

RESILIENT FUTURES

URBAN SYSTEMS LAB
PROGRAM REPORT
2021

THE
NEW
SCHOOL

URBAN
SYSTEMS
LAB

ABOUT THE URBAN SYSTEMS LAB

The planet is rapidly urbanizing, placing tremendous pressure on cities and urban areas to provide good and just living conditions for the majority of humanity. Ensuring a resilient and equitable future means addressing challenges of climate change, ecological degradation, and social justice simultaneously maintains Earth's biodiversity and crucial ecological processes is essential to transform cities towards sustainability.

Since 2015, the Urban Systems Lab has advanced urban systems research to support development of systemic solutions to social and environmental challenges driving inequity in urban areas. As an interdisciplinary research, design, and practice space at The New School

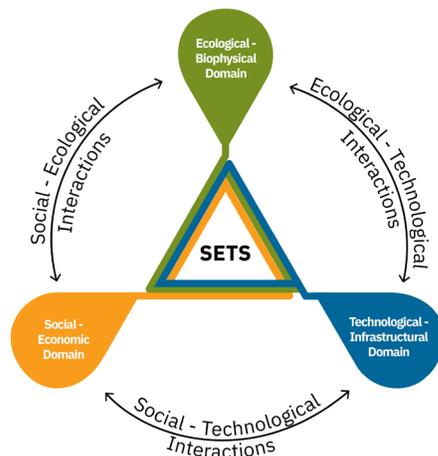
we provide analyses, data, and insights for developing more equitable, resilient, and sustainable cities. Our work spans a variety of issues including urban climate resilience, nature-based solutions, big data and artificial intelligence, data visualization and design, urban ecology, environmental justice and equity, and urban policy and planning.

In this year-end report for 2021, learn more about how we bring together designers, urban ecologists, scientists, researchers, and policymakers with the goal to improve the lives of those most vulnerable and to enhance decision making and science communication from local to global scales.

MESSAGE FROM THE DIRECTOR

I founded the Urban Systems Lab in 2015 as an interdisciplinary research, design and practice space at The New School that examines the urban systems interactions that drive persistent patterns and challenges in cities. Our goal is to create a space that is fundamentally based on systems thinking, and that can advance qualitative and quantitative scientific methods, design and data visualization, and an urban systems theory to provide new insight into developing more equitable, resilient, and

sustainable cities. The USL's impact on both a global and local level has grown quickly in a short time and has achieved national and global recognition while also providing a relevant resource for our university community across disciplines and backgrounds. The future vision of the USL is to advance many of the areas we are currently conducting research on, but to also better leverage our vast network of community partners, City and regional stakeholders.



Timon McPhearson

Director, Urban Systems Lab

Associate Professor of Urban Ecology, The New School

Senior Research Fellow, Cary Institute of Ecosystem Studies

Associate Research Fellow, Stockholm Resilience Centre

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OUR WORK



The Nature-based solutions for Urban Resilience in the Anthropocene (NATURA)

Team: Timon McPhearson, Chris Kennedy, Loan Diep, Yeowon Kim, Elizabeth Cook (2020 - 2024)

The NATURA project links networks in Africa, Asia-Pacific, Europe, North and Latin America, and globally to enhance connectivity among the world's scholars and practitioners and improve the prospects for global urban sustainability.

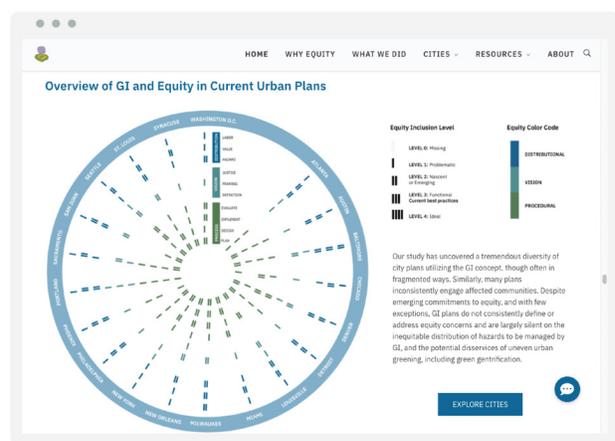
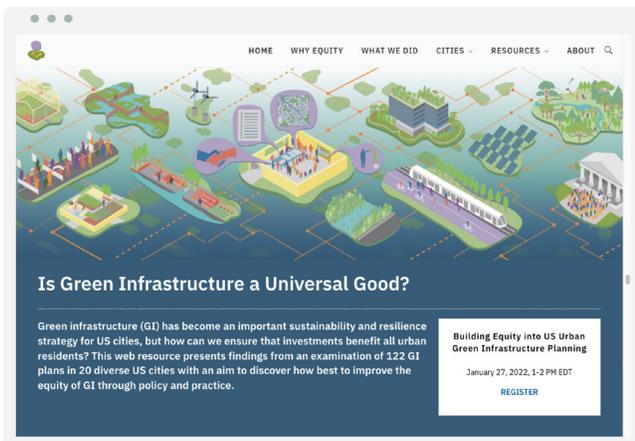


Since launching in 2019, NATURA has seen significant growth and movement with networks increasing from 26 to 43. The regional nodes groups also increased their members and the Early Career Network increased by 25% (now 83 members). We also established 2 thematic working groups: 1) Urban Ecological Resilience and 2) NBS Global Roadmap. In total, 19 networks have presented to the NATURA community in monthly webinars with attendance commonly 30-50 people.

In 2021, we launched a series of Early-Career Fellowships, a paid 6- or 15-week opportunity for research and networking at collaborating network institutions. At the Urban Systems Lab we hosted 2 Fellows, Melissa Ingaruca Moreno and Clair Cooper. Melissa's work explores the transformative potential of urban nature-based solutions (NBS), and seeks to develop a SETS-based theoretical framework to assess the potential of urban NBS innovations. Clair is

investigating the role of social media data in the evaluation of relationships between nature-based solutions and health. This past year NATURA also launched a new program to support student research on nature-based solutions and to advance knowledge production across the networks.

In February 2021, we joined The Nature of Cities Festival to create a unique forum to host our Virtual All-Hands Meeting (VAHM) February 22-26, 2021 with the USL's Timon McPhearson as a Keynote Speaker. His talk was titled: "Global insights and challenges on Nature-based solutions for urban climate resilience." The festival included programming across five regional time zones, focused on facilitating transdisciplinary dialogue, small group workshops, and arts engagement. As part of the NATURA initiative, USL members participated in special Seed sessions and panel discussions.



Is Green Infrastructure a Universal Good?

