



Data Opportunities Brief

GREEN INFRASTRUCTURE, CLIMATE RESILIENCE, & HEALTH EQUITY POLICY AGENDA

MAY 2022

Challenge: Insufficient Impact Data, Tracking Metrics, and Co-Benefit Benchmarks

Gaps in current data, metrics, and shared benchmarks limit both implementation of green infrastructure (GI) and the ability to effectively monitor performance and broader impacts. There are numerous tools and resources that allow for the assessment of GI in the context of stormwater management, including runoff volume reduction, pollutant removal, and groundwater recharge. These tools include the [Runoff Reduction Method](#), [National Pollutant Removal Performance Database](#), and [Prospects for Enhanced Groundwater Recharge](#), respectively. There are also tools that assess the impacts of other GI elements, such as the carbon sequestration potential of street trees, [i-Tree Design Calculator](#), and the energy demand reduction potential of green roofs, [Cost Benefit Evaluation of Ecoroofs](#). There are numerous other valuation assessments and resources for GI, especially in the context of GI for stormwater management.¹

Use of these tools for GI projects, beyond stormwater management, is limited due to lack of comparability across different tools/assessments due to use of different data indicators. Additionally, there is currently insufficient data and methodology to develop tools to measure the public health and equity impacts, such as mental health benefits, or increased community cohesion, associated with exposure to GI, or access to public green space. This relates to the broader issue of valuation, or assigning a set value to an outcome's worth, to "intangible" benefits such

as mental and social wellbeing, while there are clear values assigned to reduction in water pollutants, or energy use. A [recent guide](#) developed by the Center for Neighborhood Technology and American Rivers, specifically designed to recognize the economic, environmental, and social benefits of GI, described the challenge of uplifting the benefits of urban heat island effect reduction, habitat preservation, community livability, and public education due to the lack of valuation research associated with these impacts.² Although there are numerous cost-benefit tools to assess the value of GI versus gray infrastructure, such as the Water Research Foundation's [Best Management Practices and Low Impact Development Whole Life Cost Model](#), they do not include valuation data related to public and mental health, community resilience, or health and social equity, and thus fail to capture the true and full potential benefit of GI use across sectors.³

These gaps in valuation data and limitations of existing tools often lead to maintenance of the status quo, gray infrastructure, and missed opportunities to leverage resources to expand the use of GI. Furthermore, the different mandates, priorities, and projects across different state and local agencies, such as runoff reduction, greenspace access, or vehicle-miles-traveled reduction, contribute to challenges comparing and/or integrating metrics across agencies. Additionally, depending on the agency and GI project or element there may be very different costs and benefits, for example, installation of rain barrels has different costs and benefits than a new community park.

Another challenge impacting the expanded implementation of GI is the lack of statewide or regional goals related to GI elements. For example, there are no standardized metrics or targets for park acreage per capita, or tree canopy. While there are recommendations for park acreage and accessibility, 3 acres per 1,000 residents and within half a mile walking distance, for example, these are not established in guidance, regulation, or law in ways that can hold agencies, municipalities, and counties accountable across different projects and funding streams.

Increase Opportunities and Investment in Applied Research, Data Collection, & Analysis Tools

Develop Green Infrastructure Research Agenda

– The Office of Planning and Research (OPR), in coordination with academic partners, community-based organizations, and local agencies, should develop a GI research agenda that includes the following:

- **Conduct Research on the Health and Social Benefits of Green Infrastructure** – research should specifically focus on quantification and valuation research on the health and social benefits of GI. Quantification research involves identifying an appropriate resource unit for the given benefit (e.g., tons of greenhouse gas emissions). Valuation research determines monetary values for the specific resource unit.⁴ Quantification and valuation of the health, social and community benefits of GI will enable stakeholders to accurately assess the value of GI. Research methods should include community-based participatory research⁵ to effectively capture the experience of communities involved and impacted by GI projects. While there is a robust body of research supporting the efficiency and cost-effectiveness of GI for stormwater management, there is a significant need for additional research and data on the social, health, and economic benefits for local communities of more broadly implemented GI.
 - > Conduct research into the dose response functions of various GI strategies with mental and physical health, including respiratory and cardiovascular health, among other relevant health outcomes.
 - > Additional research should focus on the extent of green gentrification and displacement associated with GI implementation and the effectiveness of anti-displacement policies and programs to mitigate



community displacement. Research areas can align with the [Urban Displacement Project](#) research agenda.

