A NEEDS ASSESSMENT WHITE PAPER

Building an Equitable and Just Green Infrastructure Strategy in the North Central Region

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EXECUTIVE SUMMARY

Climate change will bring more intense storms, droughts, heatwaves, and other severe weather events. Histories of subjugation and institutional racism in the United States mean that the communities most exposed to these events are those that are already facing inequities. Low-income communities in both urban and rural areas are on the front line of climate change. To rise to these challenges "we cannot continue to plan for it using the tools of the past" (Bullard, 2016, p. 2).

Building social equity and environmental justice into the conversation of green infrastructure (GI) is an opportunity to transform communities by integrating economic, environmental, and social goals. GI has the potential not only to meet community stormwater management needs but to address the other inequitable burdens exasperated by climate change, such as pollution and lack of access to greenspace (Schrock, 2015).

As communities begin to adopt GI to update their stormwater infrastructure and address these challenges, the lack of institutional knowledge and formal guidance at the state level has led to a highly localized approach. To understand how communities were addressing these issues at the local level, 18 listening sessions were organized with representatives of more than 30 communities across nine states between January and April 2020. On April 28, over 100 people participated in a virtual summit to help identify and prioritize barriers and opportunities for communities seeking to add socially just benefits to their GI practices.

The listening sessions identified five key recommendations for communities seeking to implement GI programs that incorporate equity and GI goals:

1. **Keep it simple.**

   Sometimes the simplest solution is the best solution. The same is true for GI. Simplifying projects helps to lower installation costs and reduces the burden of care over a project's lifetime.

2. **Emphasize co-benefits.**

   Of the communities that we spoke with, those that connected GI to other societal benefits best were more successful at implementing a low-cost distributed GI network and using that GI network to benefit and enhance their communities in ways that extended beyond stormwater management.

3. **Design GI careers, not GI jobs.**

   Rather than focusing on entry-level jobs that may not yet be in demand, workforce development efforts should focus on ways to create sustaining careers that afford opportunities for advancement.

4. **Provide education at every level.**

   Educational materials are needed for governmental staff, officials, and city planners to implement GI policies, contractors and maintenance crews to design for both performance and maintenance needs, and for decision makers to learn about the function and value that GI provides. Curriculum should also be developed for K-12 students.

5 Build relationships and establish partnerships.

Public-private-resident partnerships are an important part of every GI project, even those where the operating organization is not working directly with community members. Partnerships between organizations allow them to share knowledge and resources and provide expanded opportunities for GI implementation.

"Through the listening sessions and virtual summit, participants identified structural, programmatic, and research needs that Extension and Sea Grant are well-equipped to address."

Extension and Sea Grant specialists and educators in the North Central and Great Lakes regions have begun collaborating on GI educational programming designed to help communities install and maintain GI practices successfully. However, programs largely focus on technical aspects of maintenance. Through the listening sessions and virtual summit, participants identified structural, programmatic, and research needs that Extension and Sea Grant are well-equipped to address. Those identified needs include the following:

- Identify funding for Extension and Sea Grant professionals to expand outreach and support for program development.
- Formalize an Extension-Sea Grant GI community of practice.
- Develop new Extension Programming.
- Develop Green Infrastructure 201 program for community decision makers.
- Develop Extension programs, case studies, and fact sheets for community leaders.
- Prioritize multilingual programs and publications to reach all audiences.
- Conduct applied research-Extension partnerships.
- Model workforce development opportunities.
- Evaluate GI co-benefits to identify best management practices (BMPs) and economic and societal value.
- Analyze the GI triple bottom line.
- Conduct interdisciplinary life-cycle cost and benefit analysis.
- Evaluate and standardize GI monitoring practices.
- Develop decision-support tools for communities.

TEAM AND CONTRIBUTORS

Figure 1. North Central Region Water Network

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PROJECT OVERVIEW

"To residents, GI looks like parks, gardens, parking lots, and green roofs, and it can provide important community amenities such as recreational spaces and pollinator habitat."

Communities around the Midwest have begun to adopt green infrastructure (GI) practices as a potentially low-cost way to update aging stormwater infrastructure (Braden & Ando, 2011) and generate social and environmental co-benefits (U.S. EPA, 2013). GI is defined by the U.S. Environmental Protection Agency (U.S. EPA) as "a variety of practices that restore or mimic natural hydrological processes" (U.S. EPA, 2019). From a hydrological perspective, GI is designed to capture stormwater at or near where it naturally flows and pools and allow it to be absorbed by soil, plants, or other media. GI allows pollutants from roadways and rooftops to be absorbed in place, improving downstream water quality, and it can help control flooding downstream by reducing the volume and speed of water reaching rivers and streams. To residents, GI looks like parks, gardens, parking lots, and green roofs, and it can provide important community amenities such as recreational spaces and pollinator habitat.

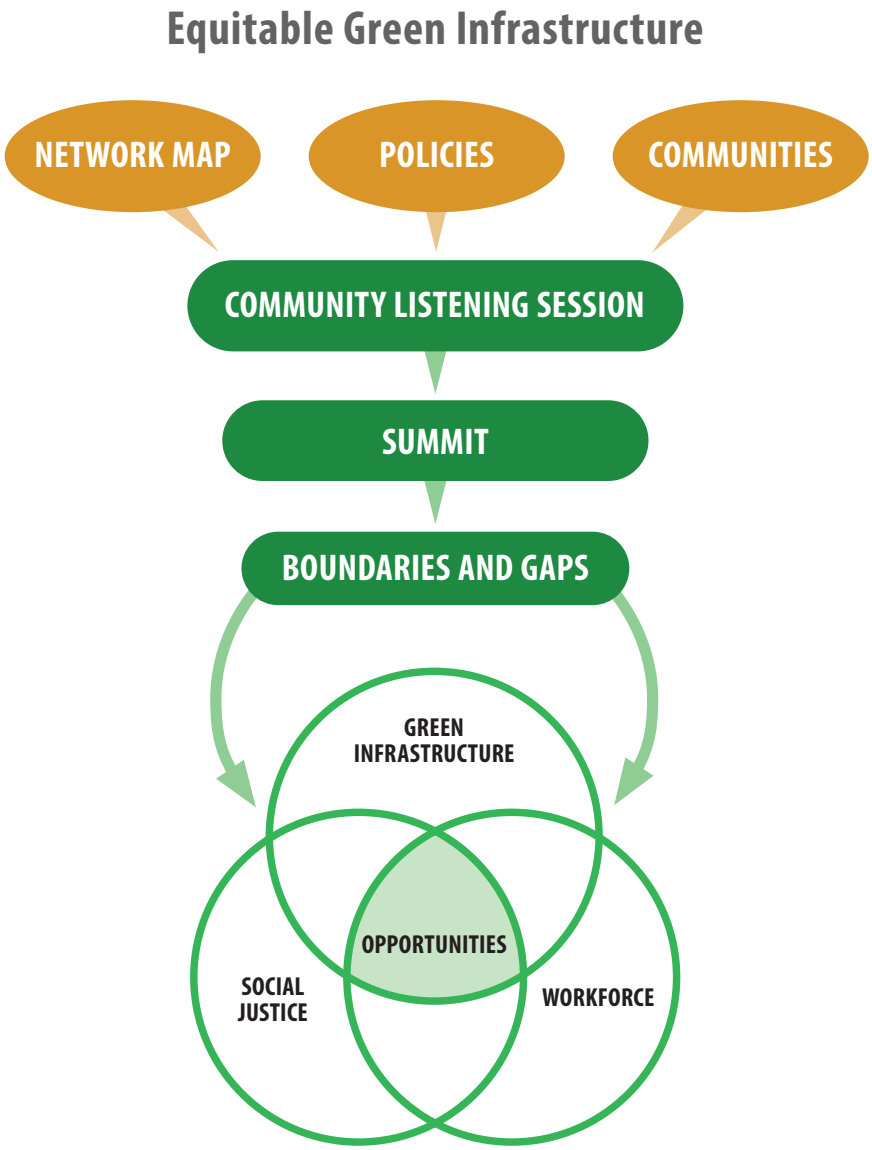


Figure 2. Equitable Green Infrastructure project overview.

"As GI becomes more prevalent, a lack of institutional knowledge in communities and lack of uniform federal or state standards has led to a highly localized approach."

However, as GI becomes more prevalent, a lack of institutional knowledge in communities and lack of uniform federal or state standards has led to a highly localized approach. While the challenges that many communities face are similar, the practices used to address them vary considerably from place to place. This is particularly true for the co-benefits of GI, such as recreation and beautification, where the best practices are not as well defined. The distribution of GI throughout a community has a major impact on who benefits. For example, GI can provide a park or recreational amenity in a part of town that might not have previously had one. However, when GI is sited in disadvantaged communities, its impact on local property values may lead to the displacement of longtime residents (Immergluck & Balan, 2018). Further, while experts project that the number of jobs within the GI industry will grow in coming years (Jobs for the Future, 2017), communities struggle to provide sustainable careers within GI and build a workforce that more closely matches population demographics and is accessible to more people.

With this in mind, Extension, Sea Grant, and other partners, with funding from the North Central Regional Water Network (NCRWN), identified the intersection of social justice, workforce development, and GI programs as a growth opportunity area for the twelve-state North Central Extension region (Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, North Dakota, Nebraska, Ohio, South Dakota, and Wisconsin). To these ends, the team designed a needs assessment that included gathering background data, conducting listening sessions in selected communities, and convening a summit to identify and prioritize successes, gaps, and opportunities.

This paper outlines the needs assessment process and summarizes best practices and recommendations for future Extension-Sea Grant programming and networking opportunities to advance work in this nexus.

Flooded streets in Madison, Wisconsin in August 2018.

CLIMATE CHANGE, GI, AND ENVIRONMENTAL JUSTICE

On July 22, 2010, the City of Milwaukee experienced a one-day record rainfall causing more than 100 street or surface floods that resulted in a declared state of emergency. Physical damages cost nearly $32 million from more than 4,000 incidents of basement backups (Soderling et al., 2018). Like most disasters, communities already in distress were most impacted. Two of Milwaukee's hardest hit neighborhoods were low-income communities of color, which received more than eight inches of rain. The record rainfall overwhelmed the aging storm infrastructure, damaged many homes, and caused one fatality. In addition to the factors that make these communities particularly exposed to the impacts of climate change, recovery is a challenge due to the lack of financial resources to quickly rebuild and repair homes and protect against future storm events.

It is well documented how structural racism has resulted in longstanding inequities for residents of vulnerable and distressed communities. High rates of unemployment, low-income households and poverty are exacerbated by stressors such as poor housing, high crime rates, inadequate educational systems, pre-existing health conditions, and food deserts. The disproportionate burdens or effects of climate change and pollution faced by these communities are also well documented. These threats are not isolated to environmental dangers, but also include the lack of access to resources, lack of political power, and lack of a voice in the decisions or development of projects designed for their communities. In response to this disparity, Dr. Robert Bullard became known as the "father of environmental justice" (EJ), or "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to development, implementation, and enforcement of environmental laws, regulations, and policies" (U.S. EPA, 2020). Dr. Bullard. who has been a leading voice on EJ issues for more than three decades, notes that the communities already facing these existing burdens are the ones that are going to be most impacted by climate change (Bullard, 2016). In a 2015 interview, Bullard explained why climate change is a social and environmental justice issue:

> Climate change is the number one problem of the 21st century. We sometimes forget that climate change is much more than simply parts per million. It is an equity issue. It affects some people directly. The most peculiar aspect of climate change is that the populations that contribute least to the problem of climate change are most likely to feel its impacts. Such disproportionality makes it a serious social justice issue.
>
> Climate change is also a very complex issue to solve. It is a global issue, a national issue, and a local issue—all at the same time. At the local level, the population at the front line of the impacts of climate change-related impacts are those with greater food and water insecurity. Hence, climate change intersects with vulnerable populations not only after a disaster but also before a disaster.
>
> Because of the complexity and uniqueness of the climate change crisis, we cannot continue to plan for it using the tools of the past. I think that from a planning perspective, we cannot assume that a uniform plan can work for all in terms of ensuring social justice. Planning must be sensitive to the fact that communities and nations have different levels of wealth, health, and education. The goal for planning should be to build community resilience and provide an opportunity for people to bounce back both before and after a catastrophic event. (Bullard, 2016, p. 2–3)

Kate Gardiner, University of Illinois Extension

In order to meet these challenges, the local level must become the lab for exploring innovative approaches that address the many layers of climate change. It is at the local level and the community scale that we must bravely experiment and explore innovative approaches. Over four hundred mayors nationwide have crafted local or regional climate action or sustainable action plans to uphold the Paris Climate Agreement, and at the 2017 Conference of the National League of Cities, more than one hundred mayors and council members signed a letter to the President reiterating the role of cities to affect climate change (National League of Cities, 2017).

"For many communities, pivoting to environment or climate change planning is also a response to crises, such as frequent basement backups or extreme flooding."

