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### From Local to Global: The Role of Interdisciplinary Place-Based Research in Teaching Environmental Economics

Sean P. MacDonald

*CUNY New York City College of Technology*

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## **From Local to Global: The Role of Interdisciplinary Place-based Research in Teaching Environmental Economics**

Sean P. MacDonald

This chapter examines the value of teaching undergraduate Environmental Economics from an interdisciplinary perspective while employing the resources of the local community as a laboratory where students engage in place-based research. The exploration of “place” assumes a central component of students’ semester research project. This process effectively encourages students to make meaningful connections between the theoretical study of both local and global environmental problems and the actual experience, observation and investigation - through either direct or virtual exploration - of those challenges in real world settings. At the same time, the purpose of the interdisciplinary approach of this methodology – considering the perspectives offered by another discipline in addition to economics – is to provide the foundation for promoting a more comprehensive understanding of current environmental challenges and policy.

The discussion that follows discusses the form that an interdisciplinary place-based learning process can take. The theme of the course that is reviewed here is followed by a description of the structure within which interdisciplinary learning is framed. A description of the activities that seek to engage students in independent place-based research in an interdisciplinary context is reviewed in the context of an Environmental Economics course targeted to third and fourth-year undergraduates in an urban setting. A description of the activities that students undertake throughout the class that culminate in the final research project is then examined in the context of how these activities serve to scaffold the final project. A sample of a recent project completed by a student in the class is also highlighted. The discussion concludes with recommendations for how such an interdisciplinary place-based approach might be adapted to other situations.

## **The Structure and Focus of Interdisciplinary Place-based Learning in an Environmental Economics course**

The theme of the course discussed here, Environmental Economics, focuses on how sustainable economic policy and growth can be effectively informed by innovative technology, planning, and design, while incorporating the goals of social, health, economic and environmental justice. It explores how economic priorities can be effectively applied to the goal of slowing global climate change and how working toward that goal at the same time strengthens and advances sustainable economic development.

This focus encompasses the valuable contributions and insights offered by other disciplines through the perspectives of invited guest lecturers from fields outside of Economics, as well as by interdisciplinary readings and activities that are viewed as central to informing the course's theme. The goal is to expose students to the perspectives, knowledge and methods of inquiry of other disciplines, while enabling them to visualize the connections across disciplines to the study of Environmental Economics, and eventually, to guide them in envisioning how they might incorporate the perspectives of another discipline into their own research.

Topics discussed by guest lecturers have included *The global economic impact of emerging market economies and rapid industrialization* (Sociology); *The importance of sustainable land use and agricultural practices*(Geosciences); *How contextual, emotional and cultural influences shape consumer decision making* (Psychology); *How the expansion of sustainable building and design practices - growth of green building design, construction, engineering and architecture – encourage renewable energy practices, reduce overall energy demand, and promote cleaner energy sources* (Architecture and Engineering); *How sustainable tourism and fair trade work to encourage and promote renewable resources and sustainability* (Hospitality Management).<sup>1</sup>

At the same time, students in the course come from a broad range of disciplines, including Hospitality Management, Electrical and Telecommunications Technology, Computer Systems, Nursing, Construction Management, Mechanical Engineering, Radiological Science, and Applied math. Thus, the diverse disciplinary perspectives that students bring to the class from their own fields of study form an integral component in developing an understanding of the concepts and methodologies of other disciplines and illustrate how varied disciplines inform and relate to the larger scope of environmental economics. This interdisciplinary approach is designed to help cultivate a comprehensive understanding of the issues central to environmental economics.

### **The Value of the Interdisciplinary Place-based Approach**

The concept of interdisciplinary place-based research can embrace a number of dimensions. First, it makes students active participants in the research process, ideally collaborating in small groups of two or three on a project. Second, it involves interaction with individuals and organizations outside the classroom, and through that interaction, gathering information through formal or informal interviews. Third, it incorporates interactive forms of documentation: recording of observations, making notes on impressions of the field visit, or taking photographs and/or short videos. This active research of place encourages the process of then making connections between these observations and secondary research sources. Interdisciplinary place-based research further encourages the development of a multidimensional understanding that integrates the perspectives of other disciplines into the research topic.

