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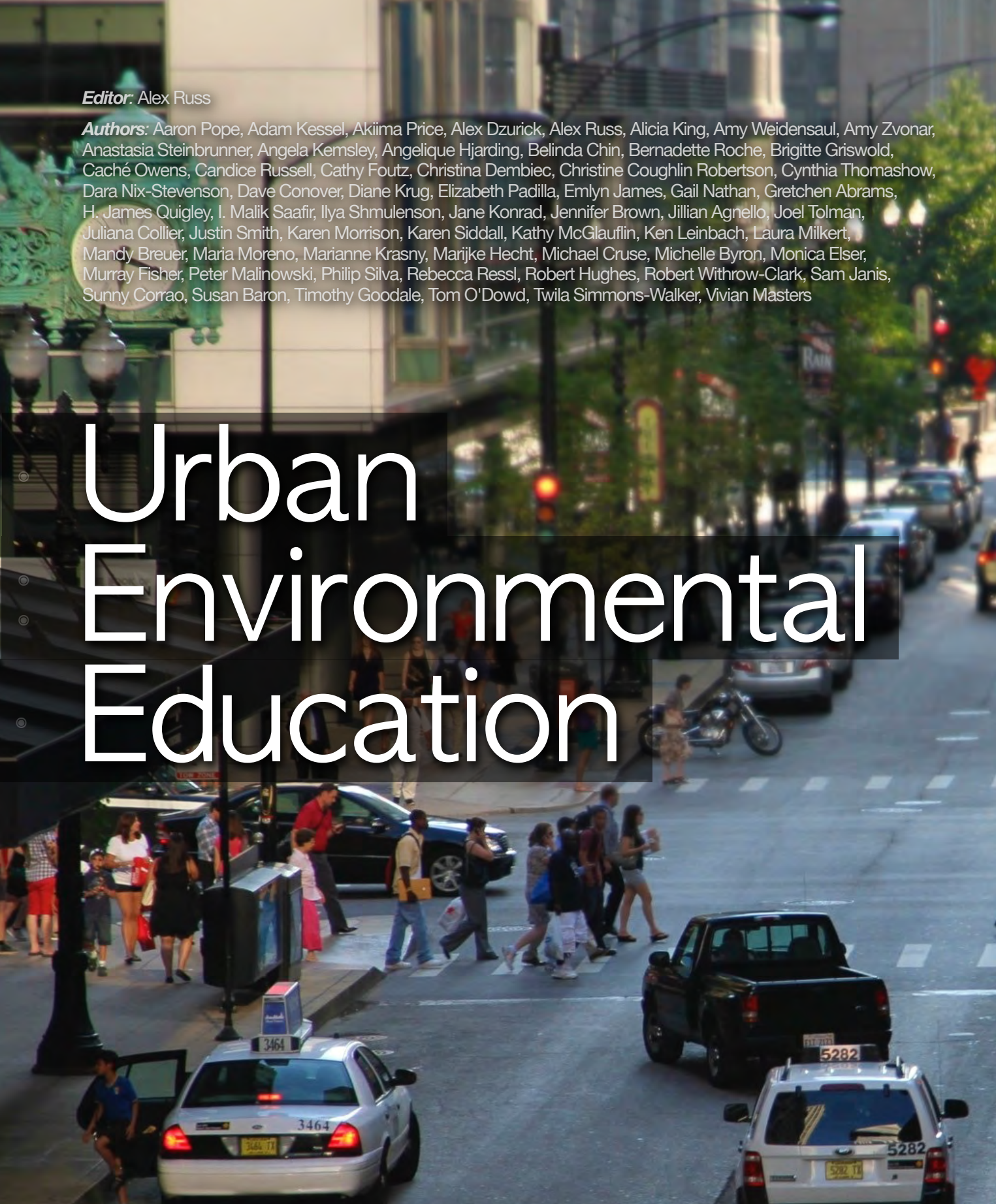
Urban Environmental Education



Cornell University Civic Ecology Lab, NAAEE, EECapacity, 2015
Produced through a cooperative agreement with the US Environmental Protection Agency

“I welcome this book as a compendium of ideas and experiences that represent a dimension of US environmental education that is increasingly important and influential. This is not about the great outdoors in the traditional sense nor is it about adventures in the wilderness; it is about empowering those who live in often challenging circumstances to work together within their communities to improve their situation for the benefit of people and wildlife. Non-US readers will be impressed by the breadth of coverage and the number of projects described. They will need to look closely to see what ideas may be relevant to their own situations and what can be borrowed. They might also see opportunities for the US to borrow from environmental education initiatives elsewhere. As such, this book offers another step in a worldwide environmental education dialogue – one which is becoming increasingly important as the consequences of modernity become ever-more pressing.”

— Justin Dillon, *University of Bristol, UK.*

“Everyone working in environmental education should read this book. Building on the field’s rich history of working in urban environments, these pages serve as a catalyst to new thinking about how we can address the profound changes and challenges facing cities today. With more than 80 percent of Americans living in urban environments, this superb collection of research, case studies, and ideas couldn't be more timely, and it’s exciting to see so many examples of programs that are working to link environmental integrity, social equity, and shared prosperity. Kudos to the talented authors and editors for providing such a creative source of new insights and inspiration for our work in urban environmental education.”

— Judy Braus, *North American Association for Environmental Education, USA.*

“This publication illustrates ways in which environmental education is evolving to meet the urgent need of increasing environmental literacy in urban areas. Cities present both opportunities and challenges for environmental education because most of the world's population already lives in cities. The authors identify important trends in environmental education that will help educators in developing programs and initiatives that will address some of the most pressing environmental issues of our time as we work towards the development of sustainable cities. Stewardship, place-based education, citizen science, problem solving, and systems thinking will be at the forefront of environmental education. Classroom teachers and environmental educators must be well versed in these strategies. This publication will serve as a practical primer for anyone wanting to acquaint themselves with urban environmental education, its theory and practice.”

— Mary Leou, *New York University, USA.*

“Humans are concentrating in urban areas despite increasing environmental risks and environmental injustice, especially in developing and underdeveloped countries. Sustainable management of cities is a great challenge; it requires social and environmental transformations that depend, though not exclusively, on education promoting critical thinking, empowerment, and networking. This book, which resulted from an online exchange and networking among environmental educators, contributes to urban sustainability by disseminating innovative educational ideas and practices. The book is particularly useful for educators and other practitioners who want to review general topics in urban environmental education, learn from case studies in various contexts, and reflect on their own assumptions and practices. The book presents cities as exciting laboratories where people engage in learning and civic actions to build a more equal and just world, both socially and environmentally.”

— Isabel Martins, *Federal University of Rio de Janeiro, Brazil; and*
— Luiz Marcelo de Carvalho, *University of State of São Paulo, Brazil.*

“As more and more people live in urban areas and spend time behind screens, the need to develop meaningful connections between city residents, communities, urban places and the natural world seems more crucial than ever. This impressive collection of innovative and diverse perspectives and practices provides powerful imagery of the possibilities that urban environmental education provides for establishing these connections. Furthermore, the book identifies the capacities citizens need to contribute to the socio-ecological well-being of their community, as well as the different ways these capacities can be developed. A must-read for anyone looking for ideas, inspiration and forms of meaningful engagement in the key challenge of our time: reconnecting people and planet.”

— Arjen Wals, *Wageningen University, Netherlands, and Gothenburg University, Sweden.*

Urban Environmental Education

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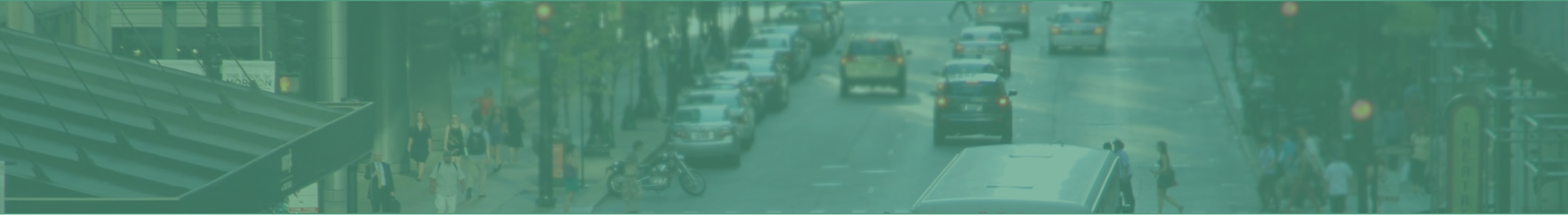
Ithaca, NY and Washington, DC, 2015



This book was written by more than 50 environmental educators in the United States who participated in an online learning community "Urban Environmental Education" in April–December 2014 (online community facilitator and book editor: Alex Russ). This online learning and networking was one of the professional development activities organized by EECapacity, a national EPA-funded environmental education training project conducted by the Cornell University Civic Ecology Lab, the North American Association for Environmental Education (NAAEE), and partner organizations.

The authors and editor thank Marianne Krasny (EECapacity PI and Cornell University Civic Ecology Lab's Director), Judy Braus (NAAEE Executive Director), Jose Marcos-Iga (NAAEE President, and International Programs Manager at Environmental Education Exchange), and others for leading the EECapacity project that enabled creating this book, and for inspiring the idea and format of this book. We thank speakers – David Maddox, Justin Dillon, Karen Purcell, Marianne Krasny, Martha Monroe, and Philip Silva – who shared with our online community their vision of urban environmental education through webinars in April-May 2014. Marianne Krasny also greatly helped by proofreading the entire book.

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Cornell University

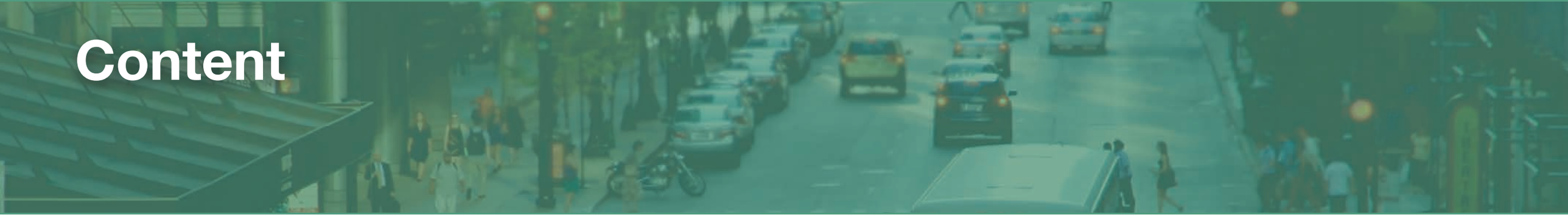
CIVIC ECOLOGY LAB

naaee
North American Association for Environmental Education

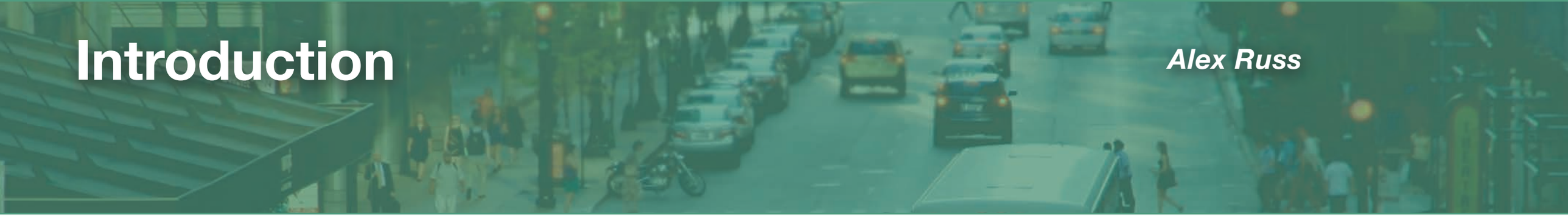
ee capacity

EPA United States Environmental Protection Agency

Content



CASE STUDY CHAPTERS



Introduction

Alex Russ

Urban environmental education programs contribute in different ways to human well-being and environmental integrity in cities. These programs focus, for example, on community environmental leadership, positive youth development, urban natural areas, urban environmental restoration, green infrastructure, sustainable urban planning, green jobs, environmental art, urban agriculture, and environmental justice. Urban environmental education is a diverse and rapidly developing field. To achieve a better understanding of its goals, teaching approaches, providers, and audiences, we are writing this book.

This book is written by environmental educators in the U.S. Most of them participated in the EECapacity project's "Urban Environmental Education" online learning community from April–December 2014, and authored "conceptual" chapters of this book. Several other educators were invited to join this community in fall 2014 to contribute shorter "case study" chapters to provide examples of urban environmental education programs. One objective of this book is professional development of its authors through chapter writing, networking, and generating new ideas for the field. Another objective is to contribute to the field of urban environmental education by reflecting on relevant concepts and practices in cities.

Cities are evolving ecosystems and we continually learn how to manage them for desired social and ecological outcomes. Urban environmental education, which can be viewed as part of the larger system of environmental governance, helps us improve cities. This task is challenging because cities are incredibly complex and perform many functions: they are engines of innovations, producers of pollution, sources of prosperity, consumers of natural resources, and labs for solutions to social and environmental problems. Cities have to develop better mechanisms for long-term sustainability, which depends on human creativity, communities' adaptive capacity, our understanding of biophysical and social systems, fostering human and social capital, commitment to human equality, and our participation in urban planning and environmental stewardship. These are some characteristics of cities that urban environmental education programs are trying to enhance through different educational approaches.

In this book, we offer just a glimpse at selected topics in urban environmental education – topics that were interesting to the participants of our online community. The idea of this book was inspired by the authors' experiences in urban environmental education and their interest in exploring relevant publications. It was further defined by the editor's understanding of urban environmental education that resulted from his experiences in New York City's programs (Photos 1-5), as well as by academic publications on urban environmental education (see References in Chapter 2) and publications in relevant fields such as environmental justice and green urbanism. The specific topics of conceptual chapters in this book were proposed by the editor and by educators who then worked in small groups to write these chapters. All case study chapters were submitted after an invitation from the editor, based on his previous connection to these programs and educators.

To preserve the authors' original thinking and style, the chapters underwent only minimal editing; the editor and the EECapacity project do not necessarily endorse the authors' viewpoints. This book can be a useful reading for in-service and in-training educators who are interested in urban environmental education. Enjoy this book, and feel free to share your comments with chapter authors.

Photo 1. Students from the Satellite Academy High School explore urban agriculture at the Eagle Street Rooftop Farm, New York City. Photo credit (all photos in this chapter): Alex Russ.

Photo 2. Students at Rocking the Boat in the South Bronx build and use boats to restore the Bronx River and help residents connect with the urban environment.

Photo 3. Educators at the Nature University summer program, New York Restoration Project, teach kids to use parks for cooking, gardening, exercising, writing, exploring, and playing.

Photo 4. Students from The POINT CDC's A.C.T.I.O.N. program restore urban soil and plant native plants in the South Bronx.

Photo 5. In the Battery Park in Downtown Manhattan, students from a transfer high school learn to grow and sell vegetables.

1. Urban environmental education trends

Alex Russ
Marianne Krasny

HIGHLIGHTS

- **Urban environmental education includes any environmental education programs in cities.**
- **Different goals of urban environmental education described in publications fall into five broad trends: City as Classroom, Problem Solving, Environmental Stewardship, Youth and Community Development, and City as Social-Ecological System.**
- **Urban environmental education programs usually try to achieve multiple goals and combine various educational approaches.**

Introduction

Why do environmental educators work with urban residents in community gardens and parks, in the shadow of skyscrapers, along crowded streets, in inner-city schools, and industrial facilities? There are too many reasons – for example, some educators want to improve environmental literacy among students, or foster positive youth development, or inspire community-based environmental stewardship. To better understand different forms of urban environmental education, this chapter describes its goals based on a review of the academic literature.

We define urban environmental education as any environmental education that occurs in cities. Some education programs in cities are similar to those outside cities, while other programs are quite different. Providers of urban environmental education are remarkably diverse. They include public schools, community-based organizations, zoos, botanical gardens, park conservancies, volunteer groups, museums, outdoor recreation clubs, and youth development programs. They vary in educational settings, target audiences, teaching approaches, curricula, and desired outcomes. Yet urban environmental education programs are similar in that they work with urban residents, operate in cities, and face specific urban social and environmental issues and opportunities. In addition, one could argue that most urban environmental education programs ultimately intend to contribute to human well-being and environmental integrity in cities.

One approach to understand urban environmental education is to review its specific goals described in the literature. This chapter is an adaptation of the literature review manuscript submitted to a journal. We analyzed articles, chapters, and books found through Google Scholar and in ERIC (an online library) by searching the phrase “urban environmental education.” By reading over 100 publications from this search, we identified the underlying goals of urban environmental education and grouped them in five trends (Table 1). Do any of these trends reflect the goals of your own environmental education program?

These trends show a rich history of urban environmental education as it has been discussed in the literature. Although the term “urban environmental education” was introduced in 1960s

Table 1. Trends in urban environmental education.

Trends	Goals	Examples of educational approaches
City as Classroom	Facilitate learning about science, ecology, and the environment using urban outdoor or indoor settings.	Nature study, citizen science, environmental monitoring, inquiry-based programs, community mapping, neighborhood inventories.
Problem Solving	Address environmental and related social problems.	Environmental activism, conservation education, action research, environmental justice education, climate change education.
Environmental Stewardship	Foster community-based management of urban ecosystems and natural resources.	Grassroots stewardship and education, civic ecology education, green jobs training, youth employment programs.
Youth and Community Development	Contribute to positive youth development, asset-based community development, community organizing, and social capital.	Youth development programs, adventure education, youth counseling, community development programs.
City as Social-Ecological System	Develop an understanding of cities as social-ecological systems, re-imagine how to manage cities to achieve desired environmental and social outcomes.	Any approaches to explore social and ecological aspects of cities: art, history, participation in green design and urban planning, environmental events, learning from professionals and lay people.

and 1970s (Glasser, Stapp, & Swan, 1972; Reid, 1970; Shomon, 1969), related ideas date back to the first half of the 20th century (Bailey, 1911; Philpott, 1946; Renner, 1942). Initially educators working in urban areas borrowed ideas from nature study, science education, and conservation education. Later they also focused on environmental and related social issues. More recently, they adopted the ideas of environmental stewardship, youth and community development, and social-ecological systems. A number of published reports, symposia proceedings, curriculum guides and anthologies explored the long history and approaches of urban environmental education (Australian Association for Environmental Education, 1984; Board of Education, 1960; Bureau of Sport Fisheries and Wildlife, 1968; Frank, Zamm, Benenson, Fialkowski, & Hollweg, 1994; Krasny, Lundholm, Shava, Lee, & Kobori, 2013; Leou, 2005; Strauss, 2013; Verrett, Gaboriau, Roesing, & Small, 1990). Unlike these publications, this chapter makes sense of urban environmental education based on a systematic review of the literature. We hope it will help you reflect on your own practice, and consider whether different approaches are applicable to your program.

Trend 1: City as classroom

The goal of the City as Classroom trend is to foster environmental literacy or knowledge of the local environment. Programs that reflect this trend use outdoor and indoor settings in cities to facilitate learning about nature, ecology, biology, environment, and related sciences. These programs take advantage of natural areas in cities where one can learn about biodiversity and environmental quality. They also use street trees, parks, green infrastructure, industrial sites, and museums to help people understand local and global ecosystem processes. Approaches in this trend include nature study, environmental monitoring, science lab activities, community mapping, measurement of ecosystem services, and citizen science (see examples in Photos 1 and 2).

In the mid-20th century, this trend was driven mostly by concerns about science literacy and the recognition that experiential learning can enhance understanding of natural history and other aspects of science. Educators were advised to teach

about biology, natural science, and resource conservation – by taking students to various urban sites including school grounds (Russell, 1973), water supply and sewage disposal facilities (Wisconsin Department of Public Instruction, 1949, p. 36), urban nature trails (Polley, Loretan, & Blitzer, 1953), vacant lots, urban schoolyards, and urban trees that could be surveyed and mapped (Milmine & Yarrow, 1972; Weaver, 1955), forests near urban schools (Bathurst & Hill, 1957), greenhouses, vegetable stands, and public markets (Bureau of Elementary Curriculum Development, 1958), and any other places in urban neighborhoods (Hollweg, 1995). The term "urban environmental education" itself was first used in 1969 to describe nature centers exposing people to urban natural areas to foster a conservation conscience (Shomon, 1969). Shortly thereafter, authors expanded on this approach to suggest that people can develop appreciation for the natural environment and a conservation conscience, evaluate pollution, understand the dependence of cities on other ecosystems, and learn about urban infrastructure through observing soils, plants, and animals around schools (Board of Education, 1960) and in urban nature/outdoor education centers (Hill & White, 1969; T. R. Tanner, 1974); visiting zoos, natural history museums, aquaria, and urban parks, or sailing on a schooner within city waters (Blaustein, 1968); exploring vacant lots and abandoned buildings (Rillo, 1971); becoming aware of the location of fire stations and public transportation corridors (Spitzner, 1975); learning how buildings and public spaces shape the environment (Sandler, 1989); and independent projects in schools (Blackwelder, 1976).

Recent publications show that learning about ecosystems, biodiversity, and related science remains a goal of many urban environmental education programs. To achieve this goal, students engage in citizen science, urban field studies, outdoor investigations, inventories, ecosystem services measurement, inquiry-based activities, and visiting urban nature centers (Barnett et al., 2006; Barnett, Vaughn, Strauss, & Cotter, 2011; Dearborn & Kark, 2009; Fialkowski, 2003; Hart, 1994; Hashimoto-Martell, McNeill, & Hoffman, 2012; Johnson & Catley, 2009; Watson, 2006). Some high schools focus their entire curriculum around environmental studies and use urban ecosystems as their outdoor classrooms (Kudryavtsev, 2011a; M. Weintraub, Park, & Jang, 2011). Expected or reported

Photo 1. Students from the Satellite Academy High School measure water quality in the Bronx River. Photo credit (all photos in this chapter): Alex Russ.

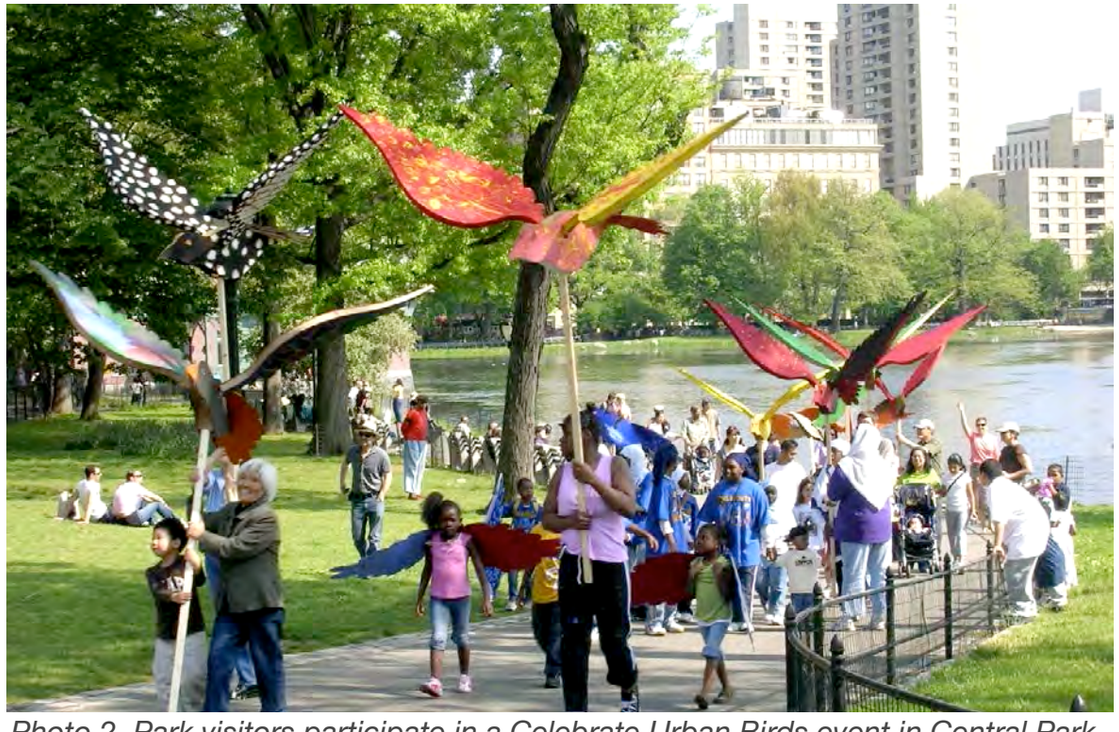


Photo 2. Park visitors participate in a Celebrate Urban Birds event in Central Park.

outcomes of such urban environmental education programs include environmental awareness (Fisman, 2005), environmental knowledge (Hashimoto-Martell et al., 2012), helping immigrant students connect to their heritage (Bruyere, Wesson, & Teel, 2012), improving people's ability to perceive and understand urban environmental aesthetics (de Sousa Vianna, 2002), and learning about local history and communities (de Kadt, 2006, 2011). In sum, City as Classroom is an established trend in urban environmental education, whose goal is to facilitate learning about science and the environment, including students' local environment, through exploration of natural, historical, social, and human-made elements in cities.

Trend 2: Problem solving

The goal of the Problem Solving trend is to mitigate related ecological and social issues – often through the development of environmental knowledge, attitudes and skills – which may contribute to pro-environmental behavior, environmental activism, and environmental restoration projects. Initially, this trend in urban environmental education was motivated by two concerns. First, it gradually emerged as a response to urban environmental issues such as air pollution, lack of green spaces, public health, crime, and unequal distribution of environmental burden and access to ecosystem services. Second, it was inspired by the perception that environmental education was too focused on ecological knowledge or conserving natural areas outside cities, and had little relevance to the everyday experiences of urban residents. The types of problems that this trend addresses have expanded over time from pollution, conservation, and infrastructure to encompass related social issues such as community health and nutrition, gentrification, crime, and unemployment (Photos 3 and 4).

In the first half of the 20th century, researchers noted that cities offer opportunities to learn about environmental problems, such as the use of rivers as sewers or roadsides as trash dumps, and their solutions (Renner, 1942; Renner & Hartley, 1940). Later, professionals reasoned that conservation education efforts should include urban residents because they are involved in decision-making affecting

Photo 3. Sustainable South Bronx organizes a "toxic tour" to show students examples of environmental injustice and discuss its possible solutions such as activism and green jobs.

Photo 4. Students at the Wildcat Academy High School use hydroponics to grow vegetables to address the "food desert" in the South Bronx.

natural resources (American Association of School Administrators, 1951), and that students can learn from firsthand experiences in urban neighborhoods and motivate their parents to help mitigate environmental problems (Donnelly, 1957). Notably, this trend attempts to make environmental education relevant to the everyday experiences of urban residents. Publications emphasize that urban children and adults may have little interest in nature study, learning about ecology and wildlife distant from cities, or outdoor education in natural areas (Roth, 1961; Schneider, 1968). Rather, authors point out that city dwellers may be more concerned about air pollution, waste disposal, cleaning up urban rivers, human health, city planning, traffic congestion, lack of recreation areas, and experiences of urban life. Echoing this idea, urban environmental centers, initially inspired by more rural nature centers, were shifting their attention from teaching about ecological principles to such issues as nutrition, waste, and pollution (Mann & Rutledge, 1981). Further, authors cite concerns about environmental justice, claiming that inner-city residents are overwhelmingly exposed to environmental hazards and experience unequal distribution of natural capital (Clark, 1972; Haluza-DeLay, 2013). Environmental education that fosters skills and knowledge for solving urban problems was repeatedly mentioned in intergovernmental (UNESCO/UNEP, 1978) and national (Australian Association for Environmental Education, 1984) conferences. Finally, authors claim that to engage city residents in environmental problem solving, urban environmental education should be relevant to individuals with different cultural, economic and ethnic backgrounds, and should respect diversity and civic culture (Verrett et al., 1990; B. A. Weintraub, 1995).

In addition to biophysical problems such as pollution or climate change, authors proposed that urban environmental education should address related social concerns including poverty, financial insecurity, youth unemployment, racism, drugs, violence, access to recreation sites and activities, food justice, and human health (Crosley, 2013; Frank et al., 1994; Glasser et al., 1972; Verrett et al., 1990). These social problems could be addressed or learned about through such activities as field trips, meetings with professionals, art, theatre, development of student skills and competences, taking photos of attractive and negative aspects of inner cities, monitoring noise pollution, building birdhouses, planting shrubs, and other actions through which local residents improve their communities (Glasser et al., 1972; Verrett et al., 1990). Within this trend, programs often take place in collaboration with neighborhood councils, faith-based organizations, community centers, housing agencies, and grassroots initiatives (EPA, 1972; Verrett et al., 1990). In sum, the ultimate goal of the Problem Solving trend in urban environmental education is to tackle environmental problems of all kinds. As a response to environmental degradation, climate change, and social issues, programs following this trend educate about causes of these problems and often call for individual, community, corporate, and governmental action to mitigate or solve these problems.

Trend 3: Environmental stewardship

Another goal of educational programs is to enhance urban ecosystems and ecosystem services, create and maintain green infrastructure, support biodiversity, and produce food – by involving individuals and communities in hands-on environmental stewardship and management of urban natural resources. A general assumption of this trend is that citizens or communities are able to design, restore, and maintain local urban ecosystems, often in collaboration with government agencies and non-profit organizations, and at the same time learn about these ecosystems. Programs within this trend may integrate community-based service learning or summer youth employment programs – for example, by involving students in neighborhood greening, urban gardening and farmers markets, installing and supporting green roofs, rain gardens, and other green infrastructure, and restoring urban forests and oyster habitat in estuaries (Photos 5 and 6).

Participants in the Environmental Stewardship trend make direct improvements to urban ecosystems, or maintain ecosystems that provide multiple benefits to urban residents. For example, in the 1950s, urban schools partnered with civic groups and city parks departments to play a role in tree-planting, beautification, and landscaping in neighborhoods, on school grounds, along streets, and in city parks

Photo 5. Students in New York Harbor School grow oysters to restore oyster reefs in urban waterways (Kudryavtsev, 2011a).

Photo 6. Students in a summer youth employment program at Mosholu Preservation Corporation care for public parks.

(Weaver, 1955). Later, authors proposed that children can be involved in constructing ponds and developing urban fisheries (Swan, 1969), and that urban wildlife could be preserved by involving residents in the management of natural areas in cities (Gill & Bonnett, 1973). In addition to contributing to urban greening (Platt, 2006), urban ecological restoration projects are tools for educating students about urban biodiversity and increasing environmental literacy (Frank et al., 1994; Ingram, 2008). Thus stewardship and educational goals may be of equal importance in some programs. Recent work in civic ecology has continued this trend in suggesting that environmental education in cities can be situated in civic ecology practices – including community forestry, community gardening, and community-based habitat restoration – thereby contributing to biodiversity, ecosystem services, and social capital while providing opportunities for environmental learning (Krasny, Kalbacker, Stedman, & Russ, 2013; Krasny & Tidball, 2009a, 2012).

Publications describe how environmental education program participants can partake in stewardship. For example, educators involved children in environmental restoration activities along the Bronx River to help communicate the value of urban natural areas, improve wildlife habitat, increase students' academic achievement, and indirectly to involve parents in recycling and composting (M. J. Tanner, Hernandez, Hernandez, & Mankiewicz, 1992). Community-based organizations such as Rocking the Boat and Youth Ministries for Peace and Justice in the Bronx provided opportunities for youth to engage in stewardship activities including restoration of Bronx River habitats and cleanup of brownfield sites. Other Environmental Stewardship programs involved students in classroom and outdoor urban forestry activities to teach inner-city youth about forest management (Broussard, Jones, Nielsen, & Flanagan, 2001; Gilbert, 2006). In sum, urban environmental education that fits Trend 3 promotes urban environmental stewardship and restoration.

