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Building a vision for more effective equity indices and planning tools

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Recent years have seen a proliferation of equity indices and environmental justice screening tools to support more just environmental planning processes that attempt to quantify the concept of equity. While the equity index framework has proven important to advance the conversation around environmental equity and connect need to investments, we are concerned that these tools do not adequately address the intersectional nature of environmental justice concerns, effectively incorporate local knowledge on the lived experience of residents, or provide an actionable set of next steps to be taken. We see opportunities to rethink and expand on the equity index model to address issues of climate justice and preparedness through the development of Planning for Resilience and Equity through Accessible Community Technology (PREACT), a multipurpose and multi-scalar climate preparedness and neighborhood planning software application informed by both community need and community assets. This perspective article will discuss the theoretical and practical importance of adding these perspectives into screening tools and will describe our research in Philadelphia, PA aimed at understanding these challenges and developing a more inclusive and community-responsive methodology for effective tool development.

KEYWORDS

climate, equity index, green stormwater infrastructure, urban heat island, racial justice advocacy

Introduction

The climate crisis is not only a crisis of nature, but also of people, understanding, coordination, analysis, and action. Today, many of our most pressing challenges involve determining how we use information for effective decision-making and collaboration, and identifying win-win opportunities to design for inevitable climate adaptation while simultaneously meeting current needs. Data analytics and data visualization can have a significant impact on helping the public identify and respond to climate challenges, but translating data insights into visible, tangible, realistic, and effective policies with public support has been challenging, especially when trade-offs are involved and policies are untested and unproven. It's essential that we develop ways to use digital tools to better communicate the trade-offs and benefits associated with planning for climate

change. One way to do this is by working with residents to identify what support they need to both visualize existing concerns and advocate for possible solutions to make their communities more equitable and climate resilient through investments in their neighborhoods. This paper describes our preliminary findings and concerns raised while working in Philadelphia, PA, USA with a National Science Foundation Smart and Connected Communities (NSF) funded Planning Grant. Planning for Resilience and Equity through Accessible Community Technology (PREACT) works with community organizations and concerned residents in North Philadelphia through a series of working group meetings and discussions to develop a pilot model for how data and visualization tools can effectively be designed with and for communities. Though we are in the early stages of project development, our discussions so far have proved fruitful in terms of critiquing existing tools and identifying significant urban challenges that we argue that data visualization and planning tools must take into consideration to enable a truly just and equitable future.

Our research began in 2013 with the development of an equity index for Green Stormwater Infrastructure (GSI) planning (Heckert and Rosan, 2016, 2018). The GSI Equity Index was designed to identify areas of need for green stormwater infrastructure (rain barrels, pervious playgrounds, parks, trees, bioswales, green roofs, etc.) investment based on multiple factors that were informed by the current research at the time about the associated co-benefits. Our goal with the creation of the Equity Index was to push the City of Philadelphia to equitably prioritize investment of green stormwater infrastructure in neighborhoods that most needed this investment (based on a set of criteria associated with need). We used the framing of *equity* rather than *equality* to argue that there were certain communities that were lacking baseline amenities that also had more vulnerable populations. The GSI Equity Index has become one of many similar tools built to consider equitable environmental planning. However, we argue that way we approach these tools needs to be more intersectional and focused on solutions and usability.

Over the past decade, numerous indices and tools related to environmental justice have been developed to assist with environmental planning, particularly around environmental justice. Among the most prominent is the US EPA's EJScreen, which combines data on social and environmental factors to map vulnerability to environmental justice concerns (Kuruppuarachchi et al., 2017). Additional location-specific indices have been developed in Maryland (Driver et al., 2019), California (Cushing et al., 2015), and Michigan (https://www.michigan.gov/egle/maps-data/miejscreen), among others (Zrzavy et al., 2022). The development of these data and visualization tools is a vital step in the normalization of discussions of equity as part of environmental planning processes; however, our community meetings for PREACT have highlighted a series of particular challenges that must be addressed for these tools to be truly useful, effective, community-informed, accessible, and transformative. Some of these challenges are easier to overcome than others, but they warrant attention and discussion, particularly given the proliferation of data tools and the growth of big data, low-cost and accessible community technologies, and civic data.

The broad range of challenges and concerns we have identified so far include addressing the intersectional nature of environmental justice concerns, finding and incorporating all appropriate data, ensuring usability for non-technical users or those without internet access, creating accountability, addressing issues of scale, making connections to policy, and building trust with local communities. In the following sections, we will specifically discuss issues of intersectionality, data, and trust as central concerns that must be addressed to ensure just and effective planning for equity and climate adaptation.

The intersectionality of environmental justice concerns

Environmental and climate justice must be understood to be not only cumulative but also intersectional. By cumulative, we refer to the fact that multiple stressors can build on each other to produce compounding impacts. Indices are well-suited to address cumulative impacts insofar as they are additive in nature. However, the intersectional nature of some environmental challenges means that they can interact with each other in ways that are more complex and not necessarily additive (Kaijser and Kronsell, 2014; McArdle, 2021; Amorim-Maia et al., 2022). Of particular concern is the way that environmental planning might interact with existing inequalities in a manner where the solution to one set of inequalities can create or exacerbate another set of inequalities.

