For first time, study identifies top trends in the biological impacts of urbanization

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A new research study overseen by Brian Verrelli, Ph.D., an associate professor in the Center for Biological Data Science at Virginia Commonwealth University, could have major implications for research

across the university and beyond. It shows that scientific researchers are looking to incorporate many of the social inequality issues raised during the pandemic and George Floyd protests into future research.

Verrelli studies biological diversity and evolution. He focuses on the impact that the urban environment has on biological organisms. He recently helped oversee research into the impact that urbanization has on black widow spiders in the American West. The research, led by Lindsay Miles, a former Ph.D. student in integrative life sciences at VCU, examined the genetics of black widow spiders as health pests in the urban and nonurban environment. The work found that urban and nonurban black widow spiders were genetically different and that has evolutionary and medical implications.

"You start taking organisms that interact in a certain way for millions of years and then you drop an urban area on top of that," Verrelli said. "And you look at what happens to those interactions and how does it impact humans and how does it impact environmental and human health."

He believes studying biological impacts of urbanization is an important and growing field, given the world's changing demographics.

"Demographic predictions suggest that by 2050, urban areas will be home to approximately 68% of the human population," he said. "With this rapid urbanization, habitats will be irrevocably changed, and natural resource extraction will accelerate."

A few years ago, Verrelli became part of a team of researchers that received a five-year grant through the National Science Foundation to create a research coordination network to study urban ecology and evolutionary dynamics around the world. Verrelli was the lead author of the first major research paper to come out of the grant.

The article was published on the *Trends in Ecology & Evolution*'s website in August and will be published in the November issue of the journal. The paper was a horizon scan of urban evolutionary ecology. Verrelli said horizon scans are frequently conducted in the social sciences but are not seen as often in the life sciences. The format surveys leaders in the field and asks them to identify major trends. The goal is to look at what the future of research will be in the field.

The survey asked the opinion of 100 scientists from around the world, using an open-ended question: What future topics will be the focus of urban evolutionary ecology research? Based on the experts' feedback, the study's authors identified 30 key categories in the field. From that, the team of researchers grouped the categories into six major themes. They were (with some examples):

- Processes (mutation and speciation).
- Scales (temporal, spatial, and historical).
- Sustainability (pathogens, rewilding, and disease).
- Climate change (extreme weather and sea level changes).
- Sociopolitical (ethics, race, legacy, and governance).
- Technology (artificial intelligence and genetic engineering).

The survey took place in 2020 during the pandemic and widespread protests after the death of George Floyd when there was a heightened awareness of social justice issues. Verrelli believes current events at that time played a large role in people's answers and the direction of the discussion. That proved particularly clear when the 29 authors of the paper met for three days in a virtual workshop and discussed the 700 entries. The conversations about the entries gravitated toward a central theme of social injustice.

"The fact that the George Floyd event got so much attention from everyone—why is it so surprising that this would have a downstream

effect on the science as well?" Verrelli said. "Why can't we look at how inequity in cities can alter our view of biodiversity?"

Verrelli believes the study has implications outside of evolutionary ecology. Other fields can benefit from seeing what concerns the field of evolutionary ecology and apply the ideas to their disciplines. He believes that fields such as engineering could look to the study when considering future research. New technologies must be developed to address the environmental impact of urbanization. Political science and urban planning investigators could also look to the study in addressing social injustices within urban areas and to set public policy.

Verrelli said he has been working with groups around the university also interested in social injustice and the role it plays in scientific research. For instance, he helps administer a core group interested in sustainability research within VCU's Institute for Inclusion, Inquiry and Innovation (iCubed), which strategically invests in academic and research programs that employ transdisciplinary approaches to solve challenging and persistent problems in urban communities.

More information: Brian C. Verrelli et al, A global horizon scan for urban evolutionary ecology, *Trends in Ecology & Evolution* (2022). DOI: 10.1016/j.tree.2022.07.012

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