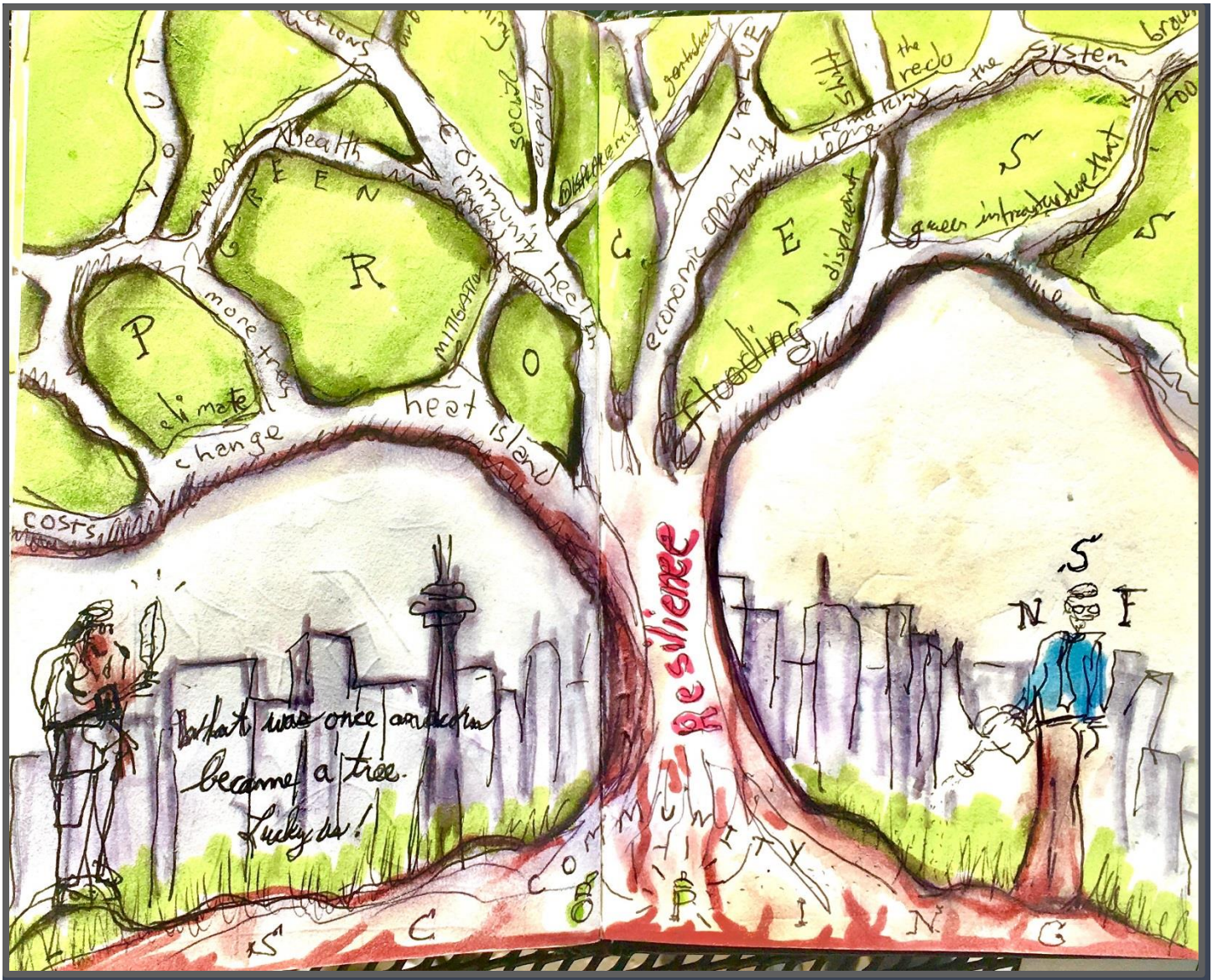


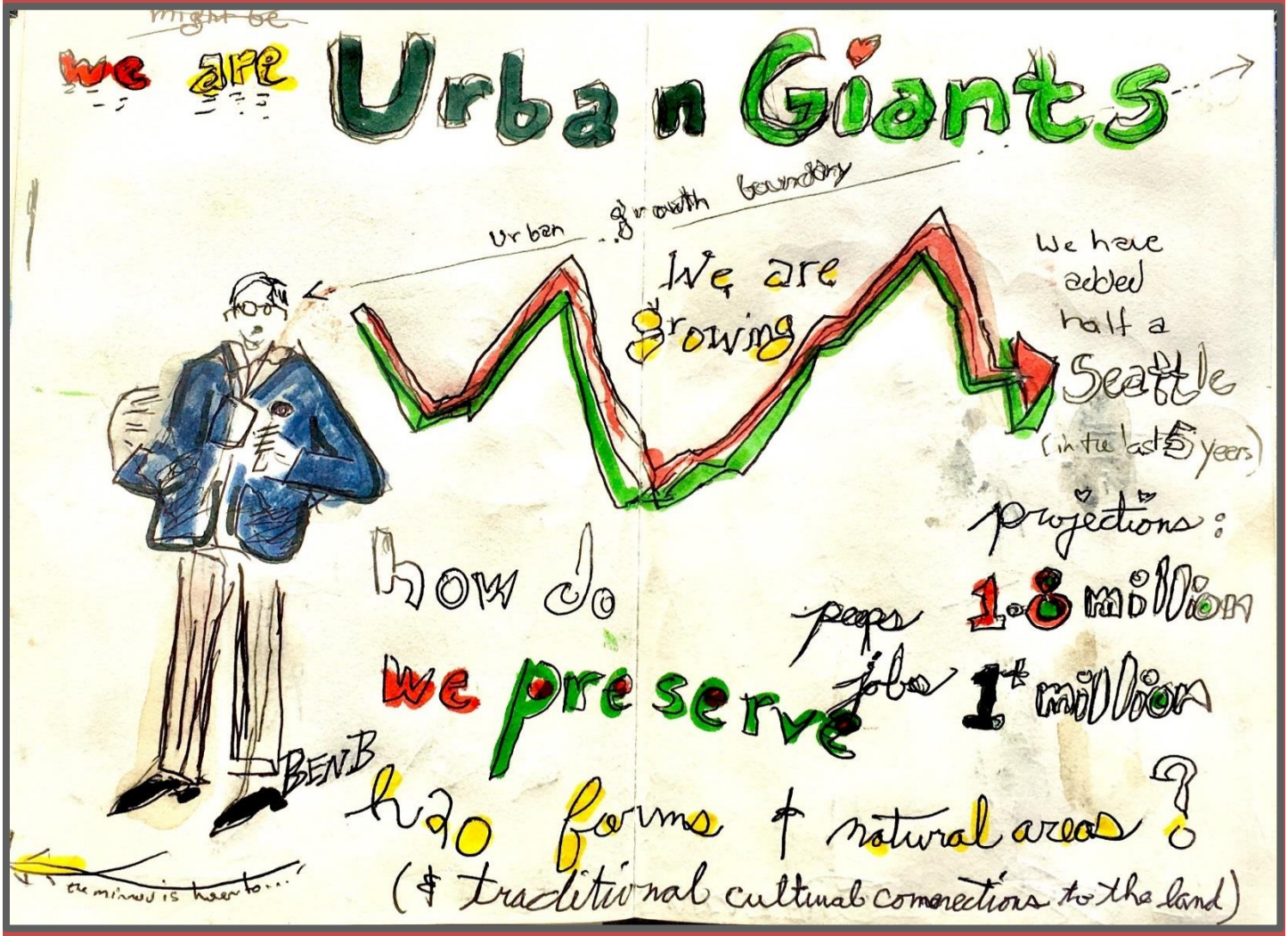
All drawings are by John Barney

The Next Urban Giants:
Building Resilience and Equity into Growing Megapolitan Regions by Greening the Urban Human-Natural System

Metropolitan Center for Applied Research & Extension
Washington State University Extension

October 2019

Ben Bakkenta, Director of Regional Planning at the Puget Sound Regional Council, provides growth projection data.



