

**UArizona Research, Innovation & Impact
International Collaboration Grant**

Project title: “Assessing environmental and microclimate impacts of green infrastructure according to communities: Lessons from plant preferences in low-income neighborhoods in Tucson to build an international network”

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Proposal Summary

As cities located in hot and arid regions experience prolonged drought and intense heat waves, they are turning to greening efforts – to planting more trees and implementing green infrastructure projects throughout the city – to rapidly adapt to these climate change impacts. Low-income neighborhoods are priority areas for greening efforts, as these often lack vegetation and experience more heat and flooding than the rest of the city. However, not all plant choices deliver the same microclimate benefits. Communities may have different preferences, which directly affects the biophysical impacts and the ecosystem services derived from plants. This study seeks to fill this gap and broadly identify low-income communities' preferences for greening in Tucson, and measure heat fluctuations, and impacts on the water and carbon cycle. This study will complement an emerging collaboration with researchers from the University of Western Australia, in Perth, which is experiencing similar impacts from climate change than Tucson. Our colleagues already have funding to conduct a similar study in Perth, but our UArizona team lacks funding. The ultimate goal of this international collaboration is to conduct pilot comparative studies and build integration among our teams, which will position us to successfully apply to a larger international grant.

Proposed Extramural Mechanism

We plan to host a workshop with our Australian colleagues to write a proposal (aka “writeshop”) from April 3-5, 2023. We identified two funding opportunities, including (i) the Robert Wood Johnson Foundation (RWJF), and (ii) the National Science Foundation (NSF)'s Human-Environment and Geographical Sciences Program (HEGS).

The RWJF's program titled “Evidence for Action: Innovative Research to Advance Racial Equity” has a rolling basis with no cap for funding. Applicants must submit a Letter of Intent (LOI) by mid-August 2023, which aligns well with our writeshop.

Similarly, the NSF's HEGS program has a deadline scheduled for August 15, 2023, which also fits well with our project. Funding (between \$40,000 to \$400,000), supports a mixed-methods approach that explores “the nature, causes and consequences of the spatial distribution of human activity and environmental processes, from the community level to the global level.” Our study focuses on community greening preferences in Tucson, but the aim is to do a comparative study with communities in Perth, so we can get generalizable results that can inform greening efforts at the global level. Co-PI has received funding from this NSF program and knows that to be competitive, we need preliminary data and a demonstrated capacity for cross-collaboration.

Key words/ key phrases

Green infrastructure, environmental justice, nature-based solutions, climate change adaptation in cities, plant preferences and derived ecosystem services, vulnerability to climate change.

Proposal specific sections

UArizona Research Innovation and Impact (RII) International Collaboration Grant

Human subjects research

Funding amount \$50,000

Primary TRIF initiative: Water, Environmental and Energy Solutions

Co-reviewed TRIF initiative:

Review panel selection: Social sciences, earth sciences.

Proposal Narrative

Project description: As cities located in hot and arid regions experience drought, heat waves and flooding, they are turning to greening efforts – to planting more trees and implementing green infrastructure (GI) projects throughout the city – to rapidly adapt to these climate change impacts [1,2]. Low-income neighborhoods have been identified as priority areas for greening efforts, as these often lack vegetation and experience more heat and flooding than the rest of the city [3,4]. However, not all plant choices deliver the same biophysical benefits [5–8]. Because different approaches to urban greening can result in varied microclimate and ecosystem services impacts, it is critical to understand low-income communities’ preferences for greening and determine distinct the biophysical and microclimatic outcomes of such choices. This study seeks to identify low-income communities’ preferences for plant materials used in urban greening (e.g., edible, natives, exotics, artificial turf), and measure the resulting heat fluctuations and impacts on the water and carbon cycle of different plant choices.

We propose a comparative study between Tucson, Arizona and the city of Perth, in Western Australia. Both cities are experiencing similar negative impacts of climate change including prolonged drought, excessive heat, and sporadic but severe storm events that result in flooding. Funding for this project will support and enhance an incipient international collaboration between a multidisciplinary team of UArizona researchers and scientists from the University of Western Australia (UWA), united in their efforts to respond to the impacts of climate change. UWA researchers have already applied for and secured local funding for international collaboration between the two universities. These funds will support travel for UWA scientists to visit Tucson in the spring 2023 and will also fund two members of the UArizona team to visit in Perth in the fall 2023 to foster international collaboration and exchange. In addition, the grant funds an examination of plant preferences in greening efforts in Perth and will assess the biophysical impacts of such plant choices in the Western Australian context.

