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Research paper

Governing metropolitan green infrastructure in the United States

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HIGHLIGHTS

► Public sector leads urban forest-based ecosystem services expansion.
► The private sector played little role in these green infrastructure initiatives.
► This contradicts critiques of public sector delivery of environmental solutions.
► This questions describing environmental governance as privileging the private sector.

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ABSTRACT

In this paper we explore whether the enhancement of urban ecosystem services through large-scale, metropolitan tree-planting initiatives is being planned and executed as a component of traditional municipal government or represents new, transdisciplinary strategies in environmental governance. Drawing on qualitative interviews with stakeholders in six major cities ($n = 58$) we further explore institutionalization of these initiatives and relationships. While much current discourse posits government cannot "go it alone" in providing preventative, "front-end" solutions to complex environmental problems, we found the public sector dominant in the visioning, planning, and management of these green infrastructure initiatives and the role of the private sector to be minimal. We also found that, despite this dominance, the initiatives had limited success in becoming institutionalized. This dichotomy reflects that while discourses labeling the public sector unable to grapple with complex environmental issues and the private sector dominant in environmental governance regimes are premature, institutionalizing the solutions into the machinery of government remains a contested arena.

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1. Introduction

The complexity of contemporary environmental problems, multiple scales across which they range and diversity of communities they affect has prompted numerous researchers to argue that traditional government ("the state") cannot, in isolation, effectively address these challenges. In response, researchers are calling for environmental governance strategies that bring together public, private, scientific, and community sector actors to inform the vision and day-to-day management of pro-active, preventative, "front-end" (as opposed to end-of-pipe) environmental solutions (Brenton, Brosio, Dalmazzone, & Garonne, 2007; Durant, Fiorino, & O'Leary, 2004; Edge & McAllister, 2009; Hemple, 1996; Seto, Sanchez-Rodriguez, & Fragkias, 2010; Thomas & Littlewood, 2010).

In addition, researchers note that efforts to institutionalize environmental governance strategies have been under-developed and under-researched (Hooghe & Marks, 2003; Swanson & Pinter, 2006). While new environmental governance initiatives garner significant preliminary attention, exploring the extent to which stakeholders view these initiatives as supported and internalized through institutional change and policy adoption has not received similar focus (Edge & McAllister, 2009; Kanie & Haas, 2004; Mann & Gennaio, 2010). Those initiatives that have received follow-up research were found "still not sufficiently linked to existing government planning, reporting, and budgeting processes. . .a serious weakness because this type of integration is a good proxy for. . .overall effectiveness" (Swanson & Pinter, 2006, p. 2).

This critique joins others who fear environmental governance yields not more effective governing, but rather greater private sector influence, loss of public accountability, and a merely symbolic role for community participation (Clapp, 1998; Falkner, 2003; Harmes, 2006; Sandercock, 2005; Thomas & Littlewood, 2010). From this perspective, environmental governance represents a potential means for private sector actors to create "a privileging of

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a business-friendly, market-oriented approach to environmental politics over a more holistic and ecology-oriented understanding of the relationship between human activity and environmental destruction. [This] 'privatization' . . . is regarded as a process that undermines established, state-centric, models of democratic accountability. . ." (Falkner, 2003, p. 81).

In response to these concerns, practitioners' and researchers have joined calls for broader participation with demands to explore the "mainstreaming" and symmetry of urban environmental governance. Evidence of these, they note, would be reflected in the systematic engagement of a broad spectrum of public, private, non-profit and scientific actors in program planning and budgeting and in adoption of local policies, ordinances and regulations supportive of urban environmental agendas (Davey, 2007; Kanie & Haas, 2004; Kearns, 1992; Peris, Acebillo-Baque, & Calabuig, 2011; Sharma & Tomar, 2010; UN, 2005).

1.1. Purpose

In this paper we explore whether stakeholders' believe efforts to expand urban ecosystem services through large-scale, metropolitan tree-planting initiatives (TPI) are planned and executed as a component of traditional municipal government or represent new, transdisciplinary strategies in metropolitan environmental governance. Further, we explore whether they view these initiatives and relationships as becoming institutionalized into the operations of municipal government. To answer these inquiries we ask the following questions:

- What is the nature of governance in major urban TPI? Do they reflect the collaborative, transdisciplinary environmental governance approach that researchers suggest complex urban environmental projects require, or have governments "gone it alone" in planning and implementing these initiatives?
- Have these initiatives and their relationships become "mainstreamed" as part of the city's institutional structure?