Trend 4: Youth and community development

Within the Youth and Community Development trend, the goals of urban environmental education programs are learning critical life and citizenship skills; achieving self-esteem; building social capital and community cohesion; improving social institutions, social norms and cultural sensitivity; integrating immigrants into local communities; and empowering communities to take collective action. In other words, programs inspired by this trend use the urban environment as a means to foster positive youth development and community well-being. Such programs often take place at after-school and summer youth employment programs, youth development organizations, community development corporations, faith-based organizations, and community-based organizations (Photos 7 and 8).

Starting in the 1980s, authors began writing about how urban environmental education may nurture students' creativity and reaffirm positive aspects of their cultures, increase self-esteem and self-confidence, create positive attitudes towards learning and improve critical thinking, reduce dropout rates and gang and drug activity, promote active citizenship, and develop an understanding of power structures and the ability to influence policy and planning decisions (Breitbart, 1984, 1995; Cooper & Smith, 1989; Verrett et al., 1990; Welsh, 1993). Employing an asset-based model of youth development, some authors (Frank et al., 1994) called for building on and promoting positive youth attributes, such as resilience, social competence, autonomy, ability to solve problems, and a sense of hope for the future. Urban environmental education programs also develop youths' work ethic and teamwork skills while increasing neighborhood food security and informing the community about environmental issues (Saveland, 1974; Schusler & Krasny, 2010; Schusler, Krasny, Peters, & Decker, 2009), as well as developing youth social capital (Krasny, Kalbacker, et al., 2013), sense of belonging to a community, mutual respect, and a sense of care (Delia, 2014; Fialkowski & Williams, 1998). In a program in the Bronx, an urban river and related ecosystems are used to inspire community-based art (Parrilla, 2006).

Photo 7. At Rocking the Boat, education programs foster positive youth development through boat building, environmental restoration, maritime skills, and youth counseling.

Photo 8. Students at the POINT CDC place an announcement about a block party to celebrate a greenway, building social capital.

In this trend, individual and community development are linked because empowered people might make positive changes in their communities. For example, programs may help city residents to articulate their environmental preferences and participate in collective advocacy and urban planning (Butterworth & Fisher, 2000); bring together schoolchildren, educators, architects, environmental officers, and graphic designers to work on community architecture, community design and art, block parties, and other projects to serve community interests (Bishop, Adams, & Kean, 1992); or address local issues through action research and community problem solving (Wals, 1996). Engaging youth and adults in shaping their future through collaborative and life-long learning is consistent with the idea of "urban ecosystem education" (Hollweg, Pea, & Berkowitz, 2003) and with the "Growing Up in Cities" program in which youth assess neighborhood conditions and influence environmental, social, and equity-related policies affecting their lives (Chawla, 2001; Driskell, Bannerjee, & Chawla, 2001; Lynch, 1977). Similarly, in programs in the Bronx, students learned life skills through engaging in data collection, public speaking, community organizing, remediation of urban rivers and brownfields, improving green spaces, and fighting for environmental justice (Kelley, 2005; Parrilla, 2006; Shiller, 2013). In sum, this trend considers positive youth development (Eccles & Gootman, 2002) and asset-based community development (McKnight & Kretzmann, 1996) as legitimate outcomes of urban environmental education.

Photo 9. Students from the Satellite Academy High School interviewing visitors of the High Line park to learn about biophilia and green infrastructure.

Trend 5: City as social-ecological system

City as Social-Ecological System helps people view cities as worthy ecosystems, where social and ecological processes are equally important, and where different approaches to managing the environment are invented and improved. In general, this trend promotes two main ideas: (1) Cities are part of the biosphere, they contain nature, people can interact and are impacted by ecological processes in cities, and urban landscapes provide ecosystem services; (2) Cities are evolving, adaptive, and legitimate social-ecological systems: people can design cities that support ecological integrity and human well-being, and where new adaptive approaches to governing ecological and social dimensions are constantly

Photo 10. Students from Rocking the Boat at the South Street Seaport learn about the environmental and social history and redevelopment of New York City's waterfront.

emerging. Programs following this trend acknowledge that we always have only a partial understanding of how cities should be managed, and that children and adults can participate in constructing new ways of governing and designing the urban environment (Photos 9 and 10).

Although cities have been viewed as existing outside nature (Spirn, 2003) or the environment (Moffett, 2006), some authors consider cities as natural (McClaren, 2009), redefining the concept of nature (Colwell, 1997). At the same time, urban environmental education publications emphasize that natural or ecological elements exist in cities along with built, social, political, economic, cultural, and psychological elements (Carter, 1979; Howard, 1980; UNESCO, 1983), and that inner-city adolescents are able to connect to and appreciate urban nature through outdoor science classes or less formal experiences (Wals, 1994a, 1994b). Further, "education for urban conservation" promotes viewing nature as integral to urban life, thus attempting to bridge the dichotomy between rural and urban ecosystems (Rohde & Kendle, 1997), while Beatley (2011) suggests that cities provide nature-based settings for learning and recreation, which might inspire environmental stewardship. In line with this reasoning, there is building evidence that urban environmental education can contribute to the development of an ecological place meaning among youth, and help see cities as ecologically valuable places (Kudryavtsev, Krasny, & Stedman, 2012).

In addition to portraying cities as legitimate landscapes that are part of the global ecosystem, this trend emphasizes that social and ecological dimensions of cities co-evolve and depend on each other, and new patterns of urban environmental governance are emerging. For example, researchers claimed that "urban environmental education builds an understanding of cities as complex systems that blend nature and culture, and ecology and society" (Williams & Agyeman, 1999, p. 29), and such a systems view of cities is found among urban environmental education programs (Frank et al., 1994; Lauber et al., 2012). Even urban environmental education itself can be viewed as an element of urban systems that may foster social-ecological resilience (Krasny & Tidball, 2009a; Tidball & Krasny, 2010, 2011). Scholars claim that people learn about the city through various channels, including formal and informal educational programs sponsored by community-based organizations, media, and families (Nilon, Berkowitz, & Hollweg, 2003). In fact, education programs motivated by this trend may use any approaches that help people explore, re-define, re-imagine, enhance, and celebrate urban sustainability and life. These approaches include urban planning, green design, field-based surveys, art, photography, cleanups, environmental restoration, school gardens, classroom teaching, formal presentations, street tree mapping, investigating road and building signs, urban field studies that focus on both physical and human systems, exploring land use, field trips to museums, zoos and factories, and learning from professionals and laypeople (Carter, 1979; Dowd, 1978; Lackstrom & Stroup, 2009; UNESCO, 1983). In sum, this trend in urban environmental education is related to social-ecological systems thinking (Folke, 2006; Krasny, Lundholm, & Plummer, 2010; Liu et al., 2007) and green urbanism (Beatley & Newman, 2009), and is helping people to learn about and contribute to our understanding of cities as integrated social-ecological systems, through urban exploration, participation in collective decision-making and action.

Conclusion

We have presented five urban environmental education trends based on the literature. In practice urban environmental education programs often combine trends. For example, in New York City, the New York Harbor School (Kudryavtsev, 2011a) and Satellite Academy High School (Kudryavtsev, 2011b) include classroom and outdoor learning about science and environment, and stewarding school gardens or culturing oysters for reintroduction into the city's estuary. Students in these programs also learn about urban history and designing green infrastructure. Thus, these programs integrate the City as Classroom, Environmental Stewardship, and City as Social-Ecological System trends. In the Bronx, youth develop leadership skills through involvement in restoration projects and advocating for transforming post-industrial blighted areas into green spaces (Parrilla, 2006), which is consistent with the Problem Solving and Youth and Community Development trends. The Garden Mosaics program engaged students

in community gardening as a means for connecting science and multicultural understanding, as well as inspiring local action to solve problems identified by elder community gardeners (Kennedy & Krasny, 2005; Krasny & Tidball, 2009b), thus incorporating ideas from the City as Classroom, Youth and Community Development, and City as Social-Ecological System trends.

Urban environmental education and its trends continue to develop in response to urban challenges and opportunities. On the one hand, cities encounter such tasks as climate change adaptation, reducing carbon dioxide and other emissions, accommodating rapid urbanization, and mitigating environmental injustices. On the other hand, cities inspire educational innovations, alternative forms of environmental governance, and novel solutions to social and ecological issues. In the face of these challenges and opportunities, we may expect that urban environmental education will continue to revise its goals, and learn from such ideas as green urbanism (Lehmann, 2010), socially restorative urbanism (Thwaites, Mathers, & Simkins, 2013), biophilic cities (Beatley, 2011), and social-ecological systems resilience (Berkes, Colding, & Folke, 2003; Ernstson et al., 2010; Gunderson & Holling, 2001) – to serve the majority of the human population now living in small and large cities.

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2. Urban complexity and environmental education

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HIGHLIGHTS

- **Educators – who are prepared to use environmental education methods, extended classroom learning, science investigation, and place-based outdoor exploration as a means to authentically study the complexity of urban neighborhoods – will deliver more relevant and meaningful educational experiences.**
- **The urban environment adds a new set of elements to "nature interpretation," which includes high-density residential and commercial infrastructure, transformed waterways, and paved surfaces that create a rather unique landscape.**
- **Environmental education has the power to transform the way people live in urban areas by revealing the complexities of social and ecological systems and using that awareness to guide engagement and action.**

Over the years, the authors of this chapter have taken our share of urban youth into 'wild' nature. The excursions were intended to introduce young urban dwellers to a different reality than the streets they navigated daily. We hoped that a trip to the 'park' or a 'wild' area that may be tied to a service project would provoke a future of stewardship. Nature, in both of our careers, represented all the 'good' in the world and was sure to inspire and change environmental behavior.

At the heart of this chapter is a challenge to the deep-seated assumptions that drive many approaches to urban environmental education. Often, environmental educators have swept urban youth outside their urban communities to teach about nature, fueled by the belief that there is nothing 'natural' to appreciate within city limits. This deficit-driven model is bound to communicate that cities are unnatural and wrong. Matthews and Riley (1995) found that the programs most likely to change behavior involve concrete, environmentally positive, action-oriented experiences; a relevant context; and long-term involvement, support, follow-up, and reinforcement by role models. This would suggest that youth who participate in nature-based programs removed from their everyday environment often undergo profound personal transformations, but that the impacts are short-lived and do not necessarily lead to pro-environmental behavior when students return to their normal lives.

Finding ways to nurture stewardship within the urban environment is critical to the success of environmental education. It is predicted that 80 percent of the US population will live in cities by 2050 and that the population demographic will be more than 50 percent people of color. However, research shows that the numbers of racially and culturally diverse youth working in environmental organizations is very low (Taylor, n.d.). This discrepancy is important when we consider the future of environmental education and its reach into the cities where most of us live. Environmental justice organizations argue that "environmental content and pedagogies which don't reflect multiple cultural perspectives, reinforce limited concepts of 'the environment' and environmental protection, and circumscribe and legitimate a limited environmental discourse will not produce empowered and informed students, graduates and environmental leaders" (Grass & Agyeman, 2002). This statement calls attention to the integral

connections between environmental concerns and wider questions of social needs, welfare and economic opportunity. It supports the necessity of creating an educational pipeline for people of color from urban areas to have access to jobs in urban environmental education.

What does this lack of cultural diversity and the potential for urban bias have to do with current approaches to urban environmental education? Environmental educators interpret and introduce ecological spaces to students. The urban environment adds a new set of elements to “nature interpretation,” which includes high-density residential and commercial infrastructure, transformed waterways and paved surfaces that create a rather unique landscape. Urban ecology mixes the examination of the biota and ecosystem processes with a place constructed and managed by humans. Navigating the interpretation of urban spaces requires an educator to decide what is important and what is not. Without a lens that values urban ecological complexity, the educator may carry significant educator bias, that is, the tendency to privilege some content over others. In the case of interpreting urban spaces, understanding and knowing the community context of one’s students is vital to building meaningful ecological relationships to a particular community and place. Understanding and communicating the rich ecological context and related social and economic dimensions that influence quality of life in urban settings lays the groundwork for relevant and meaningful environmental education.

What knowledge and skills might help urban youth better understand environmental stewardship? An example may help to illustrate an urban ecology approach: Working with high school students in South Boston, we brainstormed issues affecting the neighborhood. Students were concerned with the rising population of rats in their neighborhoods and began to research the movement of that population through the city with scientists from Boston College's Urban Ecology Institute. Using GIS technology and ecological research techniques, the students revealed that rats were moving in droves from the high socio-economic neighborhoods in Beacon Hill to the lower socio-economic communities of South Boston. The students mapped their movement, investigated multiple causes and finally determined that new rat-proof trashcans issued by the city to Beacon Hill residents left the rats with nothing to eat. The rats streamed into the South Boston neighborhoods to find a new food source. In an evidence-rich presentation to City Council and savvy use of social media, students made their case and won. New trashcans were issued to South Boston within the year. The students learned to translate the impact of social, economic, and political behavior on environmental outcomes.

Education, both formal and informal, has the power to transform the way people live in urban areas, viewing humans as nested within and able to take action to improve communities and ecosystems (Photos 1 and 2). Educators prepared to use environmental education methods, extended classroom learning, science investigation and place-based outdoor exploration as a means to authentically

Photo 1. Children from the First Place Scholar Charter School in Seattle learn to “grow food everywhere” to combat the challenging impact of food deserts on health and nutrition in urban areas.

Photo 2. This verdant food garden provides fresh and healthy food as well as a place to find community to immigrant populations streaming through Seattle's Belltown district.

study the complexity of urban neighborhoods will deliver more relevant and meaningful educational experiences. The example above shows that by using state-of-the-art GIS technology and on-the-ground exploration, an urban community can be assessed to reveal the dynamic among its environmental, social, political and economic characteristics. This knowledge prepares young environmental scientists for meaningful problem identification and solution generation bringing learning into more meaningful real-life application.

Urban Ecology is a relatively new science that requires educators to broaden their approach to scientific inquiry in the investigation of place. The book *Who's asking: Native science, Western science, and science education* introduces a mapmaking metaphor to explore one's perspective of a place – a helpful tool for preparing educators: "*Imagine some geographical area (e.g., Central Park in New York) and then consider maps that we might make of it. A map is a representation that highlights some features and relations but ignores others… there are virtually an unlimited number of maps that could be drawn of Central Park. They would vary depending on the associated goals and purposes of the map users. They would all be grounded in the same reality, but often different aspects of this reality would be revealed or concealed by the alternative representations*" (Medin & Bang, 2014).

In this case, there are many conceptual limitations to privileging any one way of interpreting phenomena as fact or preference. Urban environmental education programs that aim to serve a larger number of students often fail to take into account the diverse perspectives of their students. In many cases, the educators are not ethnically, culturally, or geographically connected to the communities they serve. As a result, the environmental education program may privilege the educator's limited views and biased perspective of the environment over that of the people who live in the community.

Imagine for a moment the map a tourist may make of a neighborhood in any city. Would the tourist's map be useful to the residents of that neighborhood? What would the tourist choose to include or leave out? In many ways current environmental education programs position educators to be tour guides in the communities they serve. They are not given the time, training, or resources to develop meaningful relationships built on listening closely to the people who live in the community. Educational leaders, both formal and informal, must learn to respond to a rapidly urbanizing society by developing the capacity to engage urban students and communities in a way that promotes the livability and resilience of their communities through meaningful and sustainable change.

In Oakland, California, Jeff Duncan Andrade sets an example by developing teaching methods that inspire urban students to achieve academic success while instilling in them a sense of responsibility to return to their neighborhoods to build thriving sustainable communities. His belief: "*Our country is at risk of losing an entire generation of young people in urban centers who feel trapped in a vicious cycle of poverty, violence, hopelessness and despair. Rather than continually investing in models that try to save the 'deserving few' who can escape from these communities, we need solutions that can help the vast majority overcome these toxic conditions to become the responsible and productive adults that will*

eliminate those conditions. By creating a sustainable community, centered around a school that gives students and families security, nourishment, care, and education, we can create a model of success and revitalization that reverses decades of disinvestment" (Duncan-Andrade, n.d.).

Preparing environmental educators to expand their approaches in a way that considers the socio-cultural, economic and ecological nature of urban communities means they can grow their programs with communities rather than taking an approach that tours them through content and spaces from a particular, sometimes biased, perspective. Too many "environmental service projects" and "solutions" come in from the outside. They tend to be the ideas that the educators value and are comfortable with. All communities stand to benefit from a form of self-determination when it comes to developing the education, interpretation, and representation of the place where they live. Working from the inside out may reveal solutions that never before occurred to environmental educators.

As we move towards increasing access to environmental education programs in urban centers, one goal is to introduce youth to conservation careers and jobs in the new "green" economy. To this end, we must be explicit and intentional with the messaging that comes from our actions, our lessons, service projects and expectations for youth. As educators, we must attend to the multitude of perspectives on stewardship and restoration by culturally diverse audiences. These perspectives include the social and political context of the communities with which we serve. For example, while Adam was teaching at a community center on the southwest side of Chicago (Photo 3), he engaged youth in monitoring and removing invasive plant populations (via Midwest Invasive Species Information Network). Approached by a parent, Adam was asked if his child was "being taught how to landscape the area." Landscape work is considered an entry-level job for many immigrant groups in Chicago. The parents have higher career hopes for their children. Clarifying the intention of service work and its relationship to conservation work helped the parent better understand the environmental stewardship connection.

Photo 3. Adam Kessel teaching in the Uptown neighborhood of Chicago for a group from the American Indian Center.

Environmental educators across the country are stepping outside their comfort zone and into a rather messy and unpredictable cityscape to cultivate new approaches to environmental education. These educators face a new frontier as they struggle to understand and respond to issues of urban ecology, ecological management, climate change and sustainable growth in cities. The M.A.Ed. in Urban Environmental Education at IslandWood (www.islandwood.org) in Seattle is an example of how these new frontiers in urban environmental education are being addressed. The program aims to prepare environmental educators to address the social, educational, economic and cultural issues of urban life with relevant and meaningful environmental approaches that may include youth and community development, environmental action and environmental justice. Graduate students will focus on educating urban youth to better understand how and why their urban communities work the way they do, while cultivating civic

engagement intended to align environmental solutions with improvements in shelter, food, water, air, safety, and health.

The premise is that when educators are better prepared to listen and understand how to align pertinent issues with environmental outcomes, they can train young leaders to have a mounting influence on society and politics, including the distribution of public finances, the way cities develop and grow, and the strength and creation of environmental laws and policies. This new model of educational preparation immerses academics and practice into the realities and dynamics of the urban community. It uses expertise from the community practitioners to enhance and complement the knowledge of academically trained faculty. Environmental educators begin to understand that education is a powerful means to cultivate knowledgeable, compassionate and responsive individuals who are capable of working together to generate resilient, collaborative and sustainable solutions to environmental issues.

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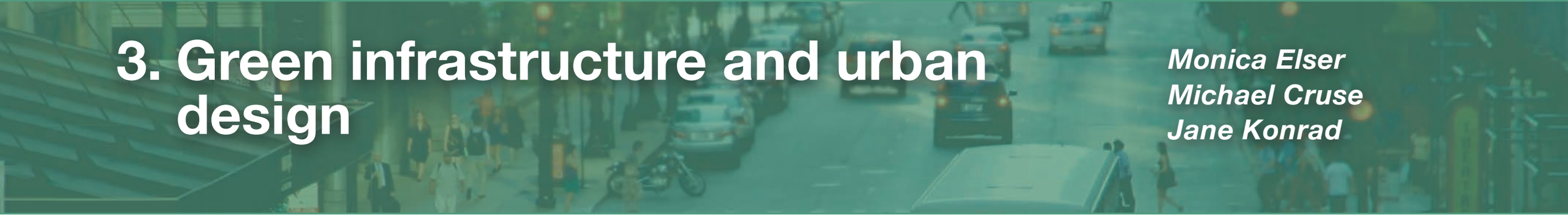

3. Green infrastructure and urban design

Monica Elser
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HIGHLIGHTS

- **We interact with the urban infrastructure every day, but rarely think about who designed it or whether there is a better way to build cities.**
- **The interaction between the built and natural environment in cities provides opportunities for urban environmental educators to engage the public in discussing benefits and challenges of living in an engineered system.**
- **Sustainable design borrows principles from biology and the natural environment, including themes of connectedness, renewability, efficiency, minimizing negative impact, and carrying capacity.**
- **Next Generation Science Standards use a systems approach to studying sustainability, and encourage teachers and students to explore and interpret relationships between their natural and built environments.**

Overview

Urban growth and native ecosystem decline

The last century has witnessed large-scale migration from rural to urban areas, and an accompanying transition in lifestyles. Over half of the world's current population lives in cities and more than 95 percent of the net increase in global populations will be in cities in the developing world (Grimm et al., 2008). As cities grow, people transform the natural environment from native ecosystems into a diverse assemblage of built structures, surfaces, plants, and animals. Cities grow and decline in response to a variety of drivers including economics, technology, policy and environmental quality. Infrastructure, such as roads and canal networks, may serve the public for hundreds of years, while private residences may last only a few generations (Warren et al., 2010). These structures and associated landscaping choices have varying impacts on biological communities and accompanying ecosystem services within cities. Urban growth can also lead to basic differences in biotic community structure between cities and their surrounding ecosystems. Some studies have shown, for example, that urban environments typically have a greater diversity of plants but lower animal biodiversity comparing to surrounding wild landscapes (Grimm et al., 2008, Warren et al., 2010). Urban environmental educators should be familiar with their cities' ecosystems and capitalize on these biotic and abiotic features in order to create programs that are responsive to their communities' unique urban characteristics.

Urban growth and social systems

Cities have distinct social hierarchies and inequalities, where inadequate planning and mismanagement of resources may amplify poor living standards and lead to detrimental environmental impact (Warren et al., 2010). For example, access to nature via green spaces varies across the socioeconomic spectrum of residents (Fuller & Irvine, 2010). Within socioeconomically disadvantaged communities, this lack of access to green space may correlate with the higher childhood obesity rates seen in many developed countries (Louv, 2008). How and for whom the green space is managed impacts both the ecosystem services provided and the type of people-nature interactions (e.g., sporting activity versus nature preservation). Community

associations and public governments work to encourage activities in remnant natural areas within cities; however, liability concerns in natural areas are one barrier to protecting more green space for nature preservation. Urban environmental educators need to be aware of the social hierarchies within cities and look for opportunities to expand their programs in underserved communities. Additionally, collaboration with other urban organizations, such as child welfare, public health agencies, and city planners can promote a shared approach to issues affecting these communities.

Sustainable design

Urban communities are placing an increasing emphasis on sustainable design. Sustainable design and urban planning are guided by several principles borrowed from biology and the natural environment. These include the concepts of (1) connectedness; (2) renewability; (3) efficiency; (4) minimization of externalities or negative impacts; and (5) carrying capacity. Urban planners, designers, and communities interested in achieving sustainable development use a variety of principles and techniques to address this challenge. Examples include smart growth strategies, sustainable urban infrastructure, new green building codes, and strategies to bring the natural environment back into our urban environments (Hopper, 2009). Through programs such as the US Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) certification, architects, city planners and land developers are including more green building practices in their projects. The USGBC encourages building innovations to increase water and energy savings, and a reduction of our dependence on natural resources in favor of sustainability and cost savings. Another approach to sustainable design includes the life cycle analysis of human-made materials. Life cycle analysis is a technique for total accounting of the environmental, social and economic impact of a product or process (Nair, 1992). These sustainability frameworks provide urban environmental educators with opportunities to engage local communities in impacting the design of their own neighborhoods.

Increasing urban environmental literacy

Urban environmental education fits well within the Next Generation Science Standards (National Research Council, 2012) as it a takes cross-disciplinary and systems approach to understanding sustainability in cities. According to Meadows (2008), using a systems approach encourages the development of new mental models, global visions and links to culture. In addition to increasing environmental literacy, urban environmental education can provide positive venues for the development of personal identity and sense of place that can lead to meaningful environmental actions. How can urban environmental educators contribute to a broader understanding of Earth's systems and their connections to humans within a highly altered landscape? The following case studies reflect our diverse approaches to this question in relation to urban infrastructure.

Case studies

Urban heat islands

As cities grow, the large amounts of concrete and asphalt increase mass density and heat-storage capacity leading to what scientists call the urban heat island (Photo 1). Urban heat island is characterized by higher temperatures in cities as compared to the

Photo 1. Handheld digital weather station for collecting microclimate data.

surrounding rural areas. These temperature changes impact urban dwellers in many ways, influencing their health, comfort, energy costs, air quality, visibility levels, water availability, and quality of life (Karl, Melillo, & Peterson, 2009). Landscaping and green infrastructure appear to be one way to mitigate the impact of the urban heat island phenomenon (Stabler, Martin, & Brazel, 2005). In Phoenix, Arizona, the urban poor are most vulnerable to this extreme heat, and the least likely to have access to cool green spaces (Dybas, 2013).

Our question when designing the Ecology Explorers' Urban Heat Island unit (http://ecologyexplorers.asu.edu/overview/urban-heat-island) was how to engage students and teachers in activities about urban heat "riskscapes" in different neighborhoods. Secondly, we sought to address how we can create a livable urban environment for ourselves and other organisms that share it. Environmental education addresses problems and solutions across interdisciplinary boundaries, so we collaborated with natural scientists, social scientists, and engineers to create this interdisciplinary unit for middle school students. The unit includes basic concepts taken from the physical, earth and biological sciences, investigated through a variety of field studies and activities. A link to the social sciences is made as students use a participatory, auto-ethnographic technique called "photovoice" (Buck & Cook, 2010), to share their own urban heat island experiences through photographs. Students are ultimately challenged to engineer a thermally efficient house. The ultimate objective of the urban heat island unit is to engage others in the community through public exhibits and projects to understand urban heat island impact and potential options for urban heat island mitigation in homes and neighborhoods. *Acknowledgement: "The Ecology Explorers program, part of the Central-Arizona Phoenix Long-Term Ecological Research project is supported by the US National Science Foundation grant number BCS-1026865."*

D.C. Greenworks

In Washington, DC, D.C. Greenworks (DCGW) supports its mission of "growing livable communities using living materials" through its expansion of the cities' green roofs. Responding to the mayor's sustainability initiative,

Photo 2. A D.C. Greenworks trainee performs maintenance on a green roof near the US Capitol Building. Photo credit: Neil Qusba at DC Green Works.

DCGW has helped the city to grow its green roof footprint to over 2 million square feet in 2014, with plans to double that number in the next three years (Photo 2). When installed and maintained properly, green roofs provide a variety of benefits to urban environments by reducing storm water runoff, improving air quality and reducing the urban heat island effect, increasing building energy efficiency and creating greater biodiversity and recreation space (Green Roof Benefits, 2014). The maintenance of these roofs for increasing efficiency became an issue in DC because of the lack of professionals trained to maintain these roofscapes for optimal efficiency. DCGW responded by working with Green Roofs for Healthy Cities (GRHC), the leader in promoting the energy and environmental benefits of green roofs across North America. Together, DCGW and GRHC developed a maintenance training program and credential for green roofs. With financial support from DC Water, the cities' water authority, DCGW recruited, trained and graduated its inaugural class of 10 green roof maintenance professionals in June 2014. Working with area green roof contractors, DCGW has connected these graduates to employment opportunities in Washington, DC's growing green roof market.

STS by Green Design

"Green design" is defined as "design that attempts to minimize environmental burdens without compromising functionality" (Konrad, 2006). It is an approach to creating more livable cities and more sustainable products. Science-Technology-Society (STS) is a classroom instructional approach, where environmental issues or concerns are the focus of curricular units (Yager & Tamir, 1993). Our program, STS by Green Design (http://www.prcst.pitt.edu/sts.html) combines both approaches to open a wider window for students and teachers in understanding the complex relationship of human activities with our environment. Encouraging systems thinking is a critical component of this approach, as students construct their knowledge base and develop concepts around sustainable urban design (Photo 3).

The STS by Green Design instructional strategy offers effective pathways to student learning. Green design is an engineering approach to teaching, serving as a catalyst for learning. Students receive information that is current, accurate, and presented in the context of meaningful relationships – all while helping students develop skills and knowledge linked across all disciplines. One example is a lesson on life cycle analysis (Konrad, 2007). This lesson provides a rich opportunity for student engagement with analysis, synthesis, and evaluation skills. By drawing the larger circle encompassing the whole life cycle analysis of a product, students gain a broader perspective and see the interrelations among science, technology and society. This interdisciplinary approach brings together the areas of science, mathematics, English, social studies, history, and art. The entire STS by Green Design program offers a viable approach to working across disciplines, addressing students' lives and life styles, and focusing on the relationships between people and their environment.

Photo 3. Students make presentations in class about their Green Design classroom project shown in the foreground.

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4. Urban planning and environmental education

Caché Owens
Angelique Hjarding

HIGHLIGHTS

- **Urban planning plays a critical role in determining how a city looks and functions.**
- **The creation and management of open space and community areas by city planners is the most important way planning influences environmental education.**
- **Urban planners and environmental educators can rely on one another for innovative ideas and guidance in shaping the ways cities will look and function in the future.**
- **Environmental education groups can involve themselves in the urban planning process in many ways such as audits, visioning workshops and charrettes, and various forms of partnership with urban developers and decision-makers.**

Continuing with the metaphor that the city is a classroom, it can be argued that urban planners are the guidance counselors, slowly shaping the "classroom" environment. Through long-range and short-term planning, zoning and land use patterns, urban design, and historic preservation, urban planners are constantly influencing the way a city looks and functions. Just as guidance counselors help students set goals and envision their future, urban planners aim to help communities do the same. According to the American Planning Association (APA), planners "help [communities] find the right balance of new development and essential services, environmental protection, and innovative change" (APA, 2014). Additionally, environmental education groups can influence the way planning is approached in their city (Kelley, 2005). Thus, we argue here that urban planning and environmental education have a mutualistic relationship, where they both rely on one another for innovative ideas and guidance.

While planners are only one piece of the larger system of governance in communities, they play a key role in creating intentional public spaces. The creation and management of open space and community areas by planners is the most important way planning influences environmental education. Environmental education organizations have the ability to guide and supplement planning efforts, such as greening the city through tree planting (Beatley, 2011). The ability of organizations to engage in environmental education is greatly improved through partnership and collaboration with urban planners, and vice versa. Planners create spaces much more conducive to public use when they consider the needs of community-based organizations. Both urban planners and community-based environmental education groups are vital to the creation of vibrant city places such as green open space, parks, waterfront areas, nature and wildlife preserves, and gardens.

The average planner is aware of the long list of benefits associated with green spaces in the city. However, to ensure future open spaces meet the needs of environmental education efforts, organizations must insert themselves into the political, and sometimes contentious, planning process (Corbun, 2009). Most cities strive to engage community stakeholders at some point during the planning phases of any particular project. Engaging with local planning agencies can be done in a variety of ways.

Audits

While city governments typically carry out audits of some sort, they are often not comprehensive and lack a participatory approach. Audits can target a wide variety of topics such as sustainability, safety, food, walkability, transportation, and open space. The general definition of an audit is “a planned and documented activity performed by qualified personnel to determine by investigation, examination, or evaluation of evidence, the adequacy and compliance with established procedures, or applicable documents, and the effectiveness of implementation”, with the end goal being to “collect evidence to test or confirm a statement” (Stamatis, 2002).

While audits are enhanced by the technical knowledge of researchers and city employees, audits are largely unsuccessful without the inclusion of local residents and community groups (Whitzman et al., 2009). The most important “qualified personnel” are those who are greatly familiar with, and regular users of the audit area. Audits can be completed separate from government agencies, allowing for environmental education organizations to customize the audit tool to their own needs. For example, as a result of an open space audit, the Project for Public Spaces states “citizens and local stakeholders can work together to develop both short and long term actions that could be taken in order to transform a place, such as a plaza, park, or vacant lot, or a street into a more vibrant, functional space that attracts people” (Project for Public Spaces, 2012). Once an audit is completed thoroughly, environmental educators can present their findings to various local government departments, including local planners.