Another important component designed to place students in the role of active learners and researchers involves their required participation in the course's online site, *Open Lab*, which is hosted at the college. Open Lab is defined as “an open-source digital platform where students,

faculty, and staff can meet to learn, work, and share their ideas. Its goals are to support teaching and learning, enable connection and collaboration, and strengthen the intellectual and social life of the college community.<sup>27</sup> To this extent, the site is yet another resource that encourages interaction and exchange among students in the class. Students are also encouraged to post notes, thoughts and photographs following the group field visit that introduces them to the concept of place-based research. They also use the site throughout the semester to post thoughts on assigned readings and preliminary thoughts on the place-based research they engage in for the final project. This is especially valuable as a resource that encourages students who may be initially reluctant to speak in class to voice their thoughts, to be heard and to obtain valuable feedback from others in the class.

Students' final projects constitute an inquiry into a central question or formulation of a thesis about a specific environmental issue or problem, supported by a thorough review of secondary research and a place-based research component. The guiding question or argument must highlight the issue in the context of both the Economic perspective and that of at least one other discipline. In this way, students are making connections across disciplinary boundaries with the goal of obtaining a more illuminating perspective. An important component of the process includes students' preparation of first and final drafts of a two-page research summary and annotated bibliography. The final project includes an oral presentation in which students discuss their own findings and conclusions based upon their primary and secondary research, and highlighting the contributions of their place-based research.

Before students even begin the process of refining research topic ideas and conducting place-based and secondary research for their final projects, they are introduced to the concept of interdisciplinarity and the role of 'place' on the first day of class. The purpose is to instill an

awareness of the centrality of both concepts both to the theme of the course, and to the semester research projects they will conduct including the way in which the project is defined and researched.

Students in the first class session are challenged to think about their own connections to the environment when they are asked to respond to one general question: “What question or issue about the environment is of greatest concern or interest to you and where might you observe it?” They are then asked to free-write for a few minutes about whatever comes to mind. This exercise is designed to help students feel comfort with the idea that they don’t need to be *prepared* on day one or to know exactly what they want to research. Instead it encourages them to gain comfort with their own ideas, whatever form these might initially take. For some, this might be the first step toward discovering what topic(s) may be of greatest interest for the project. For others, it is a first step in exploring the concept of “environment,” what it means to them and how they might visualize it.

Following this brief writing exercise, students are asked to share their ideas with the person sitting next to them. Students provide feedback to one another and ask one another questions about their thoughts, etc. This informal peer review very quickly leads to an engaging discussion – an essential first step in the brainstorming process and working toward the formulation of more pointed questions and ideas. Over the next few weeks, students are asked to revisit what they wrote in the first class and to write for another five minutes on their own, now thinking about two or three questions they might want to investigate further and where they might go to conduct a first-hand study. The purpose is to encourage students to begin reflecting on how they might examine the interests they initially wrote about in the context of their own field of study or other discipline while thinking about the economic applications.

### **The Interdisciplinary Place-based Experience**

The next step – introducing students to the concept of interdisciplinary place-based research – involves the class taking part in a scheduled group tour early in the semester, typically during the fourth or fifth week of class. The tour is designed to link directly to both local and global environmental topics. Its central purpose is to introduce students to the value and contributions of place based observation in the research process, encouraging them to make connections between research on a particular environmental theme and the first hand experience of it in a real-world setting. The tours have focused on a number of sites tied to the Brooklyn waterfront, incorporating its history as well as its economic and environmental evolution. The sites have included the SIMS Municipal Recycling Facility in Sunset Park, the Gowanus Canal Conservancy, and the Brooklyn Navy Yard which sponsors a number of specialized tours, including a *Sustainable Architecture and Industries* tour and an *Urban Ecology* tour.

Prior to a tour, students are asked to become familiar with the site by exploring its website and acquiring some knowledge of what the site's principal purpose is. Based on this knowledge, they are asked to think about a few questions they want to ask the tour guide during the tour. They are also provided guidelines for the trip: take pictures, ask follow-up questions, and record or write down their observations. Before the actual visit, the processes of documentation and interview techniques are reviewed. The visit then functions as an opportunity for students to practice and refine those techniques in preparation for their own independent place-based research.