For many communities, pivoting to environment or climate change planning is also a response to crises, such as frequent basement backups or extreme flooding. According to an end-of-year assessment by Climate Central, an independent organization of leading scientists and journalists researching and reporting on climate change and its impact on the public, 2019 was not only the wettest year on record but also the second consecutive year of record-breaking rainfall. Climate Central further stated that the "year's most intense rainfall was concentrated in the Midwest and Great Plains—areas that have struggled to cope with devastating flooding" (Climate Central, 2019).

Adapting local responses to frequent flooding includes integrating GI practices into stormwater management plans. The EPA notes that "GI can reduce a community's infrastructure costs, promote economic growth, and create construction and maintenance jobs" (U.S. EPA, 2013). The integration of gray projects (e.g., storm sewers and detention basins) with green projects (e.g., rain gardens and permeable pavement) is a way to respond comprehensively to the stormwater needs of communities and, in most cases, reduce costs (Braden & Ando, 2011). While these initiatives mitigate devastating flooding, GI strategies can also be a way to address the impact of longstanding social inequities in vulnerable communities. GI is, and should be viewed as, a tool with the potential to address both environmental and social injustices."

When local leaders, decision makers, and organizations work to tackle stormwater challenges in these communities, it is also critical to tackle issues of equity and social justice. A green stormwater management strategy that embeds and centers equity and social justice at the onset can produce a more balanced approach to accomplishing sustainable development goals that deliver economic, ecological, and social benefits to these communities. Weaving social equity into climate action plans has only recently been explored by cities. A 2015 review of the twenty-eight largest U.S. cities that operated with either a sustainability or climate action plan found that "relatively few U.S. cities were making social equity goals an important component of their climate and sustainability plans" (Schrock, 2015, p. 288). In 2018, the Global Climate Action Summit, hosted by California governor Jerry Brown, brought together non-state actors at the regional and local level to discuss how localities can mitigate the impacts of climate change. The summit attuned attendees to the tremendous opportunity to include equity considerations more directly in climate plans to address the experiences of marginalized citizens and vulnerable communities disproportionately burdened by climate change.

Integrating elements of equity in the development of a stormwater plan must start with a shared understanding of terminology. A consensus on the vocabulary allows for standardization in the work as it relates to processes, clear communication, and the reduction of bias. There are numerous glossaries for equity and social justice terminology. However, the reference from the National Academy of Public Administration (NAPA) is relevant for this discussion because of their audience of government officials and decision makers. Their Standing Panel on Social Equity in Governance defines social equity as "the fair, just and equitable management of all institutions serving the

public directly or by contract, and the fair and equitable distribution of public services, and implementation of public policy, and the commitment to promote fairness, justice, and equity in the formation of public policy" (Center for the Study of Social Policy, 2020). The Standing Panel highlights the Center for Study of Social Policy document "Key Equity Terms and Concepts: A Glossary for Shared Understanding" that includes the following definitions:

- **Equity** is the effort to provide different levels of support based on an individual's or group's needs in order to achieve fairness in outcomes. Working to achieve equity acknowledges unequal starting places and the need to correct the imbalance.
- **Equality** is the effort to treat everyone the same or to ensure that everyone has access to the same opportunities. However, only working to achieve equality ignores historical and structural factors that benefit some social groups and disadvantages other social groups in ways that create differential starting points.
- **Social justice** is a process, not an outcome, that (1) seeks fair (re)distribution of resources, opportunities, and responsibilities; (2) challenges the roots of oppression and injustice; (3) empowers all people to exercise self-determination and realize their full potential; (4) and builds social solidarity and community capacity for collaborative action.

"When tackling environmental issues in distressed communities, the project must consider that these communities need different levels of support due to institutionalized and historically unfair policies that have resulted in different levels of resources and restricted access to resources for those communities."

Often and mistakenly, equity and equality are used interchangeably. Doing so can cause confusion and lead to unintended consequences in the delivery of programs and policies. Project teams and policy design professionals must understand that these are not synonymous terms and recognize the nuances between them. When tackling environmental issues in distressed communities, the project must consider that these communities need different levels of support due to institutionalized and historically unfair policies that have resulted in different levels of resources and restricted access to resources for those communities. Therefore, in order to achieve an equitable goal or outcome, the project needs to provide different types and levels of resources to these different communities. This is increasingly needed as integrated stormwater strategies are created to respond to more frequent flooding events in economically distressed frontline neighborhoods.

The Portland State University (PSU) research team of Schrock, Bassett, and Green highlight the unique opportunity to address social equity in climate or sustainability strategies through stormwater initiatives. They assert that "efforts to target GI and other amenities toward low-income neighborhoods and communities have significant potential to address the inequitable burdens associated with climate change, but also long-standing forms of environmental and health disparities, such as pollution exposure and lack of access to greenspace" (2015, p. 284).

One approach is to intentionally connect and invest in job creation for or develop the human capacity of frontline residents where projects are sited. Along with the increased demand for green capital improvements, there will be a need for skilled workers who have specialized knowledge and training in sectors like landscaping, groundskeeping, forestry, conservation management, and maintenance. In the 2017 NatureWORKS issue brief, *Exploring the Green Infrastructure Workforce,* Jobs for the Future (JFF) examined workforce trends in the green job industry with attention to employment opportunities for low-income residents in vulnerable communities (2017). The JFF study focused on green jobs for installation, maintenance, and inspection since these were found to have a direct link to entry- and middle-skill level opportunities. The study concluded that there is a growing GI job industry with strong potential to develop the future for these occupations.

Cities are beginning to design stormwater plans more comprehensively with the inclusion of social equity, social justice, and workforce development. Based in part on the historic urban floods of 2010, Milwaukee adopted a formal green infrastructure plan in 2019. It not only requires GI on all large developments through ordinance that roots GI strategies in city policy, but the plan also prioritizes training and job opportunities with a policy to create a diverse and equitable green workforce (City of Milwaukee, 2019). The plan spotlights the partnership between the city and a local, community-based nonprofit located in the neighborhood hit hardest in 2010 with a mission to use GI to build resilience in low-income neighborhoods.

While this is a promising example, the PSU assessment warns that "many U.S. cities continue to ignore equity goals as part of their climate and sustainability plans, or at least treat them as secondary or tertiary goals relative to environmental and economic goals" (Schrock, 2015, p. 292). These results were echoed in a recent study led by Dr. Steward Pickett and Dr. Timon McPhearson of the Carey Institute of Ecosystem Studies. In their assessment of equity in GI plans from 20 cities across the United States, they determined that cities treated equity as an aspirational goal and included no "mechanisms for assessment or enforcement" (2020).

For those communities that wish to make environmental justice a core part of their planning efforts, there are numerous equity training resources and consultancies for practitioners, stakeholders, professionals, and decision makers. Cities can turn to nonprofit organizations like the International Council for Local Environmental Initiatives, the U.S. Conference of Mayors, the National League of Cities, the C40 Cities, the U.S. Climate Mayors Network, and Green For All for advice and guidance on equity and sustainability. Those cities that are members of the Urban Sustainable Directors Network (USDN) can access their equity training program. For budget-strapped communities, there are several free online portals to build knowledge around equity principles. For example, the U.S. EPA website has the Environmental Justice Learning Center with links to tools, tutorials, and webinars for local governments, communities, and Tribes.

Climate change and environmental justice are inextricably linked. GI policies, practices, and programs that integrate and implement these concepts build pathways for community transformation that deliver on true sustainability— a balance of economic, environmental, and social factors in harmony. Such projects and initiatives can build a foundation from which to engage affected communities, respond to local climate crises, and unlock opportunity for distressed communities to take part in the GI economy.

LISTENING SESSIONS

Purpose and Scope

As communities around the Midwest adopt GI to update their stormwater infrastructure and enhance their quality of life, there has been a lack of institutional knowledge and formal guidance at the state level, leading to a highly localized approach. Most states in the NCRWN region either reference GI in their National Pollution Discharge Elimination System (NPDES) permits or provide funds for GI through grants or revolving loan programs, but they do not have formal statutes governing how GI should be used, particularly as it pertains to societal co-benefits. GI co-benefits are the aspects a community gains from a GI installation beyond stormwater management. Co-benefits include recreation space, street beautification, and wildlife habitat. Further, GI installations can provide co-benefits in the form of social justice and workforce development opportunities.

In 2018, the Great Lakes Commission published the *Great Lakes Regional Infrastructure Policy Analysis* (Great Lakes Commission, 2018) that summarized policies and practices by state. Using that data as our framework, we evaluated the remainder of the states in the North Central Region. None of these states have explicit practices to link GI to workforce development or social justice programs. In most states, GI practices are determined by local programs. Table 1 provides an overview of state-level GI guidance and estimated spending in the region.

State	Number of sites*	$ spent on GI*	NPDES permit references**	Funding opportu-nities**	Number of stormwater utilities***
Illinois	31–40	$10–100M	• Public education requirement • GI must be considered	Grants	26
Indiana	1–10	$10–100M	• No reference to GI	None	80
Iowa	1–10	$10–100M	• No reference to GI	Loans	105
Kansas	1–10	$10–100M	• No reference to GI	Loans	37
Michigan	11–20	$10–100M	• Public education requirement • Compliance documents encourage GI	Grants and loans	8
Minnesota	11–20	$10–100M	• GI preferred	Grants	197
Missouri	11–20	$10–100M	• GI suggested as acceptable	Loans	4
Nebraska	1–10	>$1M	• No reference to GI	Loans	0
North Dakota	0	$0	• GI suggested as acceptable	None	4

Table 1. State-level GI summary (continued on next page)

(State-level GI summary – continued)

State	Number of sites*	$ spent on GI*	NPDES permit references**	Funding opportu-nities**	Number of stormwater utilities***
Ohio	>40	>$100M	• GI listed, but no preference • BMP selection rationale must be reported	Loans	106
South Dakota	0	$0	• No reference to GI	Loans	4
Wisconsin	11–20	$10–100M	• Public education requirement • GI preferred, rationale for lower-preference BMPs must be reported	Grants	126

Sources: *Great Lakes Commission (2018). **Zimmerman (2019). ***Campbell, Dymond, Key, & Dritschel (2017).

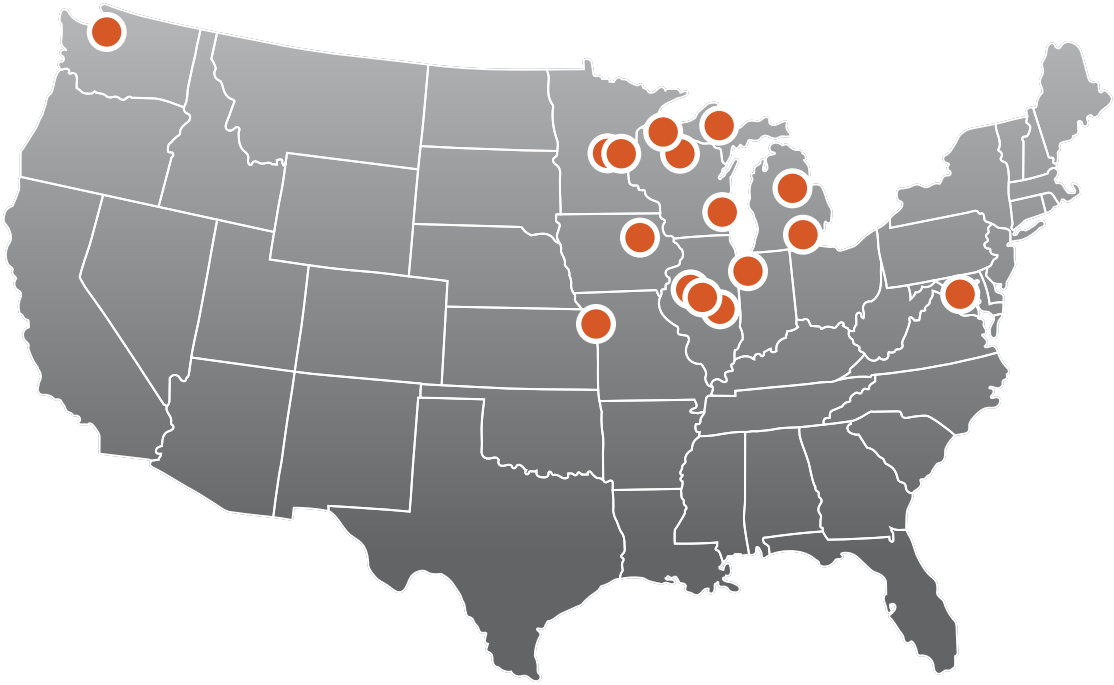
In order to understand how communities in the NCRWN region are using GI to address equity and workforce development, map the barriers they face when implementing GI, and identify the best practices used to overcome those barriers, 18 listening sessions were held with representatives of more than 30 communities from across nine states between January and April 2020.

Participating Communities and Organizations

The listening sessions were organized as a series of informal interviews with stormwater stakeholders from communities in the NCRWN Sessions were also conducted with Seattle, and Washington, D.C. because of their work in this area. Multiple methods were used to select the communities invited to participate in the listening sessions to represent the diversity of the region.