- **Assess Current Gaps in GI Impact Data** – in addition to the quantification and valuation research, OPR and partners should assess other gaps related to the impacts, costs, and benefits of GI.
- **Assess Granularity of Data** – to determine data availability and gaps at a scale granular enough to assess equity implications of GI projects (e.g., data availability on green roofs, street trees, or permeable pavements).

Develop Tools and Metrics to Standardize

Assessment of Green Infrastructure – Based on the quantification and valuation research of GI benefits, OPR and partners should develop tools that can be used across state, regional, and local agencies and other entities to assess the full benefits of various GI elements. The tools and metrics can be used to compare GI elements (e.g., rain garden compared to permeable pavement) or GI to gray infrastructure.

- The suite of tools should include the following:
 - > A tool to assess the impact of various GI projects on greenhouse gas emissions reduction in specific geographies.
 - > Project-level tools for health impact assessments for various GI strategies. Tools can be modeled off of the project level Integrated Transport Health Impact Model (ITHIM) that is being developed to assess the health benefits of trail use and trail projects.⁶

- The state should implement standard practices for the use of the GI tool(s) in state funding streams to ensure comparability across agencies and projects that may implement GI.
- The state should provide public education and technical assistance on the use of the tool(s) to increase visibility and implementation of the tool(s).
- The Department of Public Health, Office of Environmental Health Hazard Assessment, and local health jurisdictions (LHJs) should be funded to develop models for excessive morbidity and mortality associated with extreme heat events and poor air quality that is reflective and predictive, and can inform the equitable implementation of GI.

Develop Standard Practices for Green Infrastructure

Data Collection and Use - There is an existing body of literature that presents the various benefits of GI, as it relates to stormwater management, including those related to water quality and quantity, air quality, flood risk reduction, climate resilience, habitat and wildlife, and community benefits; however there are still significant gaps and certainly no standard practices across agencies for collecting and disseminating data related to GI projects.⁷ Additionally, impact and benefit metrics and data vary significantly depending on the type of GI (e.g., urban tree planting versus bioswales), contributing to differing and inconsistent collection, monitoring, and reporting practices across agencies and funding streams. Therefore, as a component of the statewide Green Infrastructure Strategic Plan, OPR, in partnership with other public agencies, academic institutions, and non-profits should collaborate to:

- Develop standard practices for monitoring/collecting, reporting, and disseminating data related to the co-benefits of GI, including the health, social, economic, and climate benefits.
- Collect and report implementation data related to frequency of GI implementation in other infrastructure projects to track the progress and overall impact of using GI.
- Systematically report and publicly disseminate data on the co-benefits of GI in order to build the evidence base for preferential use of GI over gray infrastructure.

Fund Local and Regional Assessments & Plans

- The State should provide funding to local agencies to conduct local and/or regional GI assessments, including private and public land. The assessment should include review of existing GI and green space, opportunities for transition to GI, constraints to implementing GI, and goals related to stormwater management, community access to greenspace, carbon sequestration, public health benefits, and local workforce opportunities. Metropolitan planning organizations, local parks departments, regional open space districts, in partnership with residents and community-based organizations should use these assessments to conduct grant-making and prioritization of improvements.

- Local assessments should use existing tools and frameworks to equitably prioritize GI projects and investments in communities disproportionately impacted by inequitable community conditions, including park and greenspace access, environmental pollution, and climate impacts. Existing tools include:
 - > The [California Protected Areas Database](#) includes data on national/state/regional parks, large and small urban parks, land trust preserves, and special district open space lands.
 - > Public Health Alliance of Southern California's California [Healthy Places Index](#)® (HPI).
 - > Office of Environmental Health Hazard Assessment's [CalEnviroScreen](#).