The demand for and development of new, environmental urban infrastructure places engaged stakeholders (i.e., public, private, and non-profit TPI participants and observers) in a strategic position to view changes and continuities in the governance and institutionalization of such projects. Stakeholder perspectives concerning these transformations can advance our understanding and therefore the outcome of metropolitan green infrastructure efforts. Soliciting stakeholders' perception of the governance and institutional "mainstreaming" of TPI in their cities can help others promoting urban green infrastructure better frame the opportunities and resources such initiatives require.

We chose TPI stakeholders' narrative statements to explore these question because researchers identify case study interviews as a method to explore 'how' or 'why' questions (Yin, 1994). Researchers recommend the narrative approach for conditions in which clear connections between current and future actions are uncertain (Uprichard & Byrne, 2006). The unprecedented development of citywide green infrastructure initiatives provides such an opportunity to examine these projects in light of both normative methods of metropolitan resource management and proposals for innovations in their governance and institutionalization.

1.2. Definition of terms

1.2.1. Urban environmental governance

Researchers define environmental governance as the articulation of new institutional formations to meet the growing complexity and scale of ecological challenges. Central to these formations are demands for higher levels of collaborative democratic and scientific engagement in developing solutions to pressing environmental problems (Backstrand, 2003; Bulkeley, 2003; Durant et al., 2004; Fiorino, 2006; Gulbrandsen, 2008). These demands are in reaction to assertions that "the state alone is not enough to propel changes" thus requiring increasing dependence upon "multilateral institutions, organized science, NGOs [non-governmental organizations] and social movements, and business and industry for formulating their views and conducting policy" (Kanie & Haas, 2004, p. 4).

Researchers have identified metropolitan areas as a critical arena for exploring environmental governance (Bai, McAllister, Beaty, & Taylor, 2010; Mol, 2009; Sellers, 2002). Cities and the urbanization process create significant environmental change across local, regional and global scales. As centers of concentrated economic activity and population their demand for large quantities of high quality energy and materials and subsequent generation of wastes are important drivers of environmental disturbance and pollution (Fernandez, 2007; Grimm et al., 2008).

Urban economic and population concentration also make metropolitan areas centers of dense information flows, social capital and capacity. These resource networks make cities locations of innovation, knowledge creation and institutional development (Cardoso & Castells, 2006; Landry, 2000). As a result, researchers argue, cities have considerable means to create new governance partnerships capable of producing solutions to environmental challenges (Rees, 1996; Rennings, 2000; Sanchez-Rodriguez, 2009; Seto et al., 2010).

1.2.2. Urban forestry

Forestry researchers and advocates have defined the urban forest as "the aggregate of all community vegetation and green spaces that provide a myriad of environmental, health, and economic benefits for a community." Planners have extended the definition to include "ecological, climatic, urban, political, and cultural conditions that foster or inhibit the growth and survival of trees" (APA, 2009, p. 2; Konijnendijk, Ricard, Kenney, & Randrup, 2006; Sustainable Urban Forests Coalition, 2010, p. 1).

Trees on public land, including "streets, highways, parks, and public buildings," and private land, including "private homes, condos, apartments, roof gardens, commercial and retail property. . .flood control channels, hillsides, utility rights of way. . .rail lines. . .airports and spandrels. . .are parts of the urban forest" (Lipkis & Lipkis, 1990, p. 8). Viewed from this perspective, urban forests cross numerous property, legal and policy regimes as well as a wide range of ecological boundaries. The boundary spanning nature of urban forests thus makes them key candidates for exploring new environmental governance formations.

1.2.3. Front-end metropolitan environmental management

Researchers and practitioners recognize that urban forests provide important opportunities to deliver preemptive solutions to urban environmental problems through their capacity to deliver ecosystem services as public goods (Amati & Taylor, 2010; APA, 2009; Konijnendijk, 2010; Schilling & Logan, 2008). Approximately 80 percent of the nation's population and 25 percent of its tree canopy reside in metropolitan areas of the continental United States (US) (Dwyer, Nowak, Noble, & Sisinni, 2000). These urban forests provide front-end environmental benefits through their capacity to absorb and slow storm water runoff, sequester carbon, mitigate urban heat island effects, reduce metropolitan air pollutants, and enhance capital accumulation (Akbari, 2002; American Forests, 1997, 2002; APA, 2009; Benedict & McMahon, 2006; Learner & Poole, 1999; Muldavin, 2010; Nowak & Crane, 2002; Nowak & Dwyer, 2004). The urban forest's importance in delivering ecosystem services that contribute to urban sustainability and the opportunities metropolitan centers offer for policy innovation

Table 1
TPI (Tree Planting Initiatives) launch dates, targets and performance.