Visioning workshops and charrettes

Visioning workshops are often precursors to the formulation of comprehensive plans which are intended to serve as a road map for a city, filled with long term objectives. Visioning is a necessary first step, defined as a “process through which a community talks about the type of future it wants, and then decides how to achieve it. A vision statement is the end product of such a process. It depicts, in words and images, what the community seeks to become-how it will look, how it will function, how it might be different or better twenty years from now” (Portage County, Wisconsin, 2008).

Similar to a visioning workshop, a charrette is a useful tool in facilitating public participation. Charrette is an intensive planning session where citizens, designers and others work in partnership on a vision for development. It provides a “forum for ideas and offers the unique advantage of giving immediate feedback to the designers and planners” (The Town Paper, n.d.). Like audits, charrettes are successful only with input from local stakeholders as residents and community organizations play an important role as co-planners and designers. Ultimately, the purpose of the charrette is to give planners and designers guidance from community members. While visioning is often done with overall goals in mind, charrettes are typically done on a project by project basis.

Partnerships

Environmental education organizations, whether nonprofit or private, can also insert themselves into the planning process by fostering and maintaining partnerships with the public sector. Public partnerships can take on many forms such as a matching grant, event sponsorship, site use and maintenance, and programming. The types of partnerships that environmental education groups might engage in are varied, but each type of partnership comes with its own set of perks and challenges. The Project for Public Spaces discuses how non-profits and private organizations partner with public agencies in the management of public parks and open space: as service providers, new project catalysts, and co-managers (Project for Public Spaces, 2000).

As assistance providers, environmental education occurs with the help of public facilities. In this type of partnership, “groups help parks departments with education, programming, and volunteers. They also advocate for increased funding for park improvements and expansion” (Project for Public Spaces, 2000). In this type of partnership, environmental education groups may have limited

flexibility in curriculum and program design, but have increased access to city employees to lobby for environmentally-based activities.

Additionally, environmental education groups might "work with public agencies and others to initiate projects and provide financial support for new parks or greenways. These kinds of partners are typically involved in advocacy, design, and construction issues, and tend to be transitional in nature, redefining their role with the public entity and in relation to the park once the project is completed" (Project for Public Spaces, 2000). This type of partnership may be initiated by activities such as neighborhood audits and charrettes, as discussed previously.

Some environmental education groups may be particularly convincing, or have needs beyond the scope of local government agencies. In these circumstances, both the group and city interests may be better served by a managerial or co-managerial relationship. According to the Project for Public Spaces, in a co-managerial partnership, organizations partially oversee park planning, design and capital construction of a project, and in some cases management and maintenance (Project for Public Spaces, 2000). Some cities may put the full operation of the space into the hands of the organization, this type of partnership gives an environmental education group the largest amount of autonomy.

Depending on the goals of any given environmental education group, one of the aforementioned types of partnerships may be more beneficial than the others. The type of partnership may expand or limit the organization's ability to influence local planning. Despite what type of partnership is ideal, it is likely the planning department will be involved in the process. Once an audit and/or charrette is completed, identifying which type of partnership will work best, and fostering that partnership, are likely the next steps.

Conclusions

With a certain level of finesse and determination, environmental education groups have the ability to inform how urban planners shape the city they occupy. A new age of planning is emerging with a realignment with community engagement and co-creation (Ellin, 2013). Collaboration with urban planners is extremely important if environmental education organizations wish for their needs and efforts to be considered in future city projects, especially those dealing with green space, and other types of natural areas. Additionally, planners must value the contributions that community-based organizations can provide to the planning process. While this list is not exhaustive, audits, visioning and charrette workshops, and partnerships are proven ways to engage with a local planning department. By recognizing the technical knowledge of the planner and the practical knowledge of environmental educators, it is certain that exceptional public spaces for environmental learning can be created.

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5. Urban parks as classrooms

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HIGHLIGHTS

- **Successful and engaging outdoor education doesn't require access to expansive wilderness areas.**
- **With proper planning you can create year-round, interdisciplinary learning for your students in urban parks.**
- **Local parks can support science, technology, engineering, and mathematics (STEM) education and allow students to make meaningful connections with their local environment.**

Introduction

Parks offer outdoor year-round, interdisciplinary learning, and integrating them as part of your curriculum toolkit is easier than one might expect. All urban cities have some access to parkland, ranging from the small pocket park with playground to the 500-acre, formally landscaped park with ballfields and man-made woods. These areas provide not only a perceived escape from the classroom, they allow for hands on learning outdoors that can enrich a teacher's standard curriculum and create tangible moments. Interactive experiences create strong personal connections and are more powerful than knowledge solely passed down through lectures in a disconnected classroom environment (Knapp, 1996). Students have the opportunity to learn more about their own neighborhood as they learn in their park. Using parks should not be considered a "fair weather" activity only. In many instances, it is the highly dramatic weather days which leave the strongest impression. These tangible outdoor moments are etched into an individual's mental and motor memory. It is also well documented that memorable field trips can have a significant influence on an individual's environmental attitudes and behaviors (Bruyere, 2012). A park, and by extension the environment, is not a simple system. The combination of multiple living systems in action makes it simple to integrate different subjects and activities in any lesson.

Parks as classrooms

Out of sheer necessity, many environmental educators have realized the potential learning opportunities urban parks possess for students living in urban centers. Most of these inner-city students may never experience wilderness until they reach adulthood, but they can begin to learn about the ecological relationships present. In 1995, the effects of a pilot park/school program were examined (Milton, Cleveland, & Bennett-Gates, 1995). Interviews and pre/post tests about ecological attitudes were conducted after a three-part science curriculum was given to two fifth-grade classes. One class was able to split their lesson time between a local park and indoor lab time, whereas the second learned solely indoors. In this small study, positive ecological attitudes were observed in the first class. Students in both groups showed improvements when answering knowledge-based questions, but it was the class

which was able to learn outside displayed a noticeable increase in positive attitudes towards the environment.

Why teach environmental education in a park setting as opposed to the safety and comfort of a classroom? As teachers, we want our students to retain the information by having memorable experiences. By teaching in a place that is outdoors, but near the school, we create a familiarity that puts students as ease. Many teachers respond that education outside of the classroom is a perfect source to develop students' personal knowledge and socials skills to work in the classroom (O'Donnell, Morris, & Wilson 2006). Once in your urban park and teaching lessons, use experiences to build a strong understanding of place. When students understand a place and the elements of that place, they can begin to appreciate the uniqueness of that place and feel a sense of pride and ownership. This is our goal, to have students excited about returning to "their" urban park to learn.

Many organizations throughout North America have trained ecologists and environmental scientists to lead lessons outdoors for teachers and their students. However, it is not necessary to strictly rely on these non-profits, NGOs, or city educators. Any educator can use a park to supplement their curriculum. All it takes is proper planning and personal enthusiasm to allow for year-round outdoor lessons.

Get to know your park

"If you don't know where you are, you don't know who you are" (Wendell Berry). Teaching environmental education in an urban setting may seem like a challenge, but the natural world does surprisingly well in urban environments. One of the best ways to facilitate a place-based learning experience for your students is to have the hands-on experience of getting to know a local park.

How does a teacher use a park as a classroom?Begin by making a pre-lesson visit to your prospective site, ideally within walking distance of school. Ask yourself some questions to gain an overview about your park: What is the cultural history of this park? How is the park used today? What type of habitat is this park, and what animals and plants might you find there? What are the major characteristics of this habitat? Are there any ecosystem benefits that this park provides to the neighborhood? Once you have a basic understanding of the history and ecosystem traits in your local park, you can create an initial investigation for your students to perform.

After your first visit to the park, students will be excited about visiting again and may have several questions that could lead to additional lessons in their park! Keep up this learning momentum by asking questions in the classroom and scheduling more visits to your park.

Year-round learning

On a beautiful spring day, it is easy to imagine taking students out to measure tree circumference or journal about weather observations, but tackling an outdoor lesson on a cold or wet day can feel much more daunting. Why put students and teachers through potential discomfort and add to the challenges of teaching outdoors? There are several benefits for engaging students in outdoor learning throughout the seasons.

The natural world is not static; visits and observations in different seasons allow students to witness short-term examples of change over time. This can form the foundation for deeper discussions on how ecosystems function. For example, a meadow that was explored in early fall will look very different and function differently in winter or spring. Students can begin to ask questions about what is happening in a given habitat during apparent dormancy, and what happens to the animals that depend on that habitat.

Multiple visits also become more substantive when students are able to make observations and conduct investigations in the park-classroom in different seasons. For example, the student may make a key observation about bird behavior in winter that helps deepen their understanding of the concept of adaptation. Cold season is, in fact, an excellent time for teachers to explore

geological ideas with their students. Landforms are much more easily observed when leaves are off trees.

Finally, students feel tremendous pride after they have successfully tackled a challenging situation. Students often remember the “bad” weather days the best and are more excited about what they accomplished on those days. These high-drama days can lead to exciting and educational discussion afterwards between the teacher and students (Cramp, 2008).

Of course, there are real challenges to learning outside in cold or wet weather – the most significant of which is making sure that students are appropriately clothed so that they are warm and comfortable when learning (Photo 1). Working with a parent volunteer or local community group to solicit donations for a class-set of weather appropriate gear, including shoes, can address this issue and allow all students to experience the wonder and satisfaction of getting outside all year-round.

Photo 1. Young students are well prepared for outdoor lesson about water and worms during a rainy day at Central Park. Photo credit: Michelle Byron.

Interdisciplinary

Using local parks as an extension of the classroom is important for students to create a connection to their environment – whether man-made or natural – and it so easily covers many disciplines (Figure 1). The natural world is not neatly divided into separate, contained issues: each section affects another (Knapp, 1996). To create strong connections, an interdisciplinary approach combining skills and exercises should be practiced. It becomes the responsibility of the educator to foster an individual’s connection to her or his space and realize the array of methods – sociological, ecological, historical, or even economical – which can be used to develop these connections (Ardoin, 2006). An interdisciplinary style of teaching can improve students’ retention of material as it provides a way to apply knowledge instead of rote memorization (Knapp, 1996). With the current Common Core teaching guideline now coming into play in US schools, the use of an interdisciplinary approach is required in fostering higher, comprehensive thinking.

Science education through the Common Core is tasking teachers with fostering their students’ thinking and putting facts together – ultimately creating argumentative essays. Using your local park will immediately have so much meaning for your students. It is science they feel and observe instantly. Hopefully, through their experiences, they will be inspired to question further, learn more, and venture into deeper discovery.

With your new lesson plan, challenge yourself to learn something new about your own local park. Each new personal discovery will enhance your enthusiasm in presenting each lesson.

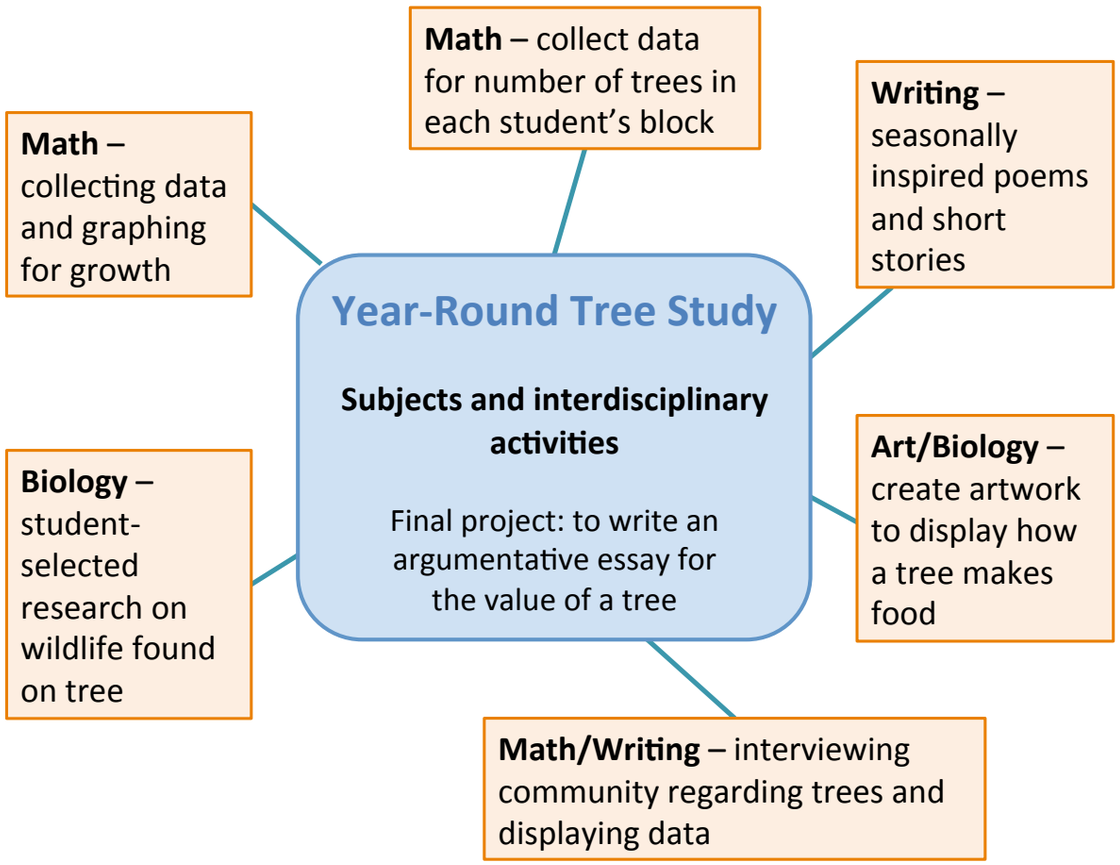

Figure 1. Example curricula project using an interdisciplinary approach at a local park.

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6. Forest kindergartens in urban areas

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HIGHLIGHTS

- **Forest kindergartens take children back to their roots by encouraging exploration, curiosity, play and learning in natural habitats.**
- **This movement marks a return to the philosophy of "children's gardens" where children learn best by connecting with the natural environment and each other during extended, regular, repeated visits to a natural space.**
- **Forest kindergartens are not about a visit to the typical playground for recess; they are about student-driven investigations out in the natural world.**

What is forest kindergarten?

Kindergarten, which means "children's garden" in German, began in the 1800s, based on the idea that much of children's play led to learning and was done outdoors in nature (Sobel, 2014). That concept has nearly disappeared from modern kindergarten. The forest kindergarten movement brings it back, wilder than ever!

The keystone of forest kindergarten is for children to connect to their local natural environment with regular and repeated access to one natural space. While playing and learning in nature, children build a relationship with the land and to one another (Carruthers Den Hoed, 2014). Forest kindergartens encourage exploration by taking advantage of children's natural curiosity and desire to learn.

Activities vary daily, dependent on the season, climate, landscape, presence or evidence of animals, ideas introduced by the educator, tools and "loose parts" (moveable materials, like sticks and rocks, used for imaginative play), children in attendance, and – most importantly – interests of the child(ren). Using the outdoor environment as a learning lab, children are free to interact with each other as they investigate, discover, create and solve problems. At times, a child may decide to work independently; at other times, children choose to work collaboratively. Through experiential, inquiry-, play-, and place-based learning, educators optimize the investigative opportunities that unfold during each unique day (Carruthers Den Hoed, 2014).

The value of play

Forest kindergarten educators encourage play because they understand its value and importance. Though to some adults, it may appear that children are "just playing" at a forest kindergarten, they are building skills across many developmental domains. Learning through "play" promotes creativity, develops imaginative thinking and fosters communication and cooperation. It also helps children develop gross and fine motor skills, stamina, self-confidence, a more positive outlook and a greater ability to set and achieve goals. Forest kindergarten educators appreciate a child's sense of awe and wonder with the natural world (Peterson, 2013; Wiedel-Lubinski, 2014).

History of forest kindergarten

The first forest kindergartens began in the early 1900s. The movement grew exponentially from 1950 to the present in European countries, especially Denmark, Sweden, Switzerland, Germany, and the United Kingdom (Peterson, 2013).

European forest kindergartens ("Waldkindergartens" in German) are vastly different from most preschools in the U.S. In a forest kindergarten, there is usually no classroom or school building. Class meets and spends the entire time outdoors; therefore, learning takes place directly in nature, including urban nature. Though "kindergarten" in the U.S. is for five-year-olds, multiple age groups are combined in one class in the European forest kindergarten. For example, a class with mixed ages three through seven is common. Older students act as role models and helpers for the younger children. Similarly, young students look up to and imitate the older children. Moderate risk-taking is encouraged and appreciated in play. Of course, forest kindergarten educators monitor physical surroundings for hazards; but they rarely intervene during play, allowing children to problem-solve and socialize without adult interference. Learning is accomplished without formal, structured lessons in a forest kindergarten. The forest kindergarten educator's role is one of observer and facilitator, rather than direct instructor teaching a tightly scripted curriculum (Peterson, 2013; Wiedel-Lubinski, 2014).

Photo 1. Weekly visits to the pond enabled students to observe how animals, including ducks, raccoons and red-tailed hawks, used the habitat for food and shelter.

Photo 2: A seven-year-old in a community garden in Manhattan experimented with the properties of soil and became immersed in making mud, a multi-sensory lesson.

Modern adaptations

Several variations of the "forest kindergarten" model are becoming popular in the U.S., particularly in urban and suburban areas. The assortment of names under which they are known, such as "forest school," "nature preschool," and "forest and nature school," are as varied as the manner in which each school divides its time between indoor and outdoor locations. Although these schools often use "forest" in the title, they creatively use whatever type of outdoor space is available nearby, including farms, urban parks, gardens, fields and vacant lots (Photos 1 and 2). While maintaining a traditional school setup with structured activities in a classroom setting, these models also recognize the benefit of spending unstructured time outdoors in nature. The magic happens outdoors, in all seasons and in all varieties of weather!

Urban obstacles

With urbanization and the global shift away from and against nature, many of us, especially as children, have lost our historic abilities to survive in, play in and enjoy nature (McKinney, 2012). The three big obstacles to nature play are lack of appropriate clothing, lack of access to natural areas, and safety or liability concerns (Ernst, 2012; Peterson 2013).

Appropriate clothing is required! Dressing for the weather often is the deciding factor between a child having a fantastic time exploring or becoming cold and miserable (Ernst, 2012; Sobel, 2014) (Photo1 1). Wearing clothes that can get wet and muddy encourages play and exploration (Photo 2). This may be especially challenging in an urban area, where people are more separate from the natural environment (Sobel, 2014).

An outdoor location near indoor facilities will expedite transitions between indoor and outdoor portions of the school day. By increasing awareness and access (or perceived access) to natural areas, more children will benefit from this type of learning. Particularly for providers serving children of lower socio-economic status, the benefits of outdoor play in natural settings are not always identified; and outdoor play is limited to a playground (Ernst, 2012).

When an urban forest kindergarten chooses to have only an outdoor location, a few additional challenges present themselves:

- Going to the bathroom outside, and toilet training young children;
- Staying warm without building a permanent shelter or campfire;
- Glass, litter, dog waste and vagrants in public spaces;
- Supplies, snacks, extra clothes and tools will be carried by the teachers and students (Carruthers Den Hoed, 2014; Sobel, 2014; M. Byron, personal communication, September 12, 2014).

Lastly, an outdoor school may encounter difficulty in obtaining liability insurance (Ernst, 2012; Peterson 2013). In many states, a preschool program must meet established state licensing requirements, which include regulations governing indoor space and facilities. Therefore, many forest kindergartens form relationships with organizations such as nature centers and local parks to acquire adequate indoor classroom space and restroom facilities necessary for licensure.

Bring nature closer

Even small urban outdoor spaces can be transformed into more natural areas, ripe for exploration. These suggested improvements may be modified to work anywhere: in a yard, an asphalt play space, a rubber-tiled playground surface, or inside the home or classroom. Try one or several of these simple creations to get started:

- Digging area: Most children love to dig. Loosen soil in a designated area of the yard if it is too compacted for digging. Dump a few bags of soil, sand or mulch over the asphalt and build a low frame around it with rocks, logs or spare materials. Fill a sandbox, shallow plastic bin or other container with sand, soil or mulch. Add digging tools, such as trowels, shovels, popsicle sticks, spoons or cups.
- Secret garden: Divide a quiet area from the main play space by lining up a few planters in a row. The growing flowers or plants will create enough of a barrier to provide a peaceful sanctuary for children, while allowing monitoring from a distance.
- Loose parts: Bring natural items small enough for children to move. Rocks, sticks, seed pods, leaves, pine cones and acorns all make great building materials and toys for imaginative minds. Plus, they provide wonderful opportunities to incorporate curricular concepts, such as math counting and sorting, into unstructured play (Roberts, 2014).

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7. Outdoor education and recreation in cities

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HIGHLIGHTS

- **Urban green spaces include parks, zoos, nature centers, bioregions and urban farms – all of which provide urban residents with excellent outdoor educational and recreational opportunities.**
- **Outdoor education and recreational opportunities in cities offer potential benefits such as physical activity, socialization, exposure to nature, environmental education, psychological development, restorative experiences, and individual and community wellness.**

Outdoor education and recreation: An overview

Outdoor education is defined in various ways, depending on who you ask or the context. For purposes of this chapter, outdoor education represents two main educational approaches:
(1) Organized activities taking place outdoors that focus on developing particular outdoor skills such as camping, fishing, tracking, building shelters, and canoeing. Lumped in with this first category is leadership, environmental literacy and social-emotional development using outdoor environments (Paisley, Furman, Sibthorp, & Gookin, 2008; Tardona, Bozeman, & Pierson, 2014).
(2) Organized or prescribed learning activities that occur outside, that have differing goals, not necessarily focused on outdoor skill development or environmental education. Many outdoor education initiatives focus on exposing children to the outside world for general health purposes, that may lead to improved learning overall (Ferreira, Grueber, & Yarema, 2012). For example, this category of outdoor education may promote outdoor classrooms, where all subject matter is taught in natural environments (Cleaver, 2007).

Outdoor recreation, also referred to as nature-based recreational activities, includes leisurely activities in a natural environment generally for the sole purpose of enjoyment (Shrestha, Stein, & Clark, 2007). This small distinction, pure fun versus "educational" purposes, offers an alternative approach to environmental education, an approach that may provide the "hook" needed to engage more individuals in environmental education. Nature-based recreational activities can include, but are not limited to, kayaking on a small lake in a park, hiking or nature walks on trails, swimming, rafting, and visiting a zoo.

Urban places

Parks

Urban parks have been vital spaces providing city dwellers with opportunities to spend time outdoors (Wilson, Tierney, Kim, Zieff, 2012). City parks, because of their close proximity to urban residents, offer easy access to nature and urban environmental education activities. Furthermore, parks have the ability to improve the social conditions of cities (Baur, Gomez, & Tynon, 2013).

Zoos

Zoos are popular city attractions, bringing urban residents closer to nature, while providing restorative experiences and educating the public on environmental issues. It is important to note that zoos are one of the more accessible opportunities for urban citizens to "experience the natural world" (Bruni, Fraser, & Schultz, 2008). Furthermore, research suggests that zoos increase the connectedness between people and nature, potentially fostering a sense of stewardship for the environment (Myers, Saunders, & Birjulin, 2004).

Nature centers and preserves

Nature centers and nature preserves located in urban settings offer individuals within those communities the opportunity to enjoy the outdoors while learning about natural history (Tardona, Bozeman, & Pierson, 2014). Centers and preserves such as these also expose urban dwellers to local plant and wildlife that currently inhabits the urban ecosystem in which they live. Along with valuable educational experiences, urban residents benefit physically and psychologically from visits to urban nature centers and nature preserves (Ulrich et al., 1991).

Bioregions

Bioregions are defined as identifiable geographical areas of interacting life-systems that are relatively self-sustaining. Each bioregion is characterized by the distinct climatic conditions or landforms that exist within each region. Examples of different types of bioregions are: coastal areas, mountain ranges, plains, and valleys (Harwell & Reynolds, 2006). Many bioregions run through urban neighborhoods, offering easily accessible natural spaces for physical activity, mental restoration, environmental education opportunities and many other forms of recreation.

Urban farms

Urban farms come in a variety of forms. Many consist of no more than a few raised beds on a vacant city lot, while others have several acres in vegetable production, and they may be owned by individuals, corporations, or land trusts. Alternatively they may be operated by individuals on land that is owned by a city, which are often times referred to as community gardens (Broadway, 2009) (Table 1).

Table 1. Activities and benefits of the various urban outdoor education and recreation mediums.

Settings	Activities offered
Parks	• Physical activity (sports, running, walking, group exercise clubs) • Socialization • Nature exposure, environmental education • Restoration (relaxation, stress reduction, reading)
Zoos	• Physical activity (walking, play areas for children) • Nature exposure, environmental education • Socialization • Restoration (relaxation, stress reduction) • Opportunities to support conservation
Nature centers and preserves	• Physical activity (walking on trails, climbing) • Socialization • Nature exposure (native species of plants and animals), environmental education • Restoration (relaxation, stress reduction) • Opportunities to support conservation
Bioregions	• Physical activity (walking, running, hiking, climbing) • Socialization • Nature exposure, environmental education • Restoration (relaxation, stress reduction, reading)
Urban farms	• Physical activity (lifting, digging) • Socialization • Nature exposure, environmental education • Restoration (relaxation, stress reduction, reading) • Community service • Community wellness

Case study: Night Hike in Irving, Texas

In 2007, in an intentional effort to draw residents out of their homes and into a system of greenbelt, linear parks that snake alongside the Elm Fork of the Trinity River, the City of Irving Parks & Recreation Department developed the Campión Trails Eco-Tourism Program. The program proposed a series of activities sited at the 22-mile long trail system and occurring at various times of the year. One of these activities that really captured the attention of adults and children alike was the Night Hike (or as it was originally titled “Nature Walks at Night!”).

Up to 60 participants are registered per event and split into smaller, homogenous groups (adults with adults, parent with smaller children in another) once on site. A table with bird skins (with a focus on owls) is manned by local University of Dallas biology students as a “gathering” activity prior to beginning the hike. The smaller groups are each led by University of Dallas professor and department head, Dr. Marcy Brown-Marsden or one of the many experienced, volunteer naturalists from the North Texas Master Naturalists (a joint venture between Texas Parks and Wildlife and the Texas A&M AgriLife Extension Service) along a specific section of the trail system – in the dark – no flashlights or other artificial sources of light.

Photo 1. Young night hikers in Irving, Texas catch night-flying insects lured in by light.

Photo 2. Cheerleaders from an Irving recreation center enjoy a Night Hike as a team-building exercise.

The walk leader acclimates the group to the dark giving the participants the opportunity to learn about how nature has adapted to nighttime by depending on other senses as well as their especially suited eyes. All ages have been taken on these short 45-60 minute treks through the forest beside the Trinity River (although the department later had to set a minimum participation age of 5 and no strollers.) Campión Trails is the home to a variety of wildlife and “hikers” have regularly reported viewing owls, nutria, skunks, and a variety of unknowns. On clear nights, a telescope is set up and a local astronomer guides participants in their perusal of the night sky.

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8. Sense of place and interpretation

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HIGHLIGHTS

- **Sense of place refers to the level of connectedness individuals feel to a specific place, and the meanings associated with this place.**
- **Developing sense of place through urban environmental education may promote pro-environmental behavior, such as involvement of residents in protecting their local, natural, urban environments.**
- **Sense of place educational initiatives not only lead to the improvement and protection of urban ecosystems, they also contribute to the physical and psychological health of individuals while increasing their environmental literacy.**

What is sense of place?

The idea of sense of place has been debated among many scholars, educators and environmental education providers (Kudryavtsev, Stedman, & Krasny, 2012). For purposes of this chapter, sense of place is described as the interplay between the level of connectedness that individuals feel to specific places, and the meanings or descriptions associated with these places. One can think of sense of place as a composite of *place attachment* (degree to which a place evokes emotions and attracts a person) and *place meaning* (how people describe a place) (Farnum, Hall, & Kruger, 2005) (see Figure 1, based on a similar figure from Kudryavtsev, Stedman, & Krasny, 2012).

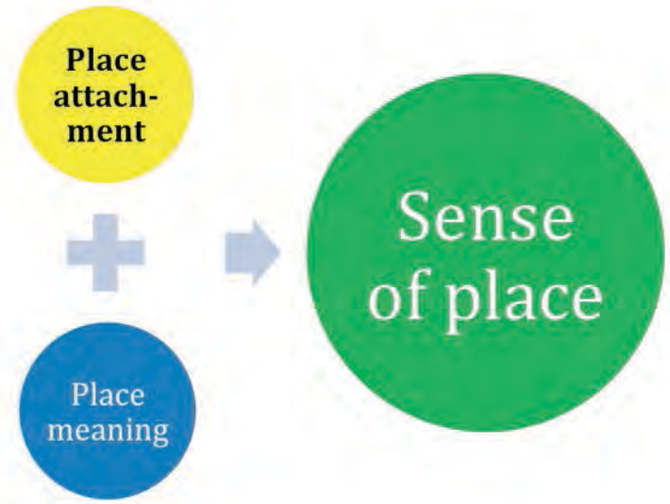

Figure 1. Sense of place components.

Sense of place and interpretation in urban environmental education

To understand the potential benefits of a sense of place approach to urban environmental education, one must become aware of the challenges that urban environmental education proponents face. Furthermore, it is imperative that urban environmental education is valued for the role it plays in the protection of urban biodiversity and urban ecosystem health. The question at the root of all this is: Why protect urban ecosystems in the first place?

Importance of protecting urban ecosystems

There are various arguments advocating the conservation of urban ecosystems, including: (1) preserve local biodiversity, (2) connect people with nature and provide environmental education, (3) fulfill ethical responsibilities, and (4) improve human well-being (Dearborn & Kark, 2009). The underlying and most practical reason why a system of conservation for urban ecosystems must

become common practice involves demographic shifts. Trending demographic data reveals growing global urban settlement. According to the World Health Organization (WHO), as of 2010, more than half of all people live in urban areas. The WHO projects that by 2030, 6 out of every 10 people will live in a city (World Health Organization, 2014). So what does this mean for the environmental education field? Simply stated, more and more habitats are becoming urbanized; thus it is crucial that urban ecosystems are monitored for health and strategic initiatives to protect urban biodiversity are established globally (Parrish, Braun, & Unnasch, 2003). Nature is no longer "out there," as Louv (2012) stated, and the human population is decreasing the distance between us and the natural world.

Challenges facing urban environmental education initiatives

Potential and real challenges urban environmental education practitioners face are placed in three categories below (also, see Table 1):

- Lack of interest in and understanding of urban ecosystems among urban dwellers.
- Lack of resources to establish effective and meaningful urban environmental education programs.
- Competing interests: development of lands, entertainment and leisure activities, work, school and after-school activities.

A prominent factor in the urban resident's disconnect from their local, urban natural habitats is the fact that people, especially youth, are spending more time indoors (Chawla, 2006; Louv, 2008). In addition to this, many youth find urban, natural environments irrelevant to their daily lives, furthering such a disconnect (Frank & Zamm, 1994). Lack of funding/resources as well as human capital (people to carry out urban environmental education initiatives) create challenges to engage urban dwellers in education about their local places (Bruyere, Wesson, & Teel, 2012). Green spaces are dwindling as humans continue to develop lands for housing (Verheij, Mass, & Groenewegen, 2008). In conjunction with limited natural landscapes available to urban residents, competing interests such as work, school, and leisure activities (e.g., sports, clubs, and watching television) leave

Table 1. Beneficial aspects: Sense of place application

Urban environmental education challenges	Sense of place contributions to urban environmental education
Lack of interest in and understanding of nature	Exposes and educates urban residents on the importance of urban ecosystem health. Engages individuals in activities in local green spaces that improve psychological, physical and cognitive health while developing place attachment and place meaning among participants
Lack of urban environmental education resources	Requires limited resources and human capital
Competing interests	Sense of place activities can be flexible and don't require a lot of time commitment, while still effectively building place + urban resident relationships (place attachment and place meaning). Can compliment already established daily activities. Reduce stress created by busy schedules (restoration)

little time for individuals to engage in urban environmental education experiences (Bruyere, Wesson, & Teel, 2012; Louv, 2012).