One key example of this is the relationship between urban greening initiatives and gentrification where greening efforts can contribute to increases in property values, with subsequent increases in rents and property taxes effectively pricing current residents out of their neighborhoods (Checker, 2011). These concerns can easily result in community opposition to greening projects, even if the greening is, in fact, desired by residents, because it is simultaneously perceived as a threat even if greening is a key component of equity and climate resilience (Immergluck and Balan, 2017; Anguelovski et al., 2019).

To enable a more intersectional approach that acknowledges cumulative and intersectional effects, equity indices and screening tools must expand beyond the typical environmental datasets to incorporate the wider range of data that speaks to the lived experiences of marginalized communities. This means that the type of equity index that we previously created which focuses primarily on greening without looking at other compounding factors, is no longer sufficient.

Many residents in low-wealth and previously redlined neighborhoods are dealing with a wide range of pressing and overwhelming day-to-day challenges, which we term "the struggle space," including, but not limited to, under and unemployment, difficulty paying rent and mortgages, accessing capital for home purchase, repairs, and weatherization, rising property taxes, evictions, food insecurity, rising utility costs, aging infrastructure, underperforming and unsafe neighborhood schools, the urban heat island effect exacerbated by a lack of tree canopy and park and recreation access, flooding, lack of affordable childcare, overabundance of vacant lots, air pollution, crime and drug use, gun violence, illegal dumping, health concerns and a lack of access to affordable housing (Rosan et al., 2021). The immediacy of many of these concerns often means that they take precedence over longer-term climate planning or projects, which can seem to communities like a waste of resources that could be better spent on more pressing needs.

Incorporating additional indicators into indices would not only enable consideration of the potential for programs to exacerbate challenges, it would also enable planning to take advantage of potential synergies. For example, there are many types of greening programs and they have different potential impacts on surrounding communities (often termed co-benefits or ancillary benefits). Greening schoolyards can provide places to play and opportunities for hands-on STEM education, while tree planting reduces the urban heat island effect, and greening vacant lots can reduce stress and gun-related violence (Dyment and Reid, 2005; Branas et al., 2011; South et al., 2015; Rahman et al., 2020). A data visualization and planning tool that also includes information on existing playground locations, health outcomes, vacant land, and gun violence would enable those factors to be considered to ensure more effective targeting of the types of initiatives that could be completed to address issues beyond the desire for specific greening outcomes.

The importance of local and contextual data

Environmental justice advocates have long argued the importance of local knowledge for effective decision-making that does not exacerbate inequalities (Corburn, 2002, 2003; Allen, 2007). Top-down planning that does not take into account the local context runs the risk of exacerbating inequalities in a similar manner to planning that does not address intersectionality.

Indices are only as good as the data behind them and the thinking about how the data intersects. Often this means they are limited to data that is collected through official channels or for entire study areas. EJScreen, for example, only includes data that is available for the entire US. Thus, demographic data is often included, but complex socioeconomic and environmental factors, as well as relevant historical information may be excluded that are nonetheless important. In Philadelphia, the initial version of our own index did not include data that we knew to exist but which was not publicly available, such as data on temperature disparities, health outcomes, and the strength of local real estate markets. Today, much of this data is also able to be collected by residents through new low-cost technologies and crowdsourced through social media platforms.

Through our work with local communities, we have identified a need for including *more* local information and crowdsourced data, such as locations prone to street or basement flooding or dumping or gun violence- problems and nuisances that build over time and cause real problems for residents, but which may or may not be regularly reported, adequately documented, or addressed by the City. Other local knowledge, such as understanding of community capacity and social cohesiveness, is even trickier to collect and operationalize and include in an index, but is still extremely important. In part because data about community capacity can be empowering for residents as well as critical to identifying policy solutions. Communities without strong internal social networks will require different kinds of support to enable successful environmental planning. The social network framing presented in some of the work on STEWMAP might be important to integrate into future iterations of the equity index to assess community capacity, particularly around environmental stewardship (Svendsen et al., 2016). Of course, local residents and community groups in each city or even different neighborhoods might also have a different way to conceptualize "community capacity" and to measure it and this will need to be explored in each community.

In addition to a more nuanced understanding of local conditions, community members also have a stronger sense of community priorities and desires than policy-makers and academics who tend to focus more at the city scale. We argue that indices should be designed to enable users to decide which factors to consider in their communities and how to weight them in order to ensure that resulting programs meet the needs of community members rather than (or, in an ideal world, in addition to) the needs of government entities or program administrators. While we recognize, for example, that a water department seeking to install green stormwater infrastructure might have a first priority of managing stormwater runoff, community residents who will live near and interact with that infrastructure will have more nuanced perspectives on what types of infrastructure they want to see given the variability in impacts of different types of projects. Residents might understand that their neighborhood lacks a safe place space and might advocate for use of water department GSI funds to create playgrounds and parks.