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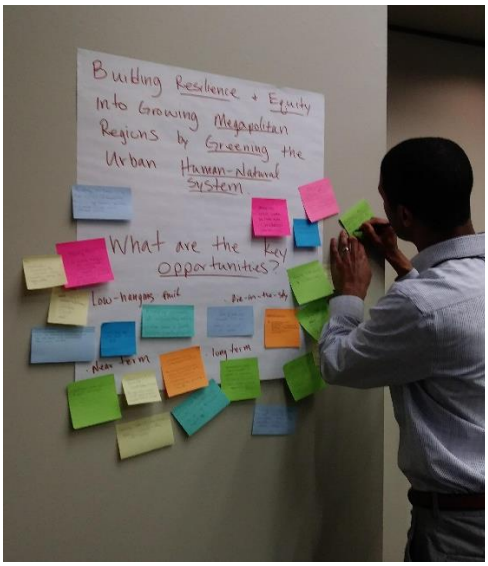

EQUITY & RESEARCH

Urban research needs to embrace the dichotomous and tensioned nature of displacement. This means understanding and explicitly investigating the winners and losers of any system change.

RESEARCH DIRECTIONS

Next generation urban research should focus on 1) the wealth of emerging data and the responsibility to use these data ethically, 2) the role that communities can play in helping shape urban research by using community members as partners, and 3) using adaptive management for the path towards a sustainable urban future.

EXECUTIVE SUMMARY

This NSF-funded Sustainable Urban Systems workshop focused on the concept of “urban greening” in megapolitan areas as a lens to understand change within our human and natural systems. Over 53 participants from academia, government, industry, non-profit organizations, and community groups came together to share insights ideas about how to improve urban sustainability. In exploring the concept of “greening,” participants grappled with issues of displacement, environmental injustice, and cumulative impacts, and explored the role of connectivity and resilience in shaping the future of urban and megapolitan systems. Threaded throughout these conversations were calls for tighter, more conscientious engagement between researchers and community members to pursue science that can meaningfully improve management and livelihoods.

Future research efforts will be able to collect and synthesize high-resolution data and knowledge across multiple scales.

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INTRODUCTION

In the United States, there are 10 interconnected metropolitan areas that encompass more than two-thirds of the total US population within roughly one-fifth of the total US land area[1]. Continued rapid urbanization and the mounting challenges associated with a changing climate will make it more difficult than ever to maintain and improve human health and well-being and advance equity within these "megapolitan" regions that encompass urban, suburban, and non-urban ecosystems and environments. A key feature of these megapolitan ecosystems is their adaptive potential and continual emergence of novel connections and feedbacks linking communities and the environment[2,3]. Our ability to create healthy, livable communities will depend on developing new knowledge and strategies to ensure these emerging connections and feedbacks evolve in an environmentally, socially, and economically sustainable and equitable manner. It is critical that we find ways to align urban development with cutting-edge science to ensure that the efforts and resources being committed to sustainability initiatives will produce positive, measurable impacts for both the people and environment in and surrounding urban centers.

EQUITY

Work is needed to understand how urban greening affects equity.

POLICY

For growth and sustainability, science-based policies are needed.

MEGAPOLITIAN

Rapid urbanization is occurring and creating more megapolitian regions.

One avenue for pursuing a more sustainable and just megapolitan future is through "green" solutions that explicitly consider the social and environmental impact of a given action or decision. This workshop used "urban greening" as a lens through

which to investigate the exogenous and endogenous challenges and changes in megapolitan areas, with a particular focus on the urban environment. Interest in "urban greening" accelerated in the 1980's and many cities now enjoy and pursue initiatives that encourage the widespread integration and acceptance of actionable green solutions into urban planning and development initiatives[4,5]. Today, there are many examples of cities and local governments pursuing sustainability through green solutions, whether by adding urban forests[6] and green stormwater infrastructure[7], designing sustainable transportation systems[8], or promoting low energy consumption buildings[9]. Yet, our scientific understanding of how these greening efforts support greater urban sustainability remains poor. Efforts are needed to 1) assess the environmental, economic, and social changes generated from, and needed to sustain, equitable green change in megapolitan regions, as well as 2) explore the unrealized potential of greening in the absence of a complete understanding of the connections and processes within an urbanizing system. To move these two efforts forward, interdisciplinary research and a research network structure that can facilitate the easy integration of information across scales and communities will be needed.