Team: Z Grabowski, Timon McPhearson, Pauline Munga, Chris Kennedy (2019 - 2021)



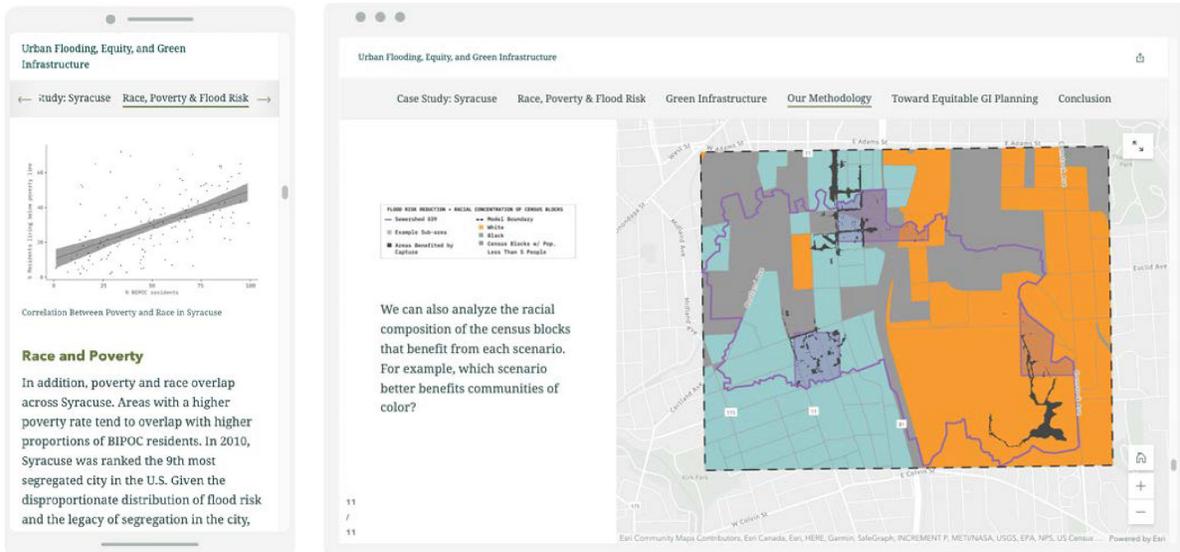
Is Green Infrastructure a Universal Good? is a collaboration with the Cary Institute examining green infrastructure city plans in 20 U.S. cities with the goal of understanding how best to improve the equity of green infrastructure through policy and practice. The project includes an interactive website and toolkit for city planners, researchers and others to use in considering the equity dimensions of future green infrastructure planning.

In 2020, the USL co-lead the development of a website to share findings from an examination of 122 GI city plans in 20 diverse US cities. The goal is to improve how GI planning and policy addresses equity. In collaboration with researchers at Cary Institute for Ecosystem Studies the team conducted a nationwide review of plans to identify how cities plan for green infrastructure, including how it is defined, along with its intended functions and benefits.

The study uncovered a tremendous diversity of city plans utilizing the GI concept, though often in fragmented ways. Similarly, many plans inconsistently engage affected communities. Despite emerging commitments to equity, and with few

exceptions, GI plans do not consistently define or address equity concerns. While many plans focus on managing hazards and providing amenity value, they are largely silent on their current inequitable distributions. A major emerging concern, that of green gentrification, is also largely absent from current planning efforts. To share findings from the research, the USL led the development of a web resource, www.giequity.org, which highlights major findings, recommendations, and other resources.

Visit giequity.org to learn more



Environmental Justice of Urban Flood Risk and Green Infrastructure Solutions

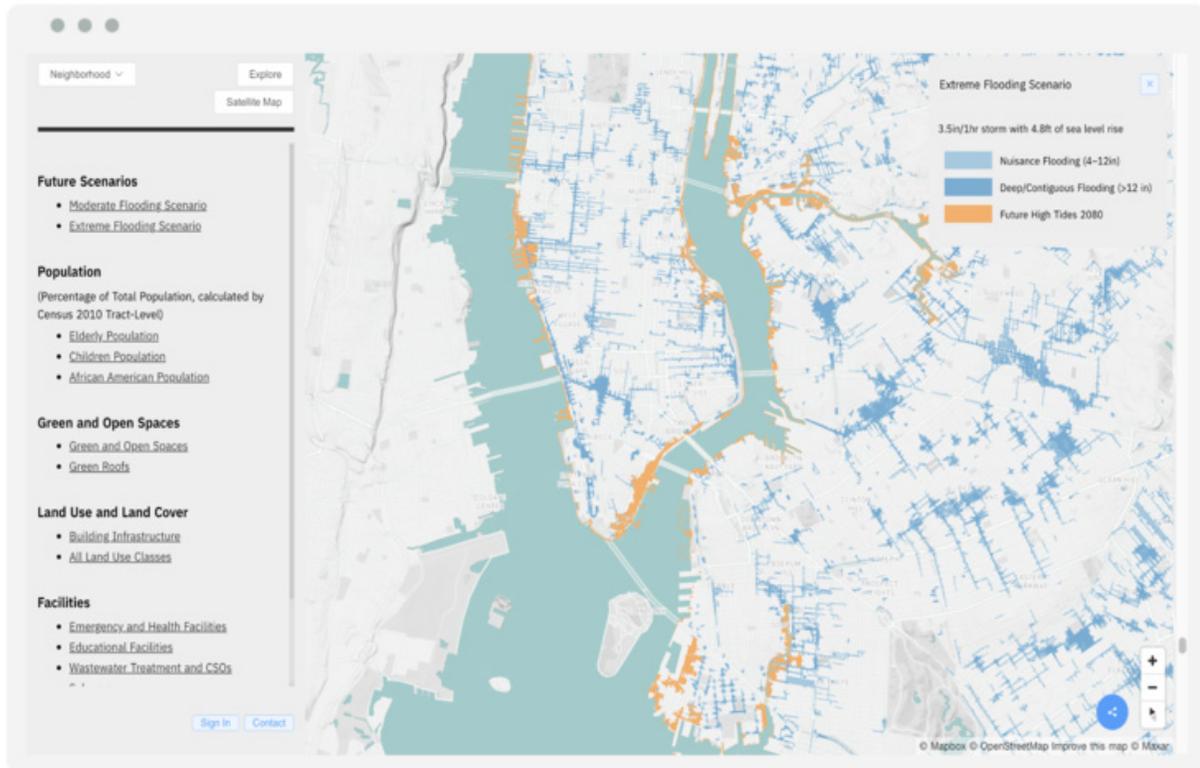
Team: Pablo Herreros-Cantis, Elizabeth Cook, Timon McPhearson, Claudia Tomateo, Chella Strong (2019 - ongoing)

THE
KRESGE
FOUNDATION

The Environmental Justice of Urban Flood Risk and Green Infrastructure Solutions project aims to better understand the environmental justice impacts of climate change related flooding on minority and low-income communities and assess social equity in green infrastructure planning for reducing urban flood risks.

This year, the USL has worked closely with the Kresge CREWS network, local NGOs and stakeholders to better understand the environmental justice impacts of climate change related flooding and how green infrastructure (GI) can be used to address disproportionate impacts of urban flood risk. In 2021, building on a hydrodynamic modeling approach called CityCAT, the team continued to model urban flood risk in the cities of Yonkers, NY, Milwaukee, WI, Elizabeth, NJ, and Syracuse, NY. The results highlight uneven distribution of benefits and services of GI and a range of

environmental justice concerns related to urban flooding, and highlight clear distributional trends across communities of color and low income communities. In the second half of 2021, the USL was awarded a 1 year renewal grant to continue working with partner organizations and NGOs. Our efforts have focused on supporting the work of Groundwork Hudson Valley and Groundwork Milwaukee, as well as building on a research study co-led by the Cary Institute on the equity of green infrastructure in US cities.



NYC Stormwater Resiliency & Stormwater.nyc



Team: Timon McPhearson, Daniel Sauter, Claudia Tomateo, Elizabeth Cook, Veronica Olivotto (2018 - 2020)

The NYC Stormwater Resiliency Study is a joint effort with New York City governmental stakeholders, including the NYC Department of Environmental Protection (DEP), Mayor’s Office of Resiliency (MOR), and Emergency Management (NYCEM).

