

PLANNING FOR EQUITY IN PARKS WITH GREEN INFRASTRUCTURE

Planners and park professionals routinely incorporate green infrastructure principles into the planning and design of public parks. This approach can be a powerful tool to improve the environmental quality of parks, engage and empower nearby communities, and provide social equity benefits.

Green infrastructure refers to natural or artificial landforms and plant communities whose ecological processes provide benefits to human developments. Researchers commonly describe these benefits as ecosystem services. At the city or regional scale, green infrastructure consists of a network of natural areas and open spaces¹. At the site or neighborhood scale, the term “green infrastructure” has been applied to stormwater management techniques that incorporate natural features or mimic ecological processes². These features include native trees and landscaping, rain gardens, bioswales, constructed wetlands, green roofs, and permeable pavement.

Green infrastructure confers a wide range of environmental, economic, and social benefits, which accrue at

KEY POINTS

- #1 Parks that include green infrastructure can build social capital in traditionally underserved communities.
- #2 Parks that include green infrastructure can improve health outcomes in traditionally underserved communities.
- #3 Parks that include green infrastructure can increase economic opportunities in traditionally underserved communities.
- #4 Careful planning and continued engagement is necessary to ensure that traditionally underserved communities receive these benefits and are not displaced through a process of environmental gentrification.

1 Benedict, Mark A., and Edward T. McMahon. 2006. *Green Infrastructure: Linking Landscapes and Communities*. Washington, D.C.: Island Press, p. 1.

2 U.S. Environmental Protection Agency (EPA). 2016. “*What Is Green Infrastructure?*”

different scales over different time horizons³. At the site or neighborhood scale, green infrastructure filters stormwater, mitigates the urban heat island effect, provides opportunities for physical activity and social interaction, reduces stress and promotes cognition, and increases property values and retail sales⁴.

Residents of neighborhoods with higher than average concentrations of low-income and racial or ethnic minority populations tend to have access to less parkland and green infrastructure than residents of other neighborhoods⁵. Additionally, parks accessible to these traditionally underserved communities tend to be of lower quality in terms of maintenance, security, and amenities⁶. Consequently, the green infrastructure benefits described above frequently do not exist in neighborhoods where conditions of environmental and social injustice persist.

Adding parks that integrate green infrastructure to traditionally underserved communities or adding green infrastructure to existing parks in these communities can improve social equity. However, absent authentic participation in the park and project planning processes and carefully targeted affordable housing and economic development policies, there is a chance that these parks and projects will contribute to displacement through a process of environmental gentrification.

KEY POINT #1

Parks that include green infrastructure can build social capital in traditionally underserved communities.

Social capital is the individual and collective value derived from human interactions and relationships. According to prominent political scientist Robert Putnam, the term

“refers to features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit”⁷. While there is no universal agreement about how to measure levels of social capital, common proxies include participation in voluntary organizations or political processes and feelings of trust toward individuals or institutions.

Societies with high levels of social capital benefit from economic efficiency and political stability⁸. Meanwhile, individuals with high levels of social capital tend to have better health outcomes and more economic opportunity⁹. This is because social networks can influence decisions to engage in healthy behaviors, offer comfort and support, and provide access to financial resources and employers.

It is important to note, however, that different types of social capital confer different benefits. Close friends and family influence lifestyle choices and can provide practical or financial support. This type of “bonding” social capital seems to have a significant effect on individual health¹⁰. Meanwhile, professional and social acquaintances can provide information about job openings or training programs, or connect entrepreneurs to capital for business development. This type of “bridging” social capital seems to have a significant effect on individual economic opportunity¹¹.

Evidence suggests that residents of neighborhoods with higher than average concentrations of low-income and racial or ethnic minority populations tend to have less bridging social capital than residents of other neighborhoods¹². While the causes for these disparities likely go far beyond disparities in access to parks and green infrastructure, there are reasons to believe that adding green infrastructure to parks in traditionally underserved communities can increase social capital in those neighborhoods.