A recent example involved class participation in the Brooklyn Navy Yard's *Urban Ecology* tour which featured a visit to the Brooklyn Grange, described as operating “the world's largest rooftop soil farms, located on two roofs in New York City”<sup>3</sup>. The location is an example of sustainable agriculture, a thriving business and an important connection to the surrounding

community. Occupying 65,000 square feet on top of one of the complexes' largest buildings, the volunteers who cultivate, maintain, and manage the site produce over 50,000 pounds of organic produce a year which is distributed to local grocers and restaurants. The Grange also serves as a vital connection to the local and global community and “partners with numerous non-profit organizations throughout New York to promote healthy and strong local communities.<sup>4</sup>” The tour also features a visit to one of the first oyster restoration reefs installed along the waterfront bordering the Brooklyn Navy Yard, which is now part of a larger initiative, the *Billion Oyster Project*<sup>5</sup>, which has installed oyster beds throughout the Hudson and East Rivers in an effort to facilitate the cleansing these historically polluted waterways.

During the tour, students are challenged to think about the connections to what they are seeing and experiencing across disciplinary boundaries, and what disciplines the experience might have a connection to for them. Further, having already been exposed to the knowledge and methods of inquiry of other disciplines from invited guest lecturers, students are encouraged to think about whether and how any of these perspectives contributed to the connections they made.

For instance, some issues students have addressed in response to this question include: What are the *economic costs* (Economics) to local communities that lack adequate access to healthy food choices – such as the residential community adjacent to the Brooklyn Navy Yard that is a food desert? The purpose is not to think of this in terms of a dollar cost, but to consider the qualitative effects: What are the *potential health impacts*, (Health care administration; Nursing) or the probability of a greater incidence of health problems such as heart disease, diabetes, obesity, etc. that have been associated with lack of healthy food choices? If there is a greater incidence of health-related effects, how does this relate to the economic impact? (i.e., higher health care costs because of more visits to medical providers). What are the implications for

economic *productivity* as a result of the inability to work due to poor health? What are the educational implications of such an environment reproducing similar food choices for the next generation? What are the *transportation and other infrastructure challenges* (Urban planning/design) that make getting to locations with healthy food choices difficult? What does community isolation from healthy food choices say about the need for greater *community and social engagement*? (Human Services) How do the *social and environmental resources* of a site such as the Brooklyn Grange offer an opportunity for increased ties with the surrounding community? How can that engagement function to enhance individual and social awareness about how the disconnectedness of people from the land and has contributed to social and economic alienation? (Sociology). Finally, what are the potential *environmental and energy* cost savings from a green roof installation, which reduces demand for energy for cooling in summer and heating in winter? (Architecture; mechanical engineering technology).

Following the tour, students are then asked to complete a short written assignment in which they reflect on the experience and address key questions aimed at persuading them to think about what they thought they knew about the site beforehand and what they actually learned from their visit. The questions students are asked to discuss in the assignment are focused on encouraging them to consider the value of direct observation and to begin making connections across disciplines.

The assignment asks students to address the following questions:

- 1) Prior to the visit: Explore the Brooklyn Navy Yard website and become informed about the range of initiatives and activities that are taking place there, including the Brooklyn Grange and the oyster reef restoration project; briefly describe what the website says about these projects.
- 2) Focusing on two specific features of the tour, discuss the environmental and economic benefits of two features of the tour (ex: the Urban Grange rooftop farm; the benefit of green roof systems overall; the architectural re-design of old buildings; the oyster reef restoration

project; the BNYDC's ongoing promotion of and commitment to renewable energy use and design).

- 3) During the tour, how did your experience of visiting and observing the workings of an urban rooftop farming project first-hand enhance your knowledge of such projects? From your perspective, how is visiting a site different from conducting exclusively secondary research? What discipline(s), other than Economics, did the experience relate to for you?
- 4) Considering the ideas you are considering for your own research project at this point, discuss how first-hand observation and enquiry might be able to enhance your own research; or how it may have provided a new perspective on your own field of study.
- 5) Please consider posting any pictures or reflections you had on the tour to the Open Lab site.