In 2021, building on previous work with the Mayor’s Office of Climate Resiliency and NYC DEP, the USL contributed to the development of the first city-wide Stormwater Resiliency Plan for New York City. The Plan includes a city-wide analysis of flooding caused by extreme rainfall events. The Urban Systems Lab along with researchers at Brooklyn College co- led the development of the first phase of a hydrologic model of flooding and simulation of citywide flood exposure for

twenty current and future storm scenarios as part of the Town + Gown Taskforce. As part of this effort, the USL has launched stormwater.nyc a 3D data visualization mapping platform that integrates publicly available data on stormwater resiliency in NYC. The USL’s Dataviz team recently added new exposure scenarios maps, which we hope will provide a multi-hazard risk decision-support tool to improve resiliency prioritization.



Converging Social, Ecological, and Technological Infrastructure Systems (SETS) for Urban Resilience

Team: Timon McPhearson, Ahmed Mustafa, Luis Ortiz, Jen Ventrella, Daniel Sauter (2019 - 2024)

This project is a 5 year initiative to accelerate advances in convergent urban systems science capable of providing cities with the knowledge and methods for building integrated SETS resilience strategies to extreme events.



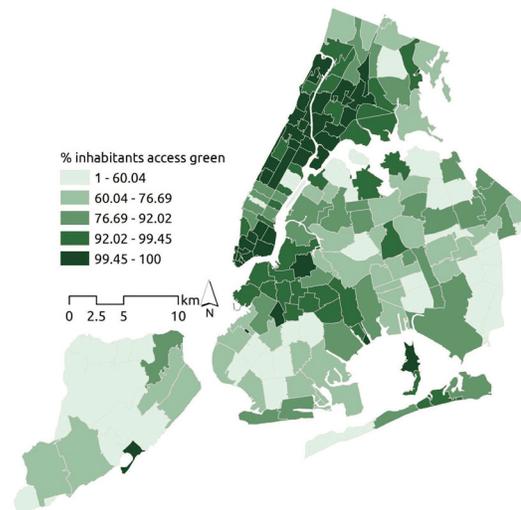
Now in its second year, the SETS Convergence research team, a collaborative effort between the Urban Systems Lab, Arizona State University, Barnard College, Georgia State University, and US Forest Service completed Phase I of the project, and was approved to proceed with Phase II. During 2021, the team developed and advanced the SETS resilience theory through capacity building meetings, team charrettes, and place-based research projects. This has produced a more critical perspective on how to navigate each domain's capabilities towards appropriate adaptation in cities. The convergence team also developed an approach for analysis and integrative assessment to evaluate SETS domains, resilience, equity, and sustainability of future scenario visions. They analyzed San Juan and Phoenix scenarios and used the results with San Juan stakeholders to plan transitions towards flood resiliency with the Alianza por la Cuenca del Río Piedras.

In parallel with ongoing infrastructure analysis and modeling, the team continues to update and enhance the USL's Data Visualization Platform, an interactive web application to advance SETS understanding of each GCR city. We now show map

layers to delineate NYC's water and power infrastructure; digital elevation models and buildings across all cities to provide location context for SETS indicators and the ability to compare and contrast across map layers. In the Fall of 2021, the NYC team worked with the Mayor's Office of Climate Resiliency (MOCR) to develop long-term future visions, bringing together multiple agencies and stakeholders that represent S-E-T perspectives. The process, including the goals and outcomes, has been co-developed with the MOCR team and builds on ongoing NYC climate resilience initiatives. The MOCR plans to integrate the co-produced visions into their upcoming Climate Adaptation Roadmap, which will be presented as guidance to the incoming Mayoral administration. As part of this initiative USL Fellow Jennifer Ventrella was awarded an NSF INTERN award, two years in a row, to support coordination and work with the MOCR team. Additionally, members of the Convergence team are collaborating with the NYC Panel on Climate Change (NPCC) to assist in the next phase of their climate risk modeling and the Environmental Justice Advisory Board to integrate environmental justice into NPCC.

Perception and Use of Urban Greenspace in NYC during COVID-19

Team: Timon McPhearson, Ahmed Mustafa, Bianca Lopez, Chris Kennedy (2020-22)



With support from the New York State Foundation, the USL continued to conduct research on the perception and use of urban green spaces (UGS) during COVID-19 in NYC. The team completed an analysis of key findings from a social survey deployed in the Spring of 202 and published in a peer-reviewed article in the journal *Urban Forestry & Urban Greening*. The study finds many people recognize the importance of UGS for their health, and that this recognition has increased since the start of the pandemic. However, results of the survey also showed that concerns about the safety of visiting UGS, a lack of UGS access, and a paucity of desired features can discourage people from using UGS and gaining associated health benefits. This may potentially further exacerbate the long-term negative health effects of the pandemic and disproportionate effects on Black, Latinx, and other often-marginalized groups.

The USL team also conducted a spatial analysis drawing from data collected from

the social survey. We further explored the correlation between spatial access to UGS and fifteen social vulnerability variables including economic status, household composition, minority status, and housing type for different zip codes. The results show that geographical proximity variables can predict a number of the perceived access variables, particularly those related to COVID-19 measures. This is significant as our analysis revealed that UGS size is a critical factor as is the travel distance, in understanding the characteristics and influencing factors of visitation and use.

This work leveraged National Science Foundation RAPID funding, which resulted in a study examining social vulnerability and COVID-19 in NYC. In 2021, the results were published in the *Journal of Extreme Events* in the article, "Pandemic Injustice: Spatial and Social Distributions of COVID-19 in the US Epicenter". This paper is now one of the most read articles over the past three years.

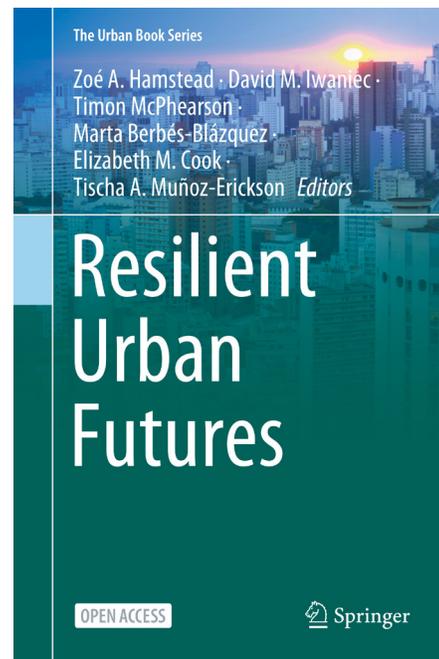
RESEARCH AND SCHOLARLY IMPACT

BOOKS AND BOOK CHAPTERS

Resilient Urban Futures

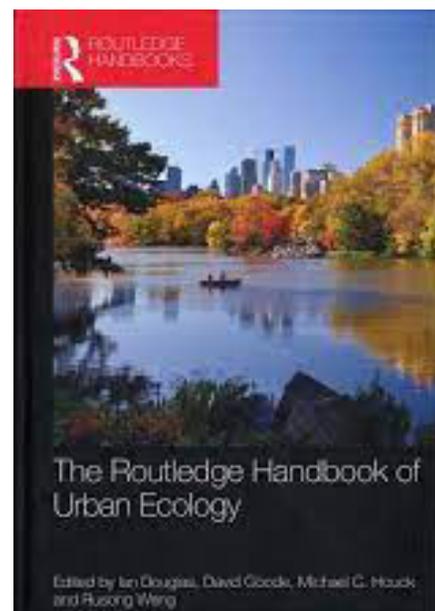
Resilient Urban Futures is an open access book that addresses the way in which urban and urbanizing regions profoundly impact and are impacted by climate change, and how cities develop anticipatory and long-range planning capacities for more resilient futures. Based on practical experience in participatory visioning in nine Latin American and U.S. cities, the volume provides tools for engaging urban communities in resilience strategies.