3 Millennium Ecosystem Assessment. 2005. *Current State & Trends Assessment*. Washington, D.C.: Island Press.

4 Coutts, Christopher, and Micah Hahn. 2015. “Green Infrastructure, Ecosystem Services, and Human Health.” *International Journal of Environmental Research and Public Health*, 12(8): 9768–9798; Crompton, John L. 2001. “The Impact of Parks on Property Values: A Review of the Empirical Evidence.” *Journal of Leisure Research*, 33(1): 1–31; Wolf, Kathleen L. 2014. “Chapter 9. City Trees and Consumer Response in Retail Business Districts.” In *Handbook of Research on Retailer-Consumer Relationship Development*. Hershey, Pennsylvania: Business Science Reference.

5 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.

6 Rigolon, “A Complex Landscape of Inequity.”

7 Putnam, Robert D. 1995. “Bowling Alone: America’s Declining Social Capital.” *Journal of Democracy*, 6: 67.

8 Knack, Stephen and Philip Keefer. 1997. “Does Social Capital Have an Economic Payoff? A Cross-County Investigation.” *Quarterly Journal of Economics*, 112(4): 1251–1288; Newton, Kenneth. 2001. “Trust, Social Capital, Civil Society, and Democracy.” *International Political Science Review*, 22(2): 201–214.

9 Kawachi, Ichiro, S.V. Subramanian, and Daniel Kim, eds. 2008. *Social Capital and Health*. New York: Springer; Granovetter, Mark. 2005. “The Impact of Social Structure on Economic Outcomes.” *Journal of Economic Perspectives*, 19(1): 33–50.

10 Kawachi, Subramanian, and Kim, *Social Capital and Health*.

11 Granovetter, “The Impact of Social Structure on Economic Outcomes.”

12 Alesina, Alberto, and Eliana La Ferrara. 2000. “The Determinants of Trust.” NBER Working Paper 7621. Cambridge, Massachusetts: National Bureau of Economic Research; Smith, Sandra S. 2000. “Mobilizing Social Resources: Race, Ethnic, and Gender Differences in Social Capital and Persisting Wage Inequalities.” *Sociological Quarterly*, 41(4): 509–537; Subramanian, S.V., Kimberley A. Lochner, and Ichiro Kawachi. 2003. “Neighborhood Differences in Social Capital: A Compositional Artifact or a Contextual Construct?” *Health & Place*, 9: 33–44.

Access to parks with green infrastructure provides opportunities for building social capital through social interactions. Neighborhood and community parks provide many opportunities for conversation and meeting of neighbors in a pleasant green setting. For example, in a study of the relationship between tree cover and social capital in Baltimore, residents of neighborhoods with lots of trees had higher levels of individual social capital than residents of neighborhoods with few trees¹³.

Passive recreational spaces in urban parks create opportunities for chance encounters among diverse groups of users, while active recreational facilities like playgrounds and basketball courts can foster bonding over cooperative or competitive play. To illustrate, in a survey of neighborhood park users in Los Angeles, 73 percent reported socializing with people they knew at the park¹⁴. In another study, women who used Prospect Park in Brooklyn, New York, reported that they valued the sense of community that comes from unplanned interactions with friends and acquaintances¹⁵. Multiple studies of Chicago residents support the idea that access to parks or other common green spaces can build social capital. For example, a study of residents in six majority-minority neighborhoods suggests that having access to parks increases feelings of social support¹⁶. Another study found that a park on the city's far north side that served as a boundary between racially and ethnically different neighborhoods attracted residents from both neighborhoods, fostering social interactions that may not otherwise occur¹⁷. Additionally, a series of related studies of public housing residents found multiple links between green infrastructure and social capital¹⁸:

- Common open areas with trees and grass attracted larger and more diverse groups of residents than hardscaped common areas¹⁹.

- Residents interacted more in common open spaces with trees and grass than in hardscaped open spaces²⁰.
- Residents with better access to green space had stronger social ties²¹.
- Elderly residents with better access to green common areas had stronger social relationships and a more positive sense of community²².

KEY POINT #2

Parks that include green infrastructure can improve health outcomes in traditionally underserved communities.

Physical and mental health outcomes depend not only on genetics, individual behavior, and quality of health care, but also on a host of social, economic, and environmental conditions²³. Researchers typically describe these conditions as the “social determinants of health.” They include factors such as socioeconomic status, race or ethnicity, and the physical environment.