The sense of place approach as a solution to urban environmental education barriers

The first step in creating a sense of place experience is identifying a potentially engaging local, urban natural place (Figure 2). Water bodies that run through neighborhoods (a creek, a river), riparian forests within city limits, urban wetlands, and other natural urban landscapes make suitable locations to nurture sense of place. Individuals who wish to establish sense of place initiatives must become

Figure 2. Steps of sense of place development.

knowledgeable about the selected site. Gaining some background knowledge about the place such as natural history, biodiversity, environmental science components of the location (climate implications) is essential, allowing sense of place practitioners to craft a plan of action that will effectively engage urban citizens in environmental education. It is important to note that sense of place activity leaders do not need to be experts on a place – the urban residents who participate in sense of place exploration will be active participants in learning about the site, therefore acting as what Louv (2012) refers to as "citizen naturalists." Developers of sense of place activities/programs should create a strategic plan on "how" they will engage local residents. An action plan should be a framework that will transform as the citizen naturalists provide feedback on how they choose to learn about the place. Finally, sense of place practitioners must increase awareness of the place, and find creative ways to get residents to participate (Figure 2).

Case study: Sense of place exploration in Stockton, California

The Friends of the Lower Calaveras River (FLCR) engage the citizens of Stockton, California in sense of place exploration, using the Lower Calaveras River as an urban environmental education tool (Photos 1 and 2). The FLCR engages community members in river walks, river cleanups, nature journaling, and ecology education while developing a relationship between the residents of Stockton and the local watershed.

Photo 1. Students from Stagg High School, Stockton, California learning about the Lower Calaveras River.

Photo 2. The FLCR organizes a "Polar Bear Cleanup" of the Lower Calaveras River each February.

Case study: Systems thinking – Pittsburgh Regional Center for Science Teachers (PRCST)

"Systems thinking" starts with the current place/environment and moves to seeing the larger picture of global systems and interaction (Photo 3). Sense of place is developed locally, then expanded to include the interconnectedness of environments. PRCST initiated a project where 20 schools participated in watershed science (water quality testing/pollution assessments) while connecting such research to global water system health, using sense of place microanalysis to inform macroanalysis.

Photo 3. Students expand water quality testing to larger water systems.

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9. Stories connect people: The role of storytelling in urban environmental education

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HIGHLIGHTS

- **Storytelling engages diverse, and highly urban audiences; it enables listeners to create connections between their experiences inside classrooms, in familiar city centers, and in urban parks.**
- **Environmental educators can use active storytelling to generate interest in, excite discussion, and create understanding of complex cultural and environmental issues.**
- **Active storytelling challenges students to use their imagination and creativity to engage in more sustainable lifestyles and environmental stewardship.**

Introduction

Storytelling is a powerful tool often used in urban environmental education to explain, excite interest, and encourage others to commit to sustainable action. It works well in highly diverse urban settings. Stories, legends, and fables enable listeners to place new information in context, and when discussed, bring people of varied backgrounds to stronger understandings and decisions.

Storytelling is a means for sharing and interpreting experiences, and is universal due to its ability to bridge cultural, linguistic, and age-related divides. Stories, legends, and fables teach ethics, values, and outline cultural norms, and differences. As audiences draw, write, act, and discuss their connections to ideas in story, they share innovative knowledge and novel approaches to solutions regarding the environment and sustainability.

Reasons to use storytelling in urban environmental education

Cities have developed in many different ways as more people have moved to metropolitan areas.

Storytelling is society's way of ensuring that we are "reflecting the kind of world we want to live in and, therefore, gives us a hope of creating it" (Forbes, 2002). For most cultures, oral traditions and stories transmit local and historical knowledge and a good sense about the condition of the environment, our relationship to the earth, and our relationship with each other as neighbors or environmental stewards.

Stories, legends, and myths provide simple, yet fascinating context for decision-making. They engage audiences and provide a thematic framework which links the subjects of language arts, history, culture, ethics, art, mathematics and science. As students develop this framework for thinking and discovery – they learn to seek relevant information and use it to communicate and find solutions.

Urban environmental education storytelling tips and techniques

Encouraging audiences to share stories of their personal experiences in the natural world shows them that they are naturalists who carry on the responsibility of helping others to care for the planet. They are encouraged to realize that they

need to know many techniques to communicate their ideas so others will listen and be encouraged to join them. Before beginning, audiences may want to share and compile a list of techniques for placing their ideas in sequential order, maintaining the interest of listeners, and taking turns speaking and listening.

Educators may wish to provide sample formats for pictorial storyboards, encourage storytellers to take a nature walk and place found items in logical order, or pantomime actions. Very young storytellers may need assistance consolidating ideas in order to sustain the interest of their audience. Passing a rain stick, changing speakers when a short piece of music is played, encourages more hesitant members of the group to share. Storytellers must also consider the values inherent in their message. Great new stories, legends, and myths encourage action that shows care for community as well as the environment.

Storytelling is not a passive activity in which the educators speak and the audience listens. Learning is active, therefore stories must contain opportunities for action. Educators guide the experience through questioning, picture viewing, and demonstrations. Before, during, and after the experience, audiences of all ages are given time to share their connections, and discuss their understandings and ideas. They allow times for roleplaying, creating crafts, and games. Finally the audience can create and share a piece of artwork, an entry in a journal or poem, a dance, music, or pictures. These objects become artifacts that help students express their understanding and remember their experience.

It is impossible to create a set of rules in storytelling that apply to all sites because there are so many factors that need to be fine-tuned to specific audiences and given situations. There are basic guidelines, however, that can be followed. While adults and children over age eight may understand a higher level of abstraction, effective story-structuring for young children is often based on a pair of binary opposites such as life-death or healthy and unhealthy (Hadzigeorgiou et al., 2011). The message is used to communicate a clear strategic purpose – the moral or the ideological statement you want your audience to remember.

Storytellers need to provide concrete examples for all audiences. Younger children or students who have few opportunities to spend time outdoors may not have the experience level to understand abstractions. It also helps to provide linguistic cues for those who speak a different language outside their home. Allow young children to explore outside, then use the items they find as concrete examples of things the characters experience. For example, when reading about the smell of pine needles, make sure the children find some pine needles and smell them during the story. When students are observing animals in the wild before hearing a story about them, it is helpful to look at pictures of the animals first. This way, students can study the details and then locate the animals more easily in the wild. Young or inexperienced eyes may not easily find the animal you are pointing out, especially if it is far away. Active storytellers move from outdoor locations to indoors or vice versa to help the audience collect the objects and ideas they need to find full understanding.

Case study 1: Eastern PA Coalition for Abandoned Mine Reclamation (EPCAMR) – "The AMD Avengers vs. The Pollution Posse" Storybook

The Wyoming Valley, Luzerne County, Pennsylvania serves as an example of an urban center in the eastern Pennsylvania Anthracite Coal Fields and is used by EPCAMR as an outdoor environmental education experiential learning place. Abandoned mines and polluted rivers and streams predate the 1972 Clean Water Act and the 1977 Surface Mining Control Reclamation Act. Incentives for restoration efforts by mine operators, federal, state, county, and local agencies are slow due to the exclusion of many of these sites from the law requiring responsible parties to clean the polluted water and reclaim the land. Area communities have historically accepted that the streams and rivers around them are dangerously polluted, unfit for drinking, recreation, or fishing, and devoid of aquatic life. Children grow up with rivers and streams the hues of orange, yellow, and red viewing them as polluted and hopeless (Photo 1). EPCAMR works with underserved schoolchildren in urban settings living in these impacted areas to

change these misconceptions through environmental awareness, volunteerism and engagement (Photos 2 and 3).

"The AMD Avengers vs. The Pollution Posse" is a storybook filled with activities, animations, crosswords, mazes, and puzzles, to bring Pennsylvania's single largest water pollution problem to life. An accompanying educational and entertaining video, published by Western Pennsylvania Coalition for Abandoned Mine Reclamation, EPCAMR's counterpart in the Bituminous Coal Region, has been created for students and teachers. "Abandoned mine drainage: An epic tale" can be viewed on YouTube or from EPCAMR's website (EPCAMR, 2014).

Photo 1. Askam Borehole Abandoned Mine Drainage (AMD) pollution source to the Nanticoke Creek just outside the city of Nanticoke.

Photo 2. Robert Hughes shows students how cattail roots and other plants assist in mitigating AMD from wetlands created for this purpose on EPCAMR's field site. Students may take field trips in conjunction with programs offered in the classroom.

Photo 3. During community events such as this Earth Day festival, students can act out the part of "Brookie the Trout" while others trace macro-invertebrates from recycled cardboard cutouts along the Susquehanna River at EPCAMR's learning station.

Case study 2: Stormwater Outreach, City of Irving, Texas

The City of Irving, Texas, Stormwater Outreach Program uses storytelling with large school groups. The program has three short plays teaching about water quality that use no costumes, only one actor, and no physical props. Large student groups of 50-60 are divided into smaller ones (4-6 students) and handed a card with an item to be used in the play pictured on it. Each group has about 20 minutes or less to figure out how to form themselves into that item and prepare to be called upon to demonstrate it during the course of the play. They may be asked to become a microscope, canoe, fishing rod and reel, school of fish – using only their bodies, similar to a game of charades (Photo 4). All the participants then "circle up" and the play begins with the single actor "using" the "props" when called out during the story. The time required for this program is only an hour and there is no need for travel outside the school. The cost is minimal; students share an effective and valuable environmental science lesson in a memorable way.

Photo 4. Students work together to become a spaceship for the play's main character to travel the universe looking for a source of water for his thirsty planet.

Case study 3: Prairie Perspectives Program, Plains Conservation Center, Aurora, Colorado

The Prairie Perspectives Program is an overnight program for grades three through five. Students experience a morning exploring the prairie, during which they record, as would scientists and historians, their discoveries of climate, plant and animal life. They search for resources needed to stay alive for a long period of time and form hypotheses of how those in the past survived the harsh climate. After lunch, they visit an 1830s style Cheyenne village and learn traditional Cheyenne skills, from building a tipi to making a paintbrush from a yucca plant. They use their paintbrushes and work collaboratively to paint a "winter count" or tale of their shared adventures. "Evening activities include listening to a professional storyteller as she describes the life of early settlers in this harsh environment. Students spend the night in the tipis. Breakfast and costumes await them in the 1887-style settlement of Wells Crossing as they are immersed in a typical pioneer's morning. Students assist with traditional chores, prepare their midday meal, and attend school lessons for a true 1887 experience" (Plains Conservation Center, 2014). Throughout the program, students journal about their perspective of prairie lifestyles and discover how their ideas change as they learn environmental science, history, and skills of those who arrived long ago.

Case study 4. Pittsburgh Regional Center for Science Teachers (PRCST) professional development program, Pennsylvania

This program provides pre-service and in-service teachers with examples of using classical mythology as a pathway to understanding the environment. Using Greek and Roman myths in storytelling offers alternative avenues for exploring environmental areas. Even in the most developed urban settings there are

seasons, weather, and other environmental components – and learning about them can be exciting when these phenomena are connected to myths. Identification of the story source is paramount: is it true or myth? Stories can be true – myths are fiction – there is a difference. Myths can be linked to other stories, scientific literature, and field trips. Work in this area links literacy skills, science research opportunities, and artistic expression. Using classical Greek and Roman myths as a basis fits with audience engagement and multiple cross-discipline academic areas of science, technology, engineering, and mathematics (STEM).

Conclusion

Active storytelling encourages participants to use imaginative and creative decision-making, and helps them get involved in environmental stewardship activities. Active storytelling is a technique which allows educators to create stronger understandings. Storytelling works with all audiences, no matter how diverse. Through the use of storytelling, audiences that are most familiar with urban environments may create stronger connections which allow for broader understandings of environmental issues. As collaboration increases regionally and globally, capable decision-making helps restore the critical bond between people and nature.

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10. Self-discovery through digital storytelling: A timeless approach to environmental education

Justin Smith

HIGHLIGHTS

- **The proliferation of digital technologies has opened up possibilities for personal expression, as well as for sharing our ideas and experiences with the world.**
- **Digital storytelling presents an opportunity for educators to engage a new generation of learners, and leverage these technologies in ways that encourage self-discovery about the environment through personal narratives.**
- **Storytelling is a tool and a method that can be instructive and transformative to both the teller and the audience.**

Introduction

Storytelling is perhaps one of the oldest mediums that humans have used to convey information, transfer knowledge and help make sense of a complex and mysterious world. Indeed, storytelling seems to be hardwired into the human species (Gottschall 2012; Mellmann 2012). While it has been one of the primary ways in which humans have taught one another through the ages, storytelling can be a powerful tool for personal learning and self-discovery. In particular, storytelling as a learning strategy for urban environmental education can be used to challenge both youth and adult learners to explore environmental issues, reflect on their experience of nature in an urban context, and examine their beliefs about the interface between the human-built and natural worlds.

When we tell a story, we draw upon the natural tendency for humans to seek connection sharing knowledge, experience and wisdom. Moreover, storytelling invites a certain intimacy as part of the process of expression, and the act of sharing with others. It requires us to embody the characters, the places and experiences we are sharing and communicating about (Abram 1997). This can be a powerful experience for people living in urban spaces, particularly where they experience a sense of disconnect from nature, and the people in their immediate community.

Today, the proliferation of digital technologies has opened up new possibilities for personal expression, as well as for sharing with the world. This presents an opportunity for educators to engage a new generation of learners, and encourage them on a path of self-discovery about the environment and their communities by considering their own narratives of place. This presents an opportunity for educators to engage a new generation of urban youth, and encourage them on a path of self-discovery about the environment, and their communities by considering their own narratives of place.

In this chapter we explore storytelling as a *learning strategy for the teller*. We present some of the foundations for this practice along with some of the new digital technologies that can be incorporated into an urban environmental education curriculum.

Learning through storytelling

Storytelling has been one of the central ways that humans have passed on knowledge from one generation to another through the ages. Stories have been used to entertain, spark our imaginations, as well as challenge us to think, feel and see the world around us in new ways. Stories can teach us about the history of a place, and teach moral lessons. They can be shared orally, acted out through drama, and shared through music and visual image; most great stories incorporate some combination of these methods.

While storytelling is perhaps one of the oldest methods of teaching and knowledge transfer, the act of storytelling itself can be deeply instructive to the one telling the story as well. It can be a process of self-discovery that invites the teller to integrate some part of the story into her or his worldview. It becomes part of the storyteller's experience and can often be a reflection of actual experience. Educators recognize the value of storytelling as a learning process for both adult and youth learners (Alterio and McDrury 2003). This has a special significance for environmental educators who seek to facilitate a deepening of environmental knowledge and sense of place among youth and adults residing in urban centers. In this context, the act of storytelling about a particular environmental issue, experience, place or idea can produce profound insights for the teller. It requires the teller to dig into the story with all their senses to intimately understand the ideas they seek to express.

The process of story creation can also be a learning process for the teller by requiring the teller to organize their knowledge, while internalizing and constructing meaning around phenomena in a way that is recognizable to others (Alterio and McDrury 2003). Finally, the act of conveyance or communicating the story challenges the teller to consider the ways in which various mechanisms of communication can shape, and influence the interpretation and understanding of the story. Visual storytelling through a painting, music, movies, poetry, and written prose all present methods for transferring knowledge and evoking a sensed connection with the core ideas or experiences being communicated.

However, for much of human history, storytelling has been constrained to a particular moment in time, accessible only to the teller and the receiver. Moreover, the storyteller, often as conveyor of knowledge held a position of power that was the privilege of only a few. Today, with the ongoing technological progress from the printing press, to radio, and motion pictures, storytelling and the teaching of storytelling has undergone a process of change and democratization. Educators increasingly engage their students, encouraging and training them to be effective storytellers. This includes learning methods for effective storytelling, as well gain skills in video production, multi-media blogging, dynamic presentation, and audio podcasting.

Digital tools for storytelling

The proliferation of new information and communication technologies has opened up opportunities for both adults and children to become avid storytellers and to share their stories around the world. Digital hardware such as audio recorders, pro-video, mobile phone devices and computers continue to be more affordable. As prices go down, the adoption of these devices is becoming more widespread. Along with the increasing affordability, there is a corresponding availability of new, free and socially connected software applications that enable people with little technical skills to edit video, edit and integrate audio resources, add text and push these new media objects across media networks such as YouTube, Facebook, Instagram and Storify.

Today, it is standard that PCs and Macs come equipped with pre-installed video editing software such as iMovie or Windows MovieMaker. Other tools like Audacity can be downloaded for free, whereas tools like Prezi, or Google Presentation can be used with a small fee, or even free. Now, modern computing is transitioning into the “cloud.” As long as you have an Internet connection, you can access software services to create, edit and publish multi-media content online.

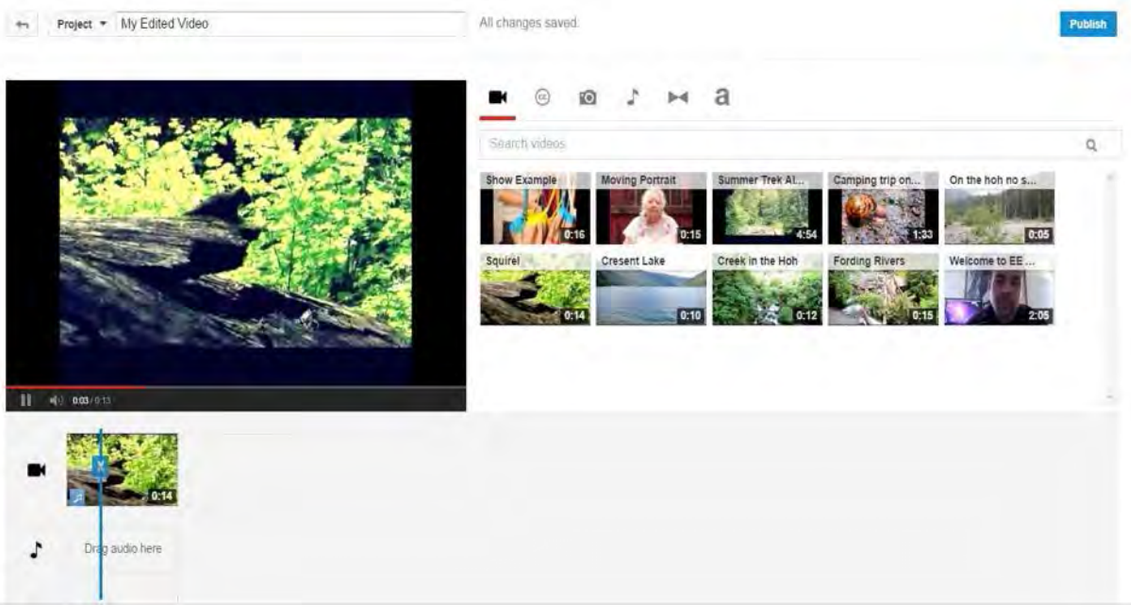

Figure 1. Screenshot of free YouTube editing software.

These new cloud services such as Google Drive, VivaVideo, Soundcloud and YouTube video editor (Figure 1) can eliminate cost by providing free services to edit, upload and distribute content. Overall, the accessibility of these tools and modern software services create opportunities for environmental education practitioners and students. Yet, to date, training and practice in storytelling as a learning strategy in environmental education has been slow to keep pace with the technology revolution.

EECapacity's "Storytelling and environmental education"

In fall 2014, over 30 urban and rural environmental educators were invited to take part in a 6-week online learning community through an EECapacity course "Storytelling and environmental education." The purpose was to provide a space for educators to explore digital storytelling as a process of self-exploration and improve their practice as environmental educators. The course was broken up into three two-week sessions. During the first two weeks participants were exposed to videos, academic journals, and webinars focusing on the theoretical and pedagogical foundations of storytelling as a teaching and learning practice for

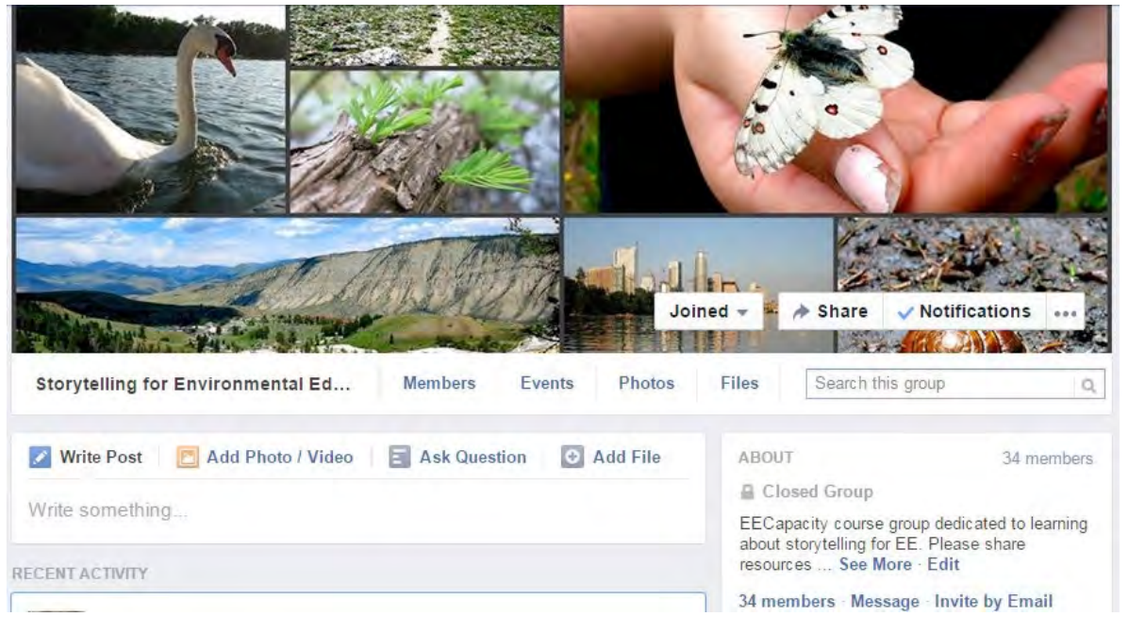

Figure 2. Screenshot of a closed Facebook group for EECapacity's "Storytelling and Environmental Education" course.

environmental education programs. During the second two weeks, participants worked through tutorials on best practices and digital tools. Throughout the process, participants accessed video and print media, and engaged each other through a discussion forum set up through Facebook (Figure 2).

Throughout, participants were invited to explore topics they felt a direct connection to; the challenge was to develop and produce a story that could convey their interests, excitement, and concerns in ways that would create a connection for others. The final two week section focused participants led projects where each participant developed a unique story, then digitizing (video, audio podcasts, or blogs). Student-practitioners created stories about bird watching in the city, like the one shown in Figure 3, while other stories covered personal nature discoveries, and travels to the Amazon, just to name a few.

Outcomes include more than just stories; participants were also encouraged to share those stories as a means to connect with one another. In each case, the storytellers participated in a "story exchange," sharing snippets of various personal histories through these audio/visual narratives. While the process proved

Figure 3. Screenshot of stop animation short written and produced by a course participant: Michael McNamee (http://youtu.be/qedZQ3CSVoA).

to be important to each person's self-discovery, the exchange was also important in the formation of a learning community where participants felt safe enough to take chances and share their work in an open and respectful way. At the end of the day, one of the most significant outcomes was the formation of a shared interest-group that people can continue to work with and draw upon. This maybe as much a product of shared interests as it was the willingness of participants to act courageously to experience vulnerability in order to become better educators.

What we learned from the storytelling course?

While the course was directed towards professionals, it is clear that this approach could be useful to a broader audience. The course provides one possible template that could be replicated in both adult and youth educational settings. Whether applying a blended or e-learning strategy, there are some key features that must be considered. First, *information literacy* is key to incorporating digital storytelling in any environmental education curriculum. The ability to search, access relevant content, and learn new skills through the web is key to being able to leverage new digital tools in the most effective way. A part of teaching digital storytelling is about improving information literacy and developing a skill set that empowers people to tell compelling stories. Of course, this is all dependent upon having access to the right technical tools. Without access the whole project falls apart. Ultimately, it is not enough to simply launch a storytelling program with digital tools as a secondary consideration. They must be integrated from the beginning while considering both access and literacy issues.

In addition to digital access and literacy, *trust formation* is another important element in a storytelling curriculum, particularly where you are asking participants to share something personal. People need to feel safe, safe to explore their own experience, and safe enough to be open to suggestions for improvement. Trust comes from everyone being willing to take a chance, and this may come from the facilitator first. This brings me to the next piece. In this setting we *become facilitators rather than teachers*. Our stories are just as valid and important as anyone else's and by sharing our stories we show ability to be vulnerable as well. We may have more experience, and that means perhaps more mistakes as well as successes. As educators, we become a resource as well as the foundation for cultivating trust.

Finally, in advancing this sense of trust, at the end of the day storytelling is as much about informing and connecting with our audience as it is about curiosity and exploration. Indeed, *exploration is the point* – there is no such thing as failure. In the absence of failure we become free to explore and learn in a way that is

driven by our own personal narrative and reinforced through the narratives we create as process unfolds.

Conclusion

Digital storytelling is a powerful strategy for supporting urban environmental education programs. Storytelling can be effective for sharing a perspective, informing others about the environment, creating community, and facilitating personal discovery. Digital storytelling is a powerful medium for sharing a perspective, informing others about the environment, creating community, and facilitating personal discovery – when developed in combination, this can lead to a transformative learning experience. Although technology can divorce people from nature, it is possible to use these tools in ways that encourage us to reflect back upon our place in the environment and our role within that environment. These can be used to get youth and adults into the outside world, and open their eyes to subtle opportunities to share profound insights. Tools like Facebook or Meetup.com can also be used to form community outside formal classroom settings to facilitate ongoing community-building through information exchange or field trips that can also serve as the basis for new content and new stories. Ultimately, through digital storytelling we give purpose and context to the use of technology where it becomes the tool for exploring our shared humanness, our environment and our place within nature.

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11. Mobile technology in urban environmental education

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HIGHLIGHTS

- **Mobile technology can be used in the field to enhance exploration and inquiry, data collection, and connections between people and their environments.**
- **These tools can be used in formal and informal educational settings with a variety of audiences.**
- **While mobile technologies have permeated everyday life and educational settings, care must be taken to consider the learning objectives and the context of instruction when using devices to support urban environmental education efforts.**

Introduction

The role of technology in the field of environmental education is a critical and timely issue. We live in a world saturated by digital media and devices, a world where unstructured play outside is taken over by video games and text messaging. In this society of increasingly indoor people, how do we, as environmental educators, facilitate connections between people and the environment around them?

Environmental educators have a complex relationship with using technology in their work. In a survey of non-formal environmental educators, researchers found that educators' attitudes regarding learning technology were nuanced and sometimes seemed contradictory. For example, about 78 percent of respondents agreed with the statement: "Integrating technology and environmental education instructional methods would enhance my students' learning," while about 56 percent also agreed that "The use of technology inhibits learning in natural settings" (Peffer, Bodzin, & Smith, 2013). Perhaps some of the concern reflected in the second statement comes from the phrase "in natural settings." Why take screens and devices into nature when so much time is devoted to screens in everyday life, and so little time is devoted to paying attention to the ecosystems in which we live? Like any tool or technique, using mobile technology in the field has its constraints and limitations, but also presents many opportunities to deepen and enhance environmental education programs.

Technology in environmental education is often most useful when used "to support and extend learning activities rooted in outdoor experiential learning" (Bodzin, 2008, p. 48). Mobile technology can serve as an entry point into the world of outdoor exploration, fuel curiosity, and build on outdoor experiences, essentially meeting people where they are in their own comfort levels. In this chapter, we highlight some ways mobile technology can be used in the field to enhance exploration and inquiry, data collection, and connections between people and their environments.

Exploration and inquiry

There is a great deal of conversation about the role that technology should play in teenagers' lives. Many teens are reluctant to put away their smartphones during class or remove their ear buds

when someone is speaking. How is it possible to encourage teens to reconnect with nature while they are plugged in? The Keep Austin Beautiful Green Teens program does not ask teens to unplug, instead, it encourages teens to explore the world around them using familiar mobile technology.

Keep Austin Beautiful is a nonprofit organization, which provides resources and education to engage citizens in building beautiful communities in Austin, Texas. Through its city-wide programming, Keep Austin Beautiful engages 11,000 students and 20,000 volunteers annually in service learning opportunities. The Keep Austin Beautiful Green Teens is a youth development, after-school program that gives teens the opportunity to engage with their local community in a way that cultivates pride of place and a sense of self. It empowers them to be active, to identify problems, find solutions, and take action.

The Keep Austin Beautiful Green Teens use tablets and digital microscopes to explore the world around them. The microscope digitally connects to the tablet, and the laboratory activity takes place outside (Photo 1). There is not any need to fund a lab space and expensive microscopes; the technology is cheap and available. Teens already know how to use tablets, and instead of spending time asking them to put away their mobile devices, educators can shift the conversation so it fits both student interests and the ideas they are teaching.

Photo 1. Studying macroinvertebrates with a portable microscope and tablet. Photo credit: Keep Austin Beautiful.

In a recent evaluation, one of the partner teachers was asked how her Green Teens used the technology. She said, “[We] took pictures with the tablet – the kids just can't get enough of the microscope as well. It doesn't matter if the lesson actually requires a microscope – they are ALWAYS using it to check out things they find outside.” She continued by stating “our students loved looking at just about anything with them (from plants and bugs to the carpet in the Library...)”

This use of mobile technology is particularly pertinent to urban environmental education. It allows the immediate environment around students to become “the field.” There is no need to take the students to any place designated as “the outdoors.” Everything can come under investigation and can be explored. The students’ immediate environment becomes the area under investigation, and questions about the urban flora, fauna, and built environments can generate inquiry.

Data collection

Mobile technology can be used for more than exploration. Once students are engaged with the subject matter, they begin to ask questions. Mobile technology can then be used to collect data about these questions. The Earth Partnership began in 1991 at the University of Wisconsin–Madison Arboretum as a place- and project-based program that combines ecological restoration, water stewardship, climate change awareness, environmental health and service learning with professional development for formal and informal educators, community partners, elders and students. Earth Partnership's “Follow the Drop” employs photo-mapping to understand patterns of water movement at school or in the community, connecting students to the larger watershed. Students can observe and collect information about water runoff on their school property or community, survey the grounds and identify the natural flow and contours of how water moves over the land. They mark this information by taking digital pictures (Photo 2). GPS coordinates are matched to pictures, locations, times and places. Finally, students write a brief description of the images that are uploaded to a Google Map and shared.

Photo 2. Collecting field data. Photo credit: Earth Partnership.

Mobile devices can also facilitate data collection for citizen science initiatives. Citizen science projects encourage people from all walks of life to collect data that will contribute to a large data set – much larger than teams of scientists could produce. There are many apps for mobile devices that make it easy for people to participate in science that interests them, while continuing to learn more about their chosen topic. In addition to encouraging individual learning, environmental educators could use citizen science programs to enhance their own programs with large data sets that connect the observations of students with those made by others. Many of the apps would be particularly well suited to urban areas, tracking data about waterways, weather, noise and light pollution, birds, insects, and phenology, among other topics. The apps simplify the data-collection process and standardize the information collected so it can be compared to data collected by others. Some citizen science projects can result in significant social outcomes, as they can provide communities and scientists with the data they need to bring about positive change (Bonney et al., 2014).

