
Bronx Land Trust	7	6751.193
Municipal Arts Society	6	5902.6

betweenness within our sample. No organizations that met these criteria refused to participate. These groups tended to be the "umbrella groups" that fund, administer, organize, and provide training and advocacy for a number of other organizations that are in direct contact with individual volunteer stewards. Most of the organizations we interviewed had begun as informal local organizing efforts in New York City. The purpose of the interviews was to understand better what role these groups play in the contemporary organizational structure of environmental governance in New York City and whether or not they could be classified as bridge organizations.

The interviews occurred over the summer of 2010 (between 9 June 2010 and 3 August 2010). Interviews lasted between one and two hours. Data were collected in accordance with Columbia University human subjects research protocol IRB#AAAC7665. In following our approved protocol, respondents were informed that their identities would be kept confidential in all reports of our results. Thus, the findings section of this paper does not list individual names. Rather, when we include excerpts from particular interviews, we list the general affiliation of the speakers. The questions focused on the development of the network of environmental organizations over the past three decades and how current connections and activities have changed over time. As well, questions covered the conditions of each organization's founding; major shifts in activities; changes over time in the geographic area where the organization works; the role of individual members; the policy environment that affects the organization most; and the strongest connections that the organization has and had with other civic, government, and private groups.

3.4.1. Interview data analysis

All interviews were recorded and transcribed for analysis. Transcribed text from the interviews was coded into major thematic categories using the qualitative analysis software NVivo. Intercoder reliability for these categories was tested across three researchers at 83 standardized sections of text for one interview transcription. Generally, there was a high degree of agreement among all three researchers. Following the test of intercoder reliability, common points of confusion were discussed and clarified before the full coding was undertaken. The clarification process resulted in 90 percent agreement across the three researchers.

4. Results

The network data were employed to identify bridge organizations. Table 1 reports the results from this analysis. It lists the results for organizations that were at or above the two standard deviation threshold for in-centrality and betweenness.

While our intention was not to conduct a full network analysis, our data provides some insights into group formations and clustering, in relation to ecosystem services. The partial network data demonstrates that groups that responded to the survey tend to cluster according to specific land use types with each providing a particular set of ecosystem services. For example, one cluster is comprised of land stewardship groups, largely community garden and local food groups - including urban farms and community supported agriculture organizations, as well as a number of local block associations, which are connected through citywide civic nodes. There are also a number of connected groups that deal with water-related issues. These water groups are connected to large, national environmental advocacy and legal organizations. The network also includes clusters of groups with a mission that is not solely environmental, but rather has some other civic aim with links to environmental stewardship. For example, there are clusters of groups concerned with historic preservation, architecture, urban planning, and the built environment.

4.1. The role of bridge organizations

The organizations that met our criteria for likely bridge organizations serve as nodes for numerous groups that work on tree planting, gardening, urban farming, water quality, salt marsh restoration, sustainable development, open space preservation, habitat protection, waste management, and historic preservation of the built environment. For each of these issues, they connect resources across various scales. All organizations interviewed described municipal, state, and federal programs that provide physical resources and legislative support for their work. Most groups also described corporate and foundation support. In all cases, these resources were mostly used to enable and coordinate the activities of smaller-scale organizations. For example, a representative from a land stewardship organization explained the group's work:

> We probably do more of the so-called planning assistance now rather than just providing funds. And in some cases we hook them [smaller groups being given planning and funding assistance] up with other groups who are kind of best practices. If the group comes to us and wants to do something, and another group is doing it somewhere, we'll hook them up together. We have workshops on best practices, so we don't have to reinvent the wheel.

The presence of meso-level brokers, such as the one quoted above, that links smaller groups with one another and with private and governmental resources, enables the work of organizations that focus on preservation of similar ecosystem services at different sites to be coordinated at the landscape scale. This example is representative of relations that all interview respondents described, a quality that supports the finding that these groups are in fact bridge organizations.

One characteristic that differentiates bridge organizations in urban environmental stewardship from straightforward managers of the local ecosystem is that they respond first to social conditions in the city and, in the process, improve urban ecosystem services. For example, many organizations spoke of the need to react to development cycles. Speaking about his organization's founding, a leader of a greening group that formed during a period of severe economic decline in the 1970s said:

> [The founder] was walking down the street with a friend of hers and their child, and the child stumbled into this vacant lot and, I don't know, tried to climb into a refrigerator or something and she sort of said, "You know, we gotta do something about these lots," and she started to get people together to [do greening in] vacant lots... but at some point development moves forward.