City	Launch date	Planting goal (# of trees)	Planting goal (# of years)	Total trees planted (7/15/2011)
New York	2008	1 million	10	495,215
Los Angeles	2008	1 million	"Several"	*300,000
Houston	2008	1 million	5	*450,000
Salt Lake County	2007	1 million	10	382,892
Sacramento	2005	5 million	20	62,273
Denver	2006	1 million	19	212,774
Total		10 million		1,903,154

* Estimated.

provide a valuable context within which to explore questions concerning environmental governance.

1.2.4. Institutional structure

For the purposes of this article, institutional structure is defined as the normative outlook, operations and output of public, private and non-profit entities in program planning and budgeting and in the adoption of local policies, ordinances and regulations.

2. Methods

This study's purpose is to explore the nature of governance relations underpinning major urban TPI. Furthermore, it explores whether these relationships are becoming "mainstreamed" into metropolitan institutional structures.

To answer these inquiries we interviewed key stakeholders ($n = 58$) in six major cities about their perception of governance strategies supporting their city's TPI (see Table 1). Using multiple-choice and open-ended questions we also queried them about the extent TPI plans had been mainstreamed into their city's institutional structure.

2.1. City selection

We studied TPI in six major US cities (New York, Los Angeles, Houston, Denver, Sacramento, and Salt Lake County). We selected cities through an initial internet search on Million Tree Initiatives. From that search, we identified cities in the United States from the initial query and through interviews with spokespersons from these cities completed a national search for US urban tree-planting programs publicly committed to planting a million or more trees in their respective city or metropolitan area within 20 years (see Table 1). We chose to study in these cities as a set defined in terms of their commitment to this program goal. While we engaged these cities as a means to gain insight on TPI governance and institutionalization, we did not, at this stage, attempt a comparative study given the social and ecological diversity of the cities under study.

2.2. Interview population

We interviewed, in each city, a similar set of public, private and community representatives knowledgeable about their respective city's TPI. In addition to municipal staffers directly engaged in their city's TPI, we interviewed members of corporate and non-governmental organizations that had a direct, often contractual, relationship with the TPI in their city. We interviewed from these organizations individuals that people, both inside and outside their organization, had identified as significantly engaged in formulating or executing the TPI. Interviewees included the:

- Mayor (or mayor's staff),
- TPI director and members (e.g., forester, publicist),

- Significant nongovernmental organization partner(s) (e.g., financial or tree advocacy organization),
- Corporate partner(s) and
- Knowledgeable non-partners (i.e., retired city staff, nurseryperson, academic, or arborist).

We administered 58 in-person interviews, each approximately 90 min in length. We recorded interviews digitally and through notes. Interviews were transcribed and sent to interviewees for review, editing and verification. Interviewees were informed of their rights according to human subjects protocols such as confidentiality of the interviewers comments, the right to withdraw from the interview or forgo questions (Gillham, 2000; Yin, 2009; Yow, 1994).

2.3. Interview instrument

The interview contained three sections of approximately 20 questions each. The first section focused on executive management with subsections on policy, vision, goals and management team structure. The second section focused on planning with subsections on implementation, budgeting and the role of science. The third section addressed initiative achievements and setbacks.

The interview contained Likert scale and open-ended questions where interviewees described governance structures supporting their city's TPI and extent of its institutionalization (Babbie, 2005). We used point scales with balanced keying (equal number of positive and negative choices) to reduce acquiescence bias. The interview presented forced choice questions (no "neutral" option) to reduce central tendency bias; however, interviewees were given "don't know" options to support scored response accuracy. As a result, scored totals in some categories sum to less than fifty-eight. Open-ended questions offered opportunities to add detail to Likert scale assessments.

2.4. Data analysis

We assigned numerical values and tabulated results from Likert scale responses and reviewed open-ended answers for repeating themes. We used these values and themes to explore the extent of collaborative governance and institutionalization in planning and implementing TPIs within each city.

3. Results

3.1. Governance

3.1.1. Vision

University of Florida urban forestry researchers note, "Plans are based on visions" (Hubbard, 2000, p. 4). Considering the origin, articulation and support of visions underpinning metropolitan TPI is fundamental to understanding the nature of governance guiding their planning and execution. To explore this we asked

Table 2
Source of TPI vision (number of respondents).