We first reached out directly to members of the NCRWN and affiliates. These members are well connected in their respective water resources communities. We leveraged these relationships to learn about communities of interest across our study area. Through this method, we were able to connect with several small, rural communities.

We performed a GIS analysis of the 12-state NCRWN region using U.S. Census data. First, a base map was created incorporating political borders, urbanized area footprints, and areal hydrography using Tiger/Line Shapefile data (U.S. Census Bureau, 2019). Next, the set of Metro and Micropolitan Statistical Areas (MSA) was overlaid and sorted into six quantiles, first based on their population and then based on their median household income. We used this map to select at least four communities of varying sizes and income levels in each state (see example quantile map on the following page). The areal hydrography and urbanized areas were then used to find communities within those areas likely to have some exposure to GI. Once potential communities were selected, a review of local agency websites was performed to find the relevant stormwater authorities. Those authorities were invited to participate and encouraged to include anyone else in their community they believed would have valuable input.



Map 1. Listening Session Communities and Organizations*

***Listening session with members of the State Association of Floodplain Managers not shown**

Finally, we reviewed news items related to GI through web and Google Alert feeds. This method allowed us to contact communities that were actively implementing GI or trying novel things that had slipped past our earlier analysis.

Overall, more than 60 communities were invited to participate, with at least four invited from each state. From these 60 invitations, 18 listening sessions were organized and held between January and April 2020. The 18 listening sessions included communities and organizations from seven North Central Region states along with subject matter experts from Seattle Public Utility, University of District Columbia, the Association of State Floodplain Managers, the National Green Infrastructure Certification Program (NGICP), and the Green Infrastructure Leadership Exchange.

State	Community/organization	In-person or remote	Date
Illinois	DuPage County	In-person	February 20, 2020
	Morton	In-person	March 5, 2020
	Peoria	Remote	February 19, 2020
	NGICP cohort, Champaign	In-person	January 16, 2020
Indiana	Northwest Indiana	Remote	April 3, 2020
Iowa	Cedar Falls	Remote	April 18, 2020
Michigan	Au Gres	Remote	March 30, 2020
	Marquette	In-person	March 10, 2020
	Southeast Michigan, Ann Arbor, Southfield	In-person	March 12, 2020

Table 2. Participating communities and organizations (continued on next page)

(Participating communities and organizations – continued)

State	Community/organization	In-person or remote	Date
Minnesota	St. Cloud & Stearns County	Remote	January 29, 2020
	Greater Twin Cities Area	Remote	April 17, 2020
Missouri	Bridging the Gap, Kansas City	Remote	April 2, 2020
Wisconsin	Ashland	In-person	March 12, 2020
	Milwaukee MSD & GI Leadership Exchange	Remote	February 3, 2020
	Northern Wisconsin	Remote	March 18, 2020
Other	Seattle	Remote	January 17, 2020
	NGICP representative, Washington D.C.	Remote	February 18, 2020
	Member, State Association of Floodplain Managers	Remote	January 24, 2020

Participants for each listening session were invited via the snowball sampling method. This method begins with initial informants who then recommend additional participants from within their community. The snowball method allowed us to reach stakeholders that we otherwise would not have access to by leveraging our initial contacts' connections in the stormwater community. The snowball method is, however, susceptible to biases. By targeting individuals who are actively engaged with GI and communities that have active GI programs, we are engaging with a sample that may not represent trends in the broader population. However, since these populations consisted of experts and professionals and the snowball method allowed us to speak with a larger sample of communities, we felt that the snowball method was the most appropriate. Further, through the methods outlined, we incorporated aspects of the peer-esteem snowballing method by using our existing connections in the NCRWN to nominate participants who would have valuable insights for our study, thereby reducing some of the randomness and bias inherent with snowballing methods (Christopoulos, 2007).

The listening sessions varied in size from one to 13 participants and a facilitator. A typical session included two to five community participants. Participants included local government employees, including office and operations staff, members of the local design and construction sectors, community organizations, and selected subject matter experts. Members of the general public were not interviewed as part of this study.

State	Community/organization	Sector represented
Illinois	DuPage County	• Local and county government
	Morton	• Local government • Professional services • Construction and maintenance • Agriculture
	Peoria	• Local government
	NGICP cohort, Champaign	• Professional services • Construction and maintenance
Indiana	Northwest Indiana	• Local and state government • Construction and maintenance • State government • Education and advocacy
Iowa	Cedar Falls	• Local government
Michigan	Au Gres	• Local government • Education and advocacy
	Marquette	• Local government • Education and advocacy
	Southeast Michigan, Ann Arbor, Southfield	• Local government
Minnesota	St. Cloud & Stearns County	• Local government
	Greater Twin Cities area	• Local government • Education and advocacy • Community-based organization
Missouri	Bridging the Gap, Kansas City	• Community-based organization
Wisconsin	Ashland	• Local and state government • Education and advocacy
	Milwaukee MSD & GI Leadership Exchange	• Local government • Subject matter expert
	Northern Wisconsin	• Local government • Construction and maintenance
Other	Seattle	• Local government
	NGICP representative, Washington D.C.	Subject matter expert
	Member, State Association of Floodplain Managers	• Professional services • Listening session format

Table 3. Sectors represented

Listening Session Format

Each listening session was structured as a semi-formal interview, where facilitators had five discussion questions to guide the conversation while allowing for the natural flow of the discussion. Listening sessions ranged from 40 minutes to two hours, with most taking between 60 and 90 minutes. Six of the 18 listening sessions took place in person, while the remainder took place remotely. Records from each listening session consisted of notes and summaries provided by each facilitator as well as audio recordings of the discussion.

To provide guidance for participants, facilitators defined GI as "practices such as rain gardens, bioswales, and permeable pavement that allow stormwater to infiltrate or evaporate in place to minimize the impact to the gray storm sewer system." Even with this definition, there was not a clear consensus among participants about what practices constituted GI. During the listening sessions, participants cited examples that ranged from GI practices defined by the U.S. EPA (2019) to more borderline practices such as wet extended detention basins or open-bottomed infiltration vaults.

The discussion questions were developed collaboratively by the members of the NCRWN team and refined between October 2019 and January 2020, with a pilot session taking place on January 16, 2020. The listening sessions were structured first to provide an overview of GI in the community, including the extent, maturity, and community response. Then, once a community baseline was established, further questions were used to delve into equity and workforce development considerations and identify any other barriers to implementation as well as ways communities have sought to overcome the barriers. With the aid of the facilitator, each listening session moved organically through five questions.

1. **What is the GI like in this community?**

This question was designed to help us determine a baseline for how the community was using GI, including the extent and maturity of the program. Beginning each listening session with background from the participants allowed us to use topics or projects that they mentioned as specific examples in our later questions about equity and workforce development. Follow-up prompts asked what types of GI have been built, what has or has not worked well, and what has been the community response.

2. **Beyond stormwater management, are there any other goals or benefits you hope to come from your GI projects?**

This question was designed to help us understand how communities are or are not fully considering the co-benefits of GI projects. This question was used to broach the topic of equity and see if communities were thinking of GI as a tool for community enhancement beyond stormwater management. We used this question to understand how communities were approaching the issue of green gentrification and displacement. As a follow-up, participants were asked to share any outcomes, both positive and negative, that they have observed from projects they have implemented.

3. **What are the factors that determine where GI is installed in this community?**

Here, we were trying to learn how communities select project sites. We were interested in whether social equity is a factor in these decisions or if the decision to use GI is based on other factors such as hydrology or demand from residents. This question was intended to evaluate how the co-benefits of GI identified in question two were incorporated into decision-making processes.

4 What are the considerations for design and maintenance when incorporating GI in your community? Is there potential for workforce development?

We used this question to gauge how communities were thinking about life-cycle care for GI and how that influences their workforce needs. Long-term care is critical for optimal performance (Liptan, 2017) and is perceived as a major obstacle for many communities. This question helped us specifically address those barriers and the ways that communities and organizations have sought to overcome them. We also used this question to learn where communities saw the most need in terms of education and workforce development. As a follow-up, we asked participants to characterize the GI labor force in their community and any plans for workforce development or training programs that they were aware of.

5 Have there been any other equity programs that you have implemented or other major challenges that you have faced when incorporating GI in this community?

Through this question, we sought to identify any other barriers communities are facing or equity measures they have implemented that we had not discussed already. This question was intended to help reveal our blind spots and identify opportunities or challenges that we had not considered. It also allowed participants to provide concluding thoughts and emphasize any items that they felt were of critical importance.

Discussion question	Follow-up prompts	Purpose
What is the GI like in this community?	• What types have been built and where? • What has worked well here? • What has been the community response?	Establish a baseline for how the community was using GI including the extent and maturity of the program.
Beyond stormwater management, are there any other goals or benefits you hope to come from your GI projects?	• What outcomes have you seen from projects you have already implemented?	Understand how communities are or are not considering the co-benefits of GI projects.
What are the factors that determine where GI is installed in this community?	• Are socio-economic or other demographic characteristics taken into consideration when evaluating locations?	Evaluate how various factors including stormwater, equity, and others were incorporated into the GI decision-making process.

Table 4. Listening Session Structure (continued on next page)

(Listening Session Structure – continued)

Discussion question	Follow-up prompts	Purpose
What are the considerations for design and maintenance when incorporating GI in your community? Is there potential for workforce development?	• Will GI maintenance be through public agencies or privately contracted? • Will employees be seasonal? Contracted? Full-time? • Are there plans for workforce development training or other programs?	Gauge how communities are thinking about life-cycle care for GI and how that influences their workforce needs. Identify areas where workforce development efforts have been or could be successful.
Have there been any other equity programs that you have implemented or other major challenges that you have faced when incorporating GI in this community?	• What are areas where Extension or a similar type programming can help make GI implementation easier?	Identify other barriers communities are facing or equity measures that we had not discussed already and areas where education and outreach materials would be beneficial.

Community Feedback

Question 1: *What is the GI like in this community?*

The extent and maturity of GI programs varied widely among the communities that we interviewed. In general, the larger metropolitan areas tended to have more established GI programs than smaller or more rural communities. Seattle and Milwaukee installed their first GI projects in 1999 and 2002 respectively, while communities such as Morton, Illinois, a community with fewer than 17,000 residents, landlocked, and fairly rural, are just beginning to think about it. Another commonality among many of the early adopters was the proximity to and cultural connection with major bodies of water. Marquette, Michigan, a city with 20,000 residents on the shores of Lake Superior in Michigan's Upper Peninsula, adopted their stormwater utility fee in 1994 to create a funding stream for water quality and GI projects.

In many of the communities that we spoke with, GI investment was spurred by a major environmental event or regulatory action. Peoria, a city in central Illinois with just over 100,000 residents, began their GI program in 2013 as part of a GI-based response to a U.S. EPA consent decree for their combined sewer overflow (CSO) to the Illinois River. Since then, Peoria has completed nearly thirty projects. They budget approximately $1M each year for GI. Peoria chose GI because they believed that it would cost less and benefit their community more than an equivalent gray stormwater solution.

The GI projects of the communities in the study generally fell into three categories, with many communities employing more than one approach. The first category included projects owned and

City of Peoria

Peoria Corps participants, staff, and local volunteers plant a tree.

operated by a local government or other public institution. These types of projects consist of pilot or demonstration practices at high visibility sites such as parks, schools, libraries, or other public spaces. These projects often have a limited direct impact on the stormwater system but typically serve educational or placemaking functions. While pilot projects are important stepping-stones, for some communities the challenge of trying something new was enough to scare them from broader implementation. A common refrain among communities was that their initial projects were over-designed, they did not have the resources or knowledge to maintain them beyond the initial installation, and they wished that they had kept things simpler. One participant said that they had to hire a landscape consultant to go back to property owners along one of their early rain gardens to talk with them and decide which plants could stay and which needed to come out because they had become overgrown. This participant said it was important to communicate with stakeholders that, especially early on, a failed project is a learning experience and not a signifier that GI as a whole is not viable. Every community with successful programs shared stories of early difficulties. Bob Spencer of Seattle of Public Utility (SPU) said that it was "like trying to build a bike while riding it downhill."

The second mechanism for implementing GI projects was regulatory, with communities incorporating GI and other infiltrative stormwater practices into their stormwater code. One approach to GI regulation was to perform a code audit, as was done in one northern Wisconsin community. In this community, the municipality evaluated their existing stormwater code to identify and remove barriers to GI through updates such as native lawn allowances. Despite vociferous protests from members of the design and construction sectors in some communities, the communities that had already enacted GI policies were grateful that they had. Bill Brown, with the State Association of Floodplain Managers, shared that he had worked with a community that had been pursuing a big development company for a number of years. The company "had no interest in the city" until they adopted their new stormwater management ordinance. The developer said that they saw the new standards as insurance on their investment. In DuPage County, a suburban area west of Chicago, officials enacted GI regulations at the county level, making GI standards and implementation consistent for the constituent municipalities. DuPage County also administers a water quality (WQ) grant program and educational programs to help their municipalities successfully implement and administer GI programs.