> The city is gonna want to develop, and there's just. . . you know, it's not like there's. . . lots of vacant lots. . . So that will create a certain amount of pressure [for our greening efforts].

Organizational programming was also in response to public demand. As one representative of a local philanthropic group explains: "We do fund a lot of environmental projects, but not because we are focused on the environment, but because that's what people want."

As well, respondents indicated that the role of bridge organizations in the network is increasing. The interviews indicated a shift away from the historic role of government agencies with a specific mandate to manage and regulate land use and ecosystem services as central nodes for environmental governance. Rather, government agencies were described as engaging with ecosystem management in a new way, recognizing civic groups as long-term partners in environmental stewardship. Of this change, one representative of a civic group focused on improving parks remarked:

> That was a big milestone for us, to be recognized at a significant level with government agencies, that there is the potential for change and to bring to them ideas. It could be a playground, it could be a park, it could be any of these things could be done. . . An agency may have money to do a capital project and they can put a nice, shiny park in place. Yet if there's no one to maintain it afterwards, that's usually contingent on getting approval for the budget for the project to move forward.

There is also evidence that civic brokers serve as experts in particular areas of environmental action. A representative from a different organization focused on urban agriculture noted: "What I think for us has changed, even in the last year, is that a lot more council members and other local representatives have reached out to us to get advice and assistance." Serving as experts within a network of groups has enabled civic brokers to bring together different government agencies into their local vision. Groups often cited examples of working across different agencies to accomplish their stated goals. As well, the network data demonstrates that they are highly connected to other civic groups. Therefore, the civic groups we interviewed are becoming the adaptive agents within a local governing structure and government agencies are seen as more restricted to operate within the boundaries of a public mandate.

4.2. Bi-modal aspect of bridge organizations

In order to maintain the bridge between civic, governmental, and private actors and carry out their role as network brokers, many directors of the groups we interviewed reported a long history of being both partners with and critics of public agencies. Numerous examples were offered wherein the relationship with government agencies was both antagonistic and collaborative. For example, one respondent remarked: "We threatened to sue the city if they didn't follow the. . . previous consent order that the Department of Environmental Conservation, the state people, had put on them. And it went back and forth for a few months. . . give and take, give and take." That same respondent later spoke of a friendly resource-sharing relationship with the agencies that his organization was suing: ". . . they all use all my photographs for their brochures and their displays, and you know the City Parks and the Army Corps of Engineers and the City Department of Environmental Protection, you know, because I give them [the photos] for nothing so that helps."

All 13 groups that we interviewed described this bi-modal relationship with public agencies to some degree, but only the more mature groups spoke of it as a conscious part of their activities. In the words of a representative of a group that was founded in the late 19th century:

> With [that city agency] we do both, dispatch funds for them but we also do projects with them. They're kind of understaffed. . . They just don't have the capacity or maybe desire to do it all and so we end up sort of taking on some of that work but we try and do it somewhat in conjunction with them. But then sometimes we file lawsuits, you know, in opposition to things they've done, so, we can go back and forth. It's amazing. They never seem to get that mad at us.

In general, the interplay that connects brokerage groups with government agencies is seen as flexible and opportunistic. The bi-modal relationship that has developed over time is often more subtle than just suing an agency or threatening to sue. Sometimes it is about leveraging the public perception and personal relationships to meet goals. A representative for a different organization provided an example from an event they planned:

> [One prominent City Councilman] came [to the event] and so I said, 'Oh, I'm so glad to meet you because this is a garden in your neighborhood,' and I said, 'we've had a hard time getting in touch with you about funding.' So this year we just got some funding from him, and I took a nice picture and I sent it to him and he put it in this newsletter, you know, in the garden with community residents. It takes a little while to develop those relationships but I think we've been around for a while and that it's working.

These types of bi-modal mechanisms commonly lead to an ongoing two-way cooperative sharing of responsibilities and staff between brokerage groups and city agencies. These quotes are exemplary of many comments made to this effect. As a representative from another group put it: "Our relationship with [the Department of] Parks [and Recreation] has always been. . . they know that we're very important to them. . . and they're very important to us. . . We've had contracts that came through Parks but. . . But even higher up, you know, they know that we are an important piece of the whole. . . of the greening in New York City."

