**Urban stream invaders: a scientist spotlight featuring Dr. Piatã Santana Marques**

**Author:**

Jennifer L. Apple, Department of Biology, SUNY Geneseo; applej@geneseo.edu

**Course Information**

Department: Biology

Level: Lower undergraduate

Course type: Lecture

Students: Majors

Number of Students: 68 students in 2 sections

**Summary:** Students read and interpret data from a primary literature paper which addresses how urbanization can affect the invasive attributes of a non-native species while reflecting on the identity of the lead researcher and how systemic racism has shaped his experiences.

**Overview:** The main purpose of this lesson is to give students an opportunity to read a paper in the primary literature and interpret, summarize, and evaluate its findings, including inspection of several key graphs. The paper, “Urbanization can increase the invasive potential of alien species,” by Piatã Santana Marques et al. touches on several important ecological issues: what factors make invasive species successful, the impacts of urbanization, the impacts of the environment on an organism’s phenotype, and the consequences of species interactions and trophic relationships. The paper should be accessible to second-year students: the study’s design and data collection is clear and easy to visualize, while most of the figures are straightforward to interpret. The author, a graduate student at the time, is a Black scientist from Brazil who had repeated encounters with police while performing field work in urban areas of Rio de Janeiro. To learn about Dr. Marques’s background and experiences, students also read a blog post he wrote, “Navigating biological invasion and structural racism in urban systems.” In response to this blog post, students respond to some questions about the identity of this scientist and the challenges he faces.

**Learning objectives:**

Quantitative learning objectives (from Clemmons et al. 2020)

1. Interpret informative graphs and other data visualizations
2. Interpret the biological meaning of quantitative results
3. Interpret, summarize, and evaluate evidence in primary literature
4. Relate conclusions to original hypothesis, consider alternative hypotheses, and suggest future research directions based on findings

Content learning objectives

1. Apply knowledge of ecological concepts to predict impacts of human activities on ecosystems and biodiversity
2. Apply knowledge of ecological processes and develop models to explain ecological patterns and make predictions

Social justice and/or diversity/equity/inclusion learning objectives

1. Identify and describe how systemic factors (e.g., socioeconomic, political) affect how and by whom science is conducted (Clemmons et al. 2020)
2. Adopt a more nonstereotypical description of who can be a scientist and increase ability to relate to scientists (Schinske et al. 2016)
3. Identify challenges that systemic racism or other biases can pose for scientists of diverse backgrounds

**Lesson sequence:**

1. Post assignment for students to read the [Marques et al. (2020)](https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2656.13293) study and [Dr. Marques’s blog post for the *Journal of Animal Ecology*](https://animalecologyinfocus.com/2020/10/15/navigating-biological-invasion-and-structural-racism-in-urban-systems/) in preparation for a group activity. This [graphical abstract](https://besjournals.onlinelibrary.wiley.com/cms/asset/7c5f226e-efdf-493c-97ac-12d163e1ae55/jane13293-toc-0001-m.jpg) provides a nice visual summary. See file: “Scientist Spotlights\_Piata Marques\_urban streams\_group activity preparation.docx.”
2. Group activity during class (could be online or in person) in which students collaborate in groups in answering questions on a Google doc after a very brief Powerpoint introduction. Powerpoint introduction includes a poll question to check students’ initial understanding of the paper. (Poll can be delivered via Zoom, as clicker question, or on paper.) See file “Scientist Spotlights\_Piata Marques\_urban streams\_intro slide.ppt” and “Scientist Spotlights\_Piata Marques\_urban streams\_group activity questions.docx.” Contents of Word file can be copied into Google Doc for sharing with students.
3. Submission of a personal reflection based on the [author’s blog post](https://animalecologyinfocus.com/2020/10/15/navigating-biological-invasion-and-structural-racism-in-urban-systems/) in response to questions posted on the learning management system. See file: “Scientist Spotlights\_Piata Marques\_urban streams\_reflection questions.docx.”

**Pre-lesson activities:** Students have had experience in interpreting graphs, identifying independent and dependent variables, inferring experimental treatments or groups from graph, and understanding the meaning of a p-value from a statistical analysis. Through previous course material students were exposed to concepts like life history evolution and different life history strategies, density dependence, and species interactions, including competition and predation. However in-depth coverage of these topics should not be required to understand the paper.

**Post-lesson activities:** Summative assessment to test students’ understanding of the study’s findings or interpretation of graphs took the form of a question in an online exam. Several possible questions students could expect were provided in a study guide provided for students before each exam. See file: “Scientist Spotlights\_Piata Marques\_urban streams\_summative assessment.docx.”

**Implementation notes:** I performed this in an online-only sophomore-level ecology course in spring 2021 in which students answered questions on a Google Doc while in groups in breakout rooms on Zoom. The group activity could be performed in a 50-min class. In person I would have probably still have students collaborate on a Google Doc in class on their laptops (we have a required laptop rule), but may have also taken the time to discuss some of the answers in this class session or the next session. Other constraints prevented me from doing this in this online implementation and instead I provided feedback on their Google Docs. Alternatively students could answer the questions individually or on paper handouts during class. This lesson does require additional out-of-class time for students to do the readings and for them to provide individual responses to the question prompts relating to the scientist’s identity and social justice learning objectives. Alternatively, students could respond to these questions in an online discussion forum in which they see and comment on each other’s responses.

**References and additional resources:**

Clemmons, A., J. Timbrook, J. Herron, & A. Crowe. (2020). BioSkills Guide. Core Competencies for Undergraduate Biology, (Version 5.0). QUBES Educational Resources.

<https://doi.org/10.25334/156H-T617>

Marques, P.S. (2020, October 15). Navigating biological invasion and structural racism in urban systems. Animal Ecology In Focus. [https://animalecologyinfocus.com/2020/10/15/navigating-biological-invasion-and-structural-racism-in-urban-systems/.](https://animalecologyinfocus.com/2020/10/15/navigating-biological-invasion-and-structural-racism-in-urban-systems/.%20)

Marques, P.S., L. Resende Manna, T. Clara Frauendorf, E. Zandonà, R. Mazzoni, & R. El‐Sabaawi. (2020). Urbanization can increase the invasive potential of alien species. *Journal of Animal Ecology* 89(10): 2345-2355. <https://doi.org/10.1111/1365-2656.13293>

Schinske, J.N., H. Perkins, A. Snyder, and M. Wyer. 2016. Scientist spotlight homework assignments shift students’ stereotypes of scientists and enhance science identity in a diverse introductory science class. *Life Sciences Education* 15(3):1-18. 2017 online publication. <https://doi.org/10.1187/cbe.16-01-0002>