City	Mayor	Staff	City council	Non-profits	Private sector
New York	10	2	0	8	0
Los Angeles	14	0	0	0	0
Houston	2	0	0	4	1
Salt Lake County	12	3	0	0	0
Sacramento	0	1	1	9	0
Denver	10	0	0	0	0
Total	48	6	1	21	1

interviewees to articulate the overall vision of their city's TPI and identify its primary source (i.e., mayor, agency staff, private sector, NGO). We also asked interviewees to rate the role of science and research in developing their TPI's vision.

3.1.2. Overall vision

Interviewees identified broad themes for their city's TPI including increasing canopy cover, educating and engaging the public on the importance of the urban forest, general environmental benefits, beautification, and quality of life. They also described more specific benefits such as improving public health and safety, air and water quality, and mitigating floods and climate change. A few noted reelecting the mayor and making their city the "greenest", and assisting underserved neighborhoods as central to their city's TPI vision.

One Los Angeles interviewee articulated this broader ideal of TPIs as a means to "[e]ducate every individual in the city. . .not just how to give back to the community, but to reduce global warming, reduce smog, and the importance of beautifying the environment. Showing how one tree can make a difference in front of their home, providing oxygen [and] increasing the value of their properties. . .and. . .make the planet a better place to live."

While the majority of interviewees shared the breadth and idealism of these visions, four held a more cynical perspective. A respondent stated this position succinctly: "I feel that it [TPI] is a sound bite for the mayor."

3.1.3. Primary source

We asked interviewees to identify the primary sources of the vision guiding their TPI. Most identified their mayor (see Table 2). An interviewee's comment reflected the recognition of this central role,

"[The] mayor. . .had a vision for the value and significance trees play in the lives of people. He took the initiative to get it started. With his initiative, all of the staff, non-profits and outside agencies fell in line to support and contribute to the program. Independent of [the] mayor['s]. . .charge it may not have been started."

Interviewees identified non-profits as the strongest voice in cities where the mayor did not take the lead. While city councils and

the business community were not viewed as important sources of TPI visions, one Houston interviewee dissented, arguing, "The good things that have happened in this city have come through the private sector because we don't have the tax base for the City to initiate much."

3.1.4. Role of science

We further asked interviewees to rate the role of scientific research in developing their city's TPI vision. Most thought it very or somewhat important while only two declared it very unimportant (see Table 3). Respondents from Los Angeles placed particular attention on the importance of science:

"The vision going in from the staff's perspective was that it had to be based on science and research. . .and not make it about putting a pretty tree in your front parking strip."

Sacramento interviewees affirmed this perspective. As one interviewee commented, "It was critical to [the TPI's] success. Without the research, it would not have been possible to get the elected official buy-in and widespread support." Another noted, "It is not just the hard science of carbon sequestration, but behavioral science and measuring the quality of life benefits from trees."

3.1.5. Management

Well-managed urban forests are an important component of metropolitan green infrastructure providing valuable contributions to the environmental, social and fiscal health of cities (American Public Works Association, 2007a, 2007b; APA, 2009). These diverse factors underline the importance of TPI management team composition and significance in determining the governance approach guiding the initiative. To investigate these attributes we asked interviewees to describe who was represented on their city TPI's management team (defined as the core group of individuals primarily responsible for TPI planning and implementation) and what representation (if any) was missing.

Respondents placed the majority of management team participation with city parks departments, the mayor's office and local non-profits while few emphasized corporate or advisory board participation. When queried on who was not represented but should be, many interviewees identified a desire for greater inclusion of other city and state agencies and of non-profits. Other potential additions to the management team management team included arborists, elected officials, scientists, and minorities. Respondents emphasized broadening the public sector's engagement and expressed concern that initial commitments of wider TPI participation had eroded. As a New York City interviewee commented,

"Million TreesNYC was originally envisioned as having tree goals for every agency in the city government. For the city side. . .it has come down to being just a Parks Department initiative. And with the recession it has been abandoned entirely by the other agencies. They were originally given numbers of trees to plant as targets but those targets have been dropped by the agencies. . .."

Table 3
Role of science and research in developing TPI vision (number of respondents).

	Very important	Somewhat important	Somewhat unimportant	Very unimportant	Don't know
New York	5	3	0	0	0
Denver	3	4	0	1	0
Houston	n/a	n/a	n/a	n/a	n/a
Los Angeles	10	2	1	0	0
Sacramento	9	0	0	0	0
Salt Lake County	2	3	6	1	0
Total	29	12	7	2	0

Table 4
TPIs embedded in other state policies (number of respondents).