- > National Recreation and Park Association’s [Green Infrastructure Evaluation Framework](#)
- > American Rivers’ [The Value of Green Infrastructure – A Guide to Recognizing Its Economic, Environmental and Social Benefits](#)
- > Institute for Sustainable Infrastructure [Envision Tool](#) helps provide standards and investment allocation assessments for sustainable, resilient, and equitable infrastructure.
- The Los Angeles County Park and Recreation Departments conducted a [Parks and Recreation Needs Assessment](#) which includes the following 1) an in-depth assessment of existing parks and recreation facilities across the county, 2) a series of metrics to determine park need, 3) plan for using a needs-based allocation of funding for parks, 4) uplifting both community parks priorities and deferred maintenance projects. The assessment includes several strategies to explicitly address equity:
 - > Expanded the understanding of a community’s “park need” from one metric – number of acres of park land available to residents – to five – park condition, park access, park amenities, park land, park pressure.
 - > Use of the comprehensive data to drive equitable allocation of funds to high park need areas.
- Local assessments and plans should include considerations to mitigate any potential adverse impacts associated with the transition from gray to green infrastructure. For example, in neighborhoods burdened by soil pollution, there may be a risk of transitioning from gray infrastructure that prevents stormwater from infiltrating the soil, to GI which allows stormwater to infiltrate the soil and potentially pass into groundwater. It is critical to follow best management practices for brownfield remediation in these contexts, to prevent further harms, especially in environmental justice communities that have been disproportionately polluted. The Environmental Protection Agency provides important information about using GI in brownfield remediation in [Reclaiming Lost Lands: revitalizing Brownfields with Green Infrastructure](#).
- Local assessments and plans should also integrate strategies to address green gentrification and prevent community displacement.

Develop Standards & Set Targets for Equitable Green Infrastructure Investments & Projects

There is a critical need to establish guidelines and benchmarks that will increase investments in and implementation of GI projects and drive investments away from single-benefit projects. GI investments and projects must be prioritized by equity and public health benefits, maximizing resources and benefits in communities disproportionately impacted by inequities in health outcomes, climate impacts, and pollution burden. These benchmarks should be used to ensure accountability and equity throughout the lifecycle of GI projects. Benchmarks and goals should be updated to reflect ongoing developments in communities’ climate-related needs. Projects should be required to meet certain multi-benefit and equity benchmarks in order to receive funding.

- **Establish Multi-Benefit Project Benchmarks & Goals** – The State, spearheaded by the Office of Planning and Research, in collaboration with other agencies and departments, should establish guidance and benchmarks for multi-benefit infrastructure projects to drive investments away from single-purpose projects and increase the use of GI to meet these multi-benefit goals. Infrastructure projects, including stormwater, transportation, etc., should be required to provide a specified number of co-benefits to the surrounding community. Benchmarks may include considerations for the following, depending on the type of project and the needs of the surrounding community (the proposed benefit should be associated with a relevant community need):
 - > Prioritization of projects that increase and/or improve community access to green space. For example, GI projects should be focused on existing/new parks, community spaces, and pedestrian thoroughfares, rather than inaccessible areas such as roadway medians.
 - > Prioritization of projects that optimize cooling effects, especially in urban heat islands (UHI).
 - > Prioritization of projects that improve air quality.
 - > Prioritization of projects that reduce flooding risk and increase climate resilience.
 - > Prioritization of projects that demonstrate improvements in public health through the above mechanisms, including increased outdoor recreation

and physical activity, decreased asthma rates, noise reduction, increased social cohesion, etc.

- **Establish Cross-Cutting Equity Goals** – The Office of Planning and Research, in partnership with other state agencies and departments, community leaders, and community-based organizations need to develop equity benchmarks and guidelines that can be applied across relevant GI projects to ensure that benefits are maximized in communities disproportionately impacted by climate impacts, poor access to greenspace and tree canopy, the UHI effect, and aging and insufficient stormwater management infrastructure. Benchmarks and goals should include specific metrics related to areas of focus, including tree canopy, open space, park space, air and water quality, and UHI.

> GI investments and projects should be required to demonstrate positive impact in a high need area, using existing data sources and tools (outlined above). For example, an initiative to transition all district schoolyards from black top to permeable surfaces and vegetated areas should begin with schoolyards located in communities with poor park access, poor air quality, and high heat, prior to transitioning those in more well-resourced communities.