This document reports on an NSF-funded Sustainable Urban Systems workshop, held July 30 - August 1, 2019 in Seattle WA. Focused on megapolitan areas and the myriad urban, suburban, rural, and natural systems connections, this group explored the key issues and challenges associated with urbanization and the role of green solutions in realizing the sustainable potential of these interconnected systems. In this white paper, we give a brief overview of the workshop itself to provide context for the ideas, challenges, and opportunities discussed here. We highlight key research themes and issues identified as critical for advancing our understanding of sustainable urban systems during these discussions. Finally, we close with a number of suggestions for how this type of research could best be supported and implemented.

ENGAGING IN COMPLEX MULTI-PERSPECTIVE DIALOGUES

This multidisciplinary workshop aimed to identify 1) a set of critical research needs, 2) key partnerships required, and 3) optimal pathways forward for advancing sustainable urban systems research that has significant societal and environmental benefits. We hosted this event in Seattle, WA, which is nested within an emerging megapolitan region known as the "Emerald Corridor" that spans from Vancouver, BC to Portland, OR, and placed particular emphasis on engaging with a diversity of participants. In total, 53 people attended, representing academia (20), government (13), industry (6), and community/non-profit organizations (14).

The workshop structure was designed to encourage participant discussion and maximize the useful feedback to the workshop organizers. To accomplish this, we used panel and breakout group discussions and educational, collaborative games to explore the various challenges and potential pathways forward for improving urban sustainability at the megapolitan scale. Having people of color and members of other marginalized communities involved in planning as well as on the speaking agenda was critical for framing conversations not only about sustainable urban systems but also about social equity and justice. Results of this workshop structure and format resulted in some realized insights that inform not only the way we engage with urban experts and residents, but how future research should be advanced. **These results centered on 1) incorporating principles of environmental justice into research efforts, 2) fostering interdisciplinary and engaged approaches, and 3) building adaptive capacity.**

Workshop participants discussed strategies for resilient urban systems.

Working Towards A Just Future

Cities are inextricably connected to their human residents. Changes to the urban landscape, whether policy- or physically based, will necessarily also change the health and wellbeing of the people who live and work there. Given this close relationship, there is both a need for 1) a deeper conceptual and theoretical understanding of the complex changes urban development brings, and 2) a real need to pursue research that also aligns with urban community needs and interests, particularly those communities that have been socially marginalized. Funding agencies have historically shaped the first need, while the Environmental Justice Movement (EJM) and community organizers have been defining the second. At its core, the EJM seeks to reframe our understanding of sustainability by demonstrating how both environmental benefits and environmental risks are unequally distributed across race, class, gender, income level, and other social categories. This inequitable distribution, perpetuated by social and political structures, is pervasive. Examples include the co-location of waste sites and communities of color[10], reduced tree canopy in low-income areas[11,12], and increased asthma[13] and breast cancer rates[14] in communities of color. Understanding the reasons and impacts of these inequalities and what solutions are possible for providing a more environmentally just future will depend on scientists intertwining these needs into their research questions and agendas. Science that produces more just and positive impacts for communities who are unequally affected is foundational for advancing our conceptual knowledge of how to build sustainable urban systems. To this end, science that explicitly acknowledges these inequalities and engages affected communities is needed. By striving for a more just scientific process, results can both advance science and provide new knowledge or pathways forward to the community for improving their circumstances.

Expanding Beyond Interdisciplinarity Through Engagement

Urban systems are multi-dimensional, integrating a wide array of actors, institutions, geographies, scales, timeframes, and disciplines. Given the complex and diverse array of problems these systems create and experience, true interdisciplinary work, integrating not only physical and social science disciplines, but those of law, medicine, and the humanities will be needed. Combined efforts will offer much needed bottom-up and top-down perspectives that can bridge divides, answer questions, and generate creative, transformative solutions by integrating science across cultures, political boundaries, and natural systems. Yet in systems

where the landscape and the humans within it are so deeply intertwined, interdisciplinary work may need an additional component: community engagement. New research would benefit from more thoughtful incorporation of the voices and viewpoints of the residents who would be most directly impacted by the results and outcomes of any urban research. To facilitate this engagement, researchers should reduce any hardships that stakeholders may face through their participation (e.g., providing childcare, holding meetings outside of normal working hours, offering food, and compensating them for their time) and be prepared to include and value alternative and traditional forms of knowledge. Finally, building science informed by community input should not be a "one-way street." It will be essential for urban research to have strong, creative, communication strategies built in as a core piece of the overall research agenda to help stakeholders digest and interpret new knowledge and move beyond study results to construct novel, place-based solutions of their own design.