Residents of neighborhoods with higher than average concentrations of low-income and racial or ethnic minority populations tend to have worse physical and mental health outcomes than residents of other neighborhoods. These traditionally underserved communities have higher rates of cardiovascular disease, cancer, respiratory illnesses, anxiety, depression, and overall mortality²⁴. As with disparities in social capital, disparities in health outcomes are not solely attributable to disparities in access to parks and green infrastructure; however, there are reasons to believe that adding green infrastructure to parks in these neighborhoods can improve health outcomes.

At all scales, green infrastructure helps to clean air and stormwater, which in turn affects public health²⁵. In urban areas, trees are especially effective at removing air pollution associated with respiratory ailments and cardiovascular

13 Holton, Megan T., Susan L. Dieterlen, and William C. Sullivan. 2015. “Social Life Under Cover: Tree Canopy and Social Capital in Baltimore, Maryland.” *Environment and Behavior*, 47(5): 502–525.

14 Cohen, Deborah, Amber Sehgal, Stephanie Williamson, Roland Sturm, Thomas L. McKenzie, Rosa Lara, and Nicole Lurie. 2006. *Park Use and Physical Activity in a Sample of Public Parks in the City of Los Angeles*. Santa Monica, California: RAND Corporation.

15 Krenichyn, Kira. 2004. “Women and Physical Activity in an Urban Park: Enrichment and Support Through an Ethic of Care.” *Journal of Environmental Psychology*, 24(1): 117–130.

16 Fan, Yingling, Kirti V. Das, and Qian Chen. 2011. “Neighborhood Green, Social Support, Physical Activity, and Stress: Assessing the Cumulative Impact.” *Health & Place*, 17: 1202–1211.

17 Gobster, Paul H. 1998. “Urban Parks as Green Walls or Green Magnets? Interracial Relations in Neighborhood Boundary Parks.” *Landscape and Urban Planning*, 41(1): 43–55.

18 Kuo, Frances E. 2003. “The Role of Arboriculture in a Healthy Social Ecology.” *Journal of Arboriculture*, 29(3): 148–155.

19 Coley, Rebekah Levine, William C. Sullivan, and Frances E. Kuo. 1997. “Where Does Community Grow? The Social Context Created by Nature in Urban Public Housing.” *Environment and Behavior*, 29(4): 468–494.

20 Sullivan, William C., Frances E. Kuo, and Stephen DePooter. 2004. “The Fruit of Urban Nature: Vital Urban Spaces.” *Environment and Behavior*, 36(5): 678–700.

21 Kuo, Frances E., William C. Sullivan, Rebekah Levine Coley, and Liesette Brunson. 1998. “Fertile Ground for Community: Inner-City Neighborhood Common Spaces.” *American Journal of Community Psychology*, 26(6): 823–851.

22 Kweon, Byoung-Suk, William C. Sullivan, and Angela R. Wiley. 1998. “Green Common Spaces and the Social Integration of Inner-City Older Adults.” *Environment and Behavior*, 30(6): 832–858.

23 Galea, Sandro, Melissa Tracy, Katherine J. Hoggatt, Charles DiMaggio, and Adam Karpati. 2011. “Estimated Deaths Attributable to Social Factors in the United States.” *American Journal of Public Health*, 101(8): 1456–1465.

24 Ellen, Ingrid Gould, Tod Mijanovich, and Keri-Nicole Dillman. 2001. “Neighborhood Effects on Health: Exploring the Links and Assessing the Evidence.” *Journal of Urban Affairs*, 23(3–4): 391–408.

25 Millennium Ecosystem Assessment, *Current State & Trends Assessment*.

disease²⁶. However, while site- or neighborhood-scale green infrastructure alone is unlikely to fully address air quality problems in traditionally underserved communities²⁷, green infrastructure projects in parks can be a valuable part of a wider strategy for air quality improvement.

Beyond air and water quality regulation, parks that include green infrastructure can also affect health by providing an environment conducive to physical activity. Regular physical activity plays an important role in preventing a host of chronic diseases and premature death²⁸. Meanwhile, residents of neighborhoods with more green infrastructure tend to be more physically active, and having better access to parks and other green spaces correlates with lower levels of obesity²⁹. While there is a potential health trade-off in neighborhoods with high levels of air pollution, where increasing outdoor physical activity could actually increase exposure to pollution³⁰, linking park improvements to community tree planting efforts and other citywide or regional green infrastructure initiatives can help ensure the benefits outweigh the risks.

