

## Environmental Restoration Science in New York Harbor - Community Based Restoration Science Hubs, or “STEM Hubs”

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**Abstract :** The project utilizes the Billion Oyster Project (BOP-CCERS) place-based “restoration through education” model to promote computational thinking in NYC high school teachers and their students. Key learning standards such as Next Generation Science Standards and the NYC CS4All Equity and Excellence initiative are used to develop a computer science curriculum that connects students to their Harbor through hands-on activities based on BOP field science and educational programming. Project curriculum development is grounded in BOP-CCERS restoration science activities and data collection, which are enacted by students and educators at two Restoration Science STEM Hubs or conveyed through virtual materials. New York City Public School teachers with relevant experience are recruited as consultants to provide curriculum assessment and design feedback. The completed curriculum units are then conveyed to NYC high school teachers through professional learning events held at the Pace University campus and led by BOP educators. In addition, Pace University educators execute the Summer STEM Institute, an intensive two-week computational thinking camp centered on applying data analysis tools and methods to BOP-CCERS data. Both qualitative and quantitative analyses were performed throughout the five-year study. STEM+C - Community Based Restoration STEM Hubs. STEM Hubs are active scientific restoration sites capable of hosting school and community groups of all grade levels and professional scientists and researchers conducting long-term restoration ecology research. The STEM Hubs program has grown to include 14 STEM Hubs across all five boroughs of New York City and focuses on bringing in-field monitoring experience as well as coastal classroom experience to students. Restoration Science STEM Hubs activities resulted in: the recruitment of 11 public schools, 6 community groups, 12 teachers, and over 120 students receiving exposure to BOP activities. Field science protocols were designed exclusively around the use of the Oyster Restoration Station (ORS), a small-scale in situ experimental platforms which are suspended from a dock or pier. The ORS is intended to be used and “owned” by an individual school, teacher, class, or group of students, whereas the STEM Hub is explicitly designed as a collaborative space for large-scale community-driven restoration work and in-situ experiments. The ORS is also an essential tool in gathering Harbor data from disparate locations and instilling ownership of the research process amongst students. As such, it will continue to be used in that way. New and previously participating students will continue to deploy and monitor their own ORS, uploading data to the digital platform and conducting analysis of their own harbor-wide datasets. Programming the STEM Hub will necessitate establishing working relationships between schools and local research institutions. NYHF will provide introductions and the facilitation of initial workshops in school classrooms. However, once a particular STEM Hub has been established as a space for collaboration, each partner group, school, university, or CBO will schedule its own events at the site using the digital platform’s scheduling and registration tool. Monitoring of research collaborations will be accomplished through the platform’s research publication tool and has thus far provided valuable information on the projects’ trajectory, strategic plan, and pathway.

**Keywords :** environmental science, citizen science, STEM, technology

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