- **Enhance Park and Greenspace Access & Quality Benchmarks** – The Department of Parks and Recreation and the Natural Resources Agency, in partnership with other relevant agencies and departments, needs to establish statewide park and greenspace access and quality standards, and benchmarks in alignment with the [Parks for All Californians](#) goals. Currently, 21% of California



residents live further than half a mile from a park or open space, and 61% live in areas with less than 3 acres of park or open space per 1,000 residents.⁸ While these metrics are useful reference points, they are likely under estimates as they do not account for parks/open space quality and safety or accessibility, including safe infrastructure to get to and from parks/open space. We recommend that the state establish:

- > Standard park access ratios per capita, and standards for park quality, including green space and trees in parks, facilities, amenities, and park programming, with accommodation and guidance for different regional contexts.
 - Local agencies should assess differing definitions and standards for parks and open spaces to ensure that definitions are consistent across agencies/programs and are supportive of health and equity. For example, to optimize health, equity, and community climate resilience open spaces should be significantly green and accessible to all community members, not paved blacktop or private rooftop gardens.
 - For more information, see the [Trust for Public Land's ParkScore Index](#) which includes criteria for park investment, equity, amenities, and acreage.
- > Standard trail access ratios for various regional contexts, including urban and rural contexts. This process should be aligned with ongoing vehicle miles traveled (VMT) reduction strategies. Integrating GI in trail systems promotes heat resilient walking, cycling, and transit infrastructure.
- > Guidelines and supportive resources for the development of local/regional tree canopy targets, with specific guidance on equitable tree canopy targets and strategies. Tree planting should be prioritized along walking and biking paths, and transit stops to provide shading for active commuters and transit users.
 - The [Urban and Community Forestry Program](#) should collaborate with local and regional agencies and organizations to provide technical assistance on appropriate plantings to support climate-smart trees and plants, shade and cooling plants, native pollinators and wildlife supporting plants, etc.

Rural Communities & Access to Parks and Greenspace

Rural communities are often left out of consideration when discussing investments in GI, parks, and greenspace, despite the fact that rural communities often have less access to parks and greenspace than urban or suburban communities.

In fact, less than 30% of rural communities (with populations under 20,000) are served by park and recreation agencies.⁹ Rural communities have received limited investment in parks, public greenspace, and active transportation infrastructure, and are more reliant on cars to get to and from jobs, schools, and other services.¹⁰ GI is often framed from an urban perspective; however given that rural communities are also impacted by climate change and inadequate access to green space, GI should be viewed as a critical strategy to attract jobs, increase recreation access, improve public health and community building.

To increase park and greenspace access in rural communities, local governments and parks and recreation agencies should focus on the following strategies:

- **Establish joint-use agreements with school districts so that the community can access school playgrounds after hours and on weekends.**
 - > Invest resources in greening schoolyards (See [Coordination Brief](#) for more information)
 - > See [San Joaquin's Joint Use of School Grounds](#) for more information
- **Create programming partnerships with local organizations (daycares, senior centers, etc.) that can provide transportation to existing parks on a regular basis.**
- **Bridge community assets and invest in community hubs so that families and community members can access numerous services and amenities in one place. For example, hosting a farmer's market in conjunction with a flea market at the local park.**
 - > For example, a regional collaborative in Merced, California set-up a farmer's market at a local flea market to increase resident access to healthy produce.
- **For more information, see: [A Green Infrastructure Guide for Small Cities, Towns and Rural Communities by Green Belt and the Green Infrastructure Ontario Coalition.](#)**

See the full [Green Infrastructure, Climate Resilience, & Health Equity Policy Agenda](#) for more information.

1. [epa.gov/green-infrastructure/green-infrastructure-cost-benefit-resources#costbenefitanalysis](https://www.epa.gov/green-infrastructure/green-infrastructure-cost-benefit-resources#costbenefitanalysis)
 2. [cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf](https://www.cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf)
 3. <https://www.epa.gov/green-infrastructure/overcoming-barriers-green-infrastructure>
 4. [cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf](https://www.cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf)
 5. Community-based participatory research is a collaborative process that equitably involves all partners in the research process and recognizes the unique strengths the each brings. – PolicyLink

6. <https://www.sciencedirect.com/science/article/pii/S22141440516303255?via%3Dihub>
 7. <https://www.epa.gov/green-infrastructure/benefits-green-infrastructure>
 8. <https://www.parksforcalifornia.org/parkaccess/?overlays1=parks%2Cnoparkaccess&overlays2=parks%2Cparksper1000>
 9. <https://www.nrpa.org/blog/highlighting-the-power-of-rural/>
 10. https://www.policylink.org/sites/default/files/pl_brief_ca-parks-equity.pdf

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