Between 2008 and 2012 the Trust for Public Land led an effort to renovate parks in low-income, underserved neighborhoods in San Francisco. These renovations included landscaping and play equipment. Visitors to the renovated parks more than doubled, and physical activity for children and adults increased significantly³¹. Additional research suggests that access to parks and green infrastructure improves mental health and cognition. Controlling for socioeconomic status, a national study in the United Kingdom found that individ-

uals reported a greater sense of well-being after moving to an area with more green space and a diminished sense of well-being after moving to an area with less green space³². A separate study in Australia found a strong positive correlation between access to green space and reported sense of well-being, even after controlling for socioeconomic status, physical activity, and social capital³³.

Apart from overall mental health, access to green space also seems to moderate stress. In Chicago, residents of neighborhoods with a large amount of green infrastructure reported less stress than residents living in neighborhoods with less green infrastructure³⁴. Beyond this, multiple studies support the idea that spending time in urban parks reduces stress³⁵. Finally, evidence suggests that access to green space improves focus and cognition. In Chicago, a study of children living in architecturally identical public housing with access to different amounts of common green space found that views of nature improved concentration, impulse control, and delayed gratification³⁶. In California, individuals who took a walk through a large natural area near Stanford University performed better on a test of memory than those who walked along a busy street in Palo Alto³⁷.

KEY POINT #3

Parks that include green infrastructure can increase economic opportunities in traditionally underserved communities.

- 26 Donovan, Geoffrey H., David T. Butry, Yvonne L. Michael, Jeffrey P. Prestemon, Andrew M. Liebhold, Demetrios Gatzolis, and Megan Y. Mao. 2013. "The Relationship Between Trees and Human Health: Evidence from the Spread of the Emerald Ash Borer." *American Journal of Preventive Medicine*, 44(2): 139–145; Nowak, David J., Daniel E. Crane, and Jack C. Stephens. 2006. "Air Pollution Removal by Urban Trees and Shrubs in the United States." *Urban Forestry & Urban Greening*, 4(3): 115–123.
- 27 Su, Jason G., Michael Jerrett, Audrey de Nazelle, and Jennifer Wolch. 2011. "Does Exposure to Air Pollution in Urban Parks Have Socioeconomic, Racial or Ethnic gradients?" *Environmental Research*, 111(3): 319–328.
- 28 Warburton, Darren E.R., Crystal Whitney Nicol, and Shannon S.D. Bredin. 2006. "Health Benefits of Physical Activity: The Evidence." *Canadian Medical Association Journal*, 174(6): 801–809.
- 29 Kaczynski, Andrew T., and Karla A. Henderson. 2007. "Environmental Correlates of Physical Activity: A Review of Evidence about Parks and Recreation." *Leisure Sciences*, 29(4): 315–354; Lachowycz, K., and A. P. Jones. 2011. "Greenspace and Obesity: A Systematic Review of the Evidence." *Obesity Reviews*, 12(5): 183–189.
- 30 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.
- 31 Cohen, Deborah, Bing Han, Jennifer Isacoff, Bianca Shulaker, Stephanie Williamson, Terry Marsh, Thomas L. McKenzie, Megan Weir, and Rajiv Bhatia. 2015. "Impact of Park Renovations on Park Use and Park-Based Physical Activity." *Journal of Physical Activity and Health*, 12(2): 289–295.

There are many potential private and public economic benefits associated with parks and green infrastructure, but the conversation to date has focused predominantly on property values, retail sales, tourism, and cost savings associated with ecosystem services. There has been comparatively little dis-