Addressing issues of trust and connections to policy

In a series of community zoom meetings for the PREACT project, it became clear that community distrust needs to be recognized and addressed before efforts to develop civic data tools are attempted. In Philadelphia, as in many U.S. cities, tensions between numerous universities and the surrounding Black and Brown communities are rooted in histories of displacement, gentrification, structural racism, elitism, and even the previous mismanagement of environmental projects. As a result, when academics and/or government officials talk with residents about planning for climate change, or helping them co-design data tools that promote "justice or equity," residents have justifiable trust concerns: (1) why are they being asked to engage in these conversations? (2) how will thinking and talking about neighborhood concerns or prioritizing future climate investments address their day-to-day concerns?; (3) how is local knowledge and expertise being acknowledged, rewarded, and mobilized?; and 4) do government officials and/or academics really understand or care about their struggles? Residents are reluctant to be involve in yet another academic planning process that might bring in large dollar amounts and prestige to university researchers, but does not tangibly change community conditions. In addition, planning processes that ignore concerns about displacement and gentrification and the power dynamics associated with government and university researchers are seen as contributing to these negative outcomes.

We are not unique in observing issues of trust as central to effective environmental planning, and that relationships take time to build (Boschetti et al., 2016). However, we argue that many tool developers and mappers underestimate its importance. In fact, our observation in our research is that "collaboration moves at the speed of trust." The vision we have laid out for an intersectional and locally responsive tool, however, cannot be achieved without meaningful, sustained participation by local residents and open and thoughtful discussions about how to overcome trust challenges. Trust is also essential for the long-term usability and sustainability of the tool itself. In fact, in our work, we have been brainstorming the possibility of creating a non-profit that is community controlled that ultimately takes over ownership and responsibility for managing the data and planning tool.

Closely related to issue of trust is the concern that tools are more effective at pointing out problems than identifying solutions. To be used meaningfully by community members, the data tools and visualizations we build with communities must connect data to action (Williams, 2020). It is not enough to be able to craft a story about cumulative impacts of multiple environmental stressors if that story remains in the tool or circulates only within the community itself. Furthermore, a tool that only highlights known challenges without offering solutions or connecting to policy solutions runs the risk of alienating or disheartening communities rather than empowering them. We believe that incorporating explicit community identified next steps and solutions will be crucial for building necessary trust that this tool is more than just an exercise but is intended to promote meaningful change in communities.

Discussion—Our vision for a more responsive and integrated tool

All of this lays out a framework where equity indices, though valuable, do not do enough in their current forms to truly lay the groundwork for a more just and equitable climate ready future in which vulnerable communities are empowered to fight for necessary community improvements without risk of displacement. We see tremendous promise in the proliferation of these tools, but see a need for considerable refinement of existing technologies and more robust community engagement processes so they can be designed for more than a narrow set of users and use cases. We believe that such a tool is possible to create, but that it cannot be created without centering the communities that it seeks to serve.

Though we are still in the early stages of planning for the PREACT research project in Philadelphia, we have already identified a range of key concerns that can help guide future efforts at equity index development and community-based environmental planning. Ultimately, our insistence that local context and community needs matter means that there is no one set of easy solutions or one specific workflow that will solve all problems. Instead, there is a need for a flexible and extendable framework of collaboration that can be built out to take an expansive, intersectional approach to understanding cumulative impacts and environmental risks. And this framework (which is as much about building trust and understanding and relationships as it is about layering data into a software and mapping tool) must be deployed in a manner that builds trust and empowers communities to act as agents of change in shaping future developments.

To include hyper-local characteristics of individual communities when gathering data, it will also be necessary to design the tool with the digital divide in mind. As the PREACT project progresses and the software tool is created, community training and feedback will also be critical. We will host community events and meetings where residents can practice using the tool to both view currently displayed information (and give feedback about how representative it is) and develop the skills necessary to upload information to the tool. These events will also serve as spaces where project partners and participants can share information relevant to the tool's effectiveness and the ability of the tool to highlight their lived experience. These events will also serve to support impacted residents that would not otherwise have the time and access to work on computers or focus on proactive climate planning for their communities.

Project partners will also individually meet with residents and participate in existing community events to solicit input on the project, advertise it, and assist residents in documenting their lived experience and their desires for a more environmentally functional existence.

By viewing the creation of equity indices as a process of building trust and relationships among researchers, policy-makers, community advocates, and community residents, we argue that we can better meet the challenges of solving complex and intersectional problems with equity indices, data and visualization tools. What is exciting is that we have the data and increasingly have cost effective ways to gather hyper-local data. But the data needs to be useful for changing the way that we think about the problem definition and the solution space in communities. To allow that to happen, we suggest that creators of equity indices and data visualization tools invest deeply in their relationships with community residents to understand and address their concerns. Through careful listening and deliberative dialogue with communities, researchers and data visualization specialists can better develop more authentic and useful planning tools and equity indices that can identify community need and policy-pathways for equitable climate investments.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Author contributions

The paper was broadly conceptualized by CR and MH. Written jointly by CR, MH, RZ, and EB. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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