Students' responses to these questions reveal the impact that first hand observation can have on how we think about the methods employed to examine environmental research and the value of direct observation and study. Sample excerpts from students' assignments following the tour reveal the positive contributions they perceived from the experience of observation. One student, V. Allen<sup>6</sup>, observed that:

I found Brooklyn Navy Yard Tour very interesting and entertaining. An opportunity to see sustainability practices applied in real life is beneficial to anyone who is planning to build a career in the industry. The Brooklyn Navy Yard serves a model for sustainable urban industrial parks and proves that even one of the most dirties and contaminated place in the city in the past with careful care can get a second chance and become home to modern industrial and creative businesses. The tour explored property along Brooklyn's industrial waterfront and we had an opportunity to take a closer look at the Yard's most intriguing sites, including a dry dock that's been used for ship repair since 1851, historic buildings that are being adaptively reused for industrial purposes, and the Green Manufacturing Center, a future hub for the development of new products and technologies. The tour guide showed historical photographs from the site's Naval past, as well as told stories of industrial innovators at the Yard today.<sup>7</sup>

Others began to make insightful connections between the Navy Yard's past and present, reflecting on the significance of its ongoing transformation to an innovative model of sustainable industries and jobs and its pioneering urban ecology projects. In the words of one of the students who participated in the Urban Ecology tour in Spring 2016, Sylvia Torres,

Every morning heading to the college I drive passed the Brooklyn Navy Yard. I knew it was an actual Naval Yard of the United States Navy and that many businesses had been through its gates. I wondered what lay beyond the intimidating and uninviting walls. BLDG 92 has the only unguarded entrance which made me wonder what went on inside. I thought the public was not allowed there.

The tour was actually very exciting and relieving at the same time. The world around us seems to focus on material possessions and a fake presentation of status. People are disconnected from the natural world, making selfish decisions without regard to its long term effects on the environment. The Brooklyn Navy Yard is a leader in making conscientious strides in improving the lives of the community it is in and making responsible sustainable choices to benefit our environment.

I was impressed by the effort to bring well-paying jobs to the community. I learned that oysters were the filters of New York City's waterways. (The oysters are a self-sustaining solution that requires no machinery to be installed or maintained and a workforce that is never late and works around the clock.) There are too many initiatives to mention but all the initiatives have one primary agenda; to be better stewards of our communities and our environment.<sup>8</sup>

For many students, this is a first of its kind experience that begins to get them thinking about what topics may be of interest to them and how those topics might be defined from multiple perspectives. Often, students begin to make connections to their own fields of study, a valuable first step in connecting experience to theoretical study in an interdisciplinary way.



Figure 5.1. View of Brooklyn Grange, Sept. 2016; photo by S. MacDonald



Figure 5.2. View of vegetable plantings at the Brooklyn Grange, September, 2016; photo by S. MacDonald

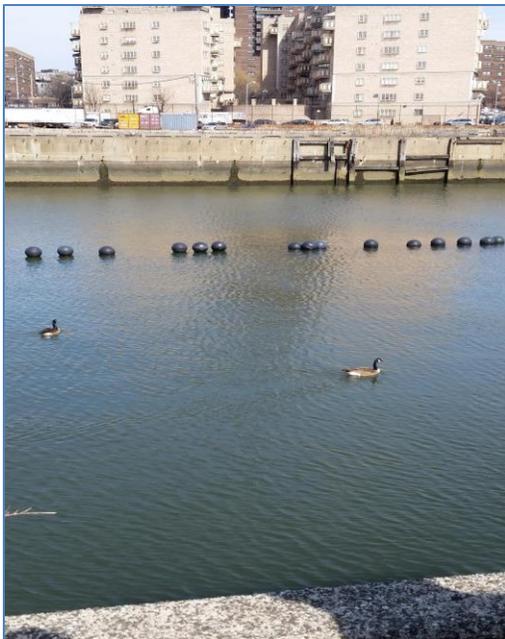


Figure 5.3. Oyster Restoration Reef: Barge Basin (Billion Oyster Project) September 2016, photo by S. MacDonald

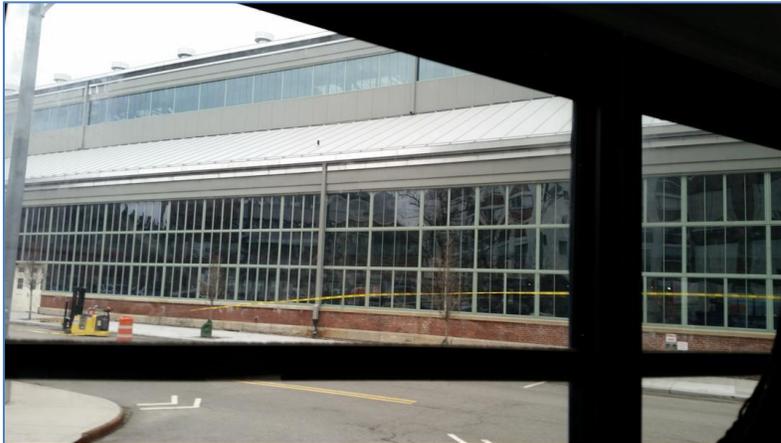


Figure 5.4. Conversion of an original building to a new manufacturing center nearing completion. September 2016; photo by S. MacDonald