Mobile technology as a connector

Sharing experiences, inquiries, and achievements digitally is an important way to use mobile technology to inspire more people to become interested in the outdoors. These shared stories are central to general processes of diffusion and adoption of innovation in practice (Rogers, 2010). New technologies and networks can help increase public visibility and open doors to include greater numbers of participants in learning about the environment. For Earth Partnership, digital storytelling has become an important component of the program. During Earth Partnership's one-week Institute, students are introduced to the theoretical, conceptual, and technical aspects of creating a digital story. Students identify what aspect of the story interests them, then produce a draft focusing on their story, goals, content, concept, and argument. The draft then directs them to community members they need to interview and serves as a map of the story prior to actual filming. Students are guided in producing and editing. The result is a two to three minute video or a photomontage including music and voiceover about their topic of choice.

Finally, mobile tools can also help document the evolution of people's thinking and experience over time. By integrating data collection, storytelling, and social media tools, students and educators can create e-portfolios. These are essentially digitized collection of media objects including images, written reflections, videos and other resources that reflect student thinking about particular topics or experiences (Barrett, 2001; Lorenzo & Ittelson, 2005). Together, the integration of these tools provides a powerful framework for engaging people in learning, inspiring others about the environment, and creating opportunities for civic action around environmental issues (Rheingold, 2008).

Considerations

Several issues should be taken into account when using mobile technology. The pace of technology development presents a serious challenge to educators in terms of remaining relevant and effectively using these tools in their work. At the

Earth Partnership, the teachers' technological knowledge lagged behind the students' knowledge, resulting in challenges to teacher credibility. Many environmental educators do not receive much training in how best to use technology in their teaching, and so there is a great opportunity for the field to begin to provide some of that training. Additionally, mobile technology tools can be too expensive for many programs and participants to afford, suggesting some will develop higher technical sophistication while leaving others behind. Access and digital literacy must be taken into account as a matter of equity in our work as environmental educators.

In addition to gaps in technical knowledge and access, there are other considerations that must be noted. For the Keep Austin Beautiful Green Teens, one of the biggest issues that arises with the technology is usability in the field. It can be difficult to read tablet screens when they are in the sun, and rain and moisture can damage electronics. The strength and availability of GPS and wireless internet signals can limit the use of some software in the field. Mobile hardware, such as smart phones and tablets, can break or become obsolete in a matter of years. Due to privacy concerns, particularly with youth, educators would be wise to investigate the privacy policies of any programs or applications they are considering using, as well as set any user-controlled privacy settings to an appropriate level.

Conclusion

In conclusion, mobile technology and associated software present significant opportunities for advancing the field of environmental education in new and exciting ways. Use of these tools can facilitate learning and outreach, while also providing students with technical skills that can transfer into more advanced inquiry. In order for educators to make effective use of digital mobile technologies, they need to consider the limitations associated with them. As with any tool, these technologies are not always appropriate, and care must be taken to consider the learning objectives and the context of instruction when using them.

In the coming years, cloud computing will continue to expand, and the culture of mobile technology use will only intensify. We have a real opportunity to define the trajectory of mobile technology use in environmental education, while also increasing the role of environmental education in multiple modes of learning in modern society.

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12. Positive youth development through urban environmental education

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HIGHLIGHTS

- **Urban environmental education contributes to the development of young people across multiple domains in addition to environmental literacy.**
- **A sense of compassion and empathy among youth are fostered through urban environmental educational experiences, leading to more caring attitudes not just toward the environment, but also toward fellow human beings.**

The relationship between positive youth development and urban environmental education

Positive youth development (PYD) and urban environmental education are often considered two unrelated fields of study and practice. Emerging research is providing a strong argument that PYD and urban environmental education are interrelated, both contributing to each other in symbiotic fashion. This chapter will discuss and expand upon the role of urban environmental education in promoting PYD.

Positive youth development

Positive youth development is a strengths-based view of adolescent development, subscribing to the notion that youth possess innate talents and abilities that should be strengthened. Proponents of PYD believe the most effective way of promoting youth development is capitalizing on what youth have to offer, not "fixing them" (Lerner, R., Lerner, J., Almerigi, & Theokes, 2005). The US Department of Health and Human Services describes PYD as an approach to youth development embodying the belief that youth who have regular access to "protective factors" or positive influences, are more likely to successfully transition into adulthood than those young people who are not exposed to consistent protective factors. Experts in the youth development field believe that there are core competencies that youth need to possess in order to thrive, which are referred to the Five C's of PYD – Competence, Confidence, Character, Connection, and Caring (Pittman & Wright, 1996; Pittman et al., 2001; Eccles & Gootman, 2002; Roth & Brooks-Gunn, 2003; Lerner et al., 2005;). A 6th C has been later identified as an outcome resulting from the development of the first Five C's: "Contribution" to self, family, community, and civil society (Jelicic, Bobek, Phelps, & Lerner, 2007).

Positive youth development in urban environmental education

Although the focus of urban environmental education initiatives is not necessarily positive youth development, there is growing research demonstrating that youth who participate in urban environmental education programs benefit across multiple domains of development (Schusler & Krasny, 2010). Using the 6 C's of PYD, the following

sections illuminate contributions urban environmental education makes to various domains of PYD (Table 1):

Table 1. The "6 Cs" of positive youth development.

"C"	Definition
Competence	Increasing ability in specific areas, including social, academic, cognitive, health, and vocational. Social competence refers to interpersonal skills (e.g., conflict resolution). Cognitive competence refers to cognitive abilities (e.g., decision-making). Academic competence refers to school performance as shown, in part, by school grades, attendance, and test scores. Health competence involves using nutrition, exercise, and rest to keep oneself fit. Vocational competence involves work habits and explorations of career choices.
Confidence	An internal sense of overall positive self-worth and self-efficacy.
Connection	Positive bonds with people and institutions that are reflected in exchanges between the individual and her or his peers, family, school, and community.
Character	Respect for societal and cultural norms, possession of standards for correct behaviors, a sense of right and wrong (morality), and integrity.
Caring	A sense of sympathy and empathy for others.
Contribution (results of 5 C's)	Contributions to self, family, community, and to the institutions of a civil society.

Competence

As described in the Table 1, the competence component of PYD includes social, academic, cognitive, health and vocational categories (Lerner, 2004). Cognitively speaking, youth gain competence through urban environmental education in several ways. Volk and Cheak (2003) found that fifth- and sixth-graders improved in reading, writing and the use of technology while participating in an urban environmental education program that used technology to research environmental issues in their community. Urban environmental education activities have also proven to be quite effective in developing social competence among youth (Schusler & Krasny, 2010; Pyle, 2002). One reason attributed to the ability of urban environmental education programs to promote social competence, is the fact that the natural setting (being outside) puts youth at ease, allowing them to be more open to positive interactions with their peers (Louv, 2012). Academically speaking, urban environmental education experiences contribute to academic competence, especially in science and math subjects (Strife, 2010). A promising trend shows that urban environmental education can also contribute to confidence building in other subjects including natural history (Tardona, Bozeman, & Pierson, 2104) and language arts (Bartosh, Tudor, Ferguson, & Taylor, 2006).

Confidence

Research indicates that individuals residing in urban settings who participate in urban environmental education activities grow more confident in various areas of their lives and experience increased self-worth (Volk & Cheak, 2003; Schusler & Krasny, 2010). Urban environmental education programs and activities that use outdoor settings while challenging youth in various ways contribute to development of confidence and self-worth because young people experience a sense of accomplishment (Louv, 2012; Cottrell, & Raadik-Cottrell, 2010). Youth who visit the Timucuan Ecological and Historic Preserve in Jacksonville, FL gain confidence engaging in urban environmental education activities such as challenging hikes in humid conditions as well as building replica Timucuan palm-thatched shelters (Tardona, Bozeman, & Pierson, 2014).

Connection

Urban environmental education activities have proven successful in fostering connections between youth and their peers, family, and community (Eckert, Goldman, & Wenger, 1997). An example of an urban environmental education initiative that promotes connections for youth would be the urban community garden movement. Community gardens in cities connect youth to the land, their teachers, peers and community as a whole. The urban community garden approach encourages a symbiotic relationship where students learn about healthy living, science and community service while contributing to the community garden's development (Kransy & Tidball, 2009).

Character

Youth who engage in urban environmental education experience character growth in various ways (Schusler & Krasny, 2010). Learning about their local, urban ecosystems, youth participate in repairing community health, which is a moral imperative. During the process of urban environmental education participation, youth learn how to not only protect the voiceless environment, but they work with others (teamwork) who have similar stewardship goals (Hashimoto-Martell, McNeil, & Hoffman, 2012). Environmental stewardship is a commitment to something bigger than oneself, therefore urban environmental education teaches young people about self-less behavior, which is a commendable character trait (Krasny & Tidball, 2009).

Caring

Youth who experience the natural world through urban environmental education gain a sense of appreciation for their local places, therefore tapping into a sense of empathy for the life that surrounds them (Louv, 2012). Jacksonville, Florida youth visiting the Timucuan Ecological and Historic Preserve learn how indigenous natives lived, creating a sense of respect and empathy for cultures and people that no longer exist. Furthermore, the same Jacksonville youth build caring relationships with their teachers who chaperone the visits as well as the staff at the preserve (Tardona, Bozeman, & Pierson, 2014).

Contribution

Contribution is the resulting "C" when youth experience the first Five C's. As previously stated, urban environmental education contributes to all of the Five C's. Contribution in this context refers to the contributions youth make to themselves, family, peers and society as a whole. The health and wellness of urban communities is dependent upon urban ecosystem health. Therefore, youth who participate in urban environmental education experiences are making one of the most important contributions to society: protecting the health of entire communities (Louv, 2012; Krasny & Tidball, 2009; Hashimoto-Martell, McNeil, & Hoffman, 2012).

Urban environmental education programs promoting positive youth development (photos 1–3)

Photo 1. 4-H youth in Sacramento, California learn about watershed science in the Water Wizards program.

Photo 2. Jersey Roots, Global Reach Climate Science Education a 4-H program.

Photo 3. "Jr. Rangers" at the Timucuan Ecological and Historic Preserve in Jacksonville, Florida. The reserve is the largest urban park system in the U.S.

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13. Cultivating compassion in urban environmental education

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HIGHLIGHTS

- **Urban outdoor learning programs have a unique opportunity to incorporate techniques for cultivating compassion.**
- **Through urban outdoor learning, students can acquire skills that will make them more sensitive to others, to animals and to the nature around them.**
- **Modeling kindness is the most effective way to encourage compassionate behaviors in others; research reveals compassion actually is contagious.**

Is there a need for cultivating compassion?

Jeff Duncan-Andrade, an English teacher from East Los Angeles High School, states that in his experience, urban youth from dangerous neighborhoods are twice as likely as soldiers returning from Iraq to experience Post Traumatic Stress Disorder (Suttie, 2012). For individuals who live with unpredictable, persistent threats of violence, or pressures of poverty, their need for exposure to green space is critical. So too is the challenge to meet their emotional needs.

In addition to issues in the U.S., research reveals the global nature of these needs. Studies from China (Bexell, Jarrett, Xi, Pingm & Xi, 2009) and South Africa (Ferreira, 2012) explain educators' efforts to help students care more about animals, nature, and each other. Developing our compassion for others and for the environment is one of the foundations of positive change in our world.

Studies from both Emory University, and Stanford University show that there are effective techniques for teaching compassion (Jazaieri et al., 2012). These techniques, combined with understanding and long-term support prove vital in the implementation of any compassion-based instructional program. This chapter examines examples of compassion training and also offers tangible tools for creating more caring behaviors among students in challenging situations.

Earl and Pearl: Eastern box turtles, ambassadors of compassion

Photo 1. Ambassadors of compassion.

Earl and Pearl are Eastern box turtles who were both saved by the same licensed non-profit wildlife rescue center. Earl was the victim of animal cruelty; hit with a hammer in an urban parking lot. Extraordinary care prevented him from becoming paralyzed. Pearl was taken from the wild and suffered from severe neglect, dehydration and

malnutrition. Both of these urban turtles not only survived, they continue to thrive (Photo 1). Today, Earl and Pearl are living happily ever after as compelling emissaries for the “Be Kind to Animals” mission and for keeping wild animals wild. Their miraculous recoveries and magnetic personalities have helped touch the hearts of people, young and old.

Compassion in an urban environment

Living in the city does not necessarily limit its denizens to concrete and mortar. Zoos, parks, aquariums, community or botanical gardens are accessible for some, but not all. The Chicago Zoo in Lincoln Park subsidizes a child-friendly farm, including barnyard animals (Photos 2 and 3). Although children are exposed to animals, they are observing from a distance, rather than actively caring for the animals. The Chicago Zoo does offer interactive programs, but parents must have the time to bring their children when these activities are scheduled at the zoo (Agyeman, 2003).

Photos 2 and 3. Urban farm exhibit in Lincoln Park, Chicago.

Case studies: An international perspective from China to South Africa

The call for compassion crosses political and cultural borders. In China, students between the ages of 6 and 12 attended a five-day camp to develop a more compassionate attitude towards animals. The Chinese program used three strategies to foster compassion in children (Bexell, Jarrett, Ping, & Xi, 2009).

1. Children played with small animals with a “getting-to-know-you” introductory session. Educators reinforced the individuality of each animal rather than seeing the animals as members of a species.
2. Responsibility for an animal became the next step. Animal care soon extended to a deeper animal-human connection as students were asked to imagine themselves as the animal.
3. Returning home and applying the newly learned behaviors by showing greater compassion was the final stage of the program.

An evaluation of this program indicated that the camp experience proved successful. Children can be taught to have a more positive connection with nature. Self-evaluations drawn from students’ journals reveal a deep attitudinal change – “Friendship ... is most important to all animals, including human beings.” “My attitude toward animals was terrible, but now I discover animals have emotion also.” Parents stated that their children not only showed greater compassion for animals, but also for other human beings and other living things (Bexell, Jarrett, Ping, & Xi, 2009) (Photo 4).

Table Top Mountain Park in South Africa hosts over 30,000 schoolchildren per year in the Kids in Parks Initiative. The larger portion of students participates in a single day program, while a smaller portion participates in a three-day residential environmental education program (Ferreira, 2012). The goal for the overnight school children is to educate students thus creating greater empathy between schoolchildren and the natural world. Though the study does not directly address compassion, it does attempt to educate children by familiarizing them with local flora and fauna, leading to greater environmental stewardship. Students each day are exposed to different facets of nature: rivers, mountains, and forests. On the final day students visit the Boulders penguin colony in Simon’s Town. Students were given a pre-visit questionnaire, and six weeks afterwards a post-visit questionnaire. Results from the post-visit questionnaire indicated the greatest change was in attitude towards the environment while lesser improvements were made in knowledge and behavior. Unlike the Chinese study, which included daily contact with animals, this study focused on the science of the environment with

Photo 4. Young, urban student petting a guinea pig in her care.

little post-camp support in evidence. Both programs sought similar end-results: to create a greater sense of stewardship and connection with nature.

The toolbox: Six strategies for increasing compassion in environmental education

The Greater Good website (2014) compiled the results of several compassion training studies from both Emory and Stanford Universities. The site offered ten suggestions to increase compassion in children, of which six were directly applicable to urban environmental education. Many types of urban environmental programs exist, so this is not a one-size-fits-all approach; it is more a menu of items that may be helpful, depending on a specific situation.

1. *To cultivate compassion in children, model kindness*. Research suggests compassion is contagious. To help compassion carry into the next generation, lead by example. Individuals who either perform or witness others performing an act of caring, experience an increase in the reward center of the brain (Simon-Thomas et al., 2012).
2. *Look for commonalities*. Seeing yourself as similar to other people or other living beings, increases feelings of compassion (Valdesolo & DeSteno,2011).
3. *Calm the inner worrier*. Practicing mindfulness can help us let go of the past, remind us that we cannot control the future, and help us focus positive energy on appreciating the present. This, in turn, fosters more caring behavior (Hofmann et al., 2011).
4. *Encourage cooperation, not competition*. Urban environmental education has a unique opportunity to pull people together to make a positive impact in local neighborhoods (Choi, Johnson, D.W., & Johnson, R. 2011).
5. *Respect your inner hero*. When we think we are capable of making a difference, we are less likely to curb our compassion (Weng et al., 2013).
6. *Have participants pay attention to how it feels to be compassionate*. Studies have shown that caring for others significantly increases brain activity in areas that signal reward. The awareness of this sensation makes it even more likely that acts of kindness will be repeated (Simon-Thomas et al., 2012).

In a nutshell

Whether for an individual or an organization, the strategies for affecting change and transforming cruelty or indifference into compassion, are the same. Whether domestic or global, if not identical, the solutions are similar enough to validate the efforts of any of the programs examined. Begin with developing empathy for living things, providing opportunities for all urban citizens, especially children, to be involved in caring for the natural and social world, and fully internalize that change with continued support from local communities, families and educators.

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14. Fostering comfort in nature among urban school children

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HIGHLIGHTS

- **Enthusiastic environmental educators provide both the impetus for exploration and distract urban program participants from their fears.**
- **Careful preparation of engaging activities and appropriately dressed participants make outdoor exploration successful.**
- **Overcoming their fear of nature is a prerequisite for inner-city residents to grow more comfortable in wild or urban natural places and choose to spend time in them, ultimately supporting protection of the environment close to and far from home.**

Introduction

Imagine joining a group trip to a far off, unfamiliar, wild land. You heard stories of the dangers that lurk behind trees and rocks. You wonder whether there are poisonous snakes, large wild animals, stinging insects or spiders. The group leader brings you to a grassy clearing and asks you to sit down on the ground. How do you feel? Do emotions like fear, disgust, anxiety and apprehension surface? This is how many urban residents experience nature (and this is why they avoid nature). Welcome to the daily challenge of urban environmental educators.

For individuals with limited exposed to natural environments, their interpretations are based on what they learned from indirect sources such as horror movies, amusement parks, television shows and zoos (Bixler, 1997). Hearsay and rumors keep alive urban legends of children being hurt or disappearing, so parents learn to fear sending their children out in nature (Blakely, 1994). But these barriers to nature exploration can be overcome in time and with patience. It is essential to acknowledge fears, provide solutions and make connections to bring urban residents closer to nature.

Background: Fears and disgust

Interpreters at 48 urban nature centers in the eastern U.S. and Canada were surveyed to list fears and discomforts expressed by students. Fear of snakes was most common (87%), followed by fear of insects (79%), non-indigenous animals (73%), plants (56%), and fear of getting lost (also 56%). The high ranking of “getting lost” was surprising, since students are led by an interpreter and accompanied by peers, parents, and teachers. Next on the list was the fear of dirt or mud, including getting dirty or sitting on the ground (48%), followed by spiders (44%). Personal comfort (too hot or cold, too much walking, no bathrooms) was another concern (35%) (Bixler, 1994; Simmons, 1994; Wals, 1994; Dillon, 2006; Aaron, 2011). We are so accustomed to indoor comforts and cleanliness, such as climate-controlled buildings and indoor plumbing (sinks, toilets), that when nature falls outside this narrow comfort zone, it causes some to withdraw (Simmons, 1994; Bixler & Floyd, 1997).

An unexpected finding was the emotion of disgust in relation to natural objects (35%) (Bixler, 1994). Students with a high “disgust sensitivity” prefer and

perhaps initially require, activities that do not involve handling soils, dead or decaying vegetation, touching worms, insects, reptiles or amphibians or conducting fieldwork in water with algae (Bixler 1994; Bixler & Floyd, 1997; Bixler & Floyd, 1999; Dillon, 2006). These fears and feelings are barriers to enjoying and learning in and about nature (Dillon, 2006). An increased preference for indoor recreation and manicured outdoor areas are related to these negative perceptions of nature (Bixler & Floyd, 1997; Dillon, 2006).

Solutions

Unfamiliarity: Combat fear and foster connections

Preparation for a successful introduction. Students benefit when teachers conduct preparatory meetings and discussions, and share explanations and materials to create accessible and inclusive outdoor learning experiences. For example, in a Queensland study of nature-based excursions, significant differences were found between students who had done pre-visit activities and those who had not. The properly prepared students looked forward to, and enjoyed, their visit more than the group with no pre-visit activities. In Israel, there is a strong rationale for preparatory work introducing students to cognitive (field trip concepts and skills), geographic (field trip setting), and psychological (field trip processes) aspects of taking a group outdoors (Dillon, 2006).

Managing expectations. Information is powerful! An introductory display provides a useful and welcoming starting point for students unfamiliar with the landscape they are about to enter. It offers reassurance that dangers they may assume lurk around every tree are absent (Photo 1). The more students know about the environment, the better they manage their fears and anticipate new adventures. All concerns should be addressed and never dismissed. Empathizing is an important part of showing the students you care and are doing everything possible to keep them safe. When addressing fears, end on the positive. For example, in response to a question about tigers, a Chicago area program leader said, “No tigers around here! They live far away in Asia. But we have other furry animals, like rabbits and squirrels.” “There are rabbits?” the little girl exclaimed.

Photo 1. At the William S. Schmidt Outdoor Educational Center, the beginning of the trail has a large bulletin board with pictures of local animals and insects, including snakes. The absence of bears on the board is very reassuring to most, disappointing to some! (Cathy Foutz, personal communication, September 4, 2014).

“Yes, would you like to look for one with me?” “Yes, please,” she smiled (Anastasia Steinbrunner, personal communication, September 5, 2014).

A sense of humor will get you and your group a long way. When students ask about snakes, I tell them “fifth-graders are not on the snake's menu. You are too tough and chewy and too big to swallow whole.” When they laugh it discharges all the anxiety and I know we can move on (Cathy Foutz, personal communication, September 4, 2014).

Taking a group outdoors

Prepare and be positive. As the proverb states, “There is no such thing as bad weather, only inappropriate clothing.” In an increasingly climate controlled world, urban residents have a low tolerance for discomfort. Even minor fluctuations in

temperature can bring complaints, and many children are aghast at the idea of staying outdoors in the rain. With an educator's guidance, students learn that every change in season and weather pattern brings new opportunities to explore. The warm sun brings out hidden reptiles, winter exposes owls, and rainstorms supply worms.

Urban residents need to know how to dress for certain types of weather and outdoor exploration. Ideally, they would bring rain jackets, rain pants and boots on rainy days, rather than umbrellas, which do not work well in the forest. Emphasize wearing clothes that can get dirty. Students cannot have an immersive experience if they are focused on staying clean and dry (Photo 2). Unfortunately, not everyone owns rain gear or heavy winter clothes. School uniforms can be another source of discomfort. Some students are required to wear a sweater over a shirt, even on a hot sunny day.

Photo 2. Harlem students overcome fear of touching the dirty ground and roll down a grassy hill.

If students are unprepared, there are numerous ways to help lessen their discomfort and use the situation as a learning experience. Playing an active game or building a shelter can warm them. Water activities are great for hot days. Often merely sympathizing with the students can bring relief. One of the best antidote to discomfort is distraction. Redirect their focus to an awesome observation, a mystery to solve or a challenge to surmount. Leader enthusiasm and energy are key to making the distraction stick.

Having a "Plan B" aids in promoting comfort. Unexpected things will happen when you are out in nature. The weather may not cooperate or students may not dress for an outdoor adventure. Occasionally, a leader will forget a necessary supply and be unable to complete the intended lesson. Adapting a lesson or having a contingency plan is the best way to ensure students have a positive experience. Keeping an optimistic and enthusiastic attitude may turn these potential disasters into memorable experiences.

"Plan B" lessons may be created in fortuitous circumstances, too. Capitalize on chance encounters with wildlife to excite and engage students. During a field trip in Brooklyn, a praying mantis hopped onto a ground cloth meant for students. They screamed and scattered. But after supportive discussions to provide information and dispel fears about the praying mantis, a few students felt comfortable enough to hold the insect (Photo 3).

Photo 3. Two Brooklyn ninth-graders hold a praying mantis.

Guided discovery. After thoughtful preparation, the best way to foster comfort is to begin guided discovery of local natural communities. These explorations can be more or less structured, depending on the interest of students. It is often beneficial to have specific tasks to accomplish or objects to find along the way. Students then focus on the task at hand, rather than their fears. Looking for pieces of a hidden map, finding secret boxes (geocaching), scavenger hunts or playing familiar games in an unfamiliar setting all can help bridge the gap between the individual and new environment. It is important to resist over-structuring learning activities. Worksheets and note taking leave less of a memorable impression than touching and interacting with wildlife. Studies have showed that sharing direct experiences and teachers' role-modeling their interests and likes about the forest environment facilitated learning (Dillon, 2006).

Students are likely to observe interactions between living things and the environment or biological processes that they do not understand. It is essential to stop and observe any phenomenon that intrigues the observer; further investigation can reveal a host of hidden connections and opportunities to relate to the learner. A teacher's guided exploration through analogies to the individual's own life helps students relate to other animals, but it is important not to anthropomorphize the organisms. Children may also see an animal as "bad" because it eats other animals. Remind them that good and bad are constructs that only apply to humans; the animal was in fact hungry or trying to fulfill a need. Encourage students to keep exploring. The more exposure students have to natural systems, the more familiar they become. Give students an opportunity to lead the guided exploration to help them become more invested in the outcome.

Conclusion

Becoming comfortable in natural areas is pivotal on many levels. It strengthens positive environmental attitudes and is developmentally important for children. Playing and exploring in nature as a child enhances all the senses, which promotes creativity and intellectual development (Louv, 2008). Children play more imaginatively, have higher test scores and better involvement in school (White, 2004; Beatley, 2011). Nature also reduces the stress of urban life and aids in recovering from illness (Bixler & Floyd, 1997; White, 2004; Beatley, 2011). Spending time in nature has been proven to reduce the effects of attention deficit hyperactivity disorder and autism (Beatley, 2011). It may influence vocation, recreation and informal educational activities. Young children build emotional attachments to what is familiar and comfortable. With positive and regular experiences in nature, children develop a sense of stewardship, learning to respect and care for the environment (White, 2004; Beatley, 2011).

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15. Environmental justice in urban environmental education

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HIGHLIGHTS

- **Environmental injustice occurs when the most vulnerable, poor, minority or underserved populations carry the greatest burden of environmental risk by living in "undesirable" areas.**
- **Environmental education can provide an opportunity to connect people to nature even in urban areas, and help empower people to mitigate environmental issues.**
- **Addressing the challenges of environmental justice through the support of environmental education programs can help engage people in actions to improve their environment.**
- **As citizens engage in environmental education and action bringing positive changes in their communities, they become more empowered to take future actions to further improve their environment.**

Introduction

According to the US Environmental Protection Agency (EPA) environmental justice is defined as, "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

Environmental injustice occurs when the most vulnerable populations carry the greatest burden of environmental risk. Environmental justice seeks to create environmental equity and address issues of environmental racism and inequalities that are the result of human settlement and industrial development. Scholars have explored the topic of environmental justice on both applied and theoretical levels. From examining the geographic distribution of toxins (Lewis & Bennett, 2013) to equitable allocation of green space (Boone et al., 2009) to the debate over how to define environmental racism, there tends to be a pattern of environmental injustice suggesting that minorities and poor people are those that live in areas considered "undesirable."

Many of the urban communities we work with are touched daily by environmental injustices. Landfills, interstates and train lines are most often located in close proximity to low-income minority neighborhoods. These areas often have reduced access to natural amenities and green space is often distributed by socio-economic lines (Agyeman & Evans, 2003). As educators, how can we work to bring environmental justice education to the forefront?

Environmental justice issues have a history of being excluded from environmental education study (Haluza-Delay, 2012). This can occur because educators lack an understanding of environmental justice or the politics of the education system dissuades teaching on controversial topics related to race and injustice. Environmental education can provide an opportunity to connect people to nature and can help empower them to actively address environmental issues. In fact, the North American Association for Environmental Education suggests that diversity and justice should be a top priority in environmental education, and that more progress should be done in this area.

Students in the urban environment can often experience a disconnect between themselves and the natural world and may not notice their direct impacts on the environment. Lessons focused on issues such as the carbon footprint allow students to visualize their impact on the environment and will help make the issue relevant.

Seattle: Race and social justice initiative

In 2002, the City of Seattle launched its Race and Social Justice initiative, and Seattle Department of Parks and Recreation (Parks) began an Environmental Stewardship Initiative. The Race and Social Justice is Seattle's effort to focus on the roots of problems – to change the underlying system that creates and preserves inequities – rather than attempt to treat the symptoms (Seattle, 2008). Seattle City Hall acknowledged the need to expose institutionalized racism and expunge discriminatory municipal policies, procedures and practices overall; and Parks wanted to equitably serve more people, more often in the public green spaces where people live, work and play.

In 2014, residents of a historically diverse, working class Seattle neighborhood applied for a grant from the Department of Neighborhoods to pay for an environmental assessment and design for a bike trail in a public green space imbedded within a residential area. The Parks Board of Commissioners approved the project early in the year. No one had proposed a recreational use in a public green space before. In fact, there were no policies to refer to regarding uses of public green spaces. By summer, advocates and opponents of the mountain bike trail were vying for time to speak to city council members about their points of view.

The story, as reported by the local newspaper, The Seattle Times, presented points of view that, intentionally or not, perpetuated historic social constructs (Shellenberger & Nordhaus, 2007). These included: conflicts between whites and people of color concerning uses of parklands, "people are not a part of nature," and people of color not having access to nature unless they are working in it.

Those interviewed for the article were all white residents of the area. A photograph with the story showed a white male leading a work group in the green space consisting only of youth of color (Photo 1). However, there were no direct quotes given by youth of color in the article. Imagine the empowering potential of environmental education if used in this situation as a tool to facilitate discussion for better understanding and clarity of the issues among the various stakeholders.

Photo 1. Volunteer work party at site of proposed bike trail.

Both opponents and advocates of the project used environmental justice to make their arguments to City Council. Opponents claimed the mountain bike trail would "exclude all but the able-bodied," with a neighbor quoted as saying (Seattle Times, July 28, 2014): "We're talking about young, white male energy. This is public land. This is a social justice issue." Advocates for the bike trail said, "…[it] would give youths who aren't able to get out of the city an opportunity to experience the joy of riding their bikes in the woods. And in the process… the kids

would gain an appreciation of nature and a sense of ownership for the green space."

The green space was an urban mix of invasive plant species and native flora. Neighborhood volunteers, including many youth groups, spent hours restoring the forest and installing public trails. The area attracted wildlife as well as illegal dumping, homeless encampments, and drug use. At the end, City Council voted to award the grant in favor of the bike trail, with a caveat that Parks develop policies for use of green spaces (Seattle Times, August 13, 2014).

A lot of progress has been made regarding Seattle's institutional commitment in 2002 to expose and scrub itself of discriminatory practices, policies and procedures. That said, there is still a lot of work to be done to reach equity and social justice.

Washington, DC: Urban Bird Treaty

Urban Bird Treaty program in Washington, DC engaged with several organizations that focus on the Anacostia River. One such organization, Anacostia Watershed Society, works to engage teachers and students in public policy and advocacy actions through targeted programs.

The Anacostia has a long history as a working port and industrial river, leaving a legacy of toxic pollution that impacts the health of aquatic life and humans that fish, swim, or otherwise recreate on the river. Stormwater runoff collects trash, bacteria, and toxins, and flows into storm drains, and straight into the Anacostia River and its tributaries. With a watershed that is 70 percent developed, the Anacostia is impacted by a huge amount of impervious surface. The Anacostia River is so severely impacted by trash that in 2007 it was declared "impaired by trash" under the provisions of the Clean Water Act. Additionally, the developed areas near this river serve a primarily low-income minority population.

There are many efforts to pick up trash manually or catch it with trash traps, but ultimately trash use needs to be reduced from the source. Reducing this impact one of the biggest challenges. The Anacostia Watershed Society has several programs available for teachers and students to help engage citizens in actions that will not only teach them about the watershed environment, but also how to take actions to improve the environment and to become part of the solution.