Participants work through The Game of Floods to explore a creative method for community input.

Building Adaptive Capacity

Urban systems are extremely dynamic and complex, and urban governing bodies could benefit greatly from conscientiously cultivating a culture that embraces greater adaptive capacity to help communities within a megapolitan region tackle positive transformation. Research that helps inform or build strategies for more deeply incorporating monitoring, modeling, experimentation, and assessment into urban design, governance, and culture would help communities better conceptualize their landscape, and how decisions made at one scale impact outcomes at other scales. To facilitate this more flexible framework of management, urban researchers should produce and share data and models that clearly capture changes in the state of the system at time and spatial scales that align with regulation, impact assessment, and planning to make results more useful to policy and decision makers. The knowledge produced from these research efforts should incorporate and reflect not only an updated, collective scientific understanding of urban systems but the environmental goals, institutional mandates, and social expectations generated by those embedded within the community. By encouraging research that includes multiple perspectives, knowledge from different domains can be used to build a more comprehensive, collective, and flexible understanding of how urban management should change, and can help ensure that when we transpose ecological metaphors of "resilience" (e.g., urban greening) onto culture and social systems, we do so in ways that are just and productive.

Marina Alberti from University of Washington provided a keynote on eco-evolutionary perspectives.

KEY THEMES AND ISSUES FOR ADVANCING SUS RESEARCH

Despite decades of discussion and experimentation aimed at tackling environmental degradation, social inequity, and urban sprawl, many of the outcomes of urbanization continue to negatively impact environmental health and human wellbeing. Outlined below are key themes and insights for the next generation of urban research identified by participants as critical for understanding the complex social and environmental impacts of urbanization.

Displacement

The concept of displacement is inherently intertwined with the process of change, impacting both humans and the natural environment in megapolitan systems. Displacement is commonly discussed within a negative discourse and is associated with issues ranging from homelessness, to rural subsummation, to urban biodiversity loss. In this workshop, discussions frequently pointed to the mounting evidence that adding green infrastructure within disadvantaged communities leads to gentrification. In particular, efforts made by cities to reintroduce ecosystem services in areas by adding trees and other green spaces, with the intention of mediating temperature extremes and control runoff, also serve to enhance the natural amenities of the community. In implementing green solutions, cities indirectly increase the property value and desirability of these areas, pricing existing residents out of their

Breakout groups discussed the roadblocks and opportunities in building sustainable urban systems.

own neighborhoods. Yet, displacement isn't inherently only a negative consequence of change. Keeping with this example, the removal of concrete and other impervious surfaces creates desired ecosystem responses that help naturally deal with temperature fluctuations and water quantity and quality issues that otherwise would require expensive technological or infrastructural solutions. In any system that is evolving, displacement will bring both positive and negative results that will be context-dependent, and scale-variable.

Cumulative Impacts and Co-Benefits

Small contributions, deletions, and alterations to a system may have little impact locally, but when assessed over longer time periods or larger spatial scales, can create measurable change, or *cumulative impacts*, that often result in unwanted or unintended outcomes. Cumulative impacts have long been acknowledged as important drivers of degradation in socio-environmental systems, including urban systems. Yet, our quantitative understanding of how and where these impacts accumulate in systems remains poor. As many urban communities embrace the "act local, think global" philosophy, new research needs to focus on the role that co-benefits from *coordinated*, small changes can have on achieving a wider set of urban sustainability goals through initiatives. These coordinated efforts are already happening in organizations like the 100 Resilient Communities or the World Mayors Council on Climate Change, therefore monitoring and assessing the impacts of these policies and changes will be vital. In moving from cumulative impacts to co-benefits, participants noted that such coordinated change would require new levels of data and knowledge integration across local, regional, and global scales, most likely utilizing new sensor technology and data mining efforts, and a mechanism by which these data would be made available to the local governments and communities who need this information to make informed on-the-ground decisions.