Editors: Zoé A. Hamstead, David M. Iwaniec, Timon McPhearson, Marta Berbés-Blázquez, Elizabeth M. Cook, Tischa A. Muñoz-Erickson



A Transdisciplinary Urban Ecology Approach to Complex Urban Systems

USL Faculty Fellow, Elizabeth Cook and Timon McPhearson are co-authors of a new book chapter “A Transdisciplinary Urban Ecology Approach to Complex Urban Systems” in *The Routledge Handbook of Urban Ecology*.



The Case of Green Infrastructure in NYC: Ecological spontaneity and infrastructuralization in the context of settler colonialism, capitalism, and white supremacy

The USL's Z Grabowski, Timon McPhearson, Katinka Wijsman, Luis Ortiz, and Pablo Herreros are co-authors of "The Case of Green Infrastructure in NYC", In *Regió Metropolitana de Barcelona - Reptes i Oportunitats de la Infraestructura Verda Metropolitana* edited by Joan Marull, María José LaRota-Aguilera i Joan Pino. l'Institut d'Estudis Regionals i Metropolitans de Barcelona, Barcelona.



FEATURED JOURNAL ARTICLES

Zhou, W., Huang, G., Pickett, S. T. A., Wang, J., Cadenasso, M. L., McPhearson, T., Grove, J. M., & Wang, J. (2021). Urban tree canopy has greater cooling effects in socially vulnerable communities in the US. *One Earth*, 4(12), 1764–1775. <https://doi.org/10.1016/j.oneear.2021.11.010>

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Pineda-Pinto, M., Herreros-Cantis, P., McPhearson, T., Frantzeskaki, N., Wang, J., & Zhou, W. (2021). Examining ecological justice within the social-ecological-technological system of New York City, USA. *Landscape and Urban Planning*, 215, 104228. <https://doi.org/10.1016/j.landurbplan.2021.104228>

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H., Niemelä, J., McPhearson, T., Moomaw, W. R., Parnell, S., ... Tan, P. Y. (2021). Integrating solutions to adapt cities for climate change. *The Lancet Planetary Health*, 5(7), e479–e486. [https://doi.org/10.1016/S2542-5196\(21\)00135-2](https://doi.org/10.1016/S2542-5196(21)00135-2)

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McPhearson, T., Grabowski, Z., Herreros-Cantis, P., Mustafa, A., Ortiz, L., Kennedy, C., Tomateo, C., Lopez, B., Olivotto, V., & Vantu, A. (2021). Pandemic Injustice: Spatial and Social Distributions of COVID-19 in the US Epicenter. *Journal of Extreme Events*, 2150007. <https://doi.org/10.1142/S234573762150007X>

McPhearson, T., M. Raymond, C., Gulsrud, N., Albert, C., Coles, N., Fagerholm, N., Nagatsu, M., Olafsson, A. S., Soininen, N., & Vierikko, K. (2021). Radical changes are needed for transformations to a good Anthropocene. *Npj Urban Sustainability*, 1(1), 1–13. <https://doi.org/10.1038/s42949-021-00017-x>

Lopez, B., Kennedy, C., Field, C., & McPhearson, T. (2021). Who benefits from urban green spaces during times of crisis? Perception and use of urban green spaces in New York City during the COVID-19 pandemic. *Urban Forestry & Urban Greening*, 127354. <https://doi.org/10.1016/j.ufug.2021.127354>

Herreros-Cantis, Pablo, Veronica Olivotto, Zbigniew Grabowski, and Timon McPhearson. (2020). “Shifting Landscapes of Coastal Flood Risk: Environmental (In)Justice of Urban Change, Sea Level Rise, and Differential Vulnerability in NYC.” *Urban Transformations* 2:9. <https://doi.org/10.1186/s42854-020-00014-w>

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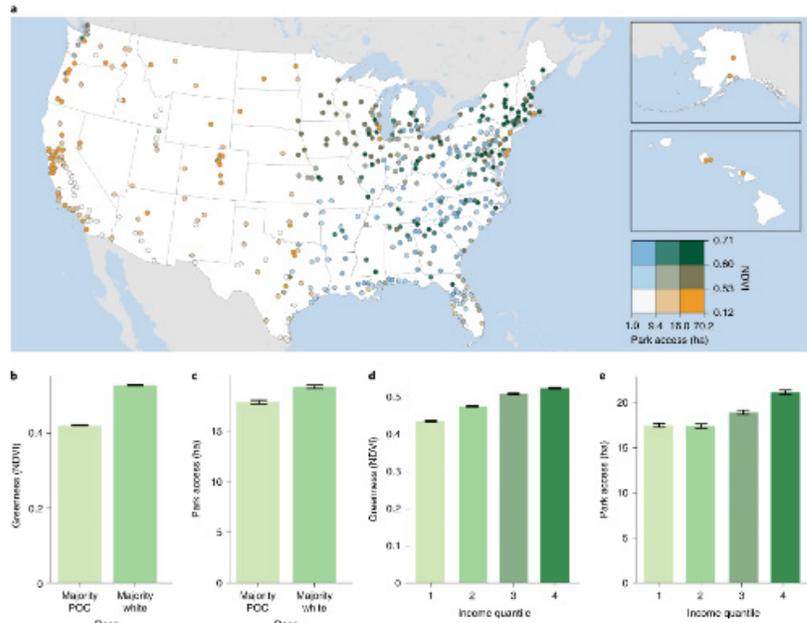
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Mustafa, A., Ebaid, A., Omrani, H., & McPhearson, T. (2021). A multi-objective Markov Chain Monte Carlo cellular automata model: Simulating multi-density urban expansion in NYC. *Computers, Environment and Urban Systems*, 87, 101602. <https://doi.org/10.1016/j.compenvurbsys.2021.101602>

RESEARCH HIGHLIGHTS

New Analysis Links COVID-19 to Nature Inequity, Showing Communities of Color

Researchers at the San Francisco Estuary Institute, The Nature Conservancy, and the Urban Systems Lab, publish a new study in the journal *Nature Sustainability* showing communities of color have both higher burdens of Covid-19 and less green vegetation, and trees in their neighborhoods across all urbanized areas in the United States. Most surprisingly, the study found that even after statistically controlling for race, income, and a host of other factors, more greenness is



associated with lower Covid-19 rates. This is one the first national studies that makes this relationship crystal clear.

New International Study on Climate Adaptation Solutions for Cities

The USL's Timon McPhearson is a co-author of a new research study, "Integrating solutions to adapt cities for climate change" published in the *Lancet Journal of Planetary Health*. The study led by Dr. Brenda Lin highlights the need for more systematic research on integrated climate solutions for urban contexts. They examine 3 city cases

including Freiburg, Germany; Durban, South Africa; and Singapore. The article concludes with a discussion of future challenges, and recommendations for implementing climate adaptation solutions that integrate the goals of improving liveability, sustainability, and equality in cities around the world.

National Study of Green Infrastructure Planning Finds Environmental Justice Rarely Including In Plans

An interdisciplinary team of researchers has completed one of the most comprehensive studies of green infrastructure (GI) planning in the U.S. to date. Building on a novel dataset of 119 planning documents from 19 U.S. cities, a team from the The National Socio-Environmental Synthesis Center, Arizona

State University, The Cary Institute of Ecosystem Studies, and The New School's Urban Systems Lab examine the justice implications of criteria used in the siting of GI projects. The team found that only 1.2% of all criteria in the GI plans considered issues of environmental justice or equity. More here in this press release.