The downside to incorporating GI into development regulations is that without development there is no driver to install GI, which can be an issue for stable or shrinking communities where new development is limited. This is where session participants identified a third method, GI retrofits, to fill the gaps. GI retrofit programs are publicly administered programs through which the agency offers an incentive for the installation of GI practices on existing developed sites. These can include private residences, neighborhood streets, businesses, or public spaces like schools and libraries. The retrofit incentive typically consists of a rebate against the city's stormwater utility fee (SUF) or similar. The legality of this funding mechanism varies from state to state, and communities should consult state precedent before proceeding with such a plan (NACWA, 2014). Communities that have implemented GI retrofit programs have seen uneven results. Incentive levels are often the driving factor in participation rates. According to Bob Spencer of SPU, which has overseen more than 1,700 such retrofits, most residents are not willing to spend any more than they will get back. Contractors say that if the installation cost exceeds the rebate amount by even $50, it can halt plans for a homeowner. Speaking of SPU's early experiences, Spencer said, "We did a couple pilots and quickly realized our limitations both in terms of speed and dollars… We know we're not limber. We're a Navy battleship and it takes us a while to turn. It's easier if you are one or two people who are on the ground. You can be much more nimble and control costs." SPU learned they are best situated to be a facilitator focused on training and oversight for private contractors.

"The downside to incorporating GI into development regulations is that without development there is no driver to install GI, which can be an issue for stable or shrinking communities where new development is limited. This is where session participants identified a third method, GI retrofits, to fill the gaps."

Question 2: *Beyond stormwater management, are there other goals or benefits you hope to come from your GI projects?*

The most significant distinction among communities interviewed was between those that saw GI solely as a tool for stormwater management and those that saw it as a tool for community improvement more broadly, where GI provides value compared to traditional gray stormwater approaches in ancillary or co-benefits (Ando et al., 2019). This was true in the experiences of communities in the study. Communities that proactively communicated co-benefits self-described more positive public reception and had more widespread adoption when compared to those that pursued it solely as a stormwater management tool. As Lisa Sasso of the Milwaukee Metropolitan Sewer District (MMSD) said, "We never want to do anything for just one reason, we always look at the triple or quadruple bottom line." Other session participants agreed that in prioritizing GI goals beyond stormwater management, communities can get more value for the money they were already spending. As one participant asked, "Why would you spend the money and not fix the problem?"

"By actively listening and empowering residents to shape the bioswale according to their values, Metro Blooms was able to grow the community's sense of ownership of the garden and help ensure that the community would continue to care for it over time."

The benefits communities hoped to achieve with their GI projects varied from place to place and within communities. For example, in communities near a river, lake, or other major body of water, water quality and aquatic habitat were identified as major concerns for residents. In communities without river or lake amenities, access to green space, public health, and beautification were considered more important. One constant was that the people implementing GI projects engaged in active listening with their communities to understand their values and to find opportunities to express those values through GI. Yordonose Solomone, the Equity Manager with Metro Blooms in Minneapolis, manages the Boulevard Bioswales project in partnership with the City of Minneapolis. Solomone said that when they began to work with residents in a north Minneapolis neighborhood, residents asked if they could include different types of medicinal and culturally significant herbs as part of the garden. To the residents, stormwater management was not a major concern, but the bioswale provided green space where they could grow something that would be meaningful and desirable in their community. By actively listening and empowering residents to shape the bioswale according to their values, Metro Blooms was able to grow the community's sense of ownership of the garden and help ensure that the community would continue to care for it over time. According to Solomone, the community needs to benefit from the labor that they provide as they care for a project. Especially in low-income areas and marginalized communities, it is important that a GI project intended to help a community does not end up placing an additional burden on residents.

In addition to the post-construction co-benefits of GI, for many communities the implementation of GI itself provides an opportunity to achieve workforce development goals. Many of the communities in the study identified the potential for workforce development as a co-benefit of GI. Many of these communities had programs inspired by the City of Philadelphia's PowerCorps PHL program implemented as part of their "Green City, Clean Waters" plan. This program

Metro Blooms

A work crew on the Boulevard Bioswales Project in Minneapolis.

model typically provides either youth or adults experiencing barriers to employment with opportunities to receive GI installation and maintenance skills as part of a one- or two-year training program. These types of programs have had mixed success. In Peoria, interviewees said that participants in the training programs reported interest in GI and the skills they learned but did not see GI as a future career path. These types of programs were providing GI jobs, but they were not providing a path to a GI career. According to Sasso, the low wages of GI maintenance and the seasonality of the work were major challenges for these programs. In Milwaukee, they are broadening the scope with the Fresh Coast Ambassadors program, which makes it possible for GI staff to work in another area of the stormwater or water resources sector during the winter.

Another challenge with these programs was that the supply of candidates trained by these programs outstripped hiring from the GI industry. As one interviewee said, "Training doesn't mean anything if they can't find a job afterward." Creation of GI incubators is one novel approach that Seattle and Minneapolis are considering. These programs are planning full-service training to prepare members of marginalized and underrepresented communities to open their own GI-based businesses. In these communities, training programs have done a good job providing skills within the construction industry, but they had not expanded the pool or created opportunities for members of under-represented populations to enter the field. In addition to the technical skills required for GI installation and maintenance, these programs would also teach the skills required to run a business.

Question 3: *What are the factors that determine where GI is installed in this community?*

For most communities, even those that fully embraced co-benefits, hydrologic considerations are still the chief driver of where, when, and how GI projects are implemented. While many communities did consider equity factors, there was only a single case, the Boulevard Bioswales project in Minneapolis, where participants reported that a marginalized community was specifically chosen for a GI program as a form of environmental justice. Many of the communities that we spoke with had policies explicitly in place to ensure that demographic characteristics were not considered and that decisions surrounding where to site GI projects were made based on ostensibly more objective physical characteristics. Various municipal staff that we spoke with admitted that they were mindful of where projects were located but that they used formal hydrologic criteria to remain unbiased. This can be both a blessing and a curse. While it helps prevent favoritism towards communities that are better off, it also restricts the ability to employ GI as a tool for social justice. This is an example of the difference between thinking of equality versus thinking of equity. Equality is treating everyone the same regardless of status while equity takes need into consideration in order to achieve a just outcome.

"Poor and marginalized people are pushed to live in the least desirable part of a community so that environmental factors compound the social and economic inequities that they are prone to facing."

Even in communities where the decision is explicitly based on hydrologic or other physical characteristics, there is often significant overlap between the areas with the worst stormwater management issues and communities that have been marginalized in other ways. Poor and marginalized people are pushed to live in the least desirable part of a community so that environmental factors compound the social and economic inequities that they are prone to facing. Aging infrastructure, low-lying areas, and increased runoff and pollution from nearby industrial areas are all hydrologic risk factors common to these areas. According to Jane Gerdes with Peoria Public Works, the ability to address this environmental injustice was a major part of what made GI an attractive option:

> Like many communities, our combined sewer area is in our oldest area of town which is also our poorest area of town, and because we're under a mandate by EPA to solve

> our combined sewer overflow (CSO) issues we're going to be investing more in that area. We're mandated to do it because it's in the CSO, but we were very cognizant of assigning those co-benefits so that we improved those areas of disinvestment and of poverty. That way we can leverage that mandated stormwater management into a community improvement.

Many communities have gotten creative in GI implementation. In DuPage County, they have been successful in incorporating GI into a range of existing projects that extend beyond stormwater management. The Boulevard Bioswales project discussed previously came about as part of a program to replace ash trees infected by emerald ash borer (Metro Blooms, 2020). According to Mary Beth Falsey, the DuPage County Water Quality Supervisor, the multifunctional nature of GI, providing both stormwater management alongside community co-benefits, helps move other projects forward. Many development grants include environmental criteria which GI can fill, and partnering with other projects outside of stormwater management can provide additional funding for equity considerations. According to Falsey, this additional funding from including GI can pay not only for the installation itself but can help the entire project become more financially viable. Employing this strategy of incorporating GI into other projects has helped communities establish a low-cost decentralized GI system while also helping to facilitate other community investments that they were hoping to make.

Many smaller and more rural communities reported that they did not have the staff, knowledge, funding, or political support to actively pursue GI projects. They implemented GI only in "opportunity areas" where GI was clearly a more effective stormwater solution than a traditional gray stormwater approach, or in cases where a property owner or developer was interested in pursuing a GI approach. As with other voluntary programs, cost was often the driving factor in these decisions. Education of designers and decision makers was often identified as a more pressing issue than installation or maintenance skills training for laborers.

Village of Carol Stream

Permeable pavements at Jay Stream Middle School in Carol Stream, Illinois.

Question 4: *What are the considerations for design and maintenance when incorporating GI in your community? Is there potential for workforce development?*

"Life-cycle care, which includes ongoing maintenance, upkeep, renewal, and more throughout the lifetime of a project, was consistently identified as a major concern in the communities interviewed as part of this study."

Life-cycle care, which includes ongoing maintenance, upkeep, renewal, and more throughout the lifetime of a project, was consistently identified as a major concern in the communities interviewed as part of this study. Even more so than with traditional gray infrastructure, life-cycle care is critical for optimal performance in GI (Liptan, 2017). Life-cycle care is particularly important for living GI practices, such as rain gardens and bioswales, where plant uptake plays a significant role in the hydrologic function of the practice (Yuan et al., 2017). Like any piece of infrastructure, GI will degrade over time if it is not properly maintained. However, unlike traditional gray stormwater practices that will never perform as well as the moment they were installed, GI that employs plant communities can improve over time. As plant communities mature in a living GI practice, performance can improve as evapotranspiration through the plants increases and root material works to break up soils, lowering the bulk density and increasing infiltration rates (Shuster et al., 2017).

Despite this potential, many GI projects decline or fail due to a lack of institutional knowledge or resources necessary to care for practices throughout their life cycle. According to Gerdes, for every $100 spent on a project's installation, they needed to budget $1 to $3 for care each year. A common experience was shared by Kerry Behr of the Village of Downers Grove, Illinois. Initial GI projects included a highly visible downtown area rain garden and bioswales within a residential area of the community. The rain garden flourished, but resident feedback indicated they felt the plants were "too tall" and "always falling over." The Village had consulted with an environmental firm to design the garden, and they provided a diverse array of forbs and grasses, adding more throughout construction. Initial results appeared successful, but many residents thought bioswales were a "plant it and forget it" area allowing the project to become overgrown and full of weeds.

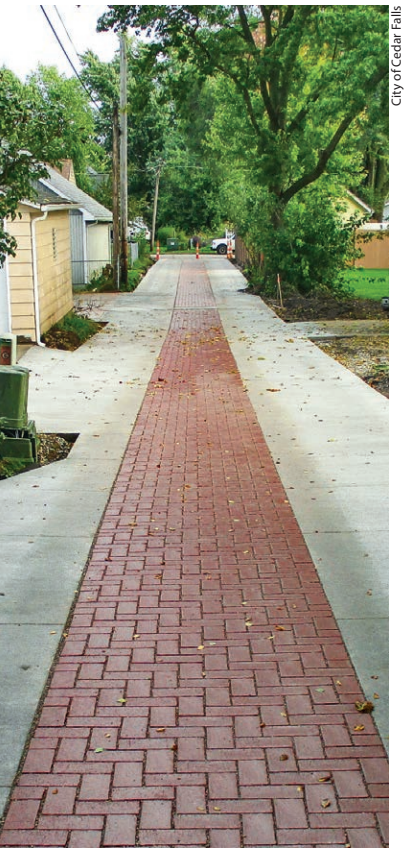
The Village learned that over-designing projects with too many species and a lack of dedicated maintenance results in less than optimal outcomes. These projects had to be revisited and future projects were modified to include a scaled-back species list and a detailed Village-led maintenance plan. These learning experiences are part of the process of adopting any new technology; it takes time for capabilities to catch up. As Jamey Bullard, an engineering technician in Morton, IL said, "It is a bit of a paradigm shift, in terms of the traditional approach to maintenance of traditional gray infrastructure… That's not the paradigm, and shifting paradigms is inherently difficult."

Despite the importance of life-cycle care for GI, in many cases it was an afterthought. Maintenance was a challenge for privately-owned projects in particular. When describing their approach to maintenance, a group of design professionals from Morton, IL said, "From a design side, it's kind of pass the buck," "There's a note on your plans that says they're required to do maintenance," and "Out of sight and out of mind." When this happens, according to Bullard, "Maintenance becomes oftentimes a reactive approach rather than a proactive approach. Then when they're reacting to that long-needed maintenance, their approach is often just to use the nuclear option." This reactive approach to maintenance is a holdover from the gray infrastructure paradigm. As another participant observed, "As a municipality, oftentimes we're used to just get her done and leave it. Then wait until it fails and then redo it, and then wait until it fails. This would have to change our mindset on maintenance to a large degree." GI can outperform traditional gray approaches over the long term, but it requires ongoing proactive care rather than reacting to failures.

The communities that we spoke with generally identified four ways of handling the design and life-cycle care for GI: through public agencies, private contractors, conservation corps-style training programs, and volunteer and community-based efforts. The appropriate approach varies from community to community, with participants reporting varying levels of success with each alternative. There is a learning curve with GI care, and the successful communities have been willing to try multiple approaches to find what works.