Key points:
***Displacement:* Urban research needs to work on human displacement. This means understanding and explicitly investigating the winners and losers of any system change and using this knowledge to focus on policies and sustainability efforts that can steer us onto equitable trajectories.**

***Cumulative Impacts:* Future research efforts will need to collect and synthesize high-resolution data and knowledge across multiple scales to better understand how changes within these systems propagate through space and time. These data and results must be accessible to decision-makers, who will be key for coordinating sustainable urban initiatives.**

Connectivity

The conference was held at theTalaris Conference Center in Seattle, WA, which was recently sold for development. This became a discussion point on urban land use.

Megapolitan centers represent a diverse landscape encompassing urban, suburban, rural, and natural areas, and provide a unique point of view for understanding the number and strength of economic, cultural, social, and environmental linkages between and within these different areas. Expanding our understanding of how not only social networks intersect, but how human and environmental systems interlink to facilitate or hinder change will be critically important for understanding how to propagate sustainable change through an urban system. In particular, funding needs to be directed towards research that helps us better understand how external impacts and drivers at different spatial or temporal scales propagate through megapolitan systems given varying degrees of internal connectivity, and how in turn megapolitan systems create impacts beyond their own boundaries (e.g., telecoupling). In particular, additional research that models and tracks how resources and ideas move through a complex urban-rural system over space and time would offer an entirely new perspective on urban dynamics. Additionally, research that explicitly focuses on how social and environmental justice issues (e.g., access to food, affordable transportation) could be addressed by mobilizing resources along or through networks that maximize solution effectiveness while minimizing unintended consequences would help decision-makers plan new, more just, policies.

Resilience: Who is Impacted and How?

Urban communities must continually react to an array of external and internal pressures, whether from population growth, a changing climate, political/cultural dynamics, or other influences as they strive towards a more sustainable, just future. Future research efforts focused on urban resilience will need to span multiple scales to detect or predict the cascading effects of current system pressures and management responses on future

sustainability goals. In addition, urban resilience research will need to address the existing dual meaning of "resilience", as this varies by discipline and is context sensitive[15]. For instance, while a resilient hydrologic system, which can withstand the effects of pollution or drought, is generally considered a positive attribute, creating or maintaining resilient systems of governance that marginalize or harm specific communities is a distinctly undesirable attribute. Future projects should work with communities to better monitor and interpret the nuanced and non-linear changes to social and environmental systems. This should include co-generating an understanding of urban system dynamics, as well as tools by which communities use this knowledge to identify where and when impending undesirable system changes will occur.

Key points:
Connectivity: ***New models that can map, interpret, and interlink information about social processes with natural processes will be critical for expanding our understanding of how human and natural systems function across the rural-urban continuum.***

Resilience: ***Funding opportunities must be designed to account for the dichotomous definition of "resilience". New theories, models, and empirical work that can track, quantify, and predict biophysical and human adaptive responses to change in urban environments need to explicitly incorporate concepts of environmental justice.***

IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

Challenges and opportunities are two sides of the same coin - challenges help us define opportunities to improve and move forward. When considered together, challenges and opportunities become springboards, revealing solutions to potential problems. This is particularly useful in a sustainable urban systems dialogue, where issues are complex and dynamic. The participants in this workshop suggest that integrating strategies to address the environmental justice issues that create sustainability roadblocks could very well be the launchpads from which new research questions and results create new pathways towards a sustainable megapolitan future. If considered a core component to any next generation urban research, this fundamental shift in approach could in turn lead to better science as community social resources are fully integrated into our conceptual understanding of urban systems. The following sections reflect where participants saw the biggest opportunities for urban research.