Research on frameworks that seek to advance global urban science

The USL's Timon McPhearson is featured in a news release from the American Association for the Advancement of Science detailing his work with The Cary Institute of Ecosystem Studies' Steward Pickett and Weiqi Zhou at the Research Center for Eco-Environmental Sciences of the Chinese Academy of Sciences

in Beijing. Together they examine five leading frameworks that seek to advance global urban science. Their synthesis refines our capacity to understand urban systems, ranging from cities to urban regions, by facilitating the interdisciplinary science needed to achieve sustainability and improve human and environmental

Mapping of NYC's Urban Ecosystem Services Reveals Significant Supply-demand Mismatches And Raises Environmental Justice

A new study led by Research Fellow Pablo Herreros-Cantis, "Mapping supply of and demand for ecosystem services to assess environmental justice in New York City" reveals significant supply-demand mismatches for ecosystem services that raises critical environmental justice concerns citywide. The research team set out to spatially map and examine both the supply and demand for urban ecosystem services (ES) in NYC, or the benefits that parks, open spaces, and urban green infrastructure can provide to communities.

The authors explain how certain socio-demographic groups are, through historical racism and other legacies of environmental and social injustice, more prone to having their needs for ecosystem services unsatisfied. They conclude that without improved analysis of current mismatches, greening investments may exacerbate or even replicate historical and current environmental injustices and inequalities in American cities. More detail here in this press release.

An Anthology Of Ideas After Hurricane Ida

In the aftermath of Hurricane Ida Rebuild By Design asked 20 experts to offer “concrete ideas of policies and projects that protect our communities from the flash flooding and loss of life which we experienced from Hurricane Ida.” In

the report the USL’s Timon McPhearson emphasizes the need to invest in data to improve stormwater resiliency, along with essays from colleagues across the New York metro region. Read the report [here](#).

New Journal: npj Urban Sustainability

The USL’s Timon McPhearson is an Associate Editor of a new peer-reviewed journal npj Urban Sustainability. The journal will publish inter-and cross-disciplinary research into how cities are reshaping and

are being reshaped to meet major economic, social and environmental challenges, including how digital tools and big data are playing an increasing role in this shaping.

New Reports on Nature-based Solutions: the Green Economy and Valuing Inclusion and Diversity, Embracing Uncertainty

The USL’s Timon McPhearson is a contributor to 2 new reports issued by The British Academy on how nature-based solutions may contribute to a green economy, and also strategies to promote their wider uptake to address pressing

interlinked climate and biodiversity challenges. Read “Valuing Inclusion and Diversity, Embracing Uncertainty: Ways Forward for Nature-based Solutions” by Linjun Xie, and “Nature-Based Solutions and the Green Economy” by Leslie Mabon.

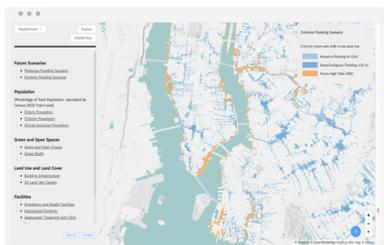
Research on MillionTreesNYC Afforestation Study in NYC

A new article was published in the journal Urban Forestry & Urban Greening, “Soil carbon sequestration in urban afforestation sites in New York City” led by Alisen Downey and members of the USL. The article highlights over 10 years of urban ecology research on the impact of the MillionTreesNYC program on soil carbon sequestration and afforestation urban restoration in urban areas. The study

integrates soil carbon readings gathered from sites established between 2009 and 2011 as part of the MillionTreesNYC Afforestation Project in New York City. The results suggest that afforestation may enhance the capacity of urban soils to store carbon compared to urban degraded soils, but that urban soil properties and site characteristics constrain this capacity.

PRODUCTS

Stormwater.nyc



Stormwater.nyc is a data visualization mapping platform that integrates publicly available data on stormwater resiliency in NYC, with population demographics, land use/cover data layers, location of critical infrastructure and greenspaces, and the New York Panel on Climate Change’s floodplain maps. To date, no other mapping platform has been developed that provides the ability to compare and contrast the potential social and infrastructural risk of future flooding scenarios in NYC. Over 2021, our data visualization team improved the functionality of the platform to allow toggling between data layers to better interact with the scenarios and social and infrastructural information. The aim is to provide a multi-hazard risk decision-support tool to improve resiliency prioritization and to create a central node for considering the interdependent and cascading risks that multiple climate hazards and threats have on NYC’s diverse communities.

Ekos: The Path to Resilience



Ekos: The Path to Resilience is a multiplayer board game that challenges a group of six community members — a Mayor, City Planner, Community Organizer, Ecologist, Designer, and Modeler — to come together and envision a more equitable and sustainable Ekos in the face of climate change and other challenges. During the game of Ekos, players alternate between building SETS and responding to moderate and extreme events. Working cooperatively to challenges earns you Sustainability, Equity, and Resilience points. Ekos was developed with the goal of creating a playful platform for individuals and communities to discuss and learn about issues of urban resilience, climate governance, and community based codesign. The Ekos team is actively working on developing a facilitators guide and curricular resources to support learning about the game’s key concepts. Since launching the game in 2021, we have reached communities in India, Japan, Belgium, Chile, Canada and the US.

Ocellus XR

Team: Daniel Sauter, Timon McPhearson, Saloni Shah, John Outwater, Emily Bowe, Peilu Fan, Yahnze Wu (2018 - ongoing)

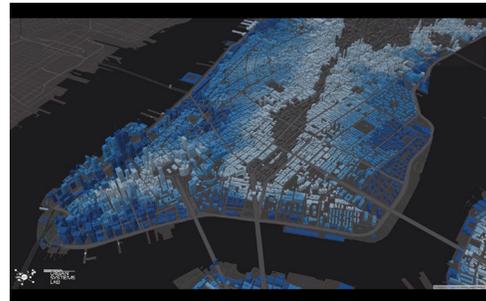


The Climate Equity XR app provides interactive geospatial maps and 3D visualizations of heat, flood risk, and other climate risk indicators in NYC. It experiments with augmented reality layers that allow you to project interactive maps onto a physical surface and explore your urban environment from a mobile-first data-driven SETS risk and resilience environment from wherever you are in the city.

The Climate Equity XR team has made significant progress in developing the XR app. The Lab hired 2 new research assistants from the Parsons School of Design - Elene Peng and Jeremy O'Dell to assist project directors Timon McPhearson and Daniel Sauter. The team is currently planning a beta launch of the app, which will include location-based map visualizations, augmented reality experiences, and a UX design framework that will help participants learn more about New York's climate hazards and potential solutions.