- 32 Alcock, Ian, Mathew P. White, Benedict W. Wheeler, Lora E. Fleming, and Michael H. Depledge. 2014. "Longitudinal Effects on Mental Health of Moving to Greener and Less Green Urban Areas." *Environmental Science & Technology*, 48(2): 1247–1255.
- 33 Sugiyama, Takemi, Eva Leslie, Billie Giles-Corti, and Neville Owen. 2008. "Associations of Neighbourhood Greenness with Physical and Mental Health: Do Walking, Social Coherence and Local Social Interaction Explain the Relationships?" *Journal of Epidemiology & Community Health*, 62(5): e9.
- 34 an, Das, and Chen, "Neighborhood Green."
- 35 Hull IV, R. Bruce, and Sean E. Michael. 1995. "Nature-Based Recreation, Mood Change, and Stress Restoration." *Leisure Sciences*, 17(1): 1–14; Orsega-Smith, Elizabeth, Andrew J. Mowen, Laura L. Payne, and Geoffrey Godbey. 2004. "The Interaction of Stress and Park Use on Psycho-Physiological Health in Older Adults." *Journal of Leisure Research*, 36(2): 232–256.
- 36 Taylor, Andrea Faber, Frances E. Kuo, and William C. Sullivan. 2002. "Views of Nature and Self-Discipline: Evidence from Inner City Children." *Journal of Environmental Psychology*, 22(1–2): 49–63.
- 37 Bratman, Gregory N., Gretchen C. Daily, Benjamin J. Levy, and James J. Gross. 2015. "The Benefits of Nature Experience: Improved Affect and Cognition." *Landscape and Urban Planning*, 138: 41–50.

cussion of the potential for parks and green infrastructure to enhance economic opportunities in traditionally underserved communities.

As previously discussed, access to green infrastructure can build social capital, which can lead to job opportunities and other economic benefits. Additionally, evidence suggests that this access can improve academic performance and, by extension, educational attainment and lifetime earnings. A study of high school performance in Michigan found that the amount of vegetation visible from cafeterias and classrooms positively correlated with:

- standardized test scores,
- graduation rates,
- and plans to attend college³⁸.

A similar study of elementary school performance in Massachusetts found a positive association between the level of greenery in a school's immediate environment and standardized test scores³⁹.

The jobs directly created by adding green infrastructure to parks can also enhance economic opportunities for traditionally underserved communities. Green infrastructure projects require manual laborers for landscaping and grounds-keeping work. These jobs are generally accessible to residents with a high school education and little to no experience. The drawback, though, is that these entry-level jobs typically pay low wages and seldom offer opportunities for career advancement unless additional leadership and business skills are obtainable⁴⁰. The National Green Infrastructure Certification Program discussed on page 6 may help workers attain such skills. Green infrastructure workers are slightly more likely to receive health coverage from their employers than other workers⁴¹.

In addition to developing clear career pathways, education and training providers can target specific underserved communities for green infrastructure training (such as the Corps Network national training model for youth and young adults facing barriers to employment)⁴².

Beyond jobs for laborers, green infrastructure projects can also support small business owners in traditionally

underserved neighborhoods. Many public agencies have procurement policies that prioritize contracting with minority-owned businesses or with firms in targeted neighborhoods. However, it is important to note that these procurement policies are only permissible as a corrective to a documented pattern of disparities in government contracting. (Following the Supreme Court decision in *City of Richmond v. J.A. Croson Co.*, any procurement policy that gives preferential treatment to minority business owners must be narrowly tailored and supported by a disparity study⁴³.) Because green infrastructure projects typically involve smaller, more piecemeal investments than gray infrastructure projects, there are potentially more opportunities to support small, minority-owned businesses through favorable procurement policies⁴⁴. Furthermore, the hiring practices of minority-owned businesses may enhance these opportunities. Multiple studies have demonstrated that jobs generated by African American-owned businesses tend to go to minority employees, regardless of the location of the firm⁴⁵.

In addition to prioritizing contracts with minority-owned businesses, local procurement policies can also require firms to focus hiring efforts on residents of targeted neighborhoods or population groups. However, to be most effective, these hiring preferences must be supported by workforce development programs to identify and train workers⁴⁶.

Finally, parks that include green infrastructure can also affect economic opportunities by providing an environment conducive to workforce development activities. These include general employment skills as well as development of specialized skills related to green infrastructure activities⁴⁷.

Landscaping and grounds-keeping work in neighborhood parks can build basic occupational skills that translate to a wide range of employment contexts. These jobs are physically accessible to neighborhood residents and can provide workers opportunities to observe and interact with higher-skilled construction or design professionals. However, connecting these entry-level jobs to careers in green infrastructure is challenging. There are few management positions and strong incentives to contain labor costs⁴⁸.

Dedicated nonprofit or social enterprise workforce development organizations can help overcome some of the barriers to career advancement by offering targeted training programs that build skills necessary to advance from entry-level to specialized or supervisory positions. Ideally,

38 Matsuoka, Rodney H. 2010. "Student Performance and High School Landscapes: Examining the Links." *Landscape and Urban Planning*, 97: 273–282.