As part of the Urban Bird Treaty program, Anacostia Watershed Society was awarded grant monies to work on several projected related to engaging diverse and minority audiences in areas that are demographically considered underserved minority neighborhoods. Sixteen teachers were mentored and equipped for the Rice Rangers program (wetland plant growing in elementary school classrooms), including 11 grow light systems set up in schools. About 300 Washington, DC students participated in a lesson on wetlands and planted native wetland seeds in classrooms, engaged in field studies on the Anacostia River by pontoon boat and participated in wetland planting events. Elementary school students grew 2200 wetland seeds in classrooms and planted the grasses in restoration plots at Kenilworth Aquatic Gardens. Kenilworth is a National Park in the inner city of Washington, DC surrounded by areas where communities are mostly underserved.

While there are not yet any statistics to show that engaging citizens in this area resulted in actions independent of the organized efforts presented to students and citizens, environmental justice actions are being shared with citizens and continued efforts are being monitored.

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16. Environmental equity in the age of climate change

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HIGHLIGHTS

- **Communities of color and people living in poverty on a global scale have historically borne the disproportionate negative impacts of environmental degradation without the benefit of representation in decision-making or self-determination.**
- **The environmental justice movement calls upon the combined efforts of urban environmental education, media literacy, and human compassion to activate and engage the global citizenry in addressing the issues of climate change on systemic levels locally, nationally, and world-wide.**
- **Urban environmental education is an effective tool for focusing the dialogue about climate on community-based solutions, diversity, equity and respect for all life on earth.**

Climate change through the lens of environmental justice

Robert Bullard, Dean of the Barbara Jordan-Mickey Leland School of Public Affairs at Texas Southern University, is considered the "father of the environmental justice movement" (Photo 1). Environmental justice embraces the principle that all people and communities are entitled to equal protection of our environmental laws. It means that all people, regardless of race, color, or national origin are entitled to be involved when it comes to implementing and enforcing environmental laws, regulations, and policies.

Photo 1. Robert Bullard Courtesy of Texas Southern University (Source: Texas Southern University).

According to Bullard, climate change is the environmental justice issue of the 21st century because the people who are impacted first, worst and longest are oppressed communities whose survival depends on their ability to address environmental inequities, sustainability and environmental degradation (Hoff, 2014). These communities often include mostly urban people of color, working-class and poor people, as well as urban and rural communities of indigenous people. As such, social inequality and imbalances of social power are at the heart of environmental degradation which breeds three types of environmental injustice: (1) inter-generational environmental injustice, (2) people from one country causing environmental damage for people in other countries (e.g., developed and industrialized countries burning fossil fuels that impacts climate change globally), and (3) the uneven distribution of environmental degradation and pollution within countries (Ballock, 2001, p 56). Unequal environmental impacts such as these are remediated in a variety of ways, but a critical intervention is for national policies to be in place which address their distributional impact. As the defining crisis of our age, the combination of urban environmental education and media literacy – in

addition to national policies – can offer critical analyses from which to mitigate the inequitable use of resources and uneven distribution of negative impacts of climate change.

Urban environmental education offers a vehicle to teach about global climate change

In light of this reality, urban environmental education focused on global climate as an environmental justice issue must move beyond abstraction or the perception that climate change is best tackled as a complex science or math problem. Only from this perspective can the challenges of global climate change be made accessible for K-12 audiences (Figure 1).

This complexity is due to the historical underpinnings and resulting social outcomes from centuries of marginalization, oppression, and exclusion of the many from decision-making and sovereignty over global resources for the benefit of a few (Cole & Foster, 2001; Shiva, 2005). It will continue to be difficult to shift the movement without addressing language and underlying issues of power, privilege and discrimination (Zandvliet, 2009). It is suggested here that an intentional shift in the point of view of environmental learning to include cultural perspectives and language can assist in moving towards more equitable, authentic, sustainable systems practices for climate change. Currently, the intersectionality of environmental educators does not always align with the diversity of their students; many environmental educators are used to view diverse, urban youth from a deficit orientation (Matias, 2013). Communities of color, underserved and disenfranchised communities have well-intentioned environmentalists as knowing more about flora and fauna than about people in ecosystems (Pyramid Communications, 2005). Complacency and lack of cultural awareness partnered with a history of discrimination makes for knowledge acquisition rather than education for thoughtful civic engagement in the global commons (Shiva, 2005).

Figure 1. Environmental justice as intersection of infrastructure, human rights, and resource access. Source: William R. DiBenedetto / wrdforwrd.com.

Case study approach shifts paradigms in urban environmental education

One route to shifting and moving beyond deficit perspectives and abstraction in urban environmental education is to rely on the instructional utility of case studies focused on distributional inequities that have altered local, regional, and global ecosystems. Among the first was an empirical study linking municipal solid waste siting with the race of surrounding residents conducted in 1979 and chronicled in *Invisible Houston: The Black Experience in Boom and Bust*. From approximately 1920-1970, 100 percent of city-owned municipal landfills and six of eight landfills were located in African American neighborhoods. From 1970 to 1978, three of the four privately owned landfills that were used to dispose of Houston's garbage were located in African American communities (Bullard, 1992, p. 11). Dumping in Dixie further revealed that African Americans bear a disparate burden in the siting of hazardous landfills and incinerators in South Louisiana's "Cancer Alley" and Alabama's "blackbelt."

A more contemporary example is reflected in divestment campaigns that have mobilized large groups of citizens and students to organize their communities and their campuses to remove their investments in companies profiting from fossil fuel extraction and combustion. This new divestment effort, it is argued by some, is more symbol than substance. Still this effort is instructive and we might consider the case of Jane Kleeb who organized her Nebraska farming and ranching community to oppose the Keystone pipeline and its climate altering delivery of Canada tar sands to US refineries and ports (Elbein, 2014). Kleeb is an example of a new form of environmental activism that should inspire the rest of us to action. This should clearly be the central goal of urban environmental education focused on creating a critical consciousness around climate change as an environmental justice issue.

A third viable and purposeful case study is represented by the Janus Institute For Justice created by the Common C.E.N.T. (Creating Energy-Efficiency Neighborhoods Together) Program to provide energy-efficiency upgrades to homeowners in the Central Little Rock Promise Neighborhood and Choice Neighborhood. Participants in the program work with home energy auditors to learn ways to conserve energy usage. Additionally, homeowners work with home energy improvement teams to make necessary repairs, save money on energy cost and reduce greenhouse gas emissions, which are directly connected to environmental education. This Common C.E.N.T. Program is also designed to recruit and train a long-term volunteer corps to work with Home Audit and Energy Efficiency Upgrade Teams to weatherize low-income homes. Volunteers assist Home Audit Teams in conducting energy audits using blower door and duct blaster equipment. Volunteers also assist Home Energy Efficiency Upgrade Teams in working with homeowners to complete repairs and retrofit low-income homes. Participants in the volunteer corps learn general skills and are given the opportunity to pursue a career in weatherization.

As a long-term strategy, this addresses the concerns of poor communities and communities of color that are often adversely affected by extreme heat and cold temperatures since they live in subsidized housing and struggle to pay high utility bills. Further, this strategy helps residents who cannot afford to relocate to safety and/or successfully repair their homes damaged by extreme flooding or tornadoes have access to pool of highly skilled labors who can repair the damaged homes efficiently and at a reduced cost. Therefore, in a practical way, the Common C.E.N.T. programs address housing inequality and its linkage to climate change by providing poor homeowners and renters access to resources and tools to alleviate the housing burden they face which is aggravated by extreme weather conditions. In a very real sense, the Common C.E.N.T programs have operationalized their resources to provide urban environmental education to low-income people of color in a Central Arkansas community who otherwise would continue to face housing, economic, educational and land inequalities. Imagine how the capacity or resilience of these residents to respond on their own behalf to conservation or ecological issues in their urban community would expand if the environmental education curriculum offered by the local K-12 school system provided opportunities to teach both students and community members environmental stewardship.

A second route towards shifting the paradigm of urban environmental education and moving beyond abstractions is to borrow from peace and reconciliation efforts in repurposing language. Rosenberg (2005) points out how present day language perpetuates hierarchies and disparity. People can be coached to use language structures that are less oppressive by raising awareness of form and function, and consciously choosing words to convey peace and collaboration. Vandana Shiva's (2005) Principles of Earth Democracy offer examples of language for justice, sustainability and peace: (1) All species, peoples, and cultures have intrinsic worth; (2) The earth community is a democracy of all life; (3) Diversity in nature and culture must be defended; (4) All beings have a natural right to sustenance; (5) Earth Democracy is based on living enconomies and economic democracy; (6) Living enconomies are built on local enconomies; (7) Earth Democracy is a living democracy; (8) Earth Democracy is based on living cultures; (9) Living cultures are life nourishing; (10) Earth Democracy globalizes peace, care, and compassion.

Therefore, a commitment to urban environmental education focused on climate change as an environmental justice issue reflects a commitment to make visible "a cultural construct [that] challenges the absolute authority of the market system and places emphasis on the interconnections between environmental equity, social justice, and civil rights" (Bryant & Callewaert, 2003, p. 48). Urban environmental education for grades K-12 in the age of global climate change can be more appealing and inclusive by incorporating authentic multicultural points of view and voice. Environmentalism needs to break from its nature-focused tradition and affirm urban places as part of the continuum of landscape. This paradigm shift to a more inclusive frame of reference would "walk the talk" that urban environmental education values a diversity of problem-solving styles and cultures. Research has shown productive results in nurturing environmentally literate decision-makers and participants in our society. A global environmental literacy, such as this, is likely to have sustainable results for the global commons, offer positive impacts on quality of life for all, and address unequal environmental impacts.

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17. Water and energy: Essential to the urban landscape

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HIGHLIGHTS

- **Urban growth puts a strain on the interconnected resources of water and energy.**
- **Urban water cycles differ greatly from the "natural" cycle taught in many classrooms.**
- **Students are aware of energy production and consumption issues, but lack the knowledge and skills to help solve them.**
- **Water and energy themes can serve as vehicles for delivering crucial environmental knowledge.**

Introduction

The consumption and transformation of energy and water, the goods and services they sustain, and the waste output of a city can be thought of as the city's "metabolism," which needs to be maintained in a healthy and efficient manner (UN-HABITAT, 2008). Energy and water are typically considered to constitute a nexus, where the growth of the energy and water sectors with increasing urban population puts strain on both resources. Electricity production requires tremendous amounts of water. According to the US Department of Energy Electricity (2006), the use of water in electrical production by 2030 could overtake the entire 1995 domestic water consumption. At the same time, extraction and treatment of ever-dwindling water resources requires substantial energy input.

The consequences of global climate change remain uncertain, and many cities may avoid cataclysmic damage, but one thing is clear: the effects are likely to have a dramatic impact on the energy and water systems and the health of the urban metabolism. The human landscape, ever-present in our cities, is often seen as destructive to natural ecosystems, "but it's more accurate to say it creates drastically different ones," according to Humphries (2014).

Topics such as climate, water and energy "can become integrating, interdisciplinary themes providing students with vital 21st century skills," and thus can be put into practice by all kinds of educators (McCaffrey, 2014, p. 19). Maintenance of a city's energy-water metabolism requires the efforts of urban environmental educators in addressing the water-energy nexus, both separately and together. In this chapter, we present information about urban water and energy education, followed by case studies.

The urban water cycle

Classic science education models nearly always include some instruction on Earth's natural water cycle: the loop of evaporation, condensation and precipitation that powers the circulation of water on Earth. However, urban landscapes can drastically alter the traditional picture so much that, as it is traditionally taught, "the natural water cycle is not a true depiction of what happens" (Miller-Rushing, Miller-Rushing, & Matz, 2014). Particularly, the traditional picture ignores the increase in

impermeable surfaces (those which do not allow water to filter into the soil) and the attendant increase in complex webs of man-made drainage.

With such a large portion of our population living in cities, one wonders why we still use a model of the water cycle that largely ignores such fundamental aspects of water's path through a city. Miller-Rushing et al. (2014, pp. 50-51) argue for a dual-pronged approach to teaching the water cycle, in which students compare the natural water cycle to the urban water cycle. This allows students to draw many of their own conclusions about the effect of urban environments on natural processes.

But, what *is* the urban water cycle and what makes it different from the natural water cycle? In addition to evaporation, condensation, and precipitation, the urban water cycle highlights the importance of import and drainage. Cities feature complex above- and underground networks of pipe systems to both import and remove water. In many cities, this consists of three separate systems.

- The ***potable*** (or drinking) water system supplies treated, healthy water (from surface reservoirs or underground aquifers) for drinking, bathing and washing.
- ***Wastewater*** systems are designed to remove used water from homes, industries, businesses and schools to be treated at a sewage treatment plant.
- The ***stormwater*** system is designed to drain large quantities of water (typically from a storm) very quickly to prevent flooding. It is rarely treated or filtered, which could allow litter and contaminants to enter local streams.

Miller-Rushing et al. (2014) note that students often enter an educational experience with numerous misconceptions about the water cycle. Many of these misconceptions deal with groundwater and permeability, key issues in an urban environment. Urban environmental educators can help to clarify many of those misconceptions by presenting a realistic urban water cycle which accurately portrays students' everyday experiences with water.

Urban energy landscapes

Urban energy presents a unique opportunity to engage local communities in designing solutions for a sustainable future. Cities consume roughly 60 percent of global energy usage (van der Hoeven, 2012). Additionally, discussions of energy issues are largely driven by local conditions – as Ansolabehere and Konisky (2014) put it, "[t]he question of local impact turns out to be key in terms of motivating people toward better solutions." The local energy grid itself is largely obvious to the naked eye; utility poles carrying thick black wires, transformer boxes giving away buried power lines, and substations buzzing away create a network snaking through neighborhoods.

Despite these obvious landmarks, many still lack a complete, holistic understanding of energy systems. A study in New York State found that while high school students were largely concerned with energy issues, they scored much lower on measurements of energy knowledge and behavior (DeWaters & Powers, 2011). That is, students lacked the information and skills to think critically about energy solutions. DeWaters & Powers (2011) concluded that students need "education that improves energy literacy by impacting student attitudes, values and behaviors," emphasizing that knowledge alone results in little positive effect.

Key to an understanding of an urban energy landscape are the following subtopics, each with a list of some potential guiding questions:

- **Energy production**: How is energy produced in your community? How much of your city's energy is imported from other places? What percentage of this production is from renewable resources? What are the implications of current energy production practices and policies?
- **Energy transmission and distribution**: How far does energy travel to reach your home or school? What equipment can you identify, such as transformers or substations? Why do power outages occur in your city? What is the aesthetic impact of energy transmission?

- **Energy consumption**: What places in your city demand the most energy? What policies, if any, exist to promote conservation and efficiency? What behaviors can you identify and use to reduce energy consumption? Why do others not commit to these behavioral changes?

The US Department of Energy's *Energy Literacy Framework* (2013) suggests that "[j]ust as both social and natural science are a part of energy literacy, energy literacy is an essential part of being literate in the social and natural sciences." Therefore, many different types of educators can teach energy concepts and urban environmental educators need not tackle each and every question above to make a meaningful contribution. Students will gain energy literacy throughout life and across educational contexts.

Conclusion

Energy and water represent two very important aspects of the health of an urban environment. Teaching these topics in a variety of settings and letting students explore their interconnections and implications provides a more holistic view of a city's impact on the environment. McCaffrey (2014, p. 21) may have said it best: "*Ideally, focusing on climate, energy and related topics in formal and informal education can help bring environmental awareness, concern and informed action back into our schools and our communities in a more rigorous and educationally productive way.*"

Water and energy case studies

Right tree, right place: Columbia Water & Light – Columbia, Missouri

Columbia Water & Light, a municipal electric and water utility, has long provided environmental education to the Columbia community through school partnerships ranging from science to art. One project in particular, called Right Tree, Right Place, encourages elementary students to step into their communities as observers and as planners. Students investigate the benefits and drawbacks of placing trees at various locations on a simplified sketch of a local neighborhood (Photo 1).

Photo 1. Students at Columbia's Lee Elementary School participate in the Right Tree, Right Place activity at Lee's Arbor Day celebration in 2014. Students worked in teams to place trees onto the map and analyze their benefits and drawbacks. Photo credit: Columbia Water & Light.

Students typically point out both pros and cons to suggested tree placements, such as the benefit of shade to homes with dark roofs while noticing that solar panels will no longer be effective, or that trees can both prevent soil erosion and cause damage to buried water pipes. Eventually, the student groups must come to a consensus to place trees onto the map. In turn, students end up discussing crucial issues of water and energy infrastructure in a realistic context.

This program works best when held outdoors. Indoors, the program loses meaning and direct connection to observable characteristics of trees in the neighborhood. The program also seems to work best when students are already

aware of trees; one particularly impactful lesson occurred following a large storm and power outage. The students were very aware of trees' impacts on the electric grid and made powerful observations about branches and falling trees. At other times, students may require more scaffolding to reach these types of conclusions.

Let your education go to waste: ALCOSAN – Pittsburgh, Pennsylvania

The Allegheny County Sanitary Authority (ALCOSAN) (Photo 2) provides wastewater treatment services in the City of Pittsburgh and 82 surrounding municipalities (Photo 3). Among its engineers and wastewater operators, the Authority employs outreach and education staff to provide public awareness about the treatment process and its impact on the natural environment and public health. Since 2002, Scholastic Outreach and Education services have expanded to include annual Summer Science Camps serving students grades 4-8; partnerships with a variety of community educators, school districts, and after-

Photo 2. ALCOSAN provides in-school, after school, and onsite education programs for hundreds of students and educators in wastewater treatment, water conservation, and STEM careers every year. Photo credit: Alex Russ.

Photo 3. Once known as the engine of heavy industry, Pittsburgh is now one of the world's leading urban centers for education, medical care, and green development, lauded as America's Most Livable City. Photo credit: Alex Russ.

school providers to implement STEM teaching activities and environmental education programs related to water. The program also partners with formal and non-formal educators to provide professional development and create a professional learning community to inform the work of outreach staff on behalf of the organization and its various education audiences.

Authentic Problem-Based Learning (PBL) is an essential component of ALCOSAN's outreach work. An increasingly popular activity is the Storm Drain Stenciling Program. Conducted within communities receiving ALCOSAN services, the program promotes awareness of non-point source pollution and provides practical tips for reducing pollution to local waterways. Popular with Eagle Scouts working towards an environmental badge, the program involves the community with door-to-door canvassing to provide printed information and stenciling storm drains with messages that alert the public about pollution entering local tributaries.

Net-zero environmental center: Pittsburgh Parks Conservancy and the City of Pittsburgh, Pennsylvania

The City of Pittsburgh and the Pittsburgh Parks Conservancy are currently constructing a new Frick Environmental Center at the city's Frick Park that will offer expanded education programming and will be the hub for park volunteer and community outreach programs. The design for the Center integrates innovative educational facilities with a public park that is at once a complex ecosystem, historic landscape, and community property. The project is being constructed to meet both Leadership in Energy and Environmental Design (LEED) Platinum standards and the Living Building Challenge (which requires that the building and site are net-zero energy and water). The building has been designed to use 40 percent less energy than a typical building (of its size, use, and location) through a combination of radiant floor heat, geothermal heating, and a highly efficient building envelope. All energy will be generated with on-site photovoltaic solar panels. The site's stormwater will either be captured for non-potable reuse or infiltrated on-site, using pervious parking surfaces and a series of stepped rain gardens. The Center will support a critical need in the Pittsburgh area to significantly increase and diversify participants in hands-on, minds-on environmental education. School and family programs are active and purposeful (programming actually helps to restore the park). Once completed, the entire building and landscape will be used for educational programs and will have interpretive information for day visitors. The site is meant to educate and inspire others in the region to consider energy and water use, and begin to make personal and political changes.

Photo 4. Marijke Hecht shows a plan of the future Frick Environmental Center. Photo credit: Alex Russ.

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18. Bird study in urban environmental education

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HIGHLIGHTS

- **Learning about birds can spark students' interest in various subjects, including science, math and environmental studies.**
- **Birds are a great teaching tool because they are easily accessible in the urban environment.**
- **Teaching and learning about birds is inexpensive and requires relatively few resources.**
- **Birds-related education activities offer a useful and effective way of connecting children to the environment in cities.**

Teaching and learning about birds in urban environmental education

More than 10,000 bird species in the world – many living near people – can help connect people to the environment. Children are fascinated with birds and they can be the portal into learning science, math, reading, writing and environmental topics.

Nature studies in cities are vital because urban areas have a profound impact on the environment even though they cover less than three percent of the Earth's terrestrial surface (Schneider, Friedl, & Potere, 2010). Cities are often located in naturally species-rich regions (Luck, 2007) where native species are impacted by a variety of challenges, including habitat loss and the introduction of non-native species. However, a recent study (Aronson et al., 2014) looked at the global impacts of urbanization on bird and plant diversity and found that cities can support both biodiversity and people, but retaining these "connections requires sustainable urban planning, conservation and education focused on each city's unique natural resources."

For people to successfully live in close association with nature, urban environmental education must overcome the perception of cities as unnatural places where little interaction between people and nature occurs (McClaren, 2009). Instead, cities need to be highlighted as places where people and nature can interact and influence each other (Lauber et al., 2012). There have been numerous studies of urban wildlife focused on birds (Fernandez-Juricic & Jokimaki, 2001), and we suggest using birds as an emphasis for urban environmental education. Birds provide a great way to introduce people, especially in cities, to their local nature because they are readily available for study even in marginal habitat.

Birds are accessible in the urban environment

For more than a hundred years, teachers have used birds to teach about science and nature. One reason for the endurance of using birds in science and nature education is that birds are easily observable. This is important for urban environmental education, since it means birds can be found even in highly developed areas of the city. Additionally, studies have found city parks to be

areas of high bird diversity, and important stopover points for birds during migration (Fernandez-Juricic & Jokimaki, 2001). A class of students interested in learning about birds can set up a bird feeder and do an entire project based on the birds that visit their feeder (McLennan, 2012). Similarly, the class could decide to take a field trip to a local city park to observe birds. Additionally, there are numerous citizen science projects that students, teachers and the public can participate in (Table 1). This makes it easy for teachers and environmental educators to organize an urban study of birds. Finally, teachers can access the expertise and resources of local bird clubs or other bird organizations to supplement their lessons.

Table 1. Examples of citizen science programs that use birds in education and life-long learning.

Citizen science program	Short description	Website
eBird	Year round online bird checklist. Input your bird sighting and view data of other's sightings	ebird.org
Project Feederwatch	Winter-long monitoring of birds that visit feeders at backyards, schoolyards or other community areas.	feederwatch.org
Great Backyard Bird Count	Annual winter bird count that takes place in February. Great for counting birds in your backyard, schoolyard and local park.	gbbc.birdcount.org

Studying birds is not resource intensive

In addition to their accessibility, a great advantage to using birds in urban environmental education is the relatively few resources that are required to study them. Simplicity is key. Classrooms with younger children may simply set up a bird feeder and count how many birds visit each day (McClennan, 2012).

Through bird walks, students gain an appreciation for birds in the city and make observations about where species are or are not found. If classes visit the same area multiple times throughout the year, they can record their bird checklists on eBird, a free internet resource, and begin to see patterns that develop over time in the species and number of birds observed in their area. Field guides are useful aids for bird identification, but purchase is not necessary. Classes can use internet resources, expertise from a local bird club volunteer, or field guides on loan from the library to develop their own guide to birds seen at their school. These student-created field guides can then be provided as a resource to other classrooms (Table 2).

Making connections to the environment

Research has shown that students in urban environments have positive associations with seeing birds in schoolyard habitats and urban parks (Simmons, 1994). Encouraging this positive association through teaching and learning about birds could lead to students and other members of the community becoming involved in improving habitat in these areas for birds (Simmons, 1994). Cities provide critical breeding and stopover habitat for many species of birds; therefore it is crucial that people in cities ensure there are green spaces where birds can find shelter, food and nesting sites. As students and members of the community, making connections with birds by studying them in the urban environment can lead to stronger motivation to invest in projects that aid bird conservation. Projects that could develop out of a bird study may range from the placing and monitoring of a series of nest boxes on the school site, to planning and

developing a schoolyard habitat complete with native plantings designed to attract more birds.

Table 2. Examples of bird activities and their curriculum connections.

Bird activity	Materials	Academic connections
Bird Feeder Observations	Bird feeder, seed. Students can make their own bird feeders out of pinecones, shortening and seeds. Field Guides.	Math: counting, making charts and graphs. Science: comparing number of birds during different seasons, or if different species are attracted to different seeds. Art: draw birds visiting feeders. Reading/writing: read field guides or write descriptions of birds at feeders.
Bird Observations on Walks	Binoculars (optional)	Math: count number of birds and number of species seen on walk. Science: log observations in eBird and recognize patterns over time. Art: draw or take photographs of birds and their habitats. Reading/writing: read books by birders, or write poetry during or after a walk.
School Field Guides	Internet access or field guides from the local library. Expert from a local bird club.	Science: learn to recognize different species of birds. Art: draw birds for field guides, or use photographs taken by students. Reading/writing: write descriptions of birds for guide, read other published guides as resources.

Long-term impacts

Tanner (1998) and Chawla (1998) reviewed the many studies that have looked at significant life experiences of conservationists to determine the formative experiences that led to their commitment to the environment. These studies found similar results: between 50-80 percent of the respondents said that experiences during childhood had a significant influence on their life-long concern for the environment (Chawla, 2007). When professionals in the environmental field were asked about their reasons for environmental commitment, the top answers were that they spent time in nature (hiked, camped, birded, participated in Scouts) and had adult role models (mostly family) who appreciated nature (Chawla, 2007). Many of the activities mentioned above, such as citizen science projects (Table 1), can be done both at school or home with an adult mentor.

Kellert (1985) found that time spent bird watching as a child was associated with adult pro-environmental behaviors. However, education must go beyond just transferring information about animals (Morgan & Gramann, 1989). A research study on how individuals perceive the world concluded that "a person's worldview is a result of the 'real world' and attitudes, beliefs, and experiences" (LaHart, 1978). Incorporating citizen science and time spent outside watching birds in a nearby park, therefore has a much greater positive influence a child's future relationship with birds and nature than just learning about birds in a classroom.

Conflicts between birds and birders

Of course, questions do arise when encouraging bird watching and exploration in the city. The habits of bird watchers are not always considered safe for the birds, for instance (Sekercioglu, 2002). Birds can be easily disturbed by watchers eager to get another bird on their list, resulting in abandoning of nests or food sources (Fernandez-Juricic & Jokimaki, 2001). Additionally, if conservation efforts are encouraged based on incomplete information, it is possible that people could end up encouraging more generalist species over specialists or predators (Fernandez-Juricic & Jokimaki, 2001). Therefore, citizen science projects and other research

projects designed around better understanding birds in the urban environment are necessary to ensure we act appropriately.

Case study: Learn, explore and restore – York, Pennsylvania.

York is a diverse and underserved small city located in central Pennsylvania. For the past few years, Audubon Pennsylvania has partnered with the York City School District to provide hands-on environmental programs, focusing on three endangered species of birds that nest in their local city park, Kiwanis Lake Park. The park was designated an Important Bird Area because of the critical habitat it provides for three species of wading birds. The program focuses on both the birds and their habitat – the local streams and rivers.

Photo 1. Students observe three endangered species of wading birds that nest in their local city park.

Learn, Explore and Restore (Photo 1) is a multifaceted program combining in-class programs and field experiences in parks. Students learn about their local environment and the birds, participate in citizen science projects that involve collecting data on the local waterways and birds, use online tools to input the data they gathered, analyze their findings, and participate in habitat enhancement projects (Photo 2). Audubon's goals of Learn, Explore and Restore are to increase the students' and teachers' knowledge of science and environment, to expand their appreciation for their local environment, and to provide opportunities for them to participate in local conservation projects, while expanding their

Photo 2. Students explore the local stream and participate in stream studies to monitor the water quality.

community pride. The birds are a portal to learning about broader environmental issues in a multidisciplinary teaching approach.

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19. Birds and schoolyard habitats

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HIGHLIGHTS

- **Enhanced understanding of key ecological concepts can be achieved through carefully planned stewardship projects.**
- **Bird habitat enhancement projects provide an excellent platform for this type of engaged learning.**
- **Improvements of bird habitats in urban areas provide a crucial set of resources for migrant and resident urban bird populations.**
- **We present Audubon's For The Birds! program as a relevant case study to demonstrate how to link key ecological concepts to stewardship projects.**

Background

Schoolyard habitat enhancement for birds not only improves a local neighborhood, but also introduces jointly the value of environmental stewardship and the ecological relationships inherent in habitats that support birds (e.g., Coverdale, 2003; Danks, 2000). Environmental stewardship – the idea of taking responsibility for the natural world to improve and protect it – starts with developing an affinity for the natural world (Brown, Garst, & Bialescheki, 2011), and it does not have to take the form of grand gestures nor does it need to involve large amounts of money. Installing bird feeders or planting bird-friendly native plants improves the natural world, and gets the students involved in such endeavors as land stewards, caring for a plot of land in a sustainable way. While engaged in stewardship, they also learn key ecological concepts that can help them better understand how the species in a community are all interconnected.

Enhancement of bird habitats involves providing easy means of accessing food, water and shelter: the main three necessities for life. Many songbirds will readily nest in nest boxes, shrubs, saplings, or trees. Seeds are enjoyed year-round by finches and other seed eaters, and adding a diversity of offerings, such as suet and peanuts, attracts a greater diversity of birds such as woodpeckers and blue jays (Santerre, 2011). Bird baths not only provide a source of water, but an area for a bird to rinse off its feathers. Not only are you providing birds with the means to survive, you are bringing them closer to your school, which allows students and teachers to observe them more readily. Increasing the density of bird feeders in urban areas should lead to increases in bird survival, and consequently bird abundance and diversity, at both small (e.g., Doherty & Grubb, 2003; Grubb & Cimprich, 1990) and large scales (e.g., Fuller, Warren, Armsworth, Barbosa, & Gaston, 2008).

Enhancing bird habitats in urban areas is important for a variety of reasons. For example, several large cities along the east coast are part of the Atlantic Flyway: New York, NY; Philadelphia, PA; Baltimore, MD; Washington, DC; Richmond, VA; Raleigh, NC, and Miami, FL. For instance, more than a hundred bird species will migrate over New York City (Rappole, Derrickson, & Hubálek, 2000). Many birds will rest during their migration in one of the green parts of the city, and creating more bird habitats in the cities is critical in their many-thousand-mile trip.

These habitat gateways are becoming more important as global climate change causes shifts in migratory behaviors (Robinson et al., 2009).

In addition to aiding birds that rest in cities during their migration, healthy habitats also help birds that reside in a city for part of the year or year-round. Neotropical migrants face a double challenge: they need healthy habitats in both their winter and breeding ranges. Enhancing habitat in their breeding ranges gives them a chance to continue to thrive in our urban environment. Urban habitats can also be home to endangered species, like the peregrine falcon in New York City. Providing ample nesting areas and food (other birds) allows the falcon to continue to live and breed in the city.

Habitat curriculum and project ideas

It is important for students to understand that a city is a habitat and is home to many creatures, including humans. Students should understand the role that humans play in the ecosystem and how they can help create a healthier, more sustainable city habitat for both humans and wildlife. This goal can be accomplished in many ways. Myriad major topics can be explored during lessons on habitats and ecosystems in an urban environment, specifically focusing on birds, and these concepts can be tailored for age-appropriate subject matter (Table 1).

In an urban environment, it can be difficult to complete a service project due to lack of schoolyard space. If a school is lucky enough to have a small green space in the front or back, work with the school administration, teachers, and most of all custodians to find an appropriate project for that particular school. The custodians can help the project prove very successful by providing access to water, turning over the soil for ease of planting, and maintaining the garden in the summer when students are on break. For schools with limited schoolyard area, look into a service project in a local green space. For example, work with the city department of parks to get permission to plant native species, which can greatly enhance the

Table 1. Key science concepts that students will engage in while working on creating and studying habitat gardens in their schools or in their city's parks.