Public agency management

Many communities chose to employ public works, engineering, forestry, parks, or another division of the local government to install and care for their GI projects. With very few exceptions, this method was employed exclusively on publicly owned projects. Communities more frequently employed public agencies for installation and care when they were starting with GI, as the requisite skills had not yet disseminated into the broader contracting community. Many continue to use them on public projects. One challenge of employing public agencies for long-term care was that GI care fell between the traditional silos of different departments, such that there was not a clear responsible party, and nobody wanted to take on the additional load. For many communities, public works or engineering is traditionally responsible for maintaining the stormwater management system, but it is often the parks or forestry divisions that have the most applicable skills. Even when communities had established rigorous maintenance standards, meeting those standards was often a challenge. Jane Gerdes, with the City of Peoria, reported that they were around 50% successful in meeting their stated maintenance interval goals. In Cedar Falls, participants reported that maintenance intervals for the Permeable Alleys program had become a source of tension between the stormwater and public works departments and identified these types of internal decision makers as a key target audience for the development of educational and outreach materials.



City of Cedar Falls

Private contractor management

Communities that do not handle life-cycle care in-house often turn to private contractors to install and care for GI installations. The reasons vary, with lower operational costs and greater flexibility being the most commonly cited. Rainwise, operated by Seattle Public Utility (SPU), has successfully employed private contractors for GI installation. Rainwise, which began in 2010, is a GI retrofit program in Seattle and Kings County, Washington. Implemented on a basin-by-basin basis, there have been more than 1,700 privately-owned Rainwise installations over the last ten years with all but the very first pilot projects completed by private contractors. Twice a year, SPU runs two eight-hour training courses that are required for contractors to become partners in the Rainwise program. Even for contractors who go through the program, this training is just the beginning of a more extensive learning process. The inspectors think of a contractors' first three to five jobs as on-the-job training. In addition to providing technical assistance, SPU has partnered with a local community lender to offer bridge loans for contractors, collateralized by SPU's pre-inspection for each project's expected rebate amount. These bridge loans function to help contractors who may be under-capitalized still meet SPU's standards. According to Spencer, SPU's role has been as an active facilitator, saying "I can't imagine how unsuccessful we'd be if we just let anyone do it without the training."

The 'conservation corps' model

Conservation corps-type programs are the third approach communities regularly employ. These programs provide employment opportunities geared towards individuals who have experienced

barriers to employment. Seattle, Milwaukee, Minneapolis/St. Paul, Kansas City, and Peoria have either implemented or are considering this approach. Philadelphia PowerCorps PHL program was cited by multiple communities as a model for their efforts. These publicly managed programs are either administered directly through a public agency or in partnership with local community-based organizations.

In Peoria, IL, the Peoria Corps program is run by the city's public works department and is designed as a pre-apprentice program for youths from ages 18–24 and allows participants to earn their NGICP certification. In others, the programs are geared toward adults who may have barriers to employment or are transitioning back into the workforce. In Kansas City, the Green Stewards program is geared towards adults from low-income areas who are experiencing barriers to employment. It is administered in partnership with Bridging the Gap, an environmentally focused, community-based organization.

Despite these variations, these types of program share a similar structure. They are intended to serve as outreach to underrepresented communities and to provide pathways to employment within the larger GI or water resources industry.

Conservation corps-type programs were generally described as experiencing mixed success. They succeeded in providing a low-cost alternative for GI maintenance while providing temporary employment and skills training, but they failed to provide sustainable employment or create pathways to long-term GI careers. Communities identified a few potential reasons for this shortcoming. According to Lisa Sasso of the MMSD, one obstacle was that the number of individuals trained by these programs each year far exceeds the hiring capacity of the GI field in its current state. Another obstacle was that the jobs that are available do not provide sustainable work due to the high seasonality and low wages of the field. A similar experience was reported in Peoria, where the program itself had high engagement, but there was little interest in continuing in the GI maintenance field upon completion. The programs are doing a good job of providing training, but to the participants of this study, that did not mean anything if it did not lead to meaningful employment. According to Sasso, for these programs to be successful, they will require a more holistic focus on water resources careers in general. This will provide a buffer against the seasonality of physical GI labor and provide additional pathways to higher-earning career opportunities. Sasso notes that Buffalo, NY is doing this well. There, GI has been paired with solar and energy work to provide more diverse and sustainable opportunities.

"The programs are doing a good job of providing training, but to the participants of this study, that did not mean anything if it did not lead to meaningful employment."

City of Peoria

Peoria Peace Corp participants at their graduation.

Communities are considering the creation of GI incubators that will be geared towards members of marginalized communities. The goal of these programs is to address some of the barriers (e.g. workforce and career advancement barriers) by growing the pool of qualified contractors and

providing people with the skills required, not only to perform the labor of GI installation and maintenance, but to run the business and reap the profits as well. These programs would last multiple weeks and would include the technical skills required to perform GI installation and care and the skills necessary to run a business, including project management, client development, and balancing a budget. Although these programs will reach a smaller number of participants, the belief is that they are more likely to lead to a long-term, family-sustaining career than current alternatives.

Volunteer and community-based GI maintenance

The fourth way that communities are approaching the design and maintenance of GI is through volunteer and community-based approaches. This approach empowers residents to shape the GI project during the design process, and, in return, asks them to be responsible for caring for it throughout its lifetime. The managing organization invests a significant amount of time, effort, and resources upfront working with members of the community to establish relationships, build trust, and create a feeling of ownership among residents. The project is turned over to the community upon completion. Community-based programs can be challenging but often provide the most opportunity for community betterment.

This approach is exemplified by the Boulevard Bioswales program in Minneapolis. According to Solomone, developing the necessary relationships took "lots of time and lots of talking." Even beyond the first year, building those relationships is a continuous and ongoing process. As part of this project, Metro Blooms partnered with existing community organizations to better connect

Rain garden in Madison, Wisconsin.

"Projects like this are intended to help the communities where they are located, so it is important to make sure that they are providing benefits and not just creating an additional burden for residents."

with established social networks and partner with leaders in the community. These relationships were critical, and part of building these relationships was asking how this project could connect with other neighborhood goals even if those goals seemed completely unrelated to GI. Projects like this are intended to help the communities where they are located, so it is important to make sure that they are providing benefits and not just creating an additional burden for residents. Solomone described their approach to community engagement:

> In a lot of the communities that we work with, economic inequity is a big issue, and if you don't have economic stability, you're not going to come to a planting… When we do our engagement, we don't want them to feel like it's a burden to come to this event, and when we're engaging residents as decision makers we don't want it to be this burden. So, we want to compensate them in different ways, and that's something that we include in our budget when we apply for grants. We want to compensate communities in a way that is tangible and is an essential part of our environmental justice work within these communities.

Community-based projects require critical thought and engagement to align agency goals with community goals. Project leaders must ask stakeholders what GI investment in this community can and should look like and how to prevent unintended consequences, such as green gentrification and displacement. Because of these challenges, few of the communities in the study reported engaging in this type of community-based GI program despite its potential for empowering residents and building engagement and ownership of the GI system.

Question 5: *Have there been any other equity programs that you have implemented or other major challenges that you have faced when incorporating GI in this community?*

At the end of each listening session, we asked participants to share their thoughts on related topics not previously covered in the listening session. One topic that came up was the need for materials to be translated into languages other than English, particularly Spanish. In Seattle, Rainwise partnered with existing community-based programs to translate their materials for the various communities they served. This approach is doubly beneficial in that in addition to the translation itself, the partnership creates a pathway to build the relationships necessary for community-based work.

Many of the communities and organizations in the study took this opportunity to emphasize the importance of education and outreach at all levels in developing an equitable and just GI strategy. Efforts were often in place to provide training and development for entry-level laborers, but they noted a lack of resources aimed at educating business owners, designers, and decision makers. As one participant from northern Wisconsin said, "You have to get out ahead of it… make sure there's a lot of public engagement and education before some of those projects even take off because if you don't have community support for a project, the likelihood it's going to fail increases." This proactive approach applies to internal stakeholders as well, with one participant noting the challenge of "city council members not fully understanding benefits," and how that can lead to internal resistance. Areas of need are the landscaping knowledge required to design and care for GI practices and materials for decision makers that quantify the benefits and value of GI. Participants also felt that youth curriculum for K-12 classrooms was lacking. Working with students is often one of the most effective ways to enhance knowledge and build capacity in the long term, and GI provides a way for students to get involved and help in their community.

Listening Session Conclusions

GI and Equity

Communities in the study were attempting to address social equity and GI in several ways. Foremost was explicitly incorporating the societal and workforce benefits of GI into their decision-making processes, which helped communities get more for their money by ensuring that their projects were providing benefits in addition to their stormwater management function. Some of the benefits noted include beautification, green space creation, wildlife habitat, and economic revitalization. Focusing on these co-benefits helped communities find more opportunities for incorporating GI as part of other projects around town. Often, incorporating GI helped secure grant funding. GI was viewed as a tool to make other community improvement projects viable.

Despite this emphasis on co-benefits in many of the study communities, equity issues were typically not considered when selecting GI project locations. Communities reported that location decisions consciously excluded socioeconomic characteristics to avoid bias. Despite this exclusion from the decision-making process, there was often a significant overlap between economically disadvantaged areas and areas with stormwater management issues. Even within a narrow hydrologic framework, GI can become a vehicle for community enhancement.

While many communities in the study saw GI as a tool for addressing equity issues, fewer of them were taking active measures to address equity issues that arose as a result of GI. Organizations addressing equity emphasized the importance of taking a critical and deliberate approach, asking what investment in this community looks like, what any unintended consequences might be, and how to approach this relationship in a way that empowers community members. Listening session participants engaged in equity work identified that empowering community members throughout the planning and design process helps ensure that the finished product improves the neighborhood and aligns with community values, rather than merely providing aesthetic benefits to make it more appealing to outsiders. Infrastructure practices that specifically seek to remedy environmental challenges and increase public safety and health, such as GI and bicycle lanes, are often seen as a precursor to gentrification and economic displacement. Addressing equity and GI requires deliberate attention to objectives, who will benefit, and how.

"Infrastructure practices that specifically seek to remedy environmental challenges and increase public safety and health, such as GI and bicycle lanes, are often seen as a precursor to gentrification and economic displacement."

GI and Workforce Development

Many communities see the implementation of GI projects as an opportunity to address equity issues through workforce development and training programs. These programs, which use GI maintenance to provide both technical skills and job skills, have led to mixed success. The programs have been successful in delivering GI training and temporary employment, but they have failed to provide meaningful career opportunities within the GI field due to both lack of demand from employers and lack of long-term opportunities. In the meantime, communities are attempting to address career opportunity gaps through GI incubator programs that target individuals in underrepresented communities by providing them with the skills needed to start their own GI-based business. These programs may reach a smaller audience, but they hope to be more successful in expanding representation in the water resources community and providing a sustainable career path.

In addition to equity-based programs, communities are taking several approaches to workforce development through GI, primarily through training and outreach geared toward GI laborers and

designers. While some communities use their own curriculum, others employ national curriculum such as the NGICP. These programs have been successful in disseminating GI skills and knowledge throughout the construction industry, but according to listening session participants, they have not had a noticeable impact on representation within the industry or in providing new opportunities. Programs like this are important to ensure quality control for projects but have a minimal impact on workforce development.

"Since many states fund grant programs specifically geared toward GI, incorporating GI can help make additional funds available."

The final form of workforce development identified was the incidental workforce development that occurred as a natural part of GI becoming more prevalent in their communities. Cedar Falls reported an increase in the number of firms offering GI services within their construction sector and saw expansion into GI from adjacent areas. For example, a sanitation company purchased a vacuum truck for permeable pavements. This natural growth in GI workforce capacity as the knowledge, importance, equipment, and demand for projects increase within a region can have a significant impact on the cost and availability of GI within a community. Costs and other barriers tend to diminish over time as skills and resources necessary to complete work become more commonplace.

Other Barriers

Among the communities interviewed, and among those that participated in informal polling at the 2020 Equitable GI Summit, funding for GI programming and education were the two barriers they spent the most time addressing. As one participant observed, "Overall there's a lot of support to have GI everywhere, but at the end of the day, if the finances don't align with the support, the finances drive the final decisions." Over the long term, successful workforce development programs and the dissemination of GI skills and resources will cause costs to decrease, but in the meantime, the most successful way that communities addressed funding issues was by making co-benefits a focus of their GI program and incorporating GI into other projects. Since many states fund grant programs specifically geared toward GI, incorporating GI can help make additional funds available.

To address the education barrier, many communities in the study had or were considering programs geared toward training GI laborers to perform installations and care. However, they identified a need for higher-level training for designers, government staff, and decision makers. Particularly in smaller communities, there was a need for outside training materials since local stakeholders often did not have the time or skills required to lead a training themselves. As with contractor training, there was a need for quick, applied programs that gave communities the skills or resources to begin their own GI program.