39 Wu, Chih-Da, Eileen McNeely, J. G. Cedeno-Laurent, Wen-Chi Pan, Gary Adamkiewicz, Francesca Dominici, Shih-Chun Candice Lung, Huey-Jen Su, and John D. Spengler. 2014. "Linking Student Performance in Massachusetts Elementary Schools with the 'Greenness' of School Surroundings Using Remote Sensing." *PloS one*, 9(10): e108548.

40 Gordon, Emily, Jeremy Hays, Ethan Pollack, Daniel Sanchez, and Jason Walsh. 2011. *Water Works: Rebuilding Infrastructure, Creating Jobs, Greening the Environment*. Oakland: Green for All.

41 Lamback, Sara. 2017. *Exploring the Green Infrastructure Workforce*. Boston: Jobs for the Future.

42 *Ibid.*

43 McEwan, Brendan, Tara Aubuchon, Harriette Crawford, Micah Davison, and Karl Seidman. 2013. *Green Infrastructure & Economic Development: Strategies to Foster Opportunities for Marginalized Communities*. Cambridge, Massachusetts: Massachusetts Institute of Technology.

44 *Ibid.*

45 Bates, Timothy. 2006. "The Urban Development Potential of Black-Owned Businesses." *Journal of the American Planning Association*, 72(2): 227–237.

46 McEwan, et al., *Green Infrastructure & Economic Development*.

47 Lamback, *Exploring the Green Infrastructure Workforce*.

48 McEwan, et al., *Green Infrastructure & Economic Development*.

this starts with including these organizations in the park or project planning process, and the benefits can be maximized by helping workforce development organizations understand job requirements and procurement processes.

One noteworthy example is the Green Train Landscaping and Urban Ecology (GLUE) program in Syracuse, New York, where the State University of New York's College of Environmental Science and Forestry has partnered with the city's parks department, the county's wastewater treatment and stormwater management department, and other local organizations to offer green infrastructure job training. GLUE consists of an eight-week curriculum with classroom-based learning—covering both green infrastructure techniques and employment readiness training—and hands-on experience with rain gardens, permeable pavement, and urban forestry⁴⁹.

Some community colleges are demonstrating a new path for green infrastructure workforce development. For example, Lynwood Community College near Seattle has established a two-year program to prepare students for green infrastructure jobs in landscaping and horticulture, and in Denver the Front Range Community College has partnered with the Tree Care Industry Association to develop a short training program offering an industry-based certificate that can be a precursor to an associate degree⁵⁰.

Certification programs represent another promising strategy for career advancement. Currently, there are at least 18 green infrastructure certification programs across the U.S., but there is great variation among these programs and low levels of awareness among hiring managers⁵¹. Many green infrastructure experts are optimistic that the newly launched [National Green Infrastructure Certification Program](#) will elevate the status of green infrastructure construction, inspection, and maintenance workers and provide clear guidance for workforce development activities⁵².

KEY POINT #4

Careful planning and continued engagement is necessary to ensure that traditionally underserved communities receive these benefits and are not displaced through a process of environmental gentrification.

The benefits highlighted above are not guaranteed to accompany every new park or green infrastructure project,

even when the explicit goal is to address disparities in access for traditionally underserved communities. Design and community context influence accessibility and usage, but design alone is insufficient to address equity concerns.

Geographic information systems make it easy to quantitatively assess park access. However, an equal distribution of identical parks is both an unrealistic goal and unlikely to lead to an equitable outcome (Lucy 1981). Different population groups can experience the same park in different ways and have varying preferences regarding park features⁵³. Also, residents of neighborhoods with higher than average concentrations of low-income and racial or ethnic minority populations may not perceive a proximate park as being accessible or safe due to concerns about traffic or crime⁵⁴.

Consequently, objective metrics must be subordinate to authentic participation in park and green infrastructure project planning processes⁵⁵. This requires going beyond traditional passive engagement techniques (e.g., public meeting notifications) and even beyond newer online decision-support tools (which require access to and proficiency with technology). Dedicated community liaisons may be necessary to overcome barriers to participation related to a lack of time, trust, or understanding⁵⁶. Ideally, these liaisons should have firsthand experience living or working in the area, as well as established relationships with community institutions and leaders. Furthermore, it is crucial to allocate sufficient economic resources to sustain engagement efforts throughout the planning process⁵⁷.

