GREEN INFRASTRUCTURE AND PARK SYSTEM PLANNING

Park system planning dates back to Frederick Law Olmsted's concept of boulevards and trails connecting significant park-lands, which he referred to as "pearls on a string." Early examples include Boston's "Emerald Necklace" and Minneapolis'"Chain of Lakes"[1]. In the late 19th and early 20th centuries cities such as Cleveland, Kansas City, Louisville, and Oklahoma City had the foresight to establish park, boulevard, and trail systems that today are among their most important civic assets.

Park system planning is increasingly important in the 21st century, as cities seek to meet residents' needs and secure their place in a competitive economy in which the benefits provided by parks and green spaces are an important factor in location decisions made by companies and individuals. In addition, as many urban communities undergo rapid growth, park system planning is critical to ensure an equitable distribution of lands, facilities, and park resources to all, especially traditionally underserved communities.

Peter Harnik identifies seven characteristics of the excellent city parks system: a clear expression of purpose; an ongoing planning and community involvement process; sufficient assets in land, staffing, and equipment to meet the

1   Lewis, Megan, ed. 2008. *From Recreation to Re-creation: New Directions in Parks and Open Space Planning*. Chicago: American Planning Association, PAS Report 551, p. 8.

KEY POINTS

#1 Community engagement is key to the planning process and can highlight the benefits of green infrastructure for people.

#2 Benefits are maximized when green infrastructure is planned as a physically connected network.

#3 The equitable distribution of and access to green infrastructure for poor and underserved communities are key system planning issues.

#4 Successful plans specify actions and funding sources to effectively implement green infrastructure at the system-wide and park scales.

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system's goals; equitable access; user satisfaction; safety from crime and physical hazards; and benefits for the city beyond the boundary of parks[2]. ChangeLab Solutions identifies seven characteristics of a "complete" parks system:

- engage (engage everyone in the process);

- connect (create safe routes to parks);

- locate (ensure equitable access to parks);

- activate (program activities and amenities for parks);

- grow (plant and maintain sustainable parks);

- protect (make parks safe); and

- fund (commit to finance the complete parks system)[3].

Green infrastructure planning at the city scale seeks to optimize the environmental, economic, and social benefits provided by open space and natural resources (including parks). This increasingly aligns with park system planning that addresses all green spaces in a community, not just those owned by the municipality. Two separate but related definitions of green infrastructure are commonly used, and park system planning has an important role to play in advancing both. The two definitions are: a large-scale network of open spaces providing ecosystem services and benefits[4], and green stormwater infrastructure, which uses or mimics natural processes at the neighborhood or site scale to prevent, capture, and/or filter stormwater runoff[5]. The park system plan can set the overall framework and specify actions to deploy green stormwater infrastructure in parks and green spaces at the local scale. A common denominator is to position parks and green space as not just an amenity, but as an essential component of a community's infrastructure.

KEY POINT #1

Community engagement is key to the planning process and can highlight the benefits of green infrastructure for people.

The park system planning process generally consists of the following four steps[6]:

- **Inventory and Needs Assessment**: Identify community needs through an inventory of resources, public involve-

ment, and community and demographic profiles. This step typically includes a Level of Service (LOS) analysis to help determine needs for parks and recreation facilities[7].

- **Vision**: Create and confirm a future vision for the park system.

- **Goals, Objectives, and Actions**: Develop strategies and actions to implement the plan.

- **Approval and Adoption**: Obtain approval for the plan from the city council or appropriate governing body.

Cites or counties may adopt park system plans as one element of a comprehensive plan[8]. This approach promotes integration of park and open space planning with other community systems such as land use and transportation.

Jurisdictions such as El Paso, Texas; Lancaster County, Pennsylvania; Prince George's County, Maryland; and Saratoga County, New York, have adopted green infrastructure plans, often as elements of a comprehensive or general plan[9]. These plans are developed through a process similar to the park system planning process[10] and typically use the "large-scale network" definition of green infrastructure. For example, the Prince George's County, Maryland plan identifies a contiguous network of environmentally sensitive areas throughout the county and sets forth a goal, objectives, policies, and strategies to preserve, protect, and enhance these elements by the year 2025[11].