Lessons Learned

Communities across the study area are taking highly localized approaches to their GI implementation with varying levels of success. Communities have identified GI as a way to address equity issues within their communities, but they have not begun to evaluate the equity issues that may arise as a result of GI implementation. Many communities agree that there is potential for workforce development from GI, but there is no consensus about the best way to achieve it, with different types of programs achieving mixed results. The most pressing need for workforce development with GI is not basic installation and care skills, but rather higher-level skills such as those required to run a GI-based business. In summary, the study identified five key lessons learned.

1 Keep it simple

Sometimes the simplest solution is the best solution. The same is true for GI. Simplifying projects helps to minimize installation costs and the burden of care over a project's lifetime. Especially when a community is first implementing their GI program, it is important to start with simple projects or projects in less visible locations before increasing the complexity and visibility of projects as the local skill and knowledge base increase. GI is like paint. You plan to cover the wall, but you test a new color in the corner behind your desk. Keeping things simple is part of planning for life-cycle care from the beginning.

2 Emphasize co-benefits

Communities in the study that developed the best connections between GI and other societal benefits were the most successful at implementing a low-cost distributed GI network and using that GI network to benefit and enhance the whole community. Explicitly evaluating co-benefits of GI, such as cultural value, access to green space, wildlife habitat, and economic vitalization, expanded the opportunity areas available for GI and helped stormwater organizations establish mutually beneficial working partnerships with other organizations. Emphasizing co-benefits also helped stormwater organizations persuade internal stakeholders of the value of GI. Demonstrating the fiscal ripple effects of GI is important in helping decision makers understand and look beyond potentially higher upfront costs. When emphasizing co-benefits, organizations must use active listening to understand what co-benefits are important in their specific community, and then empower residents throughout the planning and design phases of GI installation to shape the project according to those values. Done correctly, emphasizing co-benefits can lead to greater community engagement and more institutional support.

Katie Gardner, University of Illinois Extension

University of Illinois students help plant the campus Red Oak Rain Garden.

"Programs that have a more holistic focus on the water resources sector can offset the high seasonality of GI maintenance work and programs. Programs that include business management and employment skills can provide better opportunities for independence and advancement whether that is within GI or not."

3 GI careers, not GI jobs

The biggest shortcoming of existing workforce development programs in the studied communities is a focus on creating GI jobs rather than GI careers. Programs that provided GI maintenance skills training reported high engagement during the program but little follow-up upon completion. At its current scale, the GI industry does not provide employment for participants upon completion. Youth participants reported little to no interest in GI maintenance as a future career. Since GI is a growing field, how do we bridge the gap between its current state as a niche industry and a more widespread, standardized field in the coming years? Rather than focusing on entry-level jobs that may not yet be in demand, workforce development efforts should focus on ways to create sustaining careers with opportunities for advancement. In addition to providing better outcomes for their participants today, these types of program also have the potential to create a new generation of leaders and mentors as the industry continues to develop. Programs that have a more holistic focus on the water resources sector can offset the high seasonality of GI maintenance work and programs. Programs that include business management and employment skills can provide better opportunities for independence and advancement whether that is within GI or not.

4 Education at every level

Information and training are available to residents and GI contractors. However, significant gaps exist in materials for designers and decision makers. Especially when implementing GI in a community, lack of knowledge within the design sectors and government can lead to high costs and poor outcomes for projects. Communities that have the resources should work in close partnership with private contractors and consultants to ensure that they have the skills to deliver high-quality projects. There is a need for educational materials for governmental staff, officials, and city planners to implement GI policies. Materials for decision makers explaining the function and value of GI would be beneficial. Curriculum should also be developed aimed at K-12 youth. Schools and young people are a part of our communities, and students can use GI as a way to explore their watershed, apply classroom materials in the real world, and build community capacity. GI can even start someone on the pathway to a career in the GI field.

5 Build relationships and establish partnerships

Because of the inherently transdisciplinary work of GI, diverse partnerships and relationships are an integral part of a successful program, especially when working with community members. It often takes multiple layers of partnerships to go from the impersonal level of city government down to the personal level of a neighborhood block. On the Boulevard Bioswales project, the City of Minneapolis partnered with Metro Blooms. Metro Blooms then established partnerships of their own with even more community organizations to tap into local networks and work with neighborhood leaders. Relationship-building was a continuous process focused on establishing trust and a sense of ownership among community members. Partnerships are an important part of every GI project, even those where the operating organization is not working directly with community members. Partnerships allow organizations to share knowledge and resources and provide expanded opportunities for GI implementation.

EQUITABLE GI SUMMIT, APRIL 2020

Summit Overview

To synthesize the results of the listening sessions and prioritize next steps, the project team coordinated an Equitable GI Summit on April 28, 2020. The summit was held virtually via Zoom because of COVID-19 shut downs. More than one hundred attendees joined from Extension, Sea Grant, state and local government agencies, nonprofits, and private businesses. Figure 1 illustrates the breakdown of attendees who chose to respond to our request for data. Figure 2 shows the representation by NCRWN state. Attendees from New York, Ontario, Kentucky, Maryland, and Pennsylvania also joined.

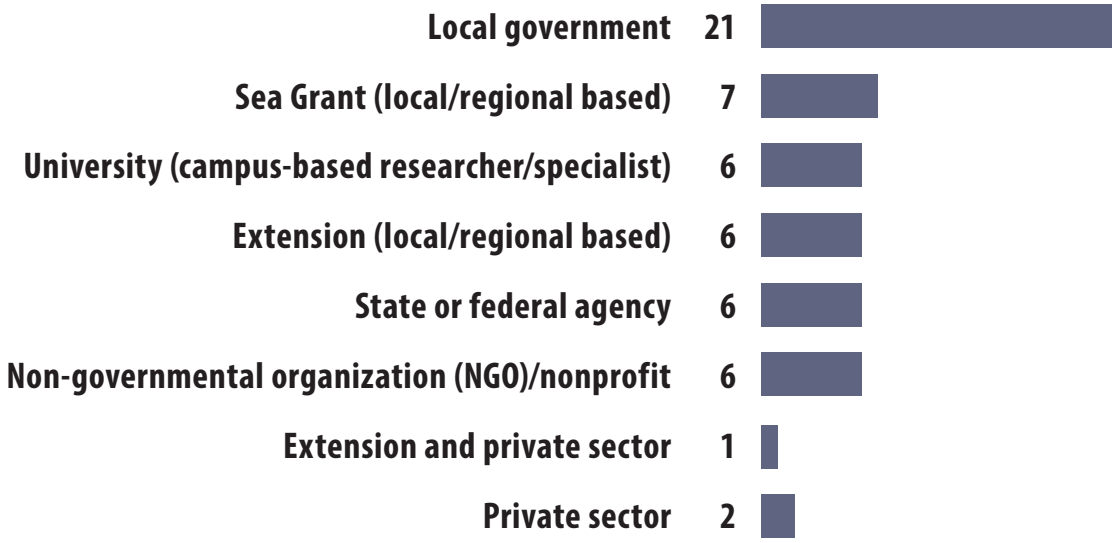


Figure 1. Summit Attendees by Sector

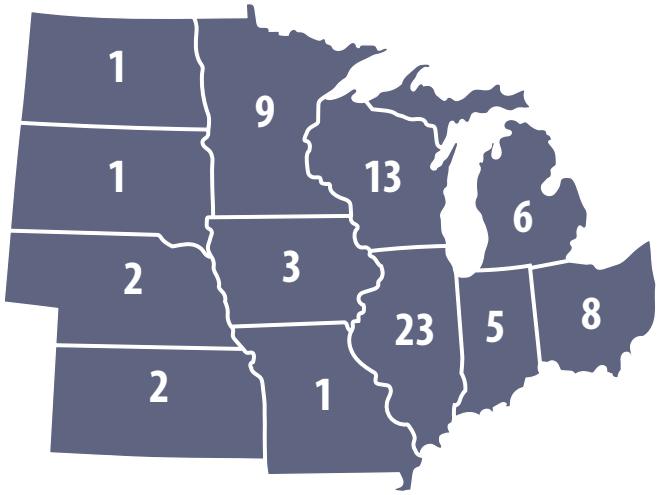


Figure 2: Summit Attendees by State

North Dakota, 1; South Dakota, 1; Nebraska, 2; Kansas, 2; Minnesota, 9; Iowa, 3; Arkansas, 1; Wisconsin, 13; Illinois, 23; Indiana, 5; Michigan, 6; Ohio, 8

The Summit agenda included presentations by members of the Extension and Sea Grant Networks, local government officials, and subject matter experts from both the private and public sectors. Presenters provided an overview and discussion of work in the region and summarized the study's results and themes identified during the listening sessions. Presentation videos and slides can be viewed at the North Central Region Water Network's website. The day's presentations are summarized below.

- ***Welcome and project overview*** – Lisa Merrifield, Community and Economic Development Specialist, University of Illinois Extension
- ***Equity and inclusion programs in other related organizations and industries*** – Carla Walker, President of think BIG strategies
- ***What we learned from community listening sessions*** – Tony Heath, PE, MUP, University of Illinois Extension
- ***Calumet Stormwater Collaborative Workforce Development Study*** – Margaret Schneemann, Illinois-Indiana Sea Grant; Kara Riggio, Opportunity Advancement Innovation in Workforce Development, Inc. (OAI); Lisa Krause, Illinois Department of Natural Resources-Coastal Management Program
- ***Peoria, Illinois GI Programs*** – Jane Gerdes, Professional Engineer City of Peoria Public Works
- ***Gary, Indiana GI Programs*** – Brenda Scott-Henry, Director, City of Gary Department of Environmental and Green Urbanism
- ***GI Champions Program, Great Lakes Commission*** – Ned Willig, Program Specialist, Great Lakes Commission

In the afternoon, participants met in five breakout sessions with approximately fifteen people per session. The groups discussed the challenges faced around each session topic and began to identify and prioritize the tools, resources, and networks needed to address them. Participants self-selected breakout groups by topic of interest. The afternoon breakout sessions included:

- Community Planning: Policy and Practice (two sessions due to demand)
- Diversity, Equity, and Inclusion
- Workforce Development
- Equitable GI Network Development

Facilitators designed a standard set of questions to discuss with participants. Because the agenda only allowed 30 minutes for the breakout sessions, participants focused discussion primarily on workforce development issues. The network development section had a slightly different focus. The discussion questions for each breakout session are summarized below.

- Community Planning: Policy and Practice; Diversity, Equity, and Inclusion; and Workforce Development
  - What are the most critical challenges?
  - What are potential tools or resources that would help solve these challenges?
  - Who are the players that need to be involved to make this happen?
  - Are there funding sources we should consider?
- Equitable GI Network Development
  - What are the tools and trainings we need to do our jobs better?
  - Ideally, how should this network be structured?

After the breakout sessions, the group reconvened to summarize the discussion and begin to identify next steps. Following is a summary of the discussion by group.

Breakout Sessions

Community Planning: Policy and Practice

The summit provided a unique opportunity for individuals from varied backgrounds and perspectives to share their experiences and insights on GI planning, policies, and practice. Planning is one way to ensure that equity is integrated into GI solutions. Truly equitable approaches will be developed through inclusive planning processes. Community-driven plans can provide residents the opportunity to determine how GI solutions are deployed in their neighborhoods.

What are the most critical planning challenges for governments?

One of the key challenges for government rests in how to define equity. The City of Baltimore equity lens identifies multiple layers of equity: transgenerational, distributional, historical, and procedural. This was highlighted as a model approach (City of Baltimore Department of Planning, 2018). Our discussion emphasized procedure as the key challenge in planning. Making sure that communities give adequate opportunity for residents to participate is essential to equity in planning. Consideration around the elements of power, knowledge, and opportunity can increase resident participation in planning and contributions to the process.

Creating a holistic framework for planning can leverage the impact of the investment and expand the public good. The most common goals that local governments consider include reducing strain on the stormwater and wastewater management systems, reducing watershed pollution, reducing flooding, creating public education opportunities, reducing carbon emissions, and addressing other effects of climate change (e.g., larger urban heat islands and excess runoff due

to more severe, less predictable weather patterns). Considering these larger sustainable development goals is a helpful part of the process and solution-seeking.

"Helping communities and decision makers use a variety of successful tools for planning GI programs will require learning from practices around the country."

Helping communities and decision makers use a variety of successful tools for planning GI programs will require learning from practices around the country. Our discussions around planning highlighted the need to pursue models that look holistically at an entire watershed, embrace equitable public-input approaches to develop community priorities, and provide tools that can assist local governments score or rank projects through an equity lens.

What are the most critical workforce challenges?

Funding was cited as the greatest challenge to workforce development programs. Participants discussed barriers and opportunities in workforce development, including pre-college programs, community college programs, apprenticeships, internships, private sector employment, public sector employment, and nonprofit sector employment. Understanding overall dynamics and trends for workforce development can help identify new solutions.

While a substantial proportion of the resources devoted to development of GI are generated by the public sector, key considerations for successful and emerging models of workforce development will require that we consider training and apprenticeship for GI within the urban forestry field. This will require collaboration with private businesses, educational institutions, nonprofits, workforce investment boards, and federal programs such as AmeriCorps. Engaging with existing federal training programs devoted to socially equitable, environmentally restorative economic development, such as workshops led by the U.S. EPA, may be a starting point for communities.