	Strongly agree	Agree	Disagree	Strongly disagree	Don't know
New York	7	3	0	0	0
Denver	2	6	1	0	0
Houston	2	4	1	0	0
Los Angeles	3	9	1	0	0
Sacramento	2	5	1	0	0
Salt Lake City	1	9	0	1	0
Total	17	36	4	1	0

Table 5
TPI effect on ordinances and regulations (number of respondents).

	Positive effect	In develop- ment	No change	Negative effect	Don't know
New York	8	1	0	0	0
Denver	0	1	5	0	0
Houston	4	1	2	0	0
Los Angeles	8	1	1	0	0
Sacramento	5	5	1	0	0
Salt Lake City	1	4	4	0	0
Total	26	13	13	0	0

3.2. Mainstreaming

3.2.1. Policies and plans

As both fundamental city infrastructure and organisms with considerable life spans, urban forests require long-term planning and support (APA, 2009). Capturing their boundary-spanning contribution to public goods – cutting across water and air quality, soil and climate maintenance, public health and metropolitan capital accumulation – requires institutional integration across the city fabric (Young, 2010).

To study extent this we asked interviewees if their TPI was embedded in their city's other sustainability policies and to rate the effect of their city's TPI on local policies, ordinances or regulations. We further inquired whether their city had developed documented stewardship and business administration plans to support their city's expanded urban forestry efforts.

3.2.1.1. Sustainability policies. Vision can sustain an initiative's early stages; however, long-term implementation requires incorporation into the fabric of metropolitan governance. To explore this we asked interviewees to rate the extent their TPI was embedded in the city's other sustainability policies. Fifty-three respondents agreed or strongly agreed that their TPI's vision was incorporated into the city's sustainability policies. Four respondents disagreed and one strongly disagreed (see Table 4).

New York interviewees felt including New York City's TPI into the city's sustainability master plan [PlaNYC] had established the initiative as part of the city's general sustainability policies. A city program director confirmed, "Million TreesNYC is embedded in PlaNYC. It's a key component of the mayor's sustainability plan for New York City." An assistant commissioner elaborated, "Million TreesNYC is one initiative that relates to several of the 10 major goals in PlaNYC; for example, reducing carbon emissions, mitigating climate change and improving public health and water and air quality."

Respondents from other cities viewed TPI policy incorporation as more incremental. Los Angeles interviewees noted their TPI prompted policies to include tree plantings in capital construction programs but larger efforts to secure dedicate funding in other agencies for urban forestry-related issues had failed. Houston interviewees also noted partial success in disseminating the TPI to other agencies.

Interviewees from Denver, Sacramento and Salt Lake City noted some success in getting tree-planting associated with city sustainability goals such as energy conservation, but saw greater opportunities in on-going policy discussions. These discussions centered on developing cross-agency policy coherence around what a Salt Lake City respondent described as a "sense of creating a landscape, a green infrastructure and what trees do as far as our long-term sustainability goals are."

3.2.1.2. Ordinances and regulations. We also asked stakeholders whether the TPI had affected local ordinances or regulations.

Seventy-five percent of respondents said it had beneficial impacts on existing regulations or positively influenced those under development while twenty-five percent felt the TPI had no effect. Only one reported it as having a negative effect (see Table 5).

New Yorkers noted TPI influence in establishing ordinances requiring ratios of tree plantings to street frontage and parking space in new developments. They further noted city council's passage of new tree removal restrictions and inclusion of a section on trees in the NYC Department of Transportation's street design manual. Similarly, Houston's TPI prompted mandatory tree planting ordinances for new developments and extended the city's Tree and Shrub Ordinance to public agencies, requiring tree-related permits for any work done on city bridges, streets or sewers. Los Angeles interviewees credited their TPI with streamlining tree-planting permits benefiting TPI implementation and long-term workforce needs. This action by the mayor and city council

> "allows non-profits to plant trees in a much quicker way. Essentially it is a non-profit employment contract. It has been very difficult to hire public servants…for two or three years now. [The streamlined process for non-profits] targets youths to give them work experience so they can be hired in the future."

These changes sometimes came at the price of political conflict. A Houston interviewee commented changing ordinances had been "damn hard in a laissez-faire culture like we have in Houston" but noted "now we have one of the best tree ordinances in the nation because of incremental advances that have changed the mindset to get trees to be thought of as part of the city's infrastructure."

Denver interviewees noted that political opposition had limited proposed ordinance changes. A stakeholder described the conflict as

> "An example of when something philosophically sound and practical gets slapped in the face with political resistance…For example, local ordinances for tree protection [required private property set-backs to protect tree canopy]. ….[D]evelopers do not want Parks and Recreation telling them what they can and cannot do on private property. They could not change the ordinance language because of political pushback and had to water it down so that it was acceptable."