A second type of city or regional-scale green infrastructure plan has emerged in recent years in response to Consent Decree requirements under the Clean Water Act to address Combined Storm-Sanitary Sewer (CSO) water quality impacts. Examples include green infrastructure plans by Philadelphia, the Northeast Ohio Regional Sewer District, Milwaukee, and the District of Columbia[12]. These plans address how green stormwater infrastructure can supplement or replace conventional gray infrastructure solutions (typically underground storage tunnels) through practices such as bioretention, green roofs, permeable pavements, and tree plantings. *Green City, Clean Waters*, Philadelphia's Long-Term Control Plan,

7 Barth, David. 2016. Alternatives for Determining Parks and Recreation Level of Service. Chicago: American Planning Association, May/June 2016 PAS Memo.

8 Atlanta, GA. 2009. Project Greenspace.

9 El Paso, TX. 2006. Mountain to River: A Green Infrastructure Plan for El Paso; Lancaster County, PA. 2009. Greenscapes; Prince George's County, MD. 2005. Countywide Green Infrastructure Plan; Saratoga County, NY. 2006. Green Infrastructure Plan for Saratoga County.

10 Rouse, David C. and Ignacio Bunster-Ossa. 2013. *Green Infrastructure: A Landscape Approach*. Chicago: American Planning Association, PAS Report 571; Firehock, Karen. 2015. *Strategic Green Infrastructure Planning: A Multi-Scale Approach*. Washington, DC: Island Press.

11 Prince George's County, Countywide Green Infrastructure Plan.

12 Philadelphia Water Department. 2011. *Green City, Clean Waters*; Northeast Ohio Regional Green Infrastructure District. 2012. *Green Infrastructure Plan*; Milwaukee Metropolitan Sewerage District. 2013. *Regional Green Infrastructure Plan*; District of Columbia Water and Sewer Authority. 2016. *Green Infrastructure Plan*.

2 Harnik, Peter. 2003. The Excellent City Park System. San Francisco: Trust for Public Land.

3 Dohm, Diane and Ian McLaughlin. 2015. Complete Parks Playbook: Seven Elements of a Safe, Healthy, and Connected Parks System. Oakland: ChangeLab Solutions.

4 Benedict, Mark A. and Edward T. McMahon. 2006. *Green Infrastructure: Linking Landscapes and Communities*. Washington, D.C.: Island Press.

5 U.S. Environmental Protection Agency (EPA). 2016. "What Is Green Infrastructure?"

6 Lewis, *From Recreation to Re-creation*, 60.

notes the role of parks in managing stormwater runoff from streets and other surrounding impervious areas "where this can be done without adversely impacting the quality of the public land itself"[13].

These plans illustrate an overall trend toward an integrated planning approach in which parks are an essential component of a larger network that provides environmental, economic, and social benefits. Community engagement is essential to a successful planning process and can highlight the benefits of green infrastructure for people.

Community engagement should begin with the resource inventory and needs assessment, which lays the foundation for public understanding of the benefits provided by parks and green infrastructure. Atlanta's *Project Greenspace*, for example, described and mapped:

- the city's green space (i.e., green infrastructure) resources as comprising city-owned and other parks;

- environmentally valuable lands such as steep slopes, floodplain, and riparian corridors;

- urban open spaces such as plazas, squares, and streetscapes;

- and existing and potential connections between these resources.

In addition to public meetings and workshops, a random, statistically valid survey during the inventory and needs assessment phase can provide invaluable information on community priorities and needs. As the process moves forward, community engagement is critical to defining the future vision of the park system and should continue through development of goals, strategies, and an action agenda to implement the plan. The vision is often drafted by a stakeholder committee or task force based on community input received during the inventory and needs assessment phase and then reviewed with the public.

KEY POINT #2

Benefits are maximized when green infrastructure is planned as a physically connected network.

The "triple bottom line" of sustainability—environment, economy, and social equity—characterizes the benefits provided by green infrastructure. Examples of environmental benefits include reducing stormwater runoff and associated impacts such as flooding and erosion, improving air and water quality, and lessening of the urban heat island effect. Examples of economic benefits include increasing job and business opportunities, stimulating economic activity in local business districts, and attracting visitors, residents, and businesses to a community. Examples of equity benefits include improving health and reducing disparities in health outcomes between poor and rich communities, promoting environmental justice

and providing improved access for underserved populations, and connecting people to nature[14].