Following the tour and the assignment, student researchers, having been introduced in the classroom to the knowledge and methods of inquiry of other disciplines offered by invited guest lecturers, and to the potential significance offered by place-based research, begin the process of giving more focused thought to their semester projects. At this point, the idea of incorporating the perspectives of more than one discipline in their field and secondary research and the concept of linking their inquiry to the theme of economic sustainability begins to take form.

In some cases, students who may not have easy access to an actual site they wish to use for the place-based component employ a virtual place-based approach. In such cases, students have used interactive virtual tours that enable them to interact with the site. Examples have included student presentations on new technologies that allow homes in urban/suburban settings to operate “off the grid,” but that were not possible to physically visit. One such example was the “Hydrogen House” described as a project that illustrated “an effort to finally rid the world of the economic, social, and environmental injustices of fossil fuels.”<sup>9</sup> In this research, the student’s purpose was to highlight how the engineering and design features of the house, specifically the developer’s installation of a mechanism that converts solar energy into hydrogen gas that powers the home, car and other appliances, increased economic efficiency by lowering utility costs while at the same time, showcasing the viability of how a clean energy resource can be creatively used.

As students work toward refining their topics, beginning the process of conducting secondary research and thinking about and planning the site for their place-based field visit, they are asked to prepare a rough first draft of their research proposal shortly after mid-semester. Even though this draft is still a work in progress, students are challenged to begin considering how they will apply interdisciplinary reasoning, thinking and analysis to their research and to contemplate how the place-based site will enhance their experiential learning. The format for this summary asks

students to address five key questions in a short 1 and ½ to two-page paper. These questions include:

1. A one paragraph discussion of the central *question/hypothesis/thesis* that guided your research project and why you chose the topic.
2. One paragraph that summarizes the main findings from your *secondary* research sources and how these have informed your research.
3. One paragraph in which you describe the *significance and the most important contributions of the site you chose for your field research* to the overall research project, *and why you chose this site*.
4. A paragraph that summarizes the *main findings and conclusions* you have drawn from your research, including new information you obtained from the research you conducted.
5. A final concluding paragraph in which you discuss what you view as the key *significant contributions of your research*. This should also address the key contributions of at least one other discipline other than Economics. This might feature your own field of study and/or the contributions of other disciplines.

Students who are still undecided about what site to choose for the place-based component of their projects are advised and provided suggestions following a review of their responses to the questions in this first draft.

The following cases highlight two examples of students' final research projects conducted in spring 2016. The students' place-based research, either virtual or actual, is tied to a central question or thesis that effectively investigates the central purpose employing an interdisciplinary perspective. Each case begins with a summary of the central question, followed by an examination of how the students addressed the guiding questions they posed in their research summaries.

**Case 1:** Central Question: *Can Wind Turbine Installations Installed Along Highways Reduce Greenhouse Gas Emissions in New York City?*

Employing an analysis that draws upon the disciplines of Ecology, Economics and Mechanical Engineering technology, the student in this case<sup>10</sup> began with a study of the Maple Ridge Wind Farm installation located just off of Route 81 just north of Syracuse, New York. The system, which is relatively new, is located very close to a predominantly rural area that includes farms and some homes.

In addition to the premise that such installations offer clear environmental benefits through the provision of clean energy, the study looked closely at questions of potential negative environmental impacts, including those of noise and dangers to animal species – primarily the case of birds colliding with turbines. The student’s analysis examined the range of data that needs to be collected prior to the installation of a planned wind farm of a given size, including required land acreage and access to it, the amount of capital required for a proposed project, determination of the size of the market for the energy source, and determining the feasibility of the site, among other factors.

In analyzing the potential positive and negative impacts, the student analyzed data on noise (decibel) levels, and statistics on wildlife impacts. The data obtained on this particular site indicated that the 55-decibel level produced by the turbines was equivalent to that of “a car travelling at a speed of 60 miles per hour,” and that while bird collisions occurred, the data did not suggest the presence of the turbines posed an environmental threat to the affected species.

