



**Learning Science as Inquiry with the Urban Advantage**  
*Formal-Informal Collaborations to Increase Science Literacy and Student Learning*  
Award No. 0918560

The **American Museum of Natural History** (AMNH) and **Michigan State University** (MSU) are currently collaborating on a development and research project focused on the hypothesis that learners must have access to the real work of scientists if they are to learn both about the nature of science and to do inquiry themselves. In this project, a teaching case serves as resources to help teachers and students understand scientific inquiry through research on freshwater ecosystems, and—with that increased understanding—support student learning.

The context for this project is the **Urban Advantage** (UA) program, a middle school science initiative involving informal science education institutions. The study focuses on the New York City-based UA program which is designed to improve teachers' and students' understanding of scientific inquiry through collaborations between an urban public school system and informal science education institutions such as museums, zoos, gardens, and science centers. The name Urban Advantage reflects the partners' belief that it is an advantage to live in an urban setting with so many science-rich cultural institutions and nature facilities. UA differs fundamentally from traditional museum-to-school collaborations as it provides a hybrid model for civic engagement where the resources of institutions are selected, designed, and shaped by the specific alignment to the science curriculum of the local school system.

The project's goals are two-pronged. First, the staff at AMNH have refined their PD approach focused on scientific inquiry using secondary data sets, by extending the resources available to support teachers' and students' learning. Second, the AMNH staff, along with collaborating researchers at MSU, are integrating a research agenda into the program to learn what aspects of UA support quality science teaching. Accordingly, there are two streams of work. The first involves UA staff developing and testing a "teaching case" featured on the Hudson River zebra mussel invasion to serve as resources to help teachers and students understand scientific inquiry and secondary research. The second involves the MSU research team describing and explaining what teachers and students learn about science and inquiry through participation in UA through interviews, observations, and surveys with teachers, students, and administrators, as well as student assessments.

The **River Ecology Teaching Case** focuses on field research related to the zebra mussel invasion of the Hudson River ecosystem and consists of text passages, video resources, and an interactive web-based graphing and data analysis tools. A written case study is used in conjunction with videos to provide background information about the history of the zebra mussel invasion and details about how data is gathered by scientists. There are four text passages with graphics and diagrams in the teaching case materials. The first passage presents the problem with information about the zebra mussel as an invasive species, the previous impact of zebra mussels in the Great Lakes, and how the Hudson River differs from the Great Lakes as a freshwater ecosystem. The second passage describes how scientists at the **Cary Institute of Ecosystem Studies** are monitoring the Hudson River and collecting a variety of biotic and abiotic variables six cardinal stations along the river. The third passage explains the short-term impact of the zebra mussels on the river ecosystem and the fourth passage explains the current long-term impact of the invasion. The project has developed both teacher and student versions of these passages for use in professional development sessions and in the classroom with students. There are four video segments in the teaching case that are each associated with one of the text passages and feature scientists from the Cary Institute of Ecosystem Studies that weave together interviews, field and laboratory footage, and animations to illustrate concepts such as food webs, populations and communities, and ecosystem change. These videos were created to provide images of the scientists doing their work and providing the learner the opportunity to hear directly from the scientists about their work.

The River Ecology Teaching Case also provides learners with access to secondary data sets via a web-based interactive data visualization and graphing tools. This online resource includes twenty-four years of authentic scientific data sets collected by scientists at the Cary Institute related to the zebra mussel invasion of the Hudson River. The online data sets include twelve biotic variables such as zebra mussel population density, phytoplankton chlorophyll, zooplankton population density and four abiotic variables such as temperature, dissolved oxygen, and suspended solids or turbidity of the water. The online graphing and data analysis tools provide learners with a user-friendly interface to access the scientific data sets and use them to conduct investigations. Once a cardinal station is chosen along the river, the user can visualize two different variables over time and select up to three different time periods to see the averages of the variables selected. The graphing tools can also be used to do scatter plots and linear regressions using the biotic and abiotic data sets. All of the teaching case components are accessible via the **River Ecology website at [amnh.org/education/hudsonriver](http://amnh.org/education/hudsonriver)**. All of the teaching case materials have been piloted and refined based on initial implementation with teachers over the past two years.