Sacramento and Salt Lake City interviewees perceived their TPIs had prompted little immediate local change but were driving focus on developing new regional ordinances. A Sacramento interviewee's comment was representative: "the end goal is to foster consistency of tree-related goals throughout the region."

3.2.1.3. Planning. As noted above, urban forests are located in public and private spaces throughout the city and deliver services benefiting metropolitan populations (Benedict & McMahon, 2006; Hirsch, 2008). Proper stewardship and financing of urban forests are central to their success in delivering these public goods. Just as traditional infrastructure requires on-going maintenance and funding in order to effectively deliver public services, green

Table 6
Documented TPI stewardship plans (number of respondents).

	Yes	In development	No	Don't know
New York	5	2	1	0
Denver	0	4	1	0
Houston	2	0	5	0
Los Angeles	6	1	2	0
Sacramento	4	0	2	0
Salt Lake City	6	1	1	0
Total	23	8	12	0

Table 7
Documented TPI business plans (number of respondents).

	Yes	In development	No	Don't know
New York	5	0	1	0
Denver	3	3	1	0
Houston	6	0	0	0
Los Angeles	2	0	3	0
Sacramento	4	0	1	0
Salt Lake City	2	4	2	0

infrastructure requires stewardship and serious business management to do the same. Without long-term maintenance and financial support, green infrastructure is unable to provide the value it is capable of producing. As a result, urban forests hold legitimate claim to a city's infrastructure and business administration planning (American Public Works Association, 2007c).

The development of these plans is fundamental to exploring questions about TPI institutionalization. To consider this we asked interviewees to describe stewardship and business plans supporting their city's TPI.

3.2.2. Stewardship

We elicited stakeholder perceptions about their TPI's stewardship plans (i.e., watering, pruning and disease control after the first growing season). Over twice as many respondents viewed them as fully developed or in development as felt their city lacked clear stewardship plans (see Table 6).

New York, Houston and Los Angeles embedded stewardship accountability into tree-planting contracts with non-profit and private contractors. These cities also required signed stewardship agreements from agencies and private parties before they would grant approval for city-sponsored plantings.

Plans also identified volunteers as a means to augment city stewardship resources. Each city planned public planting events (e.g., Arbor Day) and established TPI websites encouraging participation. In addition, each city except Houston institutionalized educational materials for those interested in caring for plantings.

Salt Lake and New York City furthered these efforts by seeking to establish permanent volunteer "stewardship corps" to care for their urban forests. New York City enlisted each borough's Botanical Gardens as education centers for TPI volunteers and established job-training programs to develop the public and private workforce that increased tree populations and stewardship would demand.

Interviewees described efforts to institutionalize wider governance in urban forest planting and stewardship as problematic. They praised sub-contracting planting and stewardship responsibilities to private or non-profit partners; however, they expressed concern about what would happen after the two-year contracts expired. As a Houston stakeholder commented, "Yes, the trees are looked after in the first two years after they are planted but after that, no, the trees are on their own." Even in cities where longer-term stewardship plans had been incorporated there were concerns. As a New York interviewee stated,

> "The city has pruning funds for looking after the trees after the first two years of contractor care. With PlaNYC we went from a ten-year pruning cycle to a seven-year cycle. But with budget cuts we have had big cuts in the pruning budget and it is not going to be a seven-year cycle. . .we are trying to get this funding replaced."

One of their colleagues described the situation in more dire terms: "The maintenance plan isn't being funded right now so in effect it doesn't exist."

Stakeholders also commented on the limitations of signed stewardship agreements. While TPIs provided stewardship information to tree-recipients, opportunities for follow-up were limited. Trees planted on private property were generally outside the jurisdiction of municipal employees A Denver stakeholder defined the issue,

> "The vast percentage [of plantings] is on property that [the City of Denver or program staff] do not control. Once a tree is planted they do not have access to the tree or the private landowner. Maintenance leaves their hands the day it is planted. That makes education all the more important because they will not be back to check on it."

While stakeholders in all cities praised event turnouts and TPI volunteers, many questioned their efficacy in meeting stewardship needs. Los Angeles reported staff-additions to assist non-profits and community groups implementing stewardship however interviewees in all study cities expressed concern about mobilizing sufficient volunteers and underlined the importance of expanding paid city staff. A New York TPI-staffer's comment reflected the limitations of relying on volunteers:

> "Volunteers are great and it's impressive to see how New Yorkers care about their environment but they are not paid and it would be good to have a better core of paid maintenance workers on staff and on salary."