Because the benefits provided by green infrastructure are complementary rather than operating independently or in opposition to each other, the term "co-benefits" describes them. For example, a robust tree canopy in a local business district can reduce runoff, improve air quality, and lessen the urban heat island effect; stimulate retail sales[15]; and lead to better community health by improving environmental quality and promoting walkability. Moreover, co-benefits amplify when green infrastructure assets are part of a physically connected system across the landscape. For example, a park connected to other parks and open spaces via a regional trail system provides more recreational opportunities than one surrounded by development without a trail connection.

Landscape ecologists describe the physical structure of landscapes—from relatively pristine natural areas to rural/agricultural landscapes to cities—as consisting of patches, corridors, edges, and matrix[16]:

- A **patch** is a discrete area of the landscape that differs from its surroundings (e.g., a park surrounded by a residential neighborhood).

- A **corridor** is a linear feature that physically connects two or more patches (e.g., a stream corridor that connects the park to a park in another residential neighborhood).

- An **edge** is the transition area between two landscape features (e.g., between the park and adjacent neighborhood or between the riparian corridor and the different patches it traverses).

- Finally, the **matrix** is the predominant landscape pattern which contains patches, corridors, and edges (e.g., a residential community with house lots, streets, and extensive urban tree canopy).

The concept of patches, corridors, edges, and matrix provides a useful construct for planning green infrastructure, including parks and trails, as a physically connected network. Benedict and McMahon define hubs and links (the equivalent of patches and corridors) as the basic building blocks used in green infrastructure network design[17]. At a statewide scale, Maryland's Greenprint uses minimum thresholds of 250 acres in size (100 acres for rare, threatened, or endangered species habitat) for hubs and 1,100 feet in width for corridors based on principles of landscape ecology and conservation biology[18].

13 Philadelphia, *Green City, Clean Waters*, 29.

14 Rouse and Bunster-Ossa. *Green Infrastructure: A Landscape Approach*, p. 12-13.

15 Wolf, Kathleen L. 2005. "Trees in the Small City Retail Business District: Comparing Resident and Visitor Perceptions." *Journal of Forestry*, Volume 103, No. 8: pp. 390–395.

16 Forman, Richard T.T., and Michel Godron. *Landscape Ecology*. 2010. New York: John Wiley & Sons.

17 Benedict and McMahon, *Green Infrastructure: Linking Landscapes and Communities*.

18 Maryland Department of Natural Resources. n.d. *Greenprint: Mary-*

At the city scale, green infrastructure network components will differ greatly in size and other characteristics from statewide or regional networks based primarily on natural ecosystem value. For example, a 100-acre regional park or natural area in a city might be a major hub, with a 30-acre community park and five-acre neighborhood park designated as smaller nodes. Where possible, greenway/trail systems following natural drainage features (streams, floodplains, etc.) provide logical corridors to connect these and other green infrastructure hubs and nodes. Given that much of the natural hydrology has been replaced by development in urban environments, human-made features such as streetscapes and utility corridors can serve as corridors in the green infrastructure network through planning and design.

The concepts of landscape edges and matrix can help plan a citywide network that maximizes the benefits of green infrastructure, for example:

- Park edges can provide inviting, easily accessible walking connections for residents.

- The streets of the surrounding landscape matrix can promote walkability and connectivity to the park using sidewalks, street trees and other design features.

Green stormwater infrastructure within the park can absorb stormwater from surrounding development while providing co-benefits such as wildlife habitat, recreation, and contact with nature. In general, the park boundary can be viewed not as a hard edge but rather as an open and welcoming transition to the surrounding neighborhood (an idea called "Parks Without Borders" by the New York City Parks Department)[19].

KEY POINT #3

The equitable distribution of and access to green infrastructure for poor and underserved communities are key system planning issues.

According to Alexandra Dapolito Dunn,

> …green infrastructure has additional and exceptional benefits for the urban poor which are not frequently highlighted or discussed. When green infrastructure is concentrated in distressed neighborhoods—where it frequently is not—it can improve
>
> urban water quality, reduce urban air pollution, improve public health, enhance urban aesthetics and safety, generate green collar jobs, and facilitate urban food security[20].

Multiple studies have found that neighborhoods with higher than average concentrations of low-income and racial or ethnic minority populations tend to have less access to parks and green infrastructure than more affluent ones[21]. Moreover, parks serving such neighborhoods tend to be of lower quality, in terms of maintenance, security, and amenities[22].