Key concept	Related concepts	Examples from the schoolyard habitat
Community ecology	Population	Students may participate in bird counts as citizen scientists to improve the understanding of bird populations.
	Community	Schoolyard bird habitats attract many other species, such as earthworms, insects, chipmunks, rabbits, and deer.
	Producers	Importance of producers in the ecosystems: no plants means no ecosystem.
	Consumers	Birds and many other consumers will be visible as well: herbivores, omnivores, carnivores, and scavengers/decomposers.
	Trophic interactions	The bird habitat will be full of examples of antagonisms, such as predator-prey, herbivore-plant, and host-parasite interactions. Students will also see mutualisms, such as plant-pollinator and plant-frugivore interactions.
	Indicator species	Birds and many of the insects that are the result of building bird habitats will be indicator species, a yardstick for how healthy the ecosystem is.
Life cycles	Plant	Seed, seedling, seed-producing adult with flowers and fruits.
	Insect	Butterflies (adults as pollinators, and caterpillars as herbivores).
	Ecosystem	Ecological succession, restoration ecology, why a diversity of habitat types is preferable (introduce the concept of ecological niche).
Habitat assessment	Neighborhood as habitat	For example, temperature measurements in and outside of their bird habitat, and biodiversity reports in and out of bird habitats.
	Ecosystem services	For example, temperature regulation, pollination services, and filtration of water through permeable surfaces.

biodiversity within a habitat (e.g., van der Wal et al., 2008; Burghardt, Tallamy, & Shriver, 2008; Villa et al., 2011). There may also be various non-profits that work in the park that could be potential partners on a project, including non-profits that focus on habitat improvements such as restoration projects. Habitat enhancement projects do not have to consist only of planting native species. Removing invasive species, mulching, hanging student-made bird feeders, setting up bird baths and other simple projects also greatly help the birds and provide an outdoor learning experience for the students.

Case study: Audubon New York's "For the Birds!" program – New York City

Audubon New York's "For the Birds!" is an elementary education program that teaches environmental awareness and appreciation of nature through the study of birds. During a 4, 8 or 16-week session, school students in grades two through four learn about their natural environment through classroom lessons, outdoor walks, a field trip to a natural area with significant bird habitat, and a conservation project designed to provide bird-friendly habitat in the local community. These lessons directly enhance students' scientific skills as well as their interest in, and appreciation for, birds and the outdoors (Becker-Klein, Chase, Duffin, & PEER Associates, 2013).

For the Birds!

For the Birds! is a place-based program focusing on local birds and local habitats. This encourages a sense of pride in the students own community, and as they gain knowledge of the local environment also empowers students to take an active interest in protecting it.

Habitat enhancement lessons

For the Birds! currently contains two newly developed indoor lessons about habitats. In lesson 1, students understand that all living creatures share the same basic needs, and that urban habitats support a diversity of life. Students are introduced to the concept of food chains and understand that changes in the ecosystem can adversely affect humans and wildlife. Key vocabulary in this lesson includes: resources, habitat, ecosystem, community, producer, consumer, herbivore, carnivore, omnivore, food chain, and indicator species (Table 1). During the lesson, the students participate in a hands-on activity building food chains. This prepares the students for the next lesson where they delve deeper into the stewardship actions they could take to protect and enhance habitats.

In lesson 2, students are introduced to the concept of environmental stewardship, and through a hands-on activity explore ways to improve the urban environment for birds. During the hands-on activity, the students are given a piece of a neighborhood and, using wipe-off markers, are tasked with drawing in their habitat enhancements while thinking about the resources birds need (Photo 1). While indoors, these lessons provide ample background and prepare the students for their outdoor habitat enhancement project.

Photo 1. Students present their habitat enhancements during lesson 2's activity.

Habitat enhancement project

Towards the end of the program, if possible, students work on a project that will leave an improved habitat for birds and other wildlife. Each habitat enhancement project will vary from school to school depending on the school's location and neighborhood resources. The hands-on learning from student-developed service projects has been shown to improve student learning and to enhance problem solving skills (MacFarland, Glover, Waliczek, & Zajicek, 2013). Past projects from the For the Birds! program have included: creating bird feeders out of used milk cartons, planting native species, mulching, pulling out invasive species, and creating a new modest bird garden. These projects relate directly back to the curricular focus. For example, during a planting project, students are introduced to the concept of native species. They are introduced to the plants and what kind of benefits each plant species provides specifically for birds (Table 1). Students learn about the necessary tools involved, including trowels/gloves, and how to properly put a plant in the ground. Throughout the project, students come across worms and other insects which provides a great opportunity to teach about these creatures, what they do for the garden, and how they help the birds.

Conclusion

Schoolyard bird habitats create needed patches of habitat for migrant and resident bird populations in urban ecosystems. Development and maintenance of bird habitats can be tied to curricular goals and civic education, and like other "green" initiatives, can instill long lasting benefits to participants via a sense of community and belonging (McCunn & Gifford, 2014).

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20. Promoting environmental action competence through urban environmental stewardship

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HIGHLIGHTS

- **Environmental stewardship activities can help develop the ecological conscience that is necessary for a shift in worldview from anthropocentric to ecocentric, which is important for promoting a sustainable future.**
- **Involving urban youth early in environmental activities can help cultivate an action competence and prepare them to meet new social and ecological challenges as more people move to cities.**
- **Engaging young people in environmental service projects where they have a stake in the outcomes will lead to the development of an ecocentric world view and promote life-long action competence.**

Young people today are inheriting a world facing unprecedented environmental problems, which are likely to get worse before they get better. Never before has the need to promote environmental stewardship been more pressing; this generation will have to greatly increase their action competence (i.e., their ability and propensity to act in a qualified way; Jensen & Schnack, 2006) in order to achieve a sustainable future. The promotion of environmental stewardship can be achieved through hands on environmental service projects, which help build action competence, and hence the tendency to engage in civic action in the future (Jensen & Schnack, 2006; Almers 2013). Environmental service activities that include qualified participation where there is a link made to either academic goals in a particular classroom, or to life-long learning, will likely have long-lasting impacts on worldview and subsequent actions. For example, Spring, Dietz, & Grimm (2006) found that when youth are exposed to a service opportunity, they are more likely to become involved in another service opportunity the following year. The shift in worldview from anthropocentric to ecocentric is a key pathway to sustainability (Uhl, 2004), and direct environmental action can help cement the "ecological conscience" (Leopold,1949) that is a requisite aspect of this shift in worldview.

The challenge to incorporate stewardship in urban environmental education has never been more important. Currently, more than half of the world's population reside in urban areas, and by the year 2050, this is projected to rise to two thirds of the world's population living in urban areas (United Nations, 2014). Cities themselves are ecosystems, and re-visioning how we live in cities and how we treat the natural resources and ecosystem services of our cities can make them highly sustainable ecosystems (Newman & Jennings, 2008; Georgescu, Morefield, Bierwagen, & Weaver, 2014). Many messages that young people get about the environment are negative, and can lead to a sense of despair and hopelessness, which, ironically, can lead to inaction (Haeffel, Abramson, Brazy, & Shah, 2008). Environmental service actions are typically carried out in a social context, which helps to promote several positive outcomes, including a positive sense of how participants can contribute to both current and future impacts (Yates, 1996), and can lead to future activism and promotion of change (Jensen & Schnack, 2006). Environmental service opportunities may be even more important

to urban youth from high poverty communities: although they are less likely to volunteer than those from more affluent backgrounds, when they do, they tend to have more positive civic dispositions and behaviors than their peers (Spring, Dietz, & Grimm, 2006).

The two case studies that follow, in the cities of Las Vegas, Nevada, and Austin, Texas, demonstrate the types of stewardship that can promote action competence in urban settings, while simultaneously improving urban ecosystems.

Case study 1: Arbor Day cleanup with Twin Lakes Elementary School

The Outside Las Vegas Foundation, in partnership with the City of Las Vegas and Twin Lakes Elementary School's fifth-grade students, held an Arbor Day Clean Up Celebration at Lorenzi Park. Service learning opportunities, such as clean ups, can ignite a passion for life long service for the student. This day was carefully planned to maximize students' connection with a local city park.

Prior to the scheduled clean up day, an environmental educator was sent to speak with each of the three fifth-grade classes. This set the stage for students to establish a relationship with a service learning "mentor" who introduced a connection between the students, their families and the city park that was located just four blocks from the elementary school.

On the day of the event, students gathered together to walk to the park. The clean up was held on Arbor Day and began with a short ceremony where city officials and Nevada Department of Forestry staff spoke before planting time capsules that students prepared (Photo 1).

Students were then sent in parent-chaperoned groups to opposite sides of the park where they picked up litter. Prior to the clean up, students were asked if their families used Lorenzi Park for recreation and the overwhelming majority of students had been to the park in the past. This city park is in a very urban location and large amounts of litter often accumulate.

After students gathered bags of litter, they returned to a central point where the bags were weighed by teams. The team that had collected the highest weight in litter won prizes. Several students remarked that they would return that weekend with family to show how beautiful the park was after the clean up. The majority of students stated that they planned to return to the park often to watch the newly planted trees grow and to one day, open their time capsules.

Photo 1. City official and students bury time capsules with a newly planted tree. Photo credit: Jennifer Brown.

This event was a huge success in the students' eyes because they had a stake in the outcome. This is their neighborhood park and after growing their connection with the park through service learning, they felt the need to continue to care for this place; in other words, their action competence was enhanced. They became the unofficial stewards of Lorenzi Park.

Case Study 2: Keep Austin Beautiful at Lady Bird Lake

Keep Austin Beautiful is a nonprofit organization which provides resources and education to engage citizens in building more beautiful communities in Austin, TX. Through its city-wide programming, Keep Austin Beautiful engages 11,000 students and 20,000 adult volunteers annually in service opportunities.

Lady Bird Lake is often described as the crown jewel of Austin, and with good reason. With miles of trails, places to picnic or play with your dog, canoeing and kayaking access, and close proximity to downtown, Lady Bird Lake exemplifies both the active and laidback aspects of the Austin lifestyle. While it tops many people's list of places to take first-time visitors, it is also the point at which nine watersheds converge and after every storm trash washes from streets to storm drains to creeks to the lake.

Keep Austin Beautiful's "Clean Lady Bird Lake" program engages school-age children, college students, and adults in service opportunities in an effort to reduce the amount of trash entering waterways, improve water quality, restore creek habitat, and educate the public about the importance of clean and healthy waterways. This program is conducted six times a year and accomplishes much more than keeping the lake and adjacent trail free of litter. Cleanups facilitate community connections – creating a vibrant city, giving neighbors the opportunity to get to know each other, and allowing people to feel good about themselves as they give back to their community. A volunteer recently said that he participates because "I am a transplant and [Austin] is now my home." Service opportunities are thus a way through which people feel a sense of ownership and pride within communities.

The Clean Lady Bird Lake program encourages active lifestyles and allows people to connect to the outdoors through physical activity. Volunteers conduct cleanups in the lake using kayaks and canoes (Photo 2). While they are cleaning they begin to understand that their actions are not just about improving how the area looks. Removal of litter and debris protects wildlife habitats and water quality by preventing animals from being trapped in trash and pollution from leaching into our soil from the decomposition of the litter.

Photo 2. Collecting trash by kayak in Clean Lady Bird Lake. Photo credit: Keep Austin Beautiful.

Once citizens are engaged they can make a long term and lasting commitment to their urban environment through the "Adopt-a-Creek" program. Groups commit to protecting local creeks by adopting a quarter-mile stretch of creek for two years. Adopters practice action competence as they conduct regular cleanups, participate in training sessions led by scientists, conduct restoration workdays, and raise neighborhood awareness of creek health. In addition to contributing to the physical improvement of creeks, the program fosters a sense of ownership for local creeks and a pride of place.

Through its programs, Keep Austin Beautiful uses service opportunities to create engaged citizens in a thriving urban center. Through their commitment to keep public places beautiful, citizens become involved in other facets of urban life, especially public policy focused on transportation, urban development, and the creation and preservation of public spaces.

Conclusion

Environmental service projects not only improve local conditions and make a healthier urban ecosystem, but also develop a sense of place and a sense of community for participants. Service done today increases the likelihood of volunteering and acting to maintain healthy urban ecosystems in the future, through development of an alternative (ecocentric) worldview and reinforcing lifelong action competence.

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21. Partners in urban environmental education: A zoo-school partnership in Jacksonville, Florida

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HIGHLIGHTS

- **Formal classroom educators can supplement their instruction through partnerships with informal education providers, such as zoos or local conservation and advocacy groups.**
- **Citizen science provides students with hands-on, project-based learning which can serve many diverse learning styles and cater to varied student interests.**
- **Educational partnerships allow students to share knowledge with science professionals, teachers, and environmental advocates through statewide and international databases.**
- **Students benefit from such partnerships through better reflection and synthesis of knowledge, collaborative work with field professionals, and community involvement and advocacy.**

Building successful partnerships

Formal classroom educators often look for ways to supplement classroom instruction with hands-on learning. They may also wish to provide their students with access to scientists in the field, scientific updates and new findings, as well as ways to answer the eternal question often posed by their students, "How will [insert some science here] ever apply to me?" Forming effective partnerships can help educators meet their goals and support student success.

Educational partnerships demonstrate many benefits to all participants, as shown by the Harvard Family Research Project (2010). For example, successful partnerships have been shown to strengthen, support, and transform individual partners, resulting in improved program quality, more efficient use of resources, and better alignment of goals and curriculum.

The Greenwood School and the Jacksonville Zoo and Gardens

The Greenwood School was established in 1985 by educators and parents seeking a solution for students who have "fallen through the cracks" of the traditional education system. In January 2002, they opened a 32,000 square foot facility located on 14 acres of wetlands – an oasis in the middle of a busy and highly developed part of Jacksonville.

The Jacksonville Zoo and Gardens sits on 110 acres in Jacksonville, Florida on the St. John's River. Like all zoos accredited by the Association of Zoos and Aquariums, it has education as a key component of the institutional mission (AZA, 2014). Although typically viewed as entertainment venues or conservation organizations, zoos serve an educational function as well, and have a responsibility to provide evidence to support their educational outcomes. It is difficult to measure educational outcomes of simply visiting a zoo or aquarium (Moss, 2013), but zoos can provide more tangible educational opportunities, inside their gates as well as within their communities.

Partnering with a school in the local community allows the Jacksonville Zoo and Gardens to create a long-term program with measurable education outcomes, and allows the Greenwood School students and faculty to benefit from the partnership activity.

Photo 1. Greenwood students actively interpreting environmental science to Zoo visitors at the annual Party for the Planet event at the Jacksonville Zoo and Gardens.

Partnership activities and involvement

The Jacksonville Zoo and Gardens and the Greenwood School have successfully partnered in order to promote scientific literacy and conservation behaviors in students ages 12-18. Through participation in several citizen science projects, the students gain hands-on experience in environmental education and work directly with local scientists and science educators.

Greenwood's students already come to the table with a strong love of the environment, which they demonstrate through the nature trail they established on their campus. Several students recognized the potential of an area of undeveloped land at The Jacksonville Zoo and Gardens. This led to the creation of a sister trail, mirroring the Greenwood trail on the Zoo's land. Students can now report data for their water and species monitoring projects at both locations, doubling the data they submit for several citizen science projects.

Table 1. Citizen Science Projects supported by the JZG/Greenwood partnership.

Project	Student involvement
Project BudBurst www.Budburst.org	Select and identify species, weekly monitoring and reporting
LeafPack Stream Ecology www.stroudcenter.org	Select locations, monthly sampling and data collection, species identification
St Johns Riverkeeper Backpack Project water quality monitoring www.stjohnsriverkeeper.org	Monthly sampling, testing, and reporting in conjunction with Leaf Pack samplings
Nature's Notebook phenology monitoring www.usanpn.org/natures_notebook	Select and identify species, weekly monitoring and reporting
eBird www.ebird.org	Incidental observations and reporting
Zooniverse online citizen science projects www.zooniverse.org	Regular participation online
Amphibian monitoring projects	Selection of study site, installation, weekly monitoring, data collection
Milkweed and Monarchs propagation study	Applied for and awarded grant money, selected site, built structures, maintain gardens, collect seeds, propagate plants, monitor daily, record observations, distribute plants to organizations throughout town

Using citizen science as a vessel for our partnership, we are able to emphasize many strands of learning, with an educationally diverse audience. Students selected projects that were determined to be appropriate for the physical location of the Greenwood School and the Jacksonville Zoo and Gardens. Student interests and input dictated some of the project selection. Options were also made available for students who did not wish to participate outdoors, or whose interests fall outside the realm of environmental science or zoology.

Students with varied learning styles actively participate in Greenwood's citizen science initiatives. Current and former students of Environmental Science, Biology, Zoology Club, Photography, Videography, and other non-science courses, all contribute to projects. Bonney et al. (2014), demonstrate how citizen science can be a unifying agent, adapting to people of different backgrounds, cultures and interests, hence our varied portfolio of project options. Both Zoo staff and Greenwood staff share a goal of improving scientific literacy among the students through citizen science. Evans et al. (2005) identified two key factors in influencing science knowledge: the initial motivation of the participants, and the ability for participants to interact with research staff. It is clear that most students have the motivation, and those that don't are quickly infected by their peers' enthusiasm. We feel the key factor in sustaining interest and increasing knowledge is the Zoo partner component. Through this "outsider" scientist, the students receive training and guidance, as well as have the opportunity to meet and interact with local experts in the fields of marine science, freshwater ecology, wildlife conservation, botany, horticulture and many more.

Benefits of participation to staff and students

Partner benefits can include improved social and academic outcomes for students, more diverse and comprehensive learning opportunities, access to additional community resources, and an improved school culture and community image (Harvard Family Research Project, 2010). The success of our particular partnership shows through the enthusiasm of the classroom teachers, and the accomplishments of the students involved.

The Zoo provides support and training in several projects, both in person and virtually. The students participate in projects on their campus, and have set up remote sampling and observation sites at the Zoo as well. They make regular reports on their findings, which promotes scientific literacy, and gives the students a huge sense of ownership, which makes the partnership sustainable. The Zoo receives benefits from this partnership as well. Many of the students involved with these citizen science projects also serve in the Zoo's summer volunteer program as Zoo Teens. The Zoo now recruits approximately ten percent of their teen volunteers from Greenwood's ranks.

Photo 2. Greenwood students collecting water quality data for the Riverkeeper Backpack Project.

The benefits of the partnership extend beyond their campus and the Zoo. Not only does the scientific community benefit (in the traditional ways that citizen science provides benefits), but the local community benefits as well. These students have become eco-ambassadors for their campus and for the surrounding areas. They are able to champion environmental issues, such as water quality or pesticide use, and provide direct evidence to support their arguments. Students are able to teach an urban audience about natural Florida ecosystems. Their affiliation with

the Zoo helps them to communicate to the larger community, as they do when they participate in eco-events on Zoo grounds, promoting their projects.

Through citizen science, these students have been given a strong voice that may be used to lobby their administration for changes on their campus, encourage other citizens to make observations of the natural world around them, or to promote scientific literacy in the younger generations. Although they could have championed these things on their own, our partnership lends greater credence to the work they do, through branding with the Jacksonville Zoo and Gardens, and provides outlets for promotion of their school and their projects. Our partnership also provides the hands-on training they need in order to participate in these citizen science projects, as well as an "outside" perspective from adults other than their teachers or parents.

Our partnership has provided us with eager participants, and we didn't have to work hard to create the high level of buy-in and ownership that these teachers and students have. The simple act of finding an enthusiastic and motivated partner equals a sustainable project, with countless benefits, that practically runs itself. A "win" for all involved.

Goals for the future

As we look to the future of our partnership, we see positive outcomes as well as challenges. It will be important to maintain involvement of current students and recruit the incoming underclassmen into the projects. It may be difficult to find a balance between the enthusiasm for taking on new projects and the repetitive nature of long-term monitoring projects. Greenwood staff must maintain their required curriculum along with the added citizen science initiatives on their campus and the Zoo grounds, so time management and transportation may be challenging. We have very ambitious goals: The Nature Conservancy's LEAF certification for Greenwood School, creating an urban environmental student consortium in northeast Florida, and recruiting a large citizen science volunteer group at the Zoo and Gardens. These goals are attainable through active partnership, but will take a great deal of front-end planning to achieve. However, we find renewed inspiration in the words of the students, and share some here to serve as seeds of encouragement.

> "I get to apply what I learned in real life, talk with kids as a teacher, learn how to better engage new people." – Zane, male, 11th-grade student.
>
> "Working as a Zoo Teen has given me the confidence to comfortably speak with total strangers about a topic I love to talk about. City people need to appreciate nature and protect what we have." – Amanda, female, 12th grade student.
>
> "I started to realize that I could speak with people I did not know and actually had something important to teach them. It made me feel that I could make a difference." – Kailey, female, 12th-grade student
>
> "[This experience] has provided me with a career path that I never thought possible." – Kyle, male, 12th-grade student.

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22. Partnerships between non-formal environmental education programs and school communities

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HIGHLIGHTS

- **Partnerships between non-formal environmental education programs and school communities may include nature centers, zoos, aquariums and other programs whose mission reflects environmental protection.**
- **These partnerships are defined by voluntary involvement and a mutual understanding that the project's goals will be developed cooperatively by all partners.**
- **Environmental organizations that form partnerships build community influence, expand community service, and have a greater impact on youth academic achievement.**
- **Schools benefit from partnerships with non-formal education programs by expanding their active learning opportunities for students, developing students' scientific literacy, and supporting educators' professional development.**

Introduction

Partnerships between non-formal environmental education programs and school communities offer multiple benefits to both types of organizations. By working together, these groups can successfully collaborate on schoolyard greening projects, habitat restoration, school gardens, and outdoor classroom initiatives. Projects like these enhance the natural environment of the community and provide important learning opportunities for students. Yet the mechanics of developing these partnerships and making them last can be challenging. Examining the value to both organizations, and the reasons why they sometimes fail to be effective can help stakeholders create procedures for developing successful and lasting partnerships.

Defining partnership

Non-formal environmental education programs include nature centers, zoos and aquariums, and non-profits with an environmental mission. School communities include the participation of administrators, teachers, children, school staff, parents, local businesses, and community organizations with interests in the school and its environment. For a partnership to develop between these two groups, all involvement must be voluntary with the understanding that the project's goals will be developed cooperatively (Poncelet, 2001). Additionally, there must be consensus that responsibility for any actions taken on the project will be shared by all (Poncelet, 2001).

Benefits to environmental organizations

Entering into this type of partnership requires cooperation and compromise on the part of all groups involved. Dialogue between the organizations must be continuous, and requires a large commitment by both groups (Poncelet, 2001). However, the benefits for each are equally substantial. For environmental organizations, the following benefits can be expected (based on Sobel, 2009):

1. **Natural partnership**: Schools are often ready and willing participants in environmental programs, a natural partner for most environmental organizations.

2. **More community influence**: Environmental organizations can use schools' far-reaching partnerships as a way to further their mission and increase ecological awareness within the whole community.
3. **Improved community service**: Environmental organizations can use the partnership as a learning resource for improving their other offerings to the community. Lessons learned from the school community can lead to programs that better meet the social, cultural, and ecological needs of their community.
4. **Improved academic impact**: Research shows that environmental interventions that occur in partnership between classrooms and non-formal programs can be more effective at improving environmental behavior than interventions done by each of these groups acting independently.

Benefits to school organizations

For schools, the obvious benefit of partnership is increased test scores (Sobel, 2009), as well as an improvement in students' physical and emotional well-being. Additionally, the following benefits can be expected:

1. **Active learning**: Students benefit from being active investigators of the natural world. They are able to make connections between the curricular content learned in school and their local environments (Donahue, Lewis, Price, & Schmidt, 1998).
2. **Scientific literacy**: Students achieve the ability to think critically and make informed decisions about the science-related problems they face in their community (Bunderson & Cooper, 1997).
3. **Professional development**: Teachers and administrators involved in these partnerships learn how to value their schoolyard as an educational resource and create meaningful opportunities for their students to learn ecology in a relevant context (Brewer, 2002).

Why partnerships sometimes fail

School and environmental education organization partnerships can be effective ways to meet academic goals and environmental missions. However, when not structured appropriately they may fail to serve urban communities effectively. There must be clear expectations for the partnership and a culture of respect for the differing goals and needs of all partners involved, otherwise programs lose support (Bunderson & Cooper, 1997). Additionally, partnerships cannot always provide appropriate academic and social engagement when the main focus is placed on only restoring the environment, expecting children and other participants to learn simply through exposure. Instead, environmental educators must be prepared to provide the appropriate mentoring and scaffolding to participants to help them learn about the environment (Krasny & Tidball, 2009). Communication challenges that arise from working in urban areas with multiple community and school partners are also a consideration. Everyone involved must be prepared to navigate these communication channels appropriately, thereby ensuring all parties involved continue to clearly understand the parameters of the project.

Creating a successful and lasting partnership

Establishing appropriate guidelines for how to create, develop, and maintain partnerships is crucial to a program's success. A model that requires involvement, at all levels, of interested businesses and community organizations is the most effective way of creating buy-in for environmental programs. Sobel (2009) echoes these sentiments, citing strong administrator, teacher, parent and community involvement as crucial components to creating an effective partnership between schools and non-formal environmental education programs. Such partnerships have the ability to integrate programs into the mission and goals of the school and other partners involved (Bunderson & Cooper, 1997). It is crucial to the longevity of the program that environmental education organizations provide schools the tools for long term commitment to program success. Efforts that include teacher trainings, developing school members' grant writing skills to help ensure that

program funding continues (Sobel, 2009), expanding the number of teachers knowledgeable about the program, and empowering the school to find their own funding may be the most essential ways to ensure program longevity.

Case Study 1: TreePeople and schools

Many environmental organizations offer programs for multiple audiences such as field trips for teachers, project guides or service hours for students, presentations on links between school greening and student academic achievement for administrators, and engagement strategies for parents. Because there are many obstacles when it comes to working on school campuses, it's tempting to offer these resources piecemeal to audiences depending on immediate needs. However, by using effective practices in multi-level campus greening, we are better able to engage campus and community leaders at all levels, thereby assuring better outcomes and greater sustainability for our projects.

TreePeople is an environmental nonprofit that unites the power of trees, people and nature-based solutions to grow a sustainable future for Los Angeles, California. The organization has been working with students and greening school campuses for nearly 40 years. The school greening program has entry points for various audiences, but it is the Citizen Forestry model that has had the greatest impact on school greening. Citizen Forestry harnesses the power of individuals to lead their communities in urban greening projects aimed at increasing a healthy tree canopy for the city. TreePeople has learned that embracing enthusiastic leaders in a given community, educating them deeply, and supporting them long-term yields the best results. This deep commitment to guidance and support as opposed to "doing it for them" may result in fewer trees being planted in total but it also creates committed and engaged Citizen Foresters who will care for the trees long after the shovels have been put away.

The TreePeople strategy involves offering resources to assemble and engage a multi-level green team before work can begin. Students are offered Eco Club resources and action guides. Teachers are offered professional development and curriculum resources. Parents are invited to be green team members and are engaged in the tree selection and permitting processes. Maintenance staff is consulted for their expertise and to form partnerships for ongoing care and project sustainability required over the summer months when schools are closed. Administrators are presented with a vision for a green school that helps promote student achievement and health.

A campus greening program without multi-level stakeholders is a missed opportunity to deeply engage the community. When administrators understand the academic and ecological benefits of trees for their school, maintenance staff feels engaged and respected for their expertise, parents feel empowered to make a positive impact in their immediate communities and lives of their children, and teachers are given resources to use in outdoor spaces for academics, students learn that they have the power to influence their environment and become leaders for positive change. These partnerships help schools go from grey to green, becoming farms, gardens, and community forests – serving as examples for the surrounding neighborhoods of what is possible.

Case Study 2: DGS, USGBC, and schools

In Washington, DC, the mayor's sustainability plan calls for the city to become "the healthiest, greenest, most livable city in the nation by using sustainability solutions to address core challenges." Armed with this mandate, the DC Office of General Services (DGS) has paired up with the US Green Building Council (USGBC) to educate students in Washington, DC's Public Schools about sustainability, by way of a friendly, energy-savings competition. The DC Green Schools Challenge's motto is "Saving Money. Protecting the Environment. Inspiring Innovation." The program provides school teams made up of students, teachers, administrators and facilities staff with USGBC mentors to help them learn about building operations, their energy use habits, and their carbon footprint on the local environment.

In its first year, students at 27 schools were challenged to think of ways to curb their energy use and track their usage via a live, online leaderboard, accessible to the public. Schools competed for a period of three weeks, with the winning school reducing its energy usage by nearly 30 percent. The school's Green Team teacher-leader cites the engagement of students, staff, and custodians in helping her school achieve these impressive results. Students noted classroom activities, such as creating energy savings posters that were then posted around the school, as one way of generating school-wide motivation and action to do their part in reaching a collective goal. Students and their mentors also worked with custodial staff to encourage them to power down computer labs, along with room and hallway lighting.

For achieving the greatest energy reduction, the school's Green Team earned prize money from DGS, which it will use to support two teachers' participation in professional development on collaborative practices around student achievement. They are planning to use the opportunity to have more conversations about the benefits of green schools on students' social-emotional and academic growth. The successes, large and small, at each of the participating schools have proven valuable to both students, and DGS' mission of reducing the carbon footprint for its building infrastructure. This combined win for DC's sustainability plan proves the value in collaboration across schools and civic agencies. DC Government plans to continue the DC Green Schools Challenge as a way to engage schools in achieving its sustainability goals, and creating an environmentally-conscious citizenry.

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23. Institutional and community partnership for environmental education

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HIGHLIGHTS

- **Institutions, such as universities and nonprofit foundations, are increasingly important to local economies.**
- **Community is a multi-dimensional term with a limitless number of definitions due to the variety of ways people self-identify. In this chapter community refers to geographic neighborhoods.**
- **Institutions and communities can be united through participatory action research, which is a reflective process of community engagement working towards tangible action steps.**
- **The Charlotte Action Research Project is an example of an effective university-community partnership that works with low income neighborhoods in Charlotte to create sustained local change in a collaborative way.**

Institutions, community, and participatory action research

How do we define institution and community? Institutions, particularly anchor institutions, have become increasingly diverse and important to local communities. As described by the Democracy Collaborative (2014), "emerging trends related to globalization – such as the decline of manufacturing, the rise of the service sector, and a mounting government fiscal crisis – suggest the growing importance of institutions to local economies." While medical and university institutions are the most common (and normally the most established) institutions available to local community groups, there is a wide variety of valuable institutions to consider, such as "cultural institutions (e.g., museums and community arts centers), libraries, hospitals, community foundations and other locally-focused philanthropies, faith-based institutions (such as churches, mosques, and synagogues) and community colleges" (Democracy Collaborative, 2014). These institutions have the ability to be extremely valuable resources for community projects and neighborhood improvement. For example, "universities alone now spend $350 billion annually and have a total endowment of over $300 billion, while nonprofit hospitals own assets in excess of $600 billion and enjoy annual revenues greater than $500 billion" (Democracy Collaborative, 2014).

Community is typically described as a group of people connected by a particular spatial geography; however, the word can be applied to any group of people with something in common (Community Toolbox, 2014). Communities can also overlap due to the limitless ways people self identify. Understanding the context of community is an important preliminary step when seeking out partnerships. The Community Toolbox (2014) provides a comprehensive discussion of facets that make up a community, including:

- Demographics
- Built environment and infrastructure
- Non-formal and formal community leaders
- Community culture, history and values
- Government and politics
- Economics
- Existing groups and institutions.