Programming aimed at creating opportunities for youth comes with its own challenges. Thinking about workforce development as a tool to address historical inequities requires considering critical questions. Are we providing people opportunities for career growth beyond entry-level jobs? Are we creating employment opportunities that advance equity, or do they reaffirm the status quo? Finding ways to trigger the interest of early-career professionals requires that we look for examples that are working in other communities. The Jobs and Equity in the Urban Forest Report (Enelow et al., 2017) work occurring with The Blueprint Foundation and others may help to inform our journey towards equitable GI and workforce development. Joining forces with other career development programming, highlighting science and STEM educational opportunities, and the personal and professional development opportunities are programming elements that will help us achieve success.

What are potential tools or resources that would help solve these challenges?

Community case studies can promote learning from others. The following resources illustrate the variety of options:

NGICP provides the base-level skill set needed for entry-level workers to properly construct, inspect, and maintain green stormwater infrastructure (GI).

Green street design tools, such as those offered by the National Association of City Transportation Officials, that integrate stormwater control and management within the right-of-way are a critical component of complete street design, ensuring the street remains usable and safe for all people during storm events, regardless of mode.

Strategic GI maintenance business plans present the role of asset management planning to support GI. Life-cycle cost analysis can help in making decisions for budgets that include programming for workforce development.

The *Building Community Resilience through Asset Management* handbook from the Federation for Canadian Municipalities provides resources to assist communities on completing asset management planning.

Who are the players that need to be involved in making this happen?

While all stakeholders need to be involved to some degree, revamping our community engagement strategies, perhaps, represents the core challenge. This means engaging communities before plans are developed and throughout the process to realize opportunities to move the entire community—not just a specific neighborhood— forward. Too often we forget to go directly to the source, and we miss important information needed for successful planning. GI alone is not enough.

While our conversation identified several key agencies, the best opportunities for learning are perhaps places that are implementing the best management practices. The Mid-South Regional Greenprint Plan, released in 2015, is an example of a plan that uses open spaces and GI as the foundations for improving social equity, transportation, and public health across a large metropolitan region (Mid-South Regional Commission, 2015). The plan centers equity-driven objectives throughout, addressing socioeconomic disparities, public safety, and job creation.

"The most common goals that local governments consider include reducing strain on the stormwater and wastewater management systems, reducing watershed pollution, reducing flooding, creating public education opportunities, reducing carbon emissions, and addressing other effects of climate change."

Creating a holistic framework for planning can maximize both the impact of the investment and the public good. The most common goals that local governments consider include reducing strain on the stormwater and wastewater management systems, reducing watershed pollution, reducing flooding, creating public education opportunities, reducing carbon emissions, and addressing other effects of climate change (e.g., larger urban heat islands, excess runoff due to more severe, less predictable weather patterns). Using this broader view can help identify funding and opportunities for integrated solutions. Each goal represents different federal and state funding sources that should be monitored for funding that matches equitable GI goals.

Pursuing pilots and demonstration projects that illustrate asset management and financial management create opportunities for exploring workforce development. Public health, equity in planning, and education and outreach opportunities are embedded as co-benefits supported through alternative funding sources.

Our conversations concluded with unanimous approval for continued regional engagement and development of a learning community around best management practices for equitable GI development. We learned a great deal from one another during our brief exchange of ideas and are very interested in creating additional opportunities for communities to learn from one another.

Diversity, Equity, and Inclusion

Although GI has the potential to make significant advancements toward diversity, equity, and inclusion, many challenges remain. This breakout session looked at diversity, equity, and inclusion within GI as it relates to workforce development programs.

What are the key challenges around diversity, equity, and inclusion?

The most critical challenge around diversity, equity, and inclusion identified by breakout session participants is the distrust between disadvantaged communities and government agencies due to a history of institutional racism. Residents are often skeptical that city officials have their best interests at heart as a result of gentrification that they have seen in other places. In addition, in many communities, residents associate the city with the police department, which further fuels feelings of distrust.

Segregation is another challenge. Residential neighborhoods are segregated, and there is poor representation from marginalized communities within the water resources and environmental sectors. In many communities, the projects are located in primarily white neighborhoods, and marginalized populations may believe that green jobs are not available for people of color. The flip side is that primarily white city workers or contractors working in communities of color may be seen as outsiders.

What are the potential tools or resources required to address these challenges?

The first tool identified by session participants is establishing community engagement guidelines that look beyond race or ethnicity and include other areas of diversity, such as gender or disability. These programs can promote a more holistic view of inclusion and require going beyond employment as physical labor. This further empowers participants in these programs by teaching them the skills involved in the planning and design phases. Allowing community members and partner organizations to be involved in planning, design, and decision-making can help break systems of power that limit community voice. Programs must allow for members of disadvantaged communities to become decision makers, increasing trust and creating role models for future generations.

"The first tool identified by session participants is establishing community engagement guidelines that look beyond race or ethnicity and include other areas of diversity, such as gender or disability. These programs can promote a more holistic view of inclusion and require going beyond employment as physical labor."

Workforce development programs must pay a living wage. A living wage helps ensure that people's basic needs are met, allowing them to be more consistent and productive members of the workforce. Grants were identified as a key way to secure additional funding for projects and cover thes0e costs. Grants from outside traditional clean water funds often had more money for diversity, equity, and inclusion efforts. Looking in these sources can enhance the financial feasibility of these types of efforts.

Who are the stakeholders that need to be involved in making this happen?

Community stakeholders need to be involved from the very start in the decision-making processes of GI. Agencies should be continually asking, "Who else should I be talking to?" Most times, an outsider will not know who to ask for help in a community, so it is important to leverage the knowledge of your existing partners and ask them who to involve. Involving community members from the start helps to establish trust and build long-term partnerships with the community, facilitating the two-way flow of ideas and needs. Having an outside group work as a facilitator was often an effective way to mediate the city-community relationship.

A need was also identified for getting buy-in from multiple departments within local government, especially human resources and public works. Making them believers and partners in projects helped to shore up internal support and ensure that diversity, equity, and inclusion remained a priority. Having people with technical and non-technical skills working together helps when working with residents where different types of voices may resonate more with different people.

Diversity, equity, and inclusion is a multi-faceted topic. Although participants did not have time to share all of the institutionalized problems they have faced, this breakout session highlighted the distrust between communities and local government agencies from a history of institutionalized racism as a key challenge around diversity, equity, and inclusion in GI. A history of institutional racism and poor representation within government organizations lead to a feeling among residents that the city does not have their best interests at heart. Empowering community members and program participants to shape GI through the design, installation, and maintenance is crucial in giving residents a voice and breaking traditional systems of power. Session participants stressed the importance of taking a holistic view of diversity, equity, and inclusion to ensure that the needs of all stakeholders, both internal and external, are addressed.

Workforce Development

Broad opportunities exist where GI meets workforce development, including impacts on job creation, training opportunities, youth and early-career programming, and GI-based pathways for those in the workforce and re-entering the workforce. A goal of this session was to gain further insight into these opportunities and to discover how to best direct resources and provide support to meet GI workforce needs. Before the discussion, the facilitator asked participants to consider workforce development issues from their own perspective working in GI.

What are the key challenges around workforce development?

Political challenges can impede resources and growth in the GI industry. For example, it can be difficult to convince local officials that GI is an industry that can and does support jobs, that there is a trained workforce, and that training opportunities in this industry need and deserve support. Regulatory barriers, such as when a utility requires but does not actually inspect for GI maintenance, provide a disincentive to maintenance. This spawned additional discussion about how difficult it can be to promote jobs and progress for important GI site maintenance when programs do not fund maintenance.

Retraining employees can present particular and persistent issues, including the energy required to manage logistical arrangements for supervision and crews, the need for a high supervisory ratio, lack of consistent or ongoing funding to maintain these programs and pay participants appropriately, and a lack of participant retention and high turnover rates in retraining programs. Session attendees observed that it can be difficult to find, motivate and inspire community and environmental investment within retraining programs, especially when program participants are frequently managing other immediate concerns and their basic needs.

"Session attendees observed that it can be difficult to find, motivate and inspire community and environmental investment within retraining programs, especially when program participants are frequently managing other immediate concerns and their basic needs."

Finding qualified people to design, run, and sustain GI training programs was identified as another challenge. Session attendees raised questions about how to ensure that training programs are leading to positive job outcomes. Can we ensure that training program participants will go on to successful jobs or careers in GI? Are we certain that there are enough jobs available? Do high-quality professional certification programs carry enough weight with employers to justify their cost and time investment? The consensus seemed to be that uncertainty surrounding successful outcomes of training programs can make it difficult to justify investment up front.

What are the potential tools or resources needed to address these challenges?

In response to questions raised over the value of GI professional certification programs, the point was raised that both the demand and the desirability of such certifications can and does increase where municipalities, watersheds and other regulatory units require that personnel on a project bid have certification. Not only does this action bolster the legitimacy of a certification program, it also helps ensure that a high level of knowledge and training is applied to a project. Further discussion around this point raised questions about equity of access to professional certification training programs that have a high cost, require a large time commitment, and may be otherwise inaccessible or out-of-reach to segments of the population. Increased cost-share, sponsorship, or other cost reduction measures may be necessary to make certification programs viable and accessible to a broader segment of the workforce.

Early-career programs that focus on natural space projects seem to be working well, and they should translate into jobs and career opportunities. Several participants observed that the conservation corps program has been successful where it has engaged young adults in GI work. There was some discussion around whether this program and similar models lead directly to jobs and careers in environmental work, as they are designed to do. The group felt that participation in conservation corps results in good experiences and highly transferable skills that nearly guarantee a job.

Who are the stakeholders that need to be involved in making this happen?

Community colleges, workforce development agencies, and nonprofits that work at the neighborhood scale and that already have expertise working in retraining and with vulnerable populations are all critical stakeholders that can help expand GI workforce programs. Some community colleges are actively supporting GI programming. Community colleges can serve as a bridge between entry-level and higher education or for those re-entering the workforce.

Several noted success with incorporating established workforce development programming into public land restoration grants. In this win-win model, grant-funded projects have explicit workforce components written into the terms. Project completion serves as a pass-through mechanism to fund workforce training and complete the requirements of the restoration project. Successful funding for specific projects often comes from unique sources, such as the example given of Minnesota's Legislative-Citizen Commission on Minnesota Resources, which has discretion over the state's Environmental and Natural Resources Trust Fund, revenue generated by the state's lottery income.

Workforce development challenges in GI programs are diverse, from direct management of crew logistics to congruence of policy and regulatory requirements to incentivize skilled construction and maintenance. Requiring GI-certified personnel on project bids would enhance the legitimacy of such workforce training programs, but there are important concerns to address that relate to accessibility and cost of these certification programs. The voices of those with workforce development expertise, such as community colleges and workforce agencies, will be essential in helping to develop and grow effective, innovative and sustainable workforce components within GI programs.

Equitable GI Network Development

The 16 session attendees represented three nonprofit organizations, six University Cooperative Extension Service programs, and four Sea Grant college programs. Attendees focused discussion on tools, training, and structure needed for technical assistance providers to support communities more effectively with equitable GI projects.

What are the key challenges around equitable GI network development?

The need for publications, decision support tools, and training formats geared toward specific audiences are key challenges around equitable GI network development. Participants also identified the need for regional and state-wide inventory compilations of GI example projects. Format options could include a decision support tool with example practices and searchable maps.

Peer-reviewed journal articles are needed, since GI is a growing and evolving field. Extension publications that summarize scientific findings and methodologies are needed to translate science into materials for decision makers and technicians. The need for GI publications is demonstrated by the lack of information on selected salt-tolerant plant species appropriate for GI projects in the Midwest.

Finally, session attendees acknowledged that it can be challenging to get elected officials and decision makers to attend training. Often, officials have other priorities and will send staff in their place. Developing strategies for reaching decision makers directly is a key priority for equitable GI network development.

What are the potential tools or resources needed to address these challenges?

"Training options can highlight examples and practices from various scales of community projects and businesses. They should include examples of failed GI projects and processes as lessons learned."

Several training formats were mentioned to educate a variety of audiences. Session attendees discussed the need for training that focuses on an introduction to the most updated GI information for elected officials, municipal staff, business owners, trainers, and community members. Training options can highlight examples and practices from various scales of community projects and businesses. They should include examples of failed GI projects and processes as lessons learned. Emphasizing the need for funding and supporting long-term maintenance of GI should be a focus.

Additional training needs include tools to cost out GI projects, including long-term projects. Financial details can include comparing the costs associated with green and gray infrastructure at the planning level for general estimates. Trainers need discussion points, summaries, and references of green and gray infrastructure costs and associated savings for community decision makers. Session attendees acknowledged that existing resources are confusing to wade through and challenging to interpret since projects are site specific.

Contacting decision makers directly requires adapting communication strategies to meet council members where they are. Options include attending and speaking at council meetings and learning from other training programs, such as the past Nonpoint Education for Municipal Officials program.