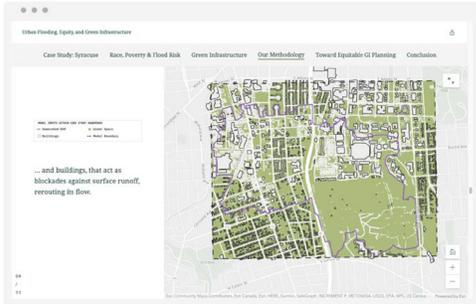
Ocellus

Team: Daniel Sauter, Timon McPhearson, Joseph Steele, Claudia Tomateo



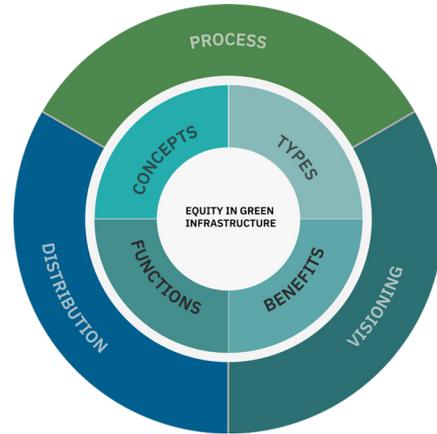
Ocellus is the USL's Data Visualization Platform, an interactive web application that visualizes Social, Ecological, and Technological Systems (SETS) data. The platform was designed and implemented initially for nine different cities within the Urban Resilience to Weather-related Extremes (UREx) Sustainability Research Network. It was conceived as a tool to produce knowledge, bridging the gap between quantitative social, ecological and infrastructure data, and the rich and layered qualitative insights compiled at local stakeholder future visioning workshops. In 2021, research technician Joseph Steele and Associate Director Daniel Sauter worked closely with the NSF Convergence teams to add data layers to the Phoenix, Atlanta, Baltimore and New York City pages. An "explore" button was also added allowing users the additional capability of viewing multiple data layers simultaneously. The team is working closely with Research Fellow Claudia Tomateo to develop an improved user experience and interface that will help inform the experience and capability of the platform.

ArcGIS Storymap: Urban Flooding, Equity and Green Infrastructure



The USL has continued to leverage the suite of tools offered by ESRI's ArcGIS program, including Stormaps or narrative driven web projects that integrate data and storytelling. For the Kresge support Environmental Justice of Urban Flood Risk project, the team developed a new storymap “Urban Flooding, Equity, and Green Infrastructure: Syracuse as Case Study”. The storymap explores the ambitious GI program that Onondaga County has successfully implemented targeting the city’s water quality problems related to the Combined Sewer Overflows (CSO) caused by its Combined Sewer System. We also discuss shortcomings of these efforts related to concerns about inclusion of flood risk reduction and need for more explicit environmental justice (EJ) considerations.

Is Green Infrastructure a Universal Good?



Researchers from Cary Institute of Ecosystem Studies and Urban Systems Lab analyzed 122 green infrastructure plans from 20 US cities to reveal how urban planning has contributed to current landscapes of inequality, and what avenues exist to transform planning for equitable infrastructure. To present findings from the study, the USL developed GIEquity.org, a new website identifying current approaches, gaps, and necessary transformations in urban green infrastructure planning. The website includes an in-depth look at each city studied, including green infrastructure history, a snapshot of key findings, maps, a GI equity score, and targeted recommendations for stakeholders, community groups, policymakers and planners, as well as foundations and funders.

www.giequity.org

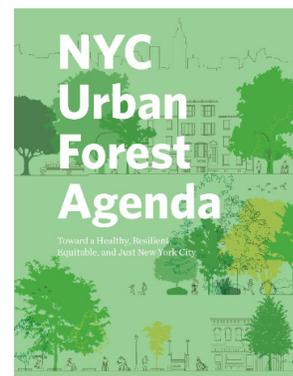
PARTNERSHIPS AND PUBLIC ENGAGEMENT

USL Joins the Zolberg Institute's Cities and Human Mobility Research Collaborative

As part of the Zolberg Institute's Cities and Human Mobility Research Collaborative the USL's Timon McPhearson began working with research partners to provide new analysis and estimates on environmental migration and climate-driven mobility at the subnational level in Latin America and the Caribbean (LAC), and sub-Saharan Africa. The goal is to facilitate the collection, analysis, and dissemination of territorial data on migrants, as a way to improve the capacity of subnational entities in the formulation of public policies for their integration and protection, as well as granular systematic data on environmental mobility patterns, identifying the policy-relevance and role of organized community groups.



Forest For All NYC, Urban Forest Agenda



With support from the NYS Health Foundation the USL team contributed to The Nature Conservancy of New York's NYC Urban Forest Agenda and joined the Forest For All NYC consortium. The NYC Urban Forest Agenda is a roadmap to protect, maintain, expand, and promote the New York City urban forest to benefit all New Yorkers in a way that is just and equitable. We are currently members of the Master Plan Action Team and have presented results from studies supported by the Foundation. The taskforce will be utilizing some of the maps and research findings in a forthcoming white paper to advocate for expanding the urban forest in parallel with the new Adams Mayoral administration in NYC.

NYC Mayor's Office RAPID Response



The USL team was invited to join the NYC Mayor's Office RAPID Response group, which met regularly throughout 2020 and 2021 to bring together experts/scholars to share advice on NYC response and decision making. We met specifically with members of the Office of Climate Resiliency where we shared results from our survey and spatial analysis. The results of the urban green space study was used to support testimony from The Nature Conservancy of New York's Emily Maxwell during the NYC City Council Oversight Committee hearing on "Improving the Equity of Green Space throughout the City in Light of the COVID Epidemic."

Urban Green Space and COVID-19 in NYC

As part of our study on the perception and use of urban green space in NYC during COVID-19, the USL team met regularly with partners at the Mayor's Office of Criminal Justice and Building Healthy Communities NYC (MOCJ), the New York State Housing Authority (NYCHA), US Forest Service (USFS), and The Nature Conservancy of New York (TNC) to discuss ongoing results, and to co-produce effective messaging for UGS advocacy.

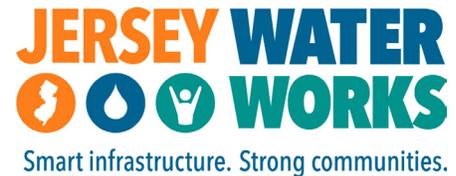
AI, People & Planet

AI, People & Planet is a research initiative hosted by the Beijer Institute of Ecological Economics at the Royal Swedish Academy of Sciences, the Princeton Institute for International Regional and Studies at Princeton University, The Urban Systems Lab at The New School and, the Stockholm Resilience Centre at Stockholm University. In 2021, the USL worked with research partners to advance thinking on urban data science, machine learning and artificial intelligence to inform resiliency planning and climate research.

NYC Panel on Climate Change

USL Director Timon McPhearson was appointed to the NYC Panel on Climate Change in 2020. In 2021, McPhearson joined a 20-member independent advisory body to synthesize scientific information on climate change and advise City policymakers on local resiliency and adaptation strategies to protect against rising temperatures, increased flooding, and other hazards.

Kresge CREWS and Groundwork Trusts



In 2021, we continued to work with the CREWS network and existing partners to assess the environmental injustice of urban flooding in US cities. Our previous work with Groundwork USA and Hudson Valley have resulted in several outcomes that have improved Groundwork's ability to provide relevant data and insights into proposed GI projects in Yonkers, New York. The scenario modeling conducted in the USL for instance was used to inform a recent Feasibility Study developed by Groundwork HV to identify the best locations for siting of GI that take into account various dimensions of social vulnerability. This work is expected to support planning processes through funding applications from Groundworks to develop green infrastructure in Yonkers, and support their Climate Safe Neighborhoods taskforce.

In Elizabeth, we engaged with partners at New Jersey Futures, Jersey Water Works and Newark Ironbound Community Corp. to provide advice on the development of a mapping platform focused on water and equity across New Jersey and develop a

response to the local Long Term Control Plans for the city's combined sewer systems. In the LTCP appeal document prepared, we outline our comments regarding the plan's environmental justice considerations including our recommendations for making them more consistent, transparent, and transformative. As a result of the interactions with these organizations, the Urban Systems Lab is now an active member of Jersey Water Works' green infrastructure and CSO committees.