The study also included an examination of the economic costs and benefits of the overall project. Operating costs per 3.45 megawatts of energy produced were calculated. In aggregate, the economic benefit (profit or gain) of the energy produced was estimated to be slightly more than double the cost of operation over the expected 25-year lifespan of the turbines. Thus, while

there is an initial significant capital outlay, profitability over the long term more than paid for the initial investment.

Further analysis considered the broader economic and environmental health benefits of wind energy overall. These included both *direct* job creation - design, building and maintaining the turbines - and *indirect* job creation through the increased demand for the specialized materials that firms produce that are needed for constructing the turbines. Implications for reduced fuel prices were also viewed as an added economic benefit, as the availability of renewable energy reduces dependence on fossil fuels whose prices can fluctuate with supply. The principal environmental benefits considered the measurable reductions in carbon pollution from sulfur dioxide and other sources that pose a threat to human health and wildlife.<sup>11</sup>

**Case 2:** Interdisciplinary Place-Based Learning in a Virtual Context:  
Central Question: *What are the Dangers of Rising Sea Levels in New York City?*

In some cases students are unable to physically visit the place(s) that they have chosen as the focus of their place-based research. In these cases, students have employed the virtual study of place to explore the significant of location to the central topic or question. In this instance, the student's research focused on the widely projected threat that rising sea levels would pose to the ecology, landscape, and sustainability of economic life of New York City. Certainly, many waterfront areas around the boroughs of New York City are easily accessible. However, aside from observing exceptional situations such as the very real damage caused by an event such as Superstorm Sandy, an analysis of the estimated threat of rising sea levels over time is certainly difficult to observe during a one-time visit to a site.

In this instance, the student, Janet Lee began with color coded maps developed by the CUNY Institute for Sustainable Cities affiliated with Hunter College (CUNY), showing predicted sea

level rise over a 100-year period from 2020 through the 2100s.<sup>12</sup> She then chose to explore the potential impact over time of how water and its ecosystems depend upon the kinds of decisions humans in the environment might decide to make. Visiting the Connected Worlds exhibit at the recently re-opened New York Hall of Science,<sup>13</sup> the student had the opportunity to interact with changes stemming from rising sea levels and the pace of climate change through an interactive exhibit simulating the causes of sea level rise resulting from various (human) choices. The exhibit features six different ecosystems – all in some critical way affected by or dependent upon water. The centerpiece of the exhibit is a virtual waterfall that projects from the ceiling across the floor and is central to the survival of the various ecosystems. On the floor are physical “logs” that can be positioned to direct the water to any of the six ecosystems. Decisions that are made about how to direct the water by positioning the logs in a particular way have a direct impact on the interrelated ecosystems. The walls of the exhibit feature an animated interactive display of plants and sea life. By interacting with the virtual environments, a participant can directly affect what happens in that environment. For instance, a gesture of ‘planting seeds’ or nurturing the various animal species might encourage a plant species in the ecosystem to grow or fish and other wildlife to reproduce. A very different kind of decision about how to route the water provided by the waterfall could have the effect of depriving the ecosystem of needed nourishment.

The student used her experience of the virtual water-based ecosystems to make connections to the issue and challenges of urban flooding. What were the potential economic impacts of devastating coastal flooding? To what extent would the local ecosystems be forever changed?<sup>14</sup> While an immediate connection may not be obvious, the notion that human interaction with ecosystems can have devastating outcomes led her to the conclusion that certain public policy

decisions affecting real coastal ecosystems are essential and have the ability to impact the projected sea level changes in a positive way, by slowing or possibly reversing their progression. Such decisions were viewed as essential to protect both the local ecosystem and its geographically contiguous economy. In this case, there was an insightful recognition of the ability to shape the outcome of what has been forecast to occur.<sup>15</sup>

### **Conclusions: Adopting Interdisciplinary Place-Based Learning in Urban Higher Education**

How can an interdisciplinary place-based focus in undergraduate teaching be implemented at other institutions? How can urban spaces in any location be employed to enhance students' experiential interdisciplinary learning? The framework of either a place-based or virtual place-based approach can be tapped in a number of ways across disciplines to utilize urban spaces in creative ways to link the study of a particular problem or issue to the real-world experience of that problem. In the process, students' understanding of the research question benefits in a number of ways through the acquisition of added knowledge about how that challenge takes shape or plays out in the actual laboratory of the larger community.