The simultaneously critical and engaged aspect of the bridging role is characteristic of the organizations that we interviewed. They literally have their bases of action in two different parts of the network. Legitimacy on both sides depends upon their capacity to be seen as representative of two distinct sets of interests. Generally, this relationship translates to reticence and circumspection about becoming too involved with government agency processes, lest the perception of bias and removal from the on-the-ground stewardship world affect their ability to participate in potential future conflicts. Here is how a representative from a non-profit sustainable development group that has worked closely with city agencies described the tension:

> You know, over time there's always been criticism I felt directed towards us, because we've sort of been looked at as a city agency by some of the community garden folks, and there have been individuals over time, I'm not going to mention anybody's name, that have always felt that they were gonna do this without us because they thought that we were 'the Man'.

In other words, the ability to operate effectively as a bridge organization is highly contingent upon not being perceived as too embedded in either side. While all of the organizations that we interviewed regularly work with public agencies, one common sentiment was expressed by a representative who had worked in both the public and private sectors. He noted: "the citizens have to prod the bureaucrats because they get too comfortable sitting at a desk." These groups require legitimacy on both sides of the network and are constantly working within that tension.

The bi-modal relationship with otherwise hierarchically arranged governmental agencies is crucial to being able to

execute the brokerage role played by bridge organizations in the UES network of New York City. Through maintaining this position, the bridge organizations we interviewed insert flexibility and multi-scaled capacity into stewardship networks that the social–ecological systems literature finds is needed for the effective management of urban ecosystem services precisely because they can fluidly cross between sectors. Civic brokers in New York City rely on balancing their position between two parts of the network in order to navigate issues of social–ecological complexity. This finding regarding their ability to preserve ecosystem services in an attempt to satisfy local demands and improve the quality of urban life and the environment is consistent with the findings of Crona and Hubacek (2010).

4.3. Initial presence of heterarchic governance network

Several respondents commented on the importance of the 1970s groups that created a heterarchic (i.e. non-hierarchical) and polycentric governance effort around stewardship in New York City. On the vision of one of the first and most influential garden groups in the city, a representative commented:

> One of the reasons why the community garden movement is the way it is in New York City and why there's all these different nonprofits in all these places is because, in the early days... they didn't have visions as sort of nonprofit empire builders; they actually wanted there to be all these resources and really looked out and said, "We need a program for this. Let's convince somebody to create it."

This perspective is consistent with the current practice for most organizations, even outside of garden groups. One described their position relative to other civic groups by saying, "even though some of them would be our competitors we actually partner with them in some capacity."

The ability to work across scales and sectors is greatly enhanced in New York City by the presence – at least since the 1970s – of a minimally competitive, heterarchic governance environment around stewardship. Several respondents observed that this non-hierarchic structure has largely been maintained over time and has been crucial for enabling flexible responses to changing political and ecological conditions. For example, in response to a 1990s effort to develop community gardens into housing, a citywide coalition formed quickly. In the words of one leader of a land preservation group: "We basically in 1999 said to gardeners: ...'We think you have three choices. You can fight for your individual garden. You can fight for the gardens in your neighborhood, or you can do this citywide fight.' They chose the citywide fight." Another representative from a different organization commented more broadly about the ongoing capacity for stewardship groups to collaborate: "I think that it's very good and important for the green groups to work together so that when somebody's talking they are talking not just for one small group, but they can say they're talking for many."

However, the heterarchic character of the stewardship system in New York City is not easily maintained. Balancing between central coordination and individual autonomy is a recurring tension among organizations. Some competition among groups certainly exists and, at times, hinders their capacity to respond to changing conditions. Some respondents observed an overall move away from the initial desire for power-sharing as newer and better-resourced organizations began operating in the city and conflicts over the right direction for stewardship activities arose. One respondent commented on the perceived effect of this move:

> We forged the local partnerships that make the most difference, and I think we do them in a very thoughtful and careful way. I don't give a lot of time to thinking about how there could be more cooperation. But we just note that there have been times when there were more like-minded groups sitting down around certain issues. And I note that there are less now.