Interviewees reported funding vulnerabilities and difficulty in motivating adequate volunteer support restricted mainstreaming broad-based stewardship. Another New York interviewee summed up the result, "Our stewardship activities and events are very effective but our overall stewardship has been ineffective."

3.2.3. Business administration

We further solicited stakeholder perceptions about TPI business plans (i.e., fundraising, budgeting, purchasing, etc.). More than fifty percent of respondents saw their TPI's plans as fully developed while less than twenty-five percent viewed them as undeveloped (see Table 7).

Each TPI drew some funding from their city's general fund. Two, New York and Salt Lake County, undertook to include tree acquisition as a budget line item. New York and Houston further leveraged their TPIs through volume purchasing contracts. As a Houston interviewee noted, "Entities like the city. . .needed to do big volume contracts to get to 1 million trees. . . [D]oing that reduced costs so more trees could be planted for the same amount of money."

TPIs also diversified beyond public budgets to new sources including corporate, foundation and federal government funding. New York, Denver, Houston and Los Angeles placed significant focus on corporate sponsorship while TPIs in Sacramento and Salt Lake focused on foundation and government grants. To pursue corporate funding, New York, Houston and Los Angeles partnered with non-profits to provide fundraising opportunities traditionally unavailable to municipalities.

Stakeholders in Sacramento and Salt Lake felt the absence of funding diversity hurt their ability to adequately support their TPI. A Sacramento interviewee detailed this sentiment noting their TPI

"should target. . .development and fundraising activities toward long-range health benefits. . .and how the program creates opportunities for corporate partners, health partners and environmental partners. . .not only [as] a philanthropic gift but an investment." This change, a colleague noted would require their TPI to "make the shift from a tree-planting group to an advocacy and partnership building organization."

Public sector funding, stakeholders noted, was also subject to difficulties such as cuts in the city's general fund, the complexities of municipal procurement and competition between agencies. Reliance on outside private, federal and foundation support was also vulnerable to issues such as fundraising shortfalls, over-reliance on a limited pool of funders and declining momentum as the program progressed.

To address these issues, stakeholders suggested moving TPI support from the general fund to a municipal budget line item. A Houston interviewee's statement was representative. "It would be better to have a dedicated source of funding rather than the general fund because if the general fund goes down then I don't have match dollars for the program."

Interviewees also expressed enthusiasm for budget diversification. Stakeholders identified public/non-profit partnerships as means to raise funds outside city budgets. New York City and Los Angeles interviewees repeatedly noted the success and breadth of their public/private fundraising efforts.

Denver interviewees confirmed diversity of sources was critical noting they initially allowed their TPI to be overly associated with a single corporate funder making it difficult to entice other supporters. Stakeholders in Sacramento, on the other hand, spoke of drawbacks in relying too much on foundation and government grant cycles. A stakeholder's description was illustrative:

"We need resources that have a steady drumbeat. . .It is hard to lift up the momentum when the boat rocks so much. . .[W]e find that the resources have wave-like patterns. This makes it hard to lift the program to the next level. . .when there is that kind of instability of resources."

4. Discussion and conclusions

4.1. Governance

Respondents clearly perceive urban forests as means to provide preventative, front-end solutions to environmental problems. Interviewees did not, in general, describe increasing canopy cover as an end in itself but rather as a form of green infrastructure delivering public goods including improved environmental education, public health and safety, water and air quality, flood control, carbon offsets, economic development and mitigation of urban heat island effects and global climate change.

This broad, synergistic perspective falls within environmental governance's positive ideal as a multi-stakeholder means to more effective resource management strategy. However, respondents' perceptions of the drivers behind the vision, planning and execution of this strategy identify more traditional sources.

Kanie and Haas (2004) note environmental governance is distinguished by the engagement of non-traditional actors (business, NGO and scientific communities) in policy development and execution. In contradistinction, nearly two-thirds of interviewees placed these roles firmly within the public sphere. Respondents identified their mayor or public staff as main sources of their TPI's overall vision. Forty-eight interviewees identified the mayor as a primary source and 29 respondents identified the mayor and 36 the public sector as the sole source of overall vision of their city's TPI. Only in Sacramento and Houston was the non-profit sector seen as dominant and only one interviewee viewed the private sector

as an important source of the vision driving the various TPIs. The scientific community fared better with 33 interviewees stating science was important in formulating TPI vision. Only nine saw it as unimportant.