Ironically, increasing the amount of high-quality parkland and amenities in traditionally underserved neighborhoods can trigger a process of environmental gentrification that eventually perpetuates disparities in access⁵⁸. *Environmental gentrification* (or ecological gentrification) refers to a process of neighborhood improvement through environmental

53 Gobster, Paul H. 2002. "Managing Urban Parks for a Racially and Ethnically Diverse Clientele." *Leisure Sciences*, 24: 143–159.

54 Day, Kristen. 2006. "Active Living and Social Justice: Planning for Physical Activity in Low-Income, Black, and Latino Communities." *Journal of the American Planning Association*, 72(1): 88–99; 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.

55 Low Impact Development Center, Inc. (LID). 2016. *Great Urban Parks Convening Summary Report*. Chicago: American Planning Association.

56 Lovell, Sarah Taylor, and John R. Taylor. 2013. "Supplying Urban Ecosystem Services Through Multifunctional Green Infrastructure in the U.S." *Landscape Ecology*, 28: 1447–1463.

57 LID, *Great Urban Parks Convening Summary Report*.

58 Checker, Melissa. 2011. "Wiped Out by the 'Greenwave': Environmental Gentrification and Paradoxical Politics of Urban Sustainability." *City & Society*, 23(2): 210–229; Wolch, Byrne, and Newell, "Urban Green Space, Public Health, 234–244; Suiter, Aaron. 2016. "Second Wave Rail-to-Trail Initiatives and Ecological Gentrification: Lessons from New York City's High Line and Atlanta's Beltline." *Undergraduate Journal of Humanistic Studies*, Winter.

49 State University of New York–College of Environmental Science and Forestry (SUNY–ESF). 2017. "Green Train Landscaping & Urban Ecology: Workforce Training Program."

50 Lamback, *Exploring the Green Infrastructure Workforce*.

51 *Certifications for Green Infrastructure Professionals—The Current State, Recommended Best Practices, and What Governments Can Do to Help*. 2014. Cambridge, Massachusetts: Emmett Environmental Law & Policy Clinic and the Environmental Policy Initiative, Harvard Law School.

52 Lamback, *Exploring the Green Infrastructure Workforce*.

remediation or the addition of green infrastructure (or other amenities that appeal to environmental protection advocates) that attracts new, wealthier residents and eventually increases property values. If unchecked, this process can lead to the displacement of existing residents, as they are priced out of the housing market.

The goal in siting and designing new parks and green infrastructure projects in traditionally underserved neighborhoods should be for reasons of social, environmental, and economic equity. Careful planning and community engagement should be undertaken to ensure that green infrastructure investments do not inadvertently lead to gentrification. Mitigating this risk requires carefully targeted housing and economic development strategies.

These strategies should address preserving and expanding the affordable housing stock, relieving immediate pressures on low-income tenants and homeowners, and building income and wealth among existing low-income residents⁵⁹. Some of the most promising strategies include using land banks and community land trusts to supplement public housing agency efforts to build or preserve affordable housing, offering tax relief or rehabilitation assistance to long-time homeowners or landlords that comply with affordability requirements, and providing assistance to existing small business owners to help them take advantage of new market opportunities.

Conclusion

While parks that incorporate green infrastructure provide multiple environmental, economic, and social benefits, not all neighborhoods have equitable access to these parks or their accompanying benefits. Often, neighborhoods with higher than average concentrations of low-income and racial or ethnic minority residents have less parkland and green infrastructure than other neighborhoods. The good news is that evidence suggests that adding green infrastructure to parks in traditionally underserved communities can not only address access disparities but also enhance social equity by building social capital, improving health outcomes, and increasing economic opportunities.

With that said, there are no objective measures of equity, only socially constructed indicators and targets. Absent authentic community participation in park and green infrastructure project planning processes, even sincere efforts to mitigate disparities can miss the mark. Furthermore, authentic

participation alone may not be sufficient to prevent involuntary displacement due to environmental gentrification. Mitigating displacement requires a combination of short- and long-term housing and economic development strategies involving a wide range of community stakeholders.

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