Demonstrating the complexity of this issue, in Oklahoma City residents of the urban core have greater access to parks than suburban residents as measured by walking distance, a commonly used level of service standard[23]. At the same time, urban core residents have a lower Wellness Score than suburban ones. (This score is an aggregate of socioeconomic and other determinants of health together with community health indicators such as obesity.) Contributing factors include, among others:

- poorer quality facilities and amenities in the urban core parks than in the newer and larger parks serving suburban areas;

- a less than hospitable walking environment around the urban core parks; and

- a lack of easy autombile access to urban parks.

Promoting equitable access to green infrastructure through park system planning begins by engaging underserved and minority populations in the planning process. This involves, for example, going beyond "city hall" meetings to reach people at convenient times in comfortable local places (local parks/recreation centers are great venues for this purpose). Planners can reach out to members of the community to engage their neighbors in the process.

During the inventory and needs assessment phase, the distribution of and relative levels of investment in parks and green infrastructure resources should be evaluated relative to socioeconomic patterns in the community. For example, are there areas with higher than average concentrations of low-income and minority populations that are lacking in parks? If these areas have parks, how large are they and what is the quality of facilities they contain compared to parks in more affluent neighborhoods? One study found that ethnic

land's Green Infrastructure Assessment.

19 New York City Department of Parks and Recreation. n.d. *Parks Without Borders*.

20 Dunn, Alexandra Dapolita. 2010. "Siting Green Infrastructure: Legal and Policy Solutions to Alleviate Urban Poverty and Promote Healthy Communities." *Boston College Environmental Affairs Law Review,* Volume 37, Issue 1, p. 41.

21 Jennings, Viniece, Lincoln Larson, and Jessica Yun. 2016. "Advancing Sustainability through Urban Green Space: Cultural Ecosystem Services, Equity, and Social Determinants of Health" *International Journal of Environmental Research and Public Health*, 13(2): 196; Rigolon, Alessandro. 2016. "A Complex Landscape of Inequity in Access to Urban Parks." *Landscape and Urban Planning*, 153: 160–169; Wolch, Jennifer R., Jason Byrne, and Joshua P. Newell. 2014. "Urban Green Space, Public Health, and Environmental Justice: The Challenge of Making Cities 'Just Green Enough.'" *Landscape and Urban Planning*, 125: 234–244.

22 Rigolon. "A Complex Landscape of Inequity in Access to Urban Parks."

23 Oklahoma City, Oklahoma. 2013. *Parks and Recreation Master Plan*.

minority groups have slightly better access to parks in terms of proximity, but major inequities exist for parameters of park acreage and quality[24]. The 10-Minute Walk Campaign, a partnership of NRPA, the Trust for Public Land, and Urban Land Institute, provides a platform and strategies for identifying and addressing disparities in park access (learn more at 10minutewalk.org).

Based on community engagement and the results of the inventory and needs assessment phase, the plan vision and action agenda should incorporate the basic concept of equitable access to parks and green infrastructure for all community members. Plan implementation provides the opportunity to realize "the additional and exceptional benefits for the urban poor" envisioned by Alexandra Dapolito Dunn by prioritizing investments in parks and green infrastructure in underserved areas. Such investment can, for example, improve air and water quality in communities with environmental justice concerns caused by the all-too-frequent practice of locating heavy industrial and similar uses in poor neighborhoods. Green infrastructure investments can also provide jobs and training for local residents as a co-benefit. Green stormwater improvements in Lindsay Park West by the city of Atlanta, The Conservation Fund, Park Pride, and other partners provided jobs and training for local youths and other community residents[25].

An oft-raised concern regarding park and green infrastructure investments in poor neighborhoods is that they will lead to neighborhood change that leads to higher housing costs and increased risk of displacing lower-income residents. For example, one study found that housing prices along a portion of the 606 trail in Chicago rose 48 percent from 2013 (when construction began) to 2016[26]. Addressing gentrification requires carefully targeted housing and economic development strategies, which are beyond the scope of a park or green infrastructure system plan (see the *Planning for Equity in Parks with Green Infrastructure Briefing Paper* at planning.org/nationalcenters/green/urbanparks/ for more information on this topic).

Per Key Point #1, incorporating the parks system plan into the comprehensive plan (which typically includes housing and economic development elements) provides a forum for coordination to address the potential for gentrification. While some commentators have called for "just green enough" strategies[27], residents of poor and underserved areas should have equal access to green infrastructure, and community engagement in the planning process is key to providing such access based on local priorities and needs.