In aggregate, as regards TPI vision, the scenario presented by interviewee's appears to describe effective government rather than an evolution in governance strategy. In two-thirds of the case study cities the public sector led formulation of the initiative. In all the cities, save Salt Lake, this process was reported as supported by scientific research. While interviewees noted non-profits led the charge in Houston and Sacramento and played an important role in New York, the overall impression is of engaged, scientifically informed, public sector initiatives.

Interviewees described TPI management governance in similar terms. Here again the public sector played the leading role. Parks departments, mayoral and public agency staff dominated TPI management in most case study cities. While interviewees in New York and Houston noted significant non-profit presence, only Sacramento's TPI management reflected a dominant NGO role. As in visioning processes, the private sector was seen as having negligible presence.

Interviewee responses regarding expanding management team representation amplified these trends. They sought greater cross-agency and to lesser degrees non-profit participation. Again, private sector inclusion was not a priority. Rather than painting a situation in which government could not "go it alone," interviewees emphasized the nearly singular role of the public sector (and within that parks departments) as the primary agent governing TPI management. Their desire was, in general, greater public sector engagement rather than a diminished or diversified role.

4.2. Mainstreaming

Interviewees in most study cities noted public sector dominance in TPI governance yet despite this saw limited TPI influence on municipal sustainability policies, regulations or ordinances. New York City's TPI was described as both embedded in the city's sustainability master plan as well as a driver of a host of tree-related changes to city development ordinances. The majority opinion in other cities reflected more limited gains. Interviewees noted advances in getting TPI visions incorporated into city policies and some success in forcing incremental regulatory change that, as Houston interviewees described, offered hard-won, cumulative opportunities to place urban forests on new institutional footing. Denver's experience reflected the political resistance facing a program's move from initiative to institutionalized status.

Institutionalizing TPI stewardship and business plans also reflected uneven success. The majority of case study cities reported documented stewardship plans, however these plans relied heavily on short-term, contract labor. New York, Los Angeles and Houston, in the face of municipal budget cuts, sub-contracted stewardship to non-profit and private actors through initial two-year agreements. While these instances of private and non-profit involvement might be viewed as evidence of broader governance, interviewees described them more in terms of stopgap measures in the face of recessionary cut backs, simply postponing decisions to invest in long-term maintenance. The absence of true governance innovation is further reflected in Denver's stewardship constraints on private land, undermining their initiative's efficacy.

TPI business plans offered more evidence of genuine transdisciplinary governance. New York's efforts were exemplary. Tree acquisition was incorporated in the line item budget while non-profits raise additional corporate funding. Houston and Los Angeles' mimicry of this approach was weakened by the loss of public investment in the recession's wake yet both garnered sufficient foundation and private capital to maintain their programs. Denver

and Sacramento's TPI showed the vulnerability of relying solely on a single corporate funder or government grants in lieu of an integrated approach of municipal budgeting and corporate largess.

4.3. Conclusion

This study of large-scale metropolitan TPI finds these initiatives genuine attempts to increase urban ecosystem services as a means to address complex environmental challenges. In addition, we find, contrary to the general discourse, these efforts are largely driven by public sector initiative and follow-through. This is not to say that outside support was absent. The scientific community and non-profit sectors provided some assistance in formulating TPI visions and to a lesser extent management, and the corporate sector offered some financial support.

However, these inputs, rather than suggesting new directions in environmental governance, seem to be evidence of effective government. Government has long drawn upon scientific reasoning and community input to support new policy initiatives. Furthermore, the private sector has historically contributed to government action through taxation, though in the neo-liberal era this is being reconfigured as corporate philanthropy. Non-profits' secondary role and the private sector's absence in TPI visioning and management and their limited role in implementation and financing suggest public sector dominance in initiating and carrying through these initiatives.

This dominant role, however, does not guarantee rapid institutionalization. Respondents report some gains in transforming municipal policies and regulations but place these in the context of private sector resistance and lack of agency integration. These obstacles may be rooted in the TPIs' status as relatively new initiatives. However they also suggest the importance of incorporating issues of economic and political power into future governance studies. Studying the relationship between public sector initiatives and popular mobilizations (either corporate or citizen-based) in insuring their institutionalization would be of considerable interest in this regard.

While in some instances broad governance configurations are no doubt emerging, it may be, to paraphrase Mark Twain, that "report of the public sector's death is an exaggeration." Moving beyond standard critiques of government as too cumbersome to manage environmental initiatives to a more grounded analyses of power relations and negotiated social conflict may enable planners to deflect ideologically charged criticisms and provide insight into when public sector initiatives could benefit from broader forms of governance.

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