What is key is to think creatively about how to employ the local environment as a laboratory that students can explore as part of the process of working toward a fuller understanding of the significance of a research topic/question takes shape in the real world. The practice of incorporating some part of that world into student research has the capacity to enrich and deepen awareness while creating an integral link between the theoretical understanding of place and its relationship to real world dynamics. Most importantly, incorporating the interdisciplinary component should involve students in a project that investigates a central question from multiple perspectives. That is, what are the various disciplinary perspectives from which this problem might be understood? Having students frame the inquiry that guides their projects in the context

of asking questions that necessarily involve incorporating diverse disciplinary perspectives is an essential starting point for such a process.

Researching the local environment might be the local neighborhood of which the university is an integral part. Students can easily become actively engaged in a research project that incorporates a study of some aspect of that neighborhood or community in nearly any course with an interdisciplinary focus, while at the same time linking that study to a theme that might be defined for that course. The challenge is to think creatively about how these spaces can be used to connect an interdisciplinary theme to the real-world experience and application of that course theme.

For instance, the theme of the course might be to understand the local community from any of a range of disciplinary perspectives and to then make connections between that perspective and a larger environmental issue. Perhaps this involves a study of the Economic and Sociological dimensions of neighborhood participation in a community garden project in an urban studies or human services course. Possibly it encompasses a health impact analysis of a nearby food desert (defined by the American Nutrition Association as “parts of the country vapid of fresh fruit, vegetables, and other healthful whole foods, usually found in impoverished areas. This is largely due to a lack of grocery stores, farmers’ markets, and healthy food providers)<sup>16</sup>” for a nursing, urban planning, health economics, or public policy course. Maybe the student project examines the transformation of the residential and commercial character of the surrounding neighborhood and considers the implications for housing affordability, the fabric of community life, the community’s voice in planning, considerations about open space and sustainable resource use, and other environmental impacts for an environmental studies or urban geography course.

Where it is not possible to connect directly to a physical place linked to a research question in the course, the limitations posed by geography (access) can be transcended through the application of a virtual experience. The real constraints posed by geographic access can be surmounted through a virtual exploration such as a simulated study.

At the same time, incorporation of a virtual place-based learning experience in a student research project also has significant socio-economic implications. Limitations posed by socio-economic circumstances that make direct observation unfeasible can be surmounted through a virtual experience. Here, the incorporation of a virtual engagement with place can serve to meaningfully enhance the process of connecting under-represented groups in urban environments with the real world. In such cases, the virtual becomes innovative and creative and makes the place real, transcending the limitations of or access to the physical space. This technique can successfully bring the real world to students in urban settings, while at the same time integrating an interdisciplinary perspective on that world.

Many such options are beginning to emerge as a result of new technologies that offer rich opportunities for direct study of environments globally. Such examples include a new series on climate change produced by the *New York Times*<sup>17</sup> that has employed drone technology to photograph and highlight the visible geographic and weather-related changes occurring in various parts of the world. One such example, “Living in China’s Expanding Deserts,<sup>18</sup>” takes observers on a virtual tour of the Tengger Desert located in a remote area of north central China to illustrate the consequences for a small farming village of rapid desertification that is linked to climate change. The accompanying narrative highlights the profound changes impacting a community that has depended for generations on income from farming and raising sheep, and

illuminates the many dimensions of community life that have been impacted by changes in climate patterns over a very short period of time.<sup>19</sup>

Another feature in the series enables visitors to virtually experience the effects of rising sea levels on the remote Pacific nation of Kiribati, described as “a collection of 33 coral atolls and reef islands scattered across a swath of the Pacific Ocean about twice the size of Alaska,<sup>20</sup>” that are no more than five to six feet above sea level. A student examining the realities of rising sea levels can see the impact on some of the islands that make up this tiny nation, where high tides periodically flood homes and farmland threatening to make life there unsustainable in the very near future. The tides also threaten fresh drinking water. Citing climate models that have predicted that sea levels could rise five to six feet by 2100, the feature notes that the nation has “been drawing up plans for its demise,” purchasing land in Fiji and encouraging residents to consider permanently relocating.<sup>21</sup>

The virtual study of this kind of change, while facilitating an examination of the impact of events as they unfold also broadens the concept of “community,” making place-based study accessible on a global scale. At the same time, it facilitates the application of an interdisciplinary perspective, providing direct access to data and information on both the economic and environmental impacts.