Overall, respondents made it clear that most groups do not feel that New York City is an ideal case of ecosystem service management within which robust localized stewardship actions are coordinated in a smooth way. However, they also tended to point out that there has been an evolution within the civic network toward a structure that mixes the activities of decentralized loosely connected groups working with a more centralized and tightly connected set of organizations from the public, private, and civic sectors. These central hubs are seen as controlling resources and coordinating stewardship functions. In other words, bridge organizations leverage their bi-modal connection with public agencies to organize the activities of smaller stewardship groups and connect them with resources but also work in a manner that maintains the heterarchic and polycentric nature of the stewardship system.

5. Discussion and conclusion

Bridge organizations in social–ecological systems organize the activities of a cluster of local groups, requiring a high in-centrality, and coordinate resources and knowledge across scales, requiring a high betweenness. Data collected from open-ended semi-structured interviews illustrate how groups in New York City build flexible and adaptive structures across scales in the stewardship network, and that they also enable bonding ties between small sets of local stewardship groups in order to coordinate activities. These groups enable small on-the-ground stewardship organizations to "specialize within clusters and integrate via bridges across clusters" (Burt, 2005, p. 13). As such, bridge organizations in UES perform a similar role to that of brokers in the sociological literature, but do so for different reasons. Whereas the sociological literature often presents brokers as maximizing personal gain through their position in the network (e.g. Burt, 2007; Merton, 1968), the social–ecological systems perspective sees bridge organizations as primarily performing an enabling function: these are civic organizations that work to enable robust management of local ecosystem services.

Through our interviews, we determined that the bridge function is present and increasing in New York City. We found, as well, that bridge organizations take on a bi-modal existence wherein they relate to public agencies as both collaborators and critics. As a result, the norms and functions of bridge organizations reflect a range of sectors and interactions among various organizational scales. We see also that these groups rely upon heterarchic relations among civic organizations rooted in the recent history of how these organizations evolved since 1970. Finally, the resources and knowledge that they provide make them central nodes for clusters of similar stewardship groups and, as a result, their importance to the traditional public sector managers of the local environment is increasing.

Bridge organizations in New York City are the brokers empowered to maintain a heterarchic governance structure between the forces of centralization and decentralization. At the same time, they are able to engage in the 'adaptive dance,' integrating various and widespread civic efforts and ecosystem services into a social–ecological framework. They do this dance as both a part of and apart from municipal agencies. They adopt some of the government's norms, but also maintain autonomy so as to be a counter-force within the stewardship system. This with-against position may be crucial to maintaining legitimacy within the civic network. Without the bi-modal, bridging role that these organizations play, efforts to preserve ecosystem services would lose the

systemic and organizing support that the governance network provides.

While bridge organizations are present, the historical development of stewardship networks in New York City has not arrived at an ideal place in terms of ecosystem service management. There is still a long way to go before ecosystem services are managed through a common view of the ecosystem as discussed in previous literatures (Anderies, Janssen & Ostrom, 2004; Ernstson et al., 2010). A key area of future examination is the role of the public sector relative to civic brokers and co-management structures. Despite recent moves toward a more flexible government structure, a majority of municipal agencies remain directed by a combination of regulations, mandates, and property jurisdictions. In some instances, the civic broker may be capable of greater fluidity in terms of weaving together demands, desires, and rights associated with ecosystem services. Emerging from a complex urban world, we find evidence of what Sirianni and Friedland call "civic innovation" (2001), as local actors develop new and resilient ways of navigating multi-sector and multi-scaled systems that include both decentralized and polycentric networks and bi-modal approaches to organizing ecosystem services.

One challenge of this study is the limitations of our network data, which did not include the full universe of stewardship groups in New York City. Given this limitation, we were unable to present the overall structural dynamics of the urban environmental stewardship network. Rather, in this paper, we have used network analytic tools to identify likely bridge organizations and then employed qualitative methods to understand these organizations more completely. As a result, we are focused only on the most active portion of the network for which we have data. There are hundreds of peripheral organizations that are loosely connected if at all to the work of the bridge organizations examined here. Future research should examine the role of these peripheral organizations, as well as the overall structure of the network. Moreover, because bridge organizations specialize within clusters mostly associated with the types of issues that are being addressed, there is a need to understand how connections are formed not only across scales and sectors, but also across landscapes and the ecosystem services that these landscapes provide. Our paper takes a first step in this direction, but future research is needed to understand bridge organizations more fully. These groups are the flexible joint that holds the urban environmental governance system together as it responds to changing conditions. Maintenance of ecosystem services requires that they be better understood.

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