Which stakeholders should be involved?

The discussion concluded with a focus on how a network of trainers and practitioners should be structured. Questions posed to the group included the following: How and how often should we

communicate? What services should the network offer? Who should lead/house the network? Are there other players we should partner with or engage in this network? What else do we need for success?

The first suggestion was to develop an information exchange system among network members. This could include a listserv for news updates, an online cloud storage system to house network resources, an ongoing webinar series to highlight projects, and continued support for online and in-person workshops. Information networks should include discussion of life-cycle care and project successes and failures with lessons learned.

The equitable GI network values connecting on issues, challenges, and similar types of work. Collaborating with community development professionals and other environmental or green space organizations provides fertile ground for additional support. Peer focus circles would be an effective tool to bring together stakeholders in smaller groups to discuss projects and peer learning opportunities.

To move forward with network development recommendations, a more formalized collaborative structure will need to be created and/or the lead institution will need to organize collaborative efforts. Sea Grant and Extension colleagues are interested in sharing and developing resources, tools, and professional development opportunities. However, without a centralized management structure, collaborative efforts will not progress.

Summit Evaluation

Following the Summit, attendees were asked about their experience and how they will use the information they gained.

Most attendees said they would use the information they learned during the Summit at multiple events. Figure 3 provides a specific breakdown of the knowledge gained by participants. In general, the Summit succeeded in increasing understanding and raising awareness of social justice and workforce practices and challenges related to GI, but because we were not able to hold the Summit in person, the ability to network and connect one-on-one was largely lost.

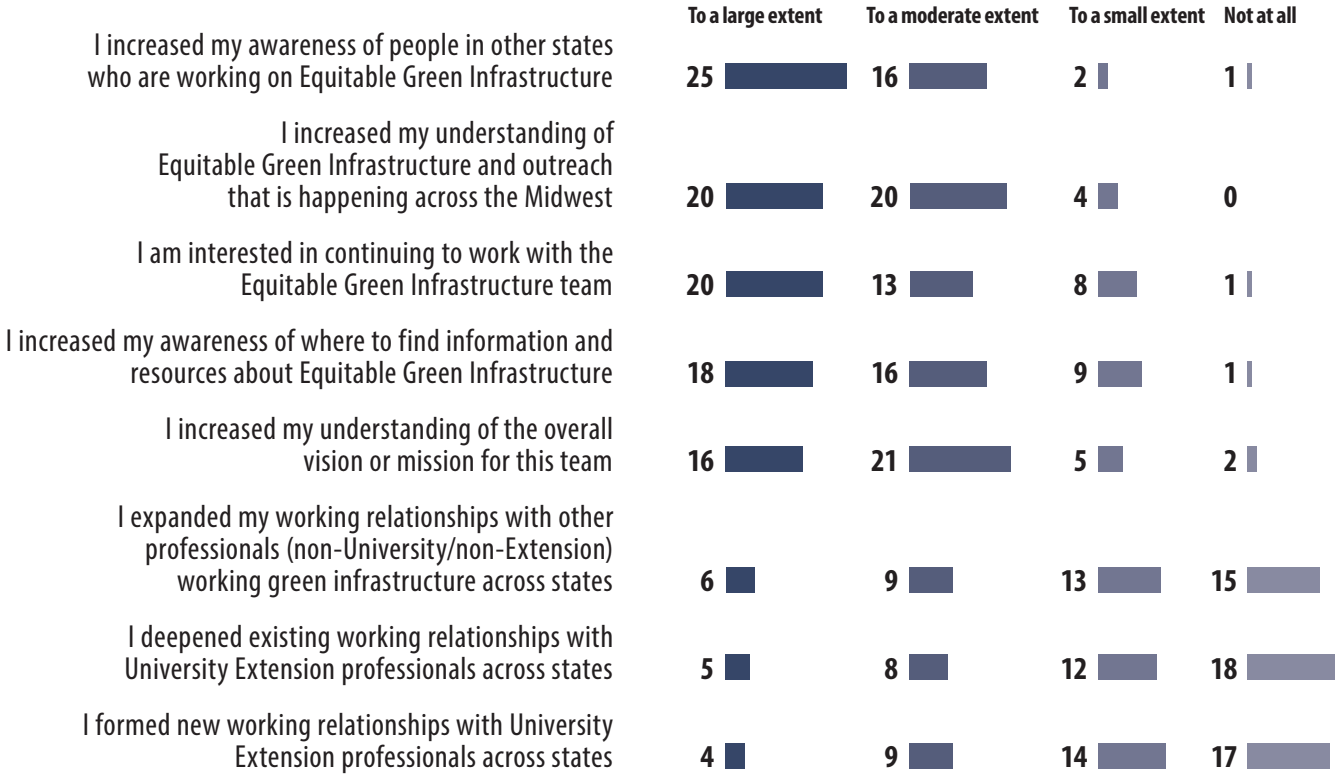


Figure 3. Summit Attendees by Sector

One participant highlighted the importance of "reframing GI and validating that there ARE intersections with workforce and equity that are real and felt across the region." Another attendee noted that the Summit has spurred other conversations in their local community. A third commented that the case studies presented were very helpful and would help them as they work locally. The need for intentional connections between equity and GI was also noted.

Participants indicated that tools are needed to help "sell" the concept to decision makers and developers. Funding for GI projects is also a concern of many participants. Others noted that while they have training on GI practices, they could use more training on connecting to social justice and workforce development tools.

Participants noted that they would have appreciated more time for the breakout discussions and said more examples from communities would have been helpful.

CONCLUSIONS AND NEXT STEPS

While communities took a variety of approaches in their GI programs, consistent themes resonated through the listening sessions and during the Summit. Communities that considered societal aspects when planning and designing GI reported greater community and internal support, were better able secure additional funding through grant programs, and were better equipped to integrate GI and other community benefit programs. Making these co-benefits, and their economic costs and benefits, an explicit part of the decision-making process helped communities address multiple needs within a single project and derive more value from money that they were already going to spend on stormwater capital improvements.

While fewer communities directly linked social justice goals to their GI programs, we found positive examples of the benefits that can be gained by doing so. Some communities are designing programs to empower residents throughout the design and planning process of projects in their communities. Partnering with and empowering residents takes a significant investment of time and effort upfront, but it pays dividends throughout a project's lifetime. Empowering residents by establishing trust and a local flavor around projects fosters a sense of ownership for GI practices and helps to ensure that communities care for them throughout their lifecycle. In addition, the relationships and trust that are built in one project do not go away when the installation is complete. These bonds are strengthened with each subsequent project, making future communication and collaboration easier and breaking down barriers around traditional structures of power.

Another approach to addressing social justice through GI is to intentionally invest in workforce development aimed at helping unemployed or underemployed residents where projects are sited. Driven by our response to climate change, experts predict a need for skilled workers with specialized knowledge in environmental disciplines in the coming years (Jobs for the Future, 2017). Existing programs have focused on green jobs for installation, maintenance, and inspection since these are directly linked to entry- and middle- skill level opportunities. However, these programs have struggled to create meaningful career pathways beyond the initial training or entry-level postings. Communities which have implemented these programs have found that the supply of qualified candidates provided by the trainings outstrips both public and private demand. These communities have also found that low wages, seasonal work, and lack of opportunities for advancement make GI maintenance an unattractive career choice.

Because of this, there is a need for a shift in the way that communities approach these types of workforce development programs, moving from a focus on entry-level labor jobs to a focus on GI careers that provide opportunity for advancement, input in decision-making processes, and sustaining wages. One innovative solution to this challenge is being tested in Seattle and Minneapolis. Organizations in these communities are in the process of creating GI incubators targeted at marginalized and underrepresented communities. These programs are intended to increase representation within the water resources sector and provide a clear pathway to a full-time career. Although these programs may not reach the quantity of participants that programs geared toward entry-level labor do, they have the potential to deliver higher-quality outcomes for those who do engage.

Funding and lack of education for local government officials and contractors were identified as the two foremost barriers faced by communities for their GI programs. The lack of formal guidance from the state has created a gap that the Extension and Sea Grant networks are well suited to fill. As university-based, science-driven entities, these networks can act as facilitators between public agencies, the private sector, and their communities. The development of best

practices, trainings, and other decision-support tools targeting specific audiences was identified as a key need. For many decision makers, finances are critical. Although the pitfalls of quantifying ecosystem services are well known (Small et al., 2017), there is a need for materials to enumerate the co-benefits derived from GI and to place them alongside the installation and maintenance costs to counter the potentially higher up-front costs.

Recommendations for Future Programming

The Equitable GI Summit provided a valuable opportunity to convene members of the Extension and Sea Grant networks with representatives from state and local government agencies, nonprofits, and private businesses. The summit was an effective way to share the results of our research, develop ideas for future efforts that help communities overcome the barriers to implementing GI, and encourage use of GI as a tool to address social equity and workforce development in communities. A key theme throughout the day was the need for more information sharing and decision-support tools among members of the network.

As a result of this study, the following next steps have been identified as the top Extension priorities.

- **Identify funding for Extension and Sea Grant professionals to expand outreach and support for GI program development**

The current funding program for GI research through the NCRWN expires in July. This network provides valuable support for stakeholders and communities across the region. To continue this work and to help communities successfully adapt to the changing climate in a just and equitable way, new funding sources are needed. Program planners will seek funding from foundations, state and federal agencies, and other nonprofits.

- **Formalize an Extension-Sea Grant GI community of practice**

To move forward with network development recommendations, a more formalized collaborative structure will need to be created and a coordinating body will need to provide leadership for future collaborative efforts. There is continued interest among Sea Grant and Extension colleagues to share and develop resources, tools, and professional development opportunities.

- **Develop Extension programs to address community needs**
    - **Develop GI 201 program for community decision makers**
      Developing strategies for reaching decision makers directly is a key priority. This type of programming needs to focus on awareness and provide data for decision makers based on documented, evidence-based best practices in community planning and design.

      This type of programming should include specific and local cost-benefit data, mechanisms for effectively engaging and empowering members of the community, sample regulatory materials, planning-level cost considerations, and design and maintenance criteria with model templates.

- **Develop Extension programs, case studies, and fact sheets for community leaders**
  Throughout our project, the researchers found that equity was not a strong consideration in GI programs in most communities. However, there is not a lot of consensus or guidance on co-benefit BMPs. Case studies and training on GI societal co-benefits, presented through Extension networks, could significantly help community leaders and organizations inform local government officials of needs and opportunities.

- **Prioritize multilingual programs and publications to reach all audiences**
  English may not be the first language for those who work in landscape trades or live in underserved communities. Extension materials about GI and equity BMPs should prioritize ease of access for target audiences.

■ **Conduct applied research-Extension partnerships to address community needs**

- **Model workforce development opportunities.**
  The biggest shortcoming of existing workforce development programs is a focus on creating GI jobs rather than GI careers. Programs that provided GI maintenance skills training reported high engagement during the program but little follow-up upon completion. At its current scale, the GI industry does not provide employment for participants upon completion. GI job creation seems to be isolated and disconnected from other workforce development systems. This is an area where research could help identify the most effective and efficient pathways to building GI careers, and Extension could share the findings with communities.

- **Evaluate GI co-benefits to identify BMPs and economic and societal value.**
  There is a rich opportunity for applied research that would begin to document the co-benefits of GI in terms of economic and societal value to communities. Extension could use the results of studies on these co-benefits to provide clear guidance and documentation to decision makers as they engage in GI planning processes.

- **Analyze the GI triple bottom line.**
  Applied, interdisciplinary research to define the GI triple bottom line—the societal, economic, and environmental costs and benefits— will help communities understand the payback on their investment. Research could identify best practices and decision points, including the impact of neighborhood enhancements, sustainable design, local policies, that contribute towards best outcomes, positive health impacts, career pathways, and other meaningful co-benefits that are readily documented with evidence.

- **Conduct interdisciplinary life-cycle cost and benefit analysis.**
  Communities would benefit from calculators that delineated and documented GI's impact on residents, environmental sustainability, and fiscal health. Engaging local business leaders, government, community colleges, high schools, labor unions, equipment operators, landscape architects, engineers, and university experts will ensure full cost and benefits are accounted for.

- **Evaluate and standardize GI monitoring practices.**
  Communities are implementing GI programs, but there is not a uniform way of tracking use and performance. Such data is needed to determine BMPs, help communities select appropriate practices for specific goals and understand maintenance and longevity. Local monitoring occurs, but there is not a standard method or reporting process that can adequately provide data that decision makers need. The Extension and Sea Grant networks have tremendous capacity to further joint efforts that promote accessible and situationally appropriate monitoring methods and standards for GI projects and applied BMPs. These networks are especially well poised to communicate evidence-based recommendations to practitioners and community leaders via accessible decision-support tools that align with existing processes.

- **Develop decision support tools for communities.**
  Decision support tools for government and community organization staff are needed to aid in evaluating technical options and presenting a holistic comparison of their costs and benefits. Calculators that compare alternatives across their entire life cycle rather than just upfront costs would be particularly valuable. GI planning tools that could be adjusted to reflect local conditions would also be beneficial to decision makers.

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