Integrating resources such as these virtual journeys to communities both far flung and close to home, or virtual tours of an innovative design such as the Hydrogen House, that are otherwise inaccessible to students for direct observation are yet another way that the world can be brought into the classroom and into students’ interdisciplinary place-based research projects.

#### NOTES

1. Guest lecturers have effectively made connections between their own discipline to environmental economics by incorporating readings, in-class and virtual activities.

2. New York City College of Technology, City University of New York, “About the Open Lab,” *Open Lab at City Tech: A place to learn, work, and share*, accessed March 20, 2017, <https://openlab.citytech.cuny.edu/about/> .
3. “About Brooklyn Grange,” accessed March 20, 2017, <https://www.brooklyngrangefarm.com/about-brooklyn-grange-1/> The Brooklyn Grange describes in its mission as comprising “the leading rooftop farming and intensive green roofing business in the US.” Among its many services, the Grange notes that “In addition to growing and distributing fresh local vegetables and herbs, Brooklyn Grange also hosts events and educational programming, provides urban farming and green roof consulting and installation services to clients worldwide.”
4. Ibid.
5. New York Harbor Foundation, “Restoring Our Harbor, Reconnecting new Yorkers to the Water,” *Billion Oyster Project*, accessed March 20, 2017, <https://www.billionoysterproject.org/about/>. The Billion Oyster Project started as an initiative of the New York Harbor School. Its stated goal is to restore one billion oysters to the waters of New York City over the next twenty years in the effort to filter the waterways. To date, according to its website, it has restored 20 million oysters throughout the waters surrounding New York City. <https://www.newyorkharborschool.org/billion-oyster-project/> .
6. All student names noted in this chapter are pseudonyms.
7. Vallerie Allen, “Urban Ecology Tour,” *Environmental Economics* short paper (New York: City Tech, Fall 2016), 1.
8. Sylvia Torres, “Urban Ecology Tour” *Environmental Economics* short paper (New York: City Tech, Spring 2016), 1.
9. Hydrogen House Project, “About the Hydrogen House Project,” accessed March 20, 2017, <http://hydrogenhouseproject.org/about.html>. Founded by inventor Mike Strizki in 2011, the Hydrogen House Project is a 501(c)(3)non-profit organization “dedicated to education and the pursuit of clean and renewable energy technologies.” The site notes that Strizki attracted international recognition in 2006 after he converted his New Jersey home to operate solely on solar and hydrogen power.
10. Raymond Rall, "Can Wind Turbine Installations Installed Along Highways Reduce Greenhouse Gas Emissions in New York City?" *Environmental Economics* final research project (New York: City Tech, Fall 2016),
11. Ibid., 6.

12. The Institute for Sustainable Cities, City University of New York, *Reports Repository*, accessed March 23, 2017, <http://www.cunysustainablecities.org/>. This site is an excellent source for initiatives and reports on community activities related to local environmental challenges.
13. Mary Record, “Connected Worlds,” *New York Hall of Science*, accessed March 23, 2017, <http://nysci.org/connected-worlds/>
14. Janet Lee, “What are the Dangers of Rising Sea Levels in New York City?” *Environmental Economics* final research project (New York: City Tech, Fall 2016),
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17. New York Times, *Carbon’s Casualties*. This series of reports from locations around the world focuses on the economic and human impacts of climate change and examines how climate related geographical changes have affected the physical landscape in various parts of the world including China, Spain, the U.S. (Louisiana and Alaska), Africa and Kiribati Islands in the Pacific. The uniqueness of the reports is in the virtual experience of the impacts on the local ecosystems and traditional ways of life experienced by communities impacted by changing climate patterns that is brought to readers. <https://www.nytimes.com/2016/07/03/world/asia/climate-change-kiribati.html>
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19. *Ibid.*, 2
20. Ives, Mike, July 2, 2016, “A Remote Pacific Nation, Threatened by Rising Seas” *New York Times*, accessed March 25, 2017, [https://www.nytimes.com/2016/07/03/world/asia/climate-change-kiribati.html?\\_r=0](https://www.nytimes.com/2016/07/03/world/asia/climate-change-kiribati.html?_r=0)
21. *Ibid.*

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