In Milwaukee and Syracuse we continued to catalyze dialogue among city agencies and NGO partners on how to integrate equity and robust urban flood risk modeling into future policy and programs. For example we presented our baseline results to Milwaukee Water Commons and provided the outputs of our mapping work. The team is now working closely with Groundwork Milwaukee on developing a Flood Health Vulnerability Index for the city.

EVENTS AND CONFERENCES

Nature of Cities Festival / NATURA Virtual All-Hands Meeting (VAHM)

The 2021 NATURA Virtual All-Hands Meeting (VAHM) took place from February 22-26, 2021, engaging network members in virtual discussions, presentations and intimate break-out conversations within The Nature of Cities (TNOC) Festival. The meeting created an opportunity for network members to exchange ideas, ongoing research and to pitch new and novel projects exploring the theory, practice and applications of nature-based solutions

globally. By combining efforts with TNOC, NATURA Network members had access to 2,200 participants from 72 countries. In total, we had ~65% of known NATURA members participate and we engaged with about 27 of our partner networks. NATURA members contributed to 45 events combined within the TNOC Festival and within internal meetings for the NATURA All-Hands Meeting.

Annual Meeting of American Meteorological Society

USL Postdoctoral Fellow Ahmed Mustafa presented a poster at the 101st Annual Meeting of American Meteorological Society: “Exploring the Impact of Positive

Land-Use/Cover Strategies on Local Climate in Central Maryland with Diverse Stakeholders”. (January 2021)

Association of Geographers 2021 Annual Meeting

USL Research Fellow Pablo Herreros Cantis presented research from the Environmental Justice of Urban Flood Risk and Green Infrastructure Solutions project at the American Association of Geographers 2021 Annual Meeting. His presentation, “Applying a Source-to-Impact flood risk assessment to identify priority areas for green infrastructure interventions in a sewershed in Syracuse,

NY” explores how a hydrodynamic modeling approach could guide the identification of priority intervention areas based on the flood risk mitigation benefits experienced downstream.

USL’s Timon McPhearson joined colleagues at the American Association of Geographers Annual Meeting to present a talk titled “Hazards, Risks, and Disasters: VGI & Risk Perception”. (April 2021)

Computational Urban Planning and Urban Management Conference

Postdoctoral Fellow Ahmed Mustafa presented at the Computational Urban Planning and Urban Management Conference. He shared recent work from an NSF-funded RAPID award investigating the

impacts of COVID-19 on communities in NYC. His talk was titled, “A spatial analysis of perceived and geographic access to urban green spaces in NY”. (June 2021)

Nature of Cities Festival / NATURA Virtual All-Hands Meeting (VAHM)

USL Research Pablo Herreros Cantis presented a published paper, “Shifting landscapes of coastal flood risk: environmental (in)justice of urban change, sea level rise, and differential vulnerability in New York City” at the 2021

Columbia Climate School’s Managed Retreat Conference. The focus was “At What Point Managed Retreat? Resilience, Relocation and Climate Justice”. (June 2021)

Resilient Urban Futures Book Launch

The USL organized a roundtable discussion and launch of Resilient Urban Futures, a new book exploring the ways in which cities are profoundly impacted by climate change, and strategies for cultivating more resilient futures. Authors of this open access volume discussed urban climate

inequity, modeling and communicating the impact of extreme climate and weather, as well as visioning equitable, positive, and resilient futures. Speakers included ditors: Zoé A. Hamstead, David M. Iwaniec, Timon McPhearson, Marta Berbés-Blázquez and Elizabeth M. Cook. (September 22, 2021)

Green Roofs In New York: Research & Practice Virtual Symposium

The USL’s Timon McPhearson presented at the symposium, “Green Roofs in New York: Research and Practice”, organized by the Green Roof Researchers Alliance and the Green Roof for Healthy Cities effort. He presented on the panel

“Where NYC Needs to be by 2050, and How to Get There” with colleagues Eric Sanderson (Wildlife Conservation Society), Shino Tanikawa (NYC Soil & Water Conservation District), and Emily Nobel Maxwell (The Nature Conservancy). (October 2021)

Reimagining Public Spaces and Built Environments in the Post-Pandemic World

USL members developed a conference paper and book chapter for the symposium, “Reimagining Public Spaces and Built Environments in the Post-Pandemic World”, organized by the University of Alberta. Drawing from six national and city-specific empirical research projects, the team synthesized results and discussed how the pandemic revealed significant

knowledge gaps in understanding how public green spaces fulfill the role of critical infrastructure for social resilience. The paper discusses the need to manage for future resilience and inclusion, refine our understanding of the role of public green spaces in times of crisis, and re-imagine the role of public and civic actors in planning and management. (December 2021)

Intelligent Machines, Emotions and Our Planet

The USL participated in the virtual event “Intelligent Machines, Emotions and Our Planet”, which explored the frontiers and social challenges created by the increased interplay between human emotions, machines and nature. Organized

by “AI, People & Planet”, an initiative between the Beijer Institute of Ecological Economics at the Swedish Royal Academy of Sciences, the Urban Systems lab at the New School, and the Princeton’s Institute for International and Regional Studies at

INVITED TALKS AND LECTURES

Columbia University, Graduate School of Architecture Presentation

USL's Timon McPhearson gave a talk for Columbia University's Graduate School of Architecture, Planning and Preservation on COVID-related research: "Pandemic Injustice: Spatial and Social Distributions of the first wave of COVID-19 in the US Epicenter".

Columbia University's COVID Information Commons

USL Luis Ortiz participated in Columbia University's COVID Information Commons: Lightning Talks. Luis discussed the Lab's research to better understand the interdependent and cascading risks presented by COVID-19 and weather-related hazards in New York City.

Cornell University Department of Architecture, Art and Planning

USL's Timon McPhearson gave a presentation to Cornell University's Department of Architecture, Art and Planning. "Climate Risks, Nature-Based Solutions, and Equity in New York City".

City University of Hong Kong, Department of Public Policy

USL's Timon McPhearson gave a presentation "Paradigm Shift in Sustainability Science: From Place-Based to Metacoupled" at the conference, Post-sustainability Science in the Transitional Era: Remaking Future Agendas and Pathways at City University of Hong Kong, Department of Public Policy.

Urban Resilience to Extreme Events Sustainability Research Network (URExSRN) All-hands Synthesis Meeting

David Iwaniec and Timon McPhearson presented, "Futures Scenarios: From Visions to Spatially Explicit Modeled Futures at the Urban Resilience to Extreme Events Sustainability Research Network (URExSRN) All-hands Synthesis Meeting.

National Academy of Sciences

USL's Timon McPhearson joined colleagues Nancy B Grimm, Marta Berbés-Blázquez, Mikhail Chester, Elizabeth Cook, David Iwaniec, Sam Markolf, and Tischa Muñoz-Erickson at the National Academy of Sciences in Washington, D.C to present: "Future of Synthesis in Ecology" workshop, "Merging concepts of resilience to meet challenges of the Anthropocene".

NEWS AND PRESS

New York Times



The USL's Timon McPhearson is featured in a new article from the New York Times, "Why an East Harlem Street Is 31 Degrees Hotter Than Central Park West" examining the disproportionate impact of extreme heat on Black and brown neighborhoods in NYC and the need consider multiple dimensions of risk/vulnerability in order to map inequality.