> ## KEY POINT #4
> Successful plans specify actions and funding sources to implement effective green infrastructure at the system-wide and park scales.

The measure of a successful plan is the extent to which it is implemented. A successful plan:

- identifies specific actions, time frames, responsibilities, and funding sources;

- connects to the annual budgeting and capital planning processes;

- establishes interagency and organizational cooperation;

- defines indicators, benchmarks, or targets to measure implementation progress; and

- establishes a process for evaluating progress and adjusting the plan as necessary[28].

From the perspective of the parks department, the plan implementation element should inform shorter term (i.e., annual) planning, decision making, and operations across the department, as well as interactions with other departments in these activities. As the purview of parks and green infrastructure planning expands to include broader community systems and benefits, the planning department is a particularly important partner for plan implementation. For example, the planning department can develop regulatory mechanisms (e.g., a parkland dedication ordinance or sidewalk/street tree standards) that address park and green infrastructure needs identified in the plan.

Because the plan sets the framework for capital and operating expenditures at the system-wide and individual park scales, it is especially important to prioritize where those expenditures will occur, and to specify funding sources to support them. For example, system-wide priorities might include a citywide trail system, safe routes to parks, and park and green infrastructure investments in underserved areas with high concentrations of poor and minority populations. The plan could also establish a policy to provide green infrastructure to manage stormwater and provide co-benefits, and designate individual parks for such investments based on suitability and watershed characteristics.

Funding sources available range from the general fund and general obligation bonds (benchmarking against per capita expenditures by peer communities can be a useful exercise) to dedicated user fees, impact fees, benefit districts, grants/foundation support, sponsorships, and many more. For the approximately 800 communities across the country obligated under the Clean Water Act to reduce stormwater pollution and sewage overflows, public and private financing

24 Rigolon. "A Complex Landscape of Inequity in Access to Urban Parks."
25 The Conservation Fund. n.d. Lindsay Street Park.
26 DePaul University, Institute for Housing Studies. 2016. *Measuring the Impact of The 606: Understanding How a Large Public Investment Impacted the Surrounding Housing Market*.
27 Wolch, et al., Urban Green Space, Public Health.
28 Godschalk, David R. and David C. Rouse. 2015. *Sustaining Places: Best Practices for Comprehensive Plans*. Chicago: American Planning Association, PAS Report 578.

for green stormwater infrastructure can create a new funding stream and/or leverage other sources[29]. (For more information, see the *Financing Green Infrastructure Projects Briefing Paper* at *planning.org/nationalcenters/green/urbanparks/*.) Given the range of funding sources available, partnerships with and across public agencies, nonprofits, foundations, and the private sector can create a "patchwork quilt" of funding for parks and green infrastructure. Regardless of the funding source, capital and operating budgets need to account for maintenance and life cycle costs.

Conclusion

In the past park system planning emphasized the recreational opportunities provided by the system[30]. While recreation is obviously still of primary importance, in the 21st century the purview of park system plans has grown to encompass many other benefits as well, such as health, open space, economic return on investment, and stormwater management. The concept of green infrastructure as a connected network of parks and other open spaces that provide triple-bottom-line benefits for people is a useful paradigm for a new generation of park system plans. Developed through a robust planning and community engagement process that includes a comprehensive inventory of current resources; assessment of community needs and priorities; and a future vision and action plan to achieve the vision, such plans can position the parks system not just as a nice amenity to have, but as an essential part of a community's infrastructure.

Equitable access to parks and green infrastructure for poor and underserved populations, who typically benefit less from these resources than more affluent residents, is a key issue that park system planning can address. Gentrification—accelerated neighborhood change resulting in higher housing costs and displacement of lower-income residents—can be a concern for park and green infrastructure investments in poor neighborhoods. Addressing this issue requires housing and economic development strategies that are beyond the scope of a park system plan, highlighting the need for integration of the plan and its implementation with the community's comprehensive plan. Regardless, community engagement is critical to determining local priorities and needs.

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29 U.S. Environmental Protection Agency (EPA). n.d. *Green Infrastructure Funding Opportunities*; Natural Resources Defense Council. n.d. *Climate-Resilient Cities: Expand Green Infrastructure Financing*.
30 Lewis, *From Recreation to Re-creation*, iii.

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