Facilitating Data-Driven Science and Policy

New technology and computing capabilities are allowing researchers to generate and collect data at scales, and in volumes, that are unprecedented. Modeling efforts that can incorporate these emerging and vast data resources will be particularly important for characterizing urbanizing areas, such as megapolitan areas, and for exploring the longer-term consequences or benefits of proposed sustainability policies or goals that are broadly focused or iterative in nature. These data in turn have the potential to support urban management at multiple levels, providing an informed understanding of potential costs and benefits, if they are harnessed and shared in ways that are accessible to the individuals or communities making on-the-ground decisions. At the same time, as remotely-collected, fine-resolution, data-intensive approaches become more commonplace, social scientists and ethics scholars will need to explore how these data can be used to address societal problems while protecting the privacy and welfare of the urban subjects. Meanwhile, students and scientists must be taught computational techniques for analyzing big data sets, and new analysis techniques must be identified and developed appropriately for data-intensive research.

Sustainable urban systems need trees and places for people to walk.

Community Engagement

Any research that has the potential to impact a human community should secure the support of those who would be potentially affected by the study and its results. This means researchers will need to invest in relationship-building interactions well in advance of proposal development to identify and earn the trust of key contacts or representatives for the system of study, show the demonstrated relevance of the project and its outcomes to all groups affected, and, as desired, include the community in the development of the research questions, methods, analysis, interpretation, and dissemination of results. Decisions that are made without consideration of these community perspectives

can lead to mistrust and create perceptions of exclusion. This can have a direct impact on research, as past efforts to “green” or “revitalize” disadvantaged communities have been met with skepticism or distaste when residents were poorly engaged or consulted. To help ensure awareness and inclusion, researchers should plan to identify and bring all the appropriate stakeholders, groups, and constituencies to the table- beginning with a firm understanding of who the partners are going to be and how they will be identified. Urban residents and leaders are often intimately familiar with the problems of their communities in ways researchers are not. Intentional, early, and respectful engagement with these community experts can provide valuable insights into how new research problems should be addressed, helping identify hidden or subtle drivers or system processes that shape urban problems. Engagement can also help researchers identify strategies for making their work meaningful to the community. When appropriate, having community members help generate and guide research questions could advance science in novel ways while potentially providing real benefits to the systems studied. Finally, it should be reiterated that urban systems are human systems. Engagement should not simply manifest as “compensation” for underrepresented groups, but acknowledge traditional forms of knowledge, and build trans-disciplinary, trans-sectoral collaborations throughout the lifespan of the project.

Breakout groups during the workshop discussed the major knowledge and implementation gaps in involving communities.

Adaptive Management

Given the complexity of urban systems and our limited ability to assess future conditions, an adaptive management framework that embraces a culture of learning- including a willingness to be flexible and try new approaches to complex challenges- is critical. Cultivating functional and mutually respectful partnerships between researchers and community members will be important, especially for building new knowledge and models of how biophysical and policy changes propagate and alter urban systems. It will be the responsibility of the researchers to develop new ways to translate science to managers, and the community leadership to maintain an openness to scientific input and the opportunity to explore bold ideas that have potential to positively transform human wellbeing and environmental health in urban systems and across the megapolitan divides (e.g., urban-rural, cultural, socio-economic status). The successfulness of such a partnership will depend on whether the key players and important boundary-spanning agents within and across systems can be identified, and where and how information is being exchanged. Such relationships would be critical for translating scientific results to communities while providing mechanisms by which researchers could identify critical "friction spots" within urban systems where opportunities for improved, coupled, environmental, technological, and institutional development is possible, and where enhanced coordination and cooperation among urban residents and the scientific community may be valuable.

Key points from Challenges and Opportunities:

- ***Significant and fundamental institutional and technological advances, as well as funding, are needed to productively harness existing and emerging data to advance our understanding of urban systems and improve decision-making.***

- ***Funding agencies should offer more planning grant awards and opportunities to better support and legitimize relationship-building efforts between researchers and the communities they study. Additionally, requirements for a Community Engagement Management Plan (similar to a Data Management Plan) could help ensure researchers are using ethical, sensitive, and well-planned strategies for studying and testing innovative solutions in urban -* human- *communities***

- ***Supporting research that embraces adaptive management, and in particular, projects that build models, tools, or develop other mechanisms that help foster an adaptive management mindset by the communities studied, will help build a new culture of openness to learning and experimentation.***

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