To implement this comparative pilot study, we require funding to conduct the work in Tucson. By meeting in Tucson and Perth to exchange knowledge and ideas, the research team will develop an enhanced understanding of the similarities and differences between these climatically comparable contexts and will engage in seminars to advance methods for collection of pilot data that will be used to develop additional research proposals for external funding. Additionally, this project will synthesize current knowledge on greening preferences in low-income communities and provide opportunities for peer-reviewed publications on the subject. Ultimately, this grant will provide partner funding in a joint research endeavor with UWA and will increase the presence and impact of UArizona researchers.

<i>Project objectives</i>	<i>Expected Outcomes</i>
1. Initiate and develop a foundation for ongoing collaboration between UWA and UArizona.	Involvement of interdisciplinary scholars and students from UArizona and UWA, and practitioners at workshops and conferences, to disseminate research and develop new ideas.
2. Synthesize research through a state-of-current-knowledge review to identify research gaps to design a collaborative and interdisciplinary research project.	Submission of a review study to a high-impact journal.
3. Test key ideas through the implementation of pilot projects derived from the assessment of public perceptions and microclimate measurements of vegetation within Tucson, Arizona.	This pilot project will be compared against companion efforts conducted in Perth, Australia that will allow for the development of robust plant measurement techniques.

4. Using the knowledge gained from objectives 1-3, we aim to develop and submit collaborative, competitive funding proposal to support a larger-scale project that includes multi-step processes such as significant data collection and on-site implementation of GI typologies.	Development of a summary report detailing tested field methods and experimental and landscape design parameters for a future larger-scale field project. Submission of a high-quality grant proposal.
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Significance. We aim to tackle core challenges for low-income urban communities living in hot and arid regions: **Developing a place-based approach for the design of a new generation of climate-resilient, waterwise, biodiverse and equitable urban green spaces.** This work aligns well with priority areas identified in the UArizona’s strategic plan and the TRIF Initiative, addressing injustice around greenspace, while training students.

<i>Priority Areas</i>	<i>Relationship</i>
Implementation of the UArizona Strategic Plan or UAHS Strategic Plan with a focus on Pillar 2: Grand Challenges	This project is highly aligned with Pillar 2: Grand Challenges as it advances research related to pressing challenges in the built and natural environment, and human health.
Advancement of graduate and particularly undergraduate research opportunities	This project will provide opportunities for UA undergraduate and graduate students to participate in research efforts, including workshops, conferences, and field-based evaluations.
Advancement of TRIF Initiative priority areas	This project advances TRIF priority areas related to health and water/energy/environmental systems as vegetation can provide important microclimate benefits related to regional climate resilience initiatives.
Inclusion and promotion of justice, equity, diversity, and inclusion (JEDI) in research	This project promotes the inclusion of traditionally underserved communities in climate adaptation initiatives.

Approach. We propose a coupled natural-human system approach in which an interdisciplinary research team will work with local stakeholders and community members to broadly identify low-income communities’ plant preferences in two low-income neighborhoods in Tucson. For this project, we partner with Tucson Water and the Sonora Environmental Research Institute, Inc. to identify sites in low income neighborhoods and conduct community engagement activities that align with city’s initiatives. Outcomes from this participatory assessment include the identification of 3-5 green infrastructure projects that include preferred plant choices in these neighborhoods. Our team of physical scientists will measure the environmental and microclimate impacts of these GI projects. Results can inform city officials of expected impacts from greening efforts, which can help envision future microclimate scenarios and how these could address equity issues within the city. Understanding these variations can help design greening programs that deliver desired ecosystem services while providing the best combination of environmental and microclimate impacts.

Our team has a proven track record of working with multiple funding and community partners, capitalizes on a wealth of past research, existing data and ongoing initiatives to realize the proposed work. Our multidisciplinary, international team combines expertise across social sciences, geography, landscape architecture, hydrology, and urban biodiversity to tackle core challenges for the growing populations of cities in arid regions.

References

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