NY1



The USL's Timon McPhearson discusses the complexity of resilience planning in NYC and the highly anticipated release of new flood risk maps in 2022 in the article, "New flood maps are coming. They won't look pretty" featured in NY1. The article highlights the Lab's work to understand the impact of pluvial and coastal flooding on those most vulnerable, as well as possibility for discorporate economic burden on communities across the New York metro region.

The Hill



The USL's Z. Grabowski and Timon McPhearson are co-authors of an Op-Ed in The Hill, "Invest in America's nature-based infrastructure." In the piece they highlight the urgent need to invest in nature-based infrastructure, parks, trails and biocultural conservation through the America Jobs Plan.

Popular Science



The USL's Timon McPhearson is featured in a new article in Popular Science, "New York City's subway system isn't ready for a storm-filled future", highlighting the need for a tiered approach to addressing urban flood risk, and the urgent need to increase urban adaptation investments in NYC to address the impacts of climate and extreme weather.

WNYC Radio's Marketplace



USL's Timon McPhearson is featured in a recent segment from WNYC Radio's Marketplace, "The affordable housing crisis meets the climate crisis in New York". McPhearson discusses the urgent need for climate resiliency measures to avoid the devastating impacts of extreme weather like 2021's Hurricane Ida

Energy News Network



New story from Energy News Network, “How tree planting can seed climate resilience in communities of color” by Audrey Henderson explores the City of Chicago’s new effort to plant 75,000 new trees, featuring commentary from USL’s Timon McPhearson on the importance of equitable green infrastructure and planning for uncertainty.

Amazon’s Fix This Podcast



The USL’s work exploring urban flood risk supported by the Kresge Foundation is featured in Amazon’s Fix This, a bi-weekly podcast of bite-sized stories about how tech makes the world a better place. Episode #47 features USL’s Pablo Herreros Cantis and Chris Kennedy.

Next City



USL’s Timon McPhearson is featured in new Next City article, “NYC Funded a Pilot to Make Basement Apartments Safer, But Then It Went Off Track”. The article explores the challenge for the City of New York to protect residents living in basement apartments from future flooding and extreme stormwater events like Hurricane Ida.

Crain’s New York



The USL’s Timon McPhearson is featured in a Crain’s New York article, “New York’s sewage system can’t handle extreme weather,” discussing the vulnerability of the NYC sewer system and urgent need for flood resilience in the aftermath of Tropical Storm Ida. “This is what happens when rain falls: instead of infiltrating into soil, it moves quickly along streets and the flood height rises very fast.... It’s the history in the way we built the city that creates these problems”, McPhearson is quoted saying in the piece.

MIT Technology Review



The Lab’s work with the NYC Mayor’s Office of Resiliency on improving stormwater resiliency is featured in an article from the MIT Technology Review, “How Ida dodged NYC’s flood defenses”. USL’s Timon McPhearson discusses the engineering challenge to combat future weather events like Hurricane Ida, and likelihood of more pluvial flooding from extreme rainfall explaining: “we need to literally redesign the city to solve the problem”.

Environment and Energy News



The USL's work on mapping and quantifying the multiple impacts of extreme heat in NYC is featured in a new article from E&E News, "Heat kills. This underfunded program could help". The article highlights the disproportionate impact that extreme heat can have on black and brown communities, the economic burden of air conditioning in the City's most vulnerable communities, and the potential of efforts like the Low Income Home Energy Assistance Program to offer some relief. The piece features the ongoing work of organizations like WE ACT, the NYC Environmental Justice Alliance, and National Energy and Utility Affordability Coalition, which continue to organize and raise awareness of these critical issues.

The USL Receives \$150K in Renewed Funding from Kresge Foundation for Environmental Justice of Urban Flood Risk Effort



The Urban Systems Lab is a recipient of \$150,000 in renewed funding from the Kresge Foundation to support the Environmental Justice of Urban Flood Risk and Green Infrastructure Solutions project. As a member of Kresge's Climate Resilient and Equitable Water Systems (CREWS) network, the USL will continue to analyze and visualize results of how planned green infrastructure interventions to build resilience to urban flooding affect minority and low-income populations in cities such as Syracuse, NY, Elizabeth, NJ, Milwaukee, WI, and Yonkers, NY.

World Economic Forum's Global Commission on BiodiverCities



The USL's Timon McPhearson joins the World Economic Forum's Global Commission on BiodiverCities, a high-level commission of 30+ world-renowned experts and practitioners to synthesize the latest research with practical solutions in the service of sustainable, inclusive and nature-positive urban development.

USL PhD Fellow Receives US National Science Foundation INTERN Award

Urban Systems Lab Fellow and Milano PhD student, Jennifer Ventrella was awarded a US National Science Foundation INTERN award to work with the NYC Mayor's Office of Resiliency on climate resilience scenario development for NYC, as part of the NSF-funded Growing Convergence Research project.

FUNDING 2020-2022

The Urban Systems Lab receives generous support from The New School, The Kresge Foundation, The Cary Institute of Ecosystem Studies, The U.S. National Science Foundation, New York State Health

Foundation, NordForsk, Biodiversa, The City of New York and the Belmont Forum, among others. Since 2015, the USL has received over \$4.5 Million to support cutting edge research and urban systems science.

AWARD	DURATION	FUNDER	USL AMOUNT	TOTAL AWARD FOR PRIMARY INSTITUTION
Climate Ready Uptown Plan	2022	WE ACT for Environmental Justice	\$7500	
NSF INTERN: Convergence science for climate resilience planning in NYC (Non-Academic Research Internships for Graduate Students)	2022 - 2023	National Science Foundation	\$54,000	
NYC Future Flood Risk Mapping project	2021 - 2022	Mayor's Office of Resiliency	\$50,000	
Is Green Infrastructure a Universal Good?	2021 - 2022	JPB Foundation / Cary Institute	\$78,000	\$500,000
Environmental migration in coastal cities of sub-Saharan Africa	2021 - 2022	Robert Bosch Stiftung GmbH Foundation / Zolberg Institute	\$20,000	
SMARTer Greener Cities: Making Smart Cities Smarter and More Liveable through Nature-based Solutions	2020 - 2022	Nordforsk (Norwegian Research Council)	In Kind	\$1,360,000
Perception and Use of Urban Parks and Open Space in NYC During COVID-19 Social Distancing	2020 - 2021	NYS Health Foundation	\$70,000	
RAPID: Interdependent social vulnerability of COVID-19 and weather-related hazards in New York City	2020 - 2021	National Science Foundation	\$200,000	
Converging social, ecological, and technological infrastructure systems (SETS) for urban resilience	2019 - 2024	National Science Foundation	\$939,000	\$3,600,000
Environmental Justice of Urban Flood Risk and Green Infrastructure Solutions	2020-2021	Kresge Foundation	\$150,000	
Nature-based solutions for Urban Resilience in the Anthropocene (NATURA)	2019 - 2024	National Science Foundation	\$968,000	\$2,000,000
Climate Equity AR: Integrating Environmental Studies and Data Visualization into Place-based Research on Social Vulnerability and Equity	2019 - 2021	The New School	\$24,000	
Total			\$2,540,500	\$24,711,900

USL MEMBERS

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Associate Director



Chris Kennedy
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Jiray Avedisian
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Ahmed Mustafa



Zbigniew Grabowski

NATURA Research Fellows



Clair Cooper
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Luis Ortiz

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Veronica Olivotto



Filipa Grilo



Bart Orr



Audrey Jenkins



Katinka Wijsman



Jen Ventrella



Belen Fodde



Rory Curtin

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LAB