Understanding all these components of a particular community lays the foundation for a mutually beneficial and healthy partnership. Historically, community projects and neighborhood partnerships have been focused on just one or two aspects of a community with little engagement. This is problematic for partnerships, because a wealth of local knowledge and reflection is lost. Furthermore, in partnerships framed around objective positivist methods the small-scale community group can often get overpowered by large institutions with structural power dynamics in their favor. In recent years, participatory action research has moved to the forefront as a popular way for institutions and communities to engage in partnership.

Participatory action research (PAR) has many definitions, but can be explained as a value laden, reflective participatory process of engagement working towards tangible action steps (Figure 1). Reason and Bradbury (2001) describe PAR as:

"A participatory, democratic process concerned with developing practical knowing in pursuit of worthwhile human purposes…It seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people and more generally the flouring of individuals and their communities."

PAR works well for institutional and community partnerships because it fuses together local expert knowledge, or living knowledge of community members, and the technical expertise of institutions.

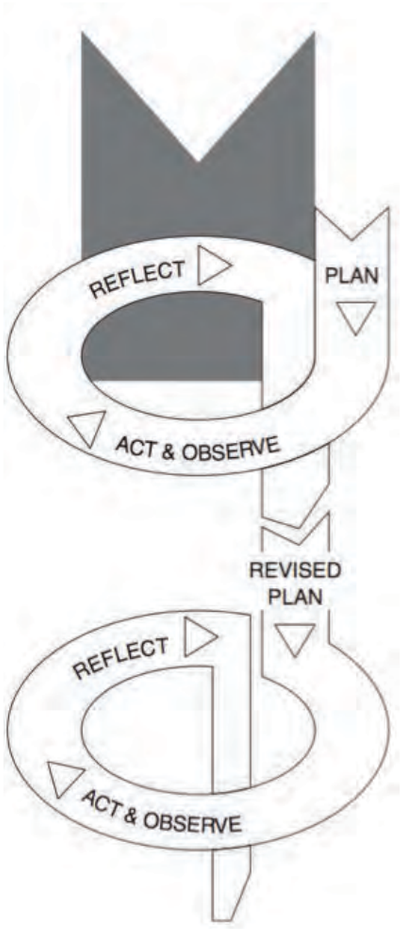

Figure 1: Action Research Spiral (Kemmis, McTaggart & Retallick, 2000).

A framework for effective institutional and community partnerships in environmental education

Many programs and initiatives involving institutional and community partnerships outside of environmental education have been evaluated and examined. Numerous variables have been identified that define successful partnerships that routinely attain goals and objectives set forth in the original intent of the union of organizations. A program evaluation on successful community-institutional partnerships for prevention research done by Seifer (2006) detailed twelve characteristics evident in "Model Partnerships" which include: (1) trusting relationships, (2) equitable processes and procedures, (3) diverse membership, (4) tangible benefits to all partners, (5) balance between partnership process, activities and outcomes, (6) significant community involvement, (7) supportive organizational policies and reward structures, (8) leadership at multiple levels, (9) culturally competent and appropriately skilled staff and researchers, (10) collaborative dissemination, (11) ongoing partnership assessment, improvement and celebration, and (12) sustainable impact.

Upon deeper review, these are broad characteristics that would be evident in any partnership regardless of mission. As a tight-knit community, environmental educators should embrace many of these facets in initial and ongoing partnership facilitation. Many of the elements are no-brainers, but when people are deeply passionate about a subject like the environment they can often become blind to perspectives outside their own. Membership turnover, budget challenges and changing regulations can often drain partnerships. It is important to revisit the factors listed above to ensure partnerships are achieving what they set forth to do upon initiation.

Varying perspectives of institutional and community partnerships in environmental education

There are many examples of past and present institutional and community partnerships that most people would deem successful in attaining goals. However,

many involved in environmental education often overlook the long-term sustainability of a program. In most instances if a program is struggling to reach its objectives it can often be traced back to some element within the framework. For example, in a report that detailed and evaluated community involvement in partnerships with universities and medical centers it was determined that at large the community was skeptical of the intention and long term availability of resources within a public health initiative (Fulbright-Anderson, Auspos, & Anderson, 2001). Struggles within such setting are probably due to the lack of equitable distribution of workload and dissemination of intent. Neither the institution or the community organization should bare an inequitable burden. Shared ownership should play an integral role in the planning phase of the project.

When the burden of a project is not equitably shared between the community organization and the institution, the essence of a participatory research process breaks down. Both partners must remain reflective at every step of the collaboration. Relationships between community organizations and institutions should remain mutually beneficial. Excitement surrounding new projects can sometimes derail success. Projects without strategic planning often lack long term sustainability. Enthusiasm surrounding a project should be celebrated, but it is crucial to identify clear goals and objectives to ensure the viability of the project and partnership.

An effective institution community partnership in practice

The Charlotte Action Research Project (CHARP) is the conduit of partnership between the University of North Carolina at Charlotte and several low income Charlotte communities. Since 2008, CHARP has engaged in intensive trust and relationship building through various projects including research with residents on neighborhood safety, environmental sustainability, and economic development. All of CHARP's work is focused around community involvement. For example, participatory mapping, community-based pollinator monitoring and environmental restoration, and community recycling initiatives have been the basis of past research, in which residents and community members act as co-researchers with graduate students and faculty.

CHARP makes an intentional effort to ensure all projects provide benefits to the community, such as job training, beautification and increased connection to place, and improved safety. The partnership is mutually beneficial as experiential learning, research, and teaching opportunities for undergraduate and graduate students sprout from CHARP's projects. In order to engage in adequate assessment and evaluation, CHARP continually reflects on its role in the neighborhoods, and receives regular feedback from neighborhood participants in the form of interviews, focus groups, and non-formal conversation.

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24. Teaching the teachers: Preparation and professional development of urban environmental educators

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HIGHLIGHTS

- **A number of colleges, universities, and other professional organizations offer a range of training opportunities for urban environmental educators.**
- **Training programs for urban environmental educators vary in content and depth, and could benefit from shared standards and understanding of urban environmental education.**
- **Urban environmental educator training and professional development can be advanced through exchange of pedagogical ideas, enhancing educator networks, and fostering practice innovations among environmental educators.**

Introduction

As we have seen in previous chapters and other publications (e.g., Russ & Krasny, 2014; Leou, 2005), urban environmental education takes many forms: from formal K-12 education to non-formal education in urban zoos, parks, gardens, industrial facilities, and nature centers, among other settings. These programs employ educators who teach about the urban environment and have different training. In this chapter, we describe some training programs for urban environmental educators; key skills, knowledge, and attitudes they need to develop; and opportunities to improve current educator training.

Training programs for urban environmental educators

Teacher education programs

Environmental education is becoming more common (as a course or even a concentration) in schools of education and environmental studies programs, but few university programs focus specifically on "urban environmental education" (gradschools.com, 2014; AASHE, 2014). Some examples of academic programs in urban environmental education include (this is by no means a complete list): New York University, Antioch University New England, Antioch University Seattle in partnership with IslandWood, and Leslie University.

New York University's M.A. in Environmental Conservation Education trains environmental educators to work in formal and non-formal urban settings. The program uses New York City as a context for teaching and learning about urban ecosystems and the role of education in addressing contemporary environmental problems. Courses include "Cities and their environments" and "Using New York City's non-formal resources to teach science," which includes projects with the New York Botanical Garden, New York City's parks, green roofs, a field station, and a recycling center (Photos 1 and 2). Students also carry out internships with local urban environmental education organizations (Leou 2014, personal communication; NYU, 2014a).

Antioch University New England's Department of Environmental Studies offers M.S. and Ph.D. in Environmental Education. Many courses, student projects, and internships focus on urban

environments. Relevant courses include “Urban environmental education,” “Community environmental education,” “Place-based education,” “Urban agriculture and education,” “Civic ecology practices and community resilience,” and “Diversity and social justice.” Antioch’s graduates teach in formal and non-formal settings (McCann, 2014, personal communication).

IslandWood, in Seattle, Washington, and Antioch University Seattle offer a new M.A.Ed. in Urban Environmental Education that emphasizes “deep immersion” in schools, community-based organizations, and governmental entities in urban communities that these organizations serve. Students work closely with schools in an “inner-city setting” and use various teaching practices, including through entrepreneurship, youth and community development, and environmental justice education (Thomashow, 2014, personal communication).

Lesley University offers a Bachelor of Arts in Earth and Environmental Science that has an urban ecology focus and an education track. The University also offers an M.S. in Ecological Teaching and Learning in which one of two summer residencies take place in an urban environment (e.g., Boston, Massachusetts). For the rest of the year this is an online master's program (Lesley, 2014b).

Professional development of urban environmental educators

For in-service educators, opportunities to supplement or infuse their curricula and programs with urban environmental education are growing. Offered by their employers, city, state, or federal governments, colleges and universities, and non-profits, such professional development opportunities do not always focus specifically on urban environmental education, but urban issues are generally getting more attention. A popular form of professional development are workshops on curriculum guides, like Project WILD, Project WET, and Project Learning Tree. These curricula are putting increased emphasis on urban issues (CEE, 2014a; CEE 2014b; Crim et al., 2008), and have a potential to reach even more teachers than they already do (Pitman, 2014). Some programs – such as EECapacity and LEAF – are creating and compiling urban environmental education lesson plans (TNC 2014a, b; EECapacity, 2014).

Photo 1. Every summer New York University environmental education students teach local youth about ecology, sustainability, and urban agriculture in places like the Eagle Street Rooftop Farm in Brooklyn. Photo Credit: Evans Manuel.

Photo 2. Wild places like this native forest in the New York Botanical Garden in the Bronx, help prepare New York University pre-service students to teach about biodiversity and local ecosystems in urban settings. Photo Credit: Bob Wallace, NYU.

More and more public high schools – such as the New York Harbor School and the High School for Environmental Studies in New York – focus on urban environmental education, and employ teachers who focus on communities and ecosystems in the city. The Nature Conservancy "supports a network of environmentally-themed high schools sharing best practices in urban environmental education" (TNC, 2014b). Some non-profit environmental education centers in cities – such as the Urban Ecology Center in Milwaukee, and the Center for Urban Pedagogy in Brooklyn – offer consulting, training, and/or field trip services to educators.

Similarly, some universities have research and outreach programs or offer courses that promote environmental education in cities – like the Cornell University Civic Ecology Lab, the Sarah Lawrence Center for the Urban River, New York University's Wallerstein Collaborative for Urban Environmental Education, and University of Wisconsin–Stevens Point (Civic Ecology Lab, 2014; SLU 2014a and 2014b; NYU, 2014b). Some of these and other hubs for urban environmental education provide professional development and offer university credits for formal and non-formal educators. Other organizations run independently of academic institutions per se, like the Baltimore Ecosystem Study with its annual Urban Ecosystem Teachers Institute (BES 2014a). Museums are also partnering with teachers to discover and/or create more urban environmental education opportunities (e.g. Field Museum, 2014). In addition, urban environmental educators can benefit from using research syntheses and summaries (e.g., Ardoin et at., 2011-2013; Braus et al., 2013) that can help them reflect on and improve their practice.

Training needs of urban environmental educators

The world is urbanizing, and it takes a diverse skill set to understand it and teach about the urban environment. While there are standards for environmental educators in general, such as the *Guidelines for the preparation and professional development of environmental educators* (NAAEE, 2010b), there are no guidelines for urban environmental educators specifically. Many of the training programs mentioned above do not explicitly state what skills, attitudes, or knowledge are necessary to become a successful urban environmental educator. In many ways, urban environmental educators, regardless of settings, need what their students need: factual knowledge, a sense of confidence, understanding of specific neighborhoods, connection to local environmental organizations, positive nature experiences, a supporting peer network, and access to various resources they need to succeed (Frank & Zamm, 1994; Pitman, 2004; Crim et al., 2008).

Knowledge

Like any environmental educators, urban environmental educators need a background that combines understanding of natural science and social science, as well as an understanding of interdisciplinary issues. In other words, they need the same urban environmental literacy that we expect them to teach students, with a special focus on cities (Leou, 2005). Educators need to recognize the urban landscape as an authentic place to teach and learn about environmental issues (Moffet, 2006; McLaren, 2009). They should also be familiar with abundant resources available for teaching in cities (e.g., NYU, 2014a; Frank & Zamm, 1994). They should know "how to optimize the use of these sites in their teaching" and how to link schools to non-formal sites (Fraser-Abder, 2005). "Urban pre-service elementary teachers in particular need to develop the ability to use the non-formal context to teach elementary science" (Fraser-Abder, 2005). Urban environmental educators should know how to use research results on environmental education and pedagogy; various curricula, guides, and publications related to urban environmental education (NYU, 2014b; TNC, 2014a; Frank & Zamm, 1994); city, state, regional, and national professional groups available to help them; and various opportunities for professional development.

Skills

Urban environmental educators need diverse skills, such as excellent teaching techniques (EERB, 2014; Leou, 2005), cultural competence and diversity sensitivity to welcome and work with different populations (e.g., adults, young children, youth, ethnic minorities, LGBT audiences, recent immigrants, people with

different learning abilities and special needs), and safety training pertinent to cities. They should know how to use urban resources (Leou, 2005; Crim et al., 2008) and use different techniques to assess and help mitigate environmental problems (e.g., through ecological restoration, gardening, tree-planting, water sampling, boat-building, oyster-restoration, and survey design) (Frank & Zamm, 1994). Skills in positive youth development are be crucial for urban environmental educators as well.

Attitudes

Urban environmental educators have to teach in unconventional contexts – outside the classroom, in non-formal education centers, in parks, in industrial and green infrastructure facilities – about place-specific and context-specific content. Thus a certain level of comfort and confidence in the outdoors and on the street is necessary (Ernst & Tornabene, 2012; Astbury, 2014). Urban environmental educators should have a positive attitude towards the future of the urban environment, a commitment to protecting urban ecosystems and communities, and a passion for the subject matter (McLeod & Kilpatrcik, 2005). And, like other educators, they will need "a certain humbleness in their approach, a certain willingness to collaborate, learn from others, [and] establish new connections" (Marcos-Iga, 2014).

Networks

No educator survives without the support of mentors, colleagues, and outside partners. This is very for urban environmental educators, who need the support of networks of community members, programmatic partners, local experts, school administrators, and fellow teachers (Pitman, 2014; Crim et al., 2008; Frank & Zamm, 1994). Sustained follow-up communication has been important for workshop participants (Crim et al., 2008; Pitman, 2014). "Classroom teachers need access to teaching strategies and resources to study issues that directly impact the urban student's life" such as service-learning; and they need "access to training opportunities, mentorships, and coaching. They need help thinking critically about their craft" (Silva, 2014).

EECapacity, the Environmental Protection Agency's national environmental education training program housed at Cornell University, provides opportunities for networking among environmental educators, youth and community development, and other professionals to exchange ideas and resources. The program aims to foster practice innovation among environmental educators, youth development professionals, faith-based organizations, military veteran organizations, and other providers of environmental education. EECapacity facilitates networks through workshops, online courses, and involving educators in writing books.

Gaps in the training of urban environmental educators

While there is a vast diversity of training opportunities for urban environmental educators, often outside of higher education and functioning independently of one another, there are no unity of mission for the field, no guidelines for excellence for the practitioners, and few national or state standards that recognize and promote urban environmental education. Relatively few teachers are taking urban environmental education courses because relevant courses and programs are limited in number, and few educators can find appropriate urban environmental education curricula or suitable lesson plans. This situation feeds the continued stigma that separates the "urban" from the "environmental" and makes it hard to get teachers to workshops and conferences with urban environmental education themes. Often, urban environmental education is simply a supplemental bonus activity for both teachers and students.

Conclusion and recommendations

Urban environmental education needs a unified vision, mission, and goals. Perhaps the field needs a checklist and self-assessment like the one NAAEE created for environmental educators (NAAEE, 2010a) or even a new Guidelines for Excellence could be created for urban environmental education specifically (NAAEE, 2010b). Existing urban environmental education programs and organizations would benefit from stronger national and regional networks or

professional groups, with conferences and webinars to bring the various practitioners together, perhaps building off of what NAAEE and the EECapacity project have already begun doing (EECapacity website). A journal of urban environmental education practice and research would be a laboratory for continued development and discussion of urban environmental education curricula. At the very least, committees and task forces should make themselves known at national conferences to make this growing subfield of environmental education a force for serving urban environments and their residents.

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25. Urban environmental education: Barriers and strategies

Michelle Byron

HIGHLIGHTS

- **Urban environmental education faces unique challenges because there are so many variables: diverse students and teachers, the built and natural environments, as well as humans' impact on these environments and infrastructures.**
- **Many teachers and students are disconnected from their local urban environments, believing there is nothing worth studying there. If they are taught the importance of their own local urban environments, they connect more deeply and their awareness may grow into caring or stewardship action.**

What is urban environmental education?

Urban environmental education is a special subdivision of environmental education because it happens in urban areas, with a diverse urban population, and deals with urban environmental systems and issues. Though all functions of "natural" ecosystems also occur in cities, humans, as the dominant organism, exert tremendous influence on the ecological processes of urban environments and make them unique ecosystems (Frank & Zamm, 1994).

Urban environmental education includes studying the "built environment," such as a city's design and architecture, as well as its infrastructure: transportation, water and food supply, energy use, housing and solid waste management. Urban environmental education is also the study of local environments surrounding students' homes (Frank & Zamm, 1994; Moffett, 2006; Powell, 2009). Importantly, students should comprehend how their local urban environment relates to the natural world and to the global environment (Frank & Zamm, 1994).

Teaching urban environmental education

Environmental education used to focus often on "pristine" environments or "wilderness" (Fisman, 2005; Moffett, 2006). Many urban teachers support the belief that there is no "environment" in the city because their definition of environment is "nature" (Moffett, 2006; Johnson, 2009; Barnett, Vaughn, Strauss, & Cotter, 2011). Regrettably, environmental education that is built on the study of wilderness may diminish environmentally responsible behavior (Fisman, 2005; Moffett, 2006). For urban students, studying the "environment" often translates to going on field trips and learning from books. Rather than cultivating an appreciation for our environment, field trips to rural areas may perpetuate an anti-urban bias that cities are unnatural and unpleasant, and that urban homes and communities are not valid environments worth teaching about (Frank & Zamm, 1994; Fisman, 2005; Huss, 2007).

A vast body of literature indicates that sustained contact with a place is what best cultivates environmental knowledge and concern (Fisman, 2005). Teaching about the positive aspects of a

Photo 1. Students of Dominican descent observe the local built and natural environment in the Harlem area of Manhattan, New York City. During a multi-week program, students learned about habitats, urban wildlife and animal adaptations. The unit of study culminated with a walk to a local park to observe the environment using binoculars. Squirrels, birds and apartment buildings were common focal points. Photo credit: Michelle Byron, 2014.

local environment may build a sense of caring and connection to places where students live (Fisman, 2005; Moffett, 2006) (Photo 1).

Urban teachers

Teaching urban environmental education meets many challenges:

1. School curriculum requirements and mandates,
2. Absenteeism and apathetic students, challenges students face at home,
3. Overcrowded classes,
4. Lack of administrative and peer support,
5. Shortages of resources, class time and time for preparation,
6. Fear and concern about health and safety, and
7. Teachers' lack of knowledge and confidence in teaching environmental education in class or outdoors.

Teachers may feel it is not feasible to create new curriculum that incorporates environmental education into their classes (Frank & Zamm, 1994; Dillon, 2006; Bruyere, Wesson, & Teel, 2012). This issue is compounded when pre-service teacher training does not focus on environmental education, the built or natural environment or outdoor classroom management skills.

Fortunately, various organizations offer hands-on multi-disciplinary training that significantly boosts teachers' knowledge, skills and motivation, increasing their confidence to incorporate environmentally-based activities and field projects into many lessons (not only science). By showing teachers how to use schoolyards and local urban resources rather than going off-site, the barrier of funding for field trips (especially transportation and program costs) is minimized (Bruyere et al., 2012).

Urban students are unfamiliar with their local environment

For urban students, studying their local environment is not as simple as it sounds. With a greater portion of the population living in urban environments, experiences in natural areas are limited due to the lack of green spaces in many cities (Bruyere et al., 2012). Urban students, comprised of every level of intellectual ability and socioeconomic level, have diverse cultural and ethnic backgrounds and often possess extensive knowledge of foreign, rather than local environments (Frank & Zamm, 1994; Huss, 2007; Powell, 2009). A disproportionate number of urban students are from disadvantaged backgrounds (Frank & Zamm, 1994). When ecology focuses on the study of areas with relatively minimal human intervention, urban students do not learn the importance of their own urban ecosystem. Students in urban areas tend not to believe that cities are viable ecosystems nor do they believe they can do a lot to improve their environment (Barnett et al., 2011).

Even when students learn about their local environments, many remain disconnected. Students did not identify opportunities for exploration of natural features on urban sites (Simmons, 1994). Socioeconomic factors influence children's perceptions of their environment (Kalvaitis & Monhardt, 2012). Opportunities for low-income students to apply knowledge gained from school-based environmental education programs are fewer than their higher income peers. Students in low-income areas may have restricted access to their local neighborhoods due to fears for personal safety and well-being (Fisman, 2005). Because of the lack of community safety, children spend lots of time indoors, using the outdoors only to get from one place to another (Wals, 1994).

Students described their fear to travel beyond areas in and immediately surrounding their apartment buildings, where they played. The children worried about being robbed or kidnapped on streets and at local stores (Chawla & Salcadori, 2003). Crime and violence, particularly murder and rape, along with the anticipation that dangerous people are "hanging out" or hiding behind trees create an extremely uncomfortable relationship with nature. That is compounded by the worry of getting lost (Wals, 1994).

In another study, children were afraid of the deep woods, particularly the wildness of the place, rather than threats from people (Simmons, 1994). Urban children exhibit a strong fear of wild animals, getting lost in nature, not being able to hide from danger and not knowing an escape route in unfamiliar natural settings (Wals, 1994). Predictably, family members and teachers forbid these places, even when some fears are projected, based on hearsay or the portrayal of nature in movies and documentaries (Wals, 1994; Chawla & Salcadori, 2003).

Children do not feel they have control over the environment; they feel powerless (Chawla & Salcadori, 2003; Barnett et al., 2011). When children do not feel secure, they do not build an awareness and sensitivity to the world around them. They cannot feel ownership over that place or a desire to improve it (Fisman, 2005).

Environmental education materials often are irrelevant to inner-city minority students (Wals, 1994). To foster meaningful participation in urban environmental education activities, new material must connect to existing experience or knowledge and have an impact on students' lives (Frank & Zamm, 1994; Hashimoto-Martell, McNeil, & Hoffman, 2012).

Strategies for success

Successful urban environmental education connects to and builds upon students' perceptions, existing beliefs, personal knowledge base and experiences. This creates an environmental awareness, which is a precursor to action (Wals, 1994; Fisman, 2005; Powell, 2009).

It is extremely important that urban environmental education uses contextually varied activities. Particularly for English language learners, teaching by lecture is unsuccessful (Huss, 2007; Powell, 2009). Students should work with real scientific tools and pursue authentic inquiry-based on relevant real world tasks. This is becoming a more easily reached goal, as user-friendly technologies and scientific data are increasingly accessible (Krasny & Roth, 2010; Riordan & Klein, 2010; Tidball, 2010; Barnett et al., 2011).

It is fundamental to include hands-on activities, relevant subject matter, and topics that engage students and encourage participation (Riordan & Klein, 2010). This teaches problem-solving and critical thinking skills (Chawla & Salcadori, 2003; Krasny, 2009; Riordan & Klein, 2010; Barnett et al., 2011). By engaging students in locally focused, in-depth and targeted environmental science investigations, they develop confidence to investigate and solve local problems, and that increases confidence in their general academic ability (Frank & Zamm, 1994; Barnett et al., 2011). With the necessary scientific skills, students understand healthy urban ecosystems, how their actions impact local systems and that they can improve their city's ecosystem (Barnett et al., 2011).

Another successful practice is to involve community and family to connect students with both in school and out-of-school experiences, such as cleanups, open space improvement, letter-writing or petitioning (Frank & Zamm, 1994;

Powell, 2009). This creates a "civic" relationship between the city and its people (Krasny, 2009; Powell 2009; Krasny & Roth, 2010; Kalvaitis & Monhardt, 2012).

Conclusion

Many urban children are disconnected from their local environments. Literature supports the idea that successful urban environmental education programs build upon children's prior experiences and are locally relevant. Teaching urban students how to interact with and connect to their environment is the foundation that leads students to feel capable of creating local change.

Resources

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26. Brightwater: An opportunity for connection

Cynthia Thomashow

The Metro bus opens its doors, releasing 40 fourth-graders who have ridden an hour from South Seattle to the Brightwater Water Treatment Center in Woodinville, Washington. “We’re in the wilderness!” squeals one of the young boys. To his credit, the landscape is very different from his urban schoolyard. But, just 20 years ago Brightwater was an industrial site, housing an old soup factory and a scrap-metal heap. Now it is home to a state-of-the-art water treatment center, flourishing wetlands, a LEED Platinum environmental education center, and 40+ acres of woods and fields crisscrossed by trails and abundant wildlife.

In 2011, IslandWood, an environmental education center on Bainbridge Island, Washington, won the contract to provide educational

programming at Brightwater in partnership with the King County Wastewater Treatment Division to a mostly urban population. The Center is a laboratory and gathering place filled with interpretive displays that creatively connect water quality, engineered waste treatment processes, and the health of the Puget Sound to everyday life choices. IslandWood educators use this site to deliver field-study approaches that enhance science curriculum in the King County schools. Woven into every lesson is relevance of the field-based learning to the home environment of the urban students.

Over 4,000 students come through the doors of Brightwater each year to study Freshwater Ecosystems, Land Forms and Humans in the Water Cycle with IslandWood educators. Sparked by the question, "*Which pond at Brightwater has more types of water bugs, Storm Pond (an untreated storm water runoff catchment) or Otter Pond (a pond fed by a stream originating in the watershed above the treatment plant)*?" Students may spend half the day mucking through wetlands, climbing hilly fields, and dipping their nets into containment ponds to collect macro-invertebrates. Student make observations and predictions about freshwater ecosystems in the field, collect specimens, tabulate data using microscopes in the lab and discuss their results together.

Another key question, "*What happens when we 'borrow' water from the water cycle in our homes, schools and businesses?*" begins the study of how humans participate in the water cycle every time they turn on their tap, run the dishwasher or go to the bathroom. During the Humans and the Water Cycle program, students experience the treatment process first-hand, discuss water issues in an interactive exhibit hall, and participate in a hands-on lab focusing on three different water-related STEM careers.

An ongoing professional development challenge for staff is to connect the field experiences to the actual neighborhoods where students live. The goal of IslandWood's Brightwater Team is to 'urbanize' their signature field-based approach of *getting kids outdoors* to the urban settings where students live. Once a month, staff delve into the assumptions that define our goals around environmental education, considering equity issues, environmental justice and cultural competency as it relates to educational approaches. Every time a new group of students arrives at Brightwater, a conceptual shift moves the educators closer to relevant and meaningful engagement with the young urban leaders of tomorrow's world. (Photo credit: Alex Russ.)

27. California Academy of Science: Learning from the green building

Aaron Pope
Michael Cruse

The age of sustainability owes a lot to the California Academy of Science. The Academy was founded in 1853, only three years after California became a state, and has been an institution committed to educating the community about the vast of collection of ecosystems it inhabits. As the state's population has expanded around its urban centers, the Academy has continued responding by addressing urban populations through programs aimed at bridging these natural and built environments.

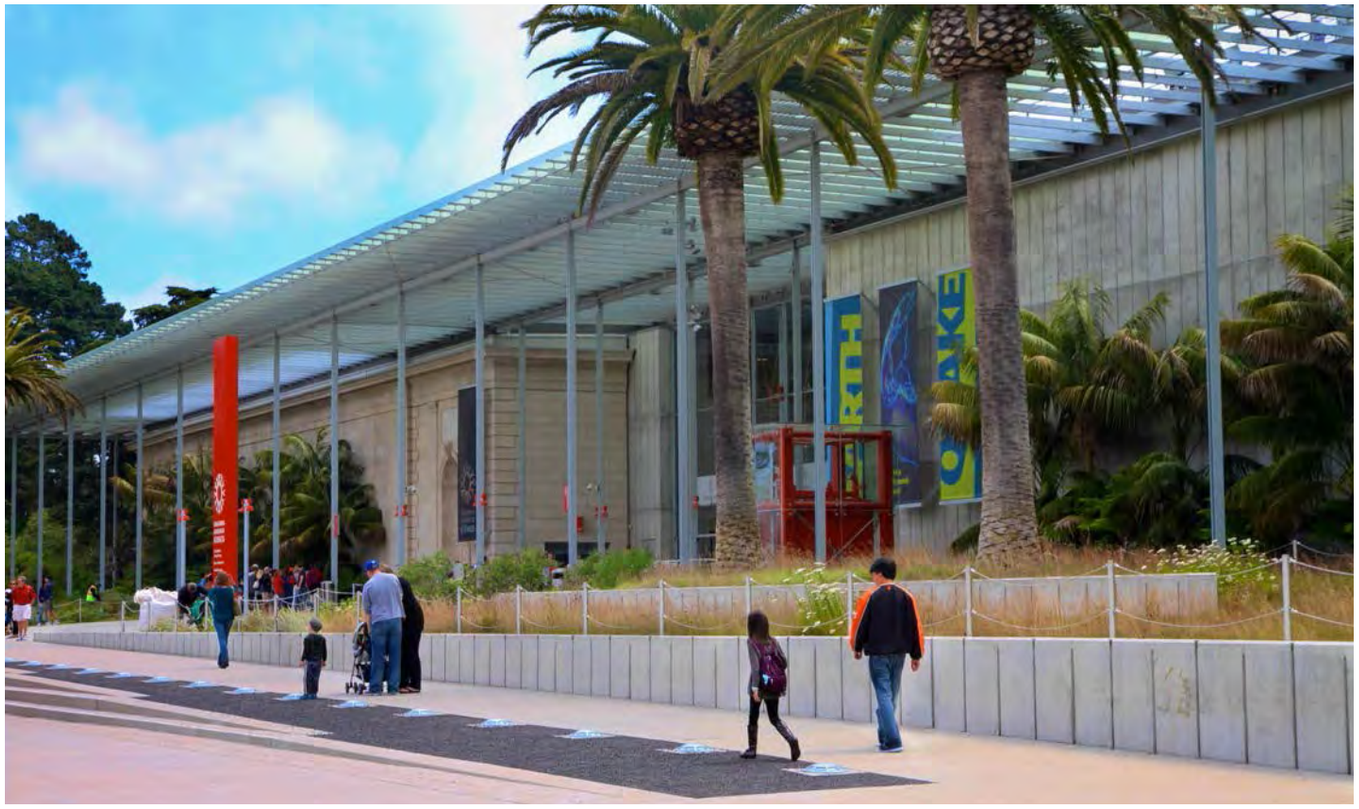
The Academy's first official museum opened in 1874 in what is now Chinatown and grew to a larger building on Market Street by 1891. However, the Great 1906 San Francisco Earthquake and subsequent fires decimated the Academy's collections, and also prompted the move to its

present day location in Golden Gate Park. The Academy's growing resources sought to exhibit many of the habitats being threatened by the widespread expansion happening across the country. Its mission to "Explore, explain and protect life" was clearly reflected in the growth of its campus.

Another earthquake in 1989 caused seismic damage to several existing buildings, which led the Academy to consider planning for green infrastructure as part of the project's design. The Academy's board and constituency became pioneers in advocating for a new building that would both provide space and support the organization's educational mission. Through advocacy and capital investment, the Academy raised funds for a new campus, to be built on the site of the existing location. With an eye towards the US Green Building Council's LEED certification system, the Academy pursued a Platinum rating – LEED's highest certification – in both Building and Design and Operation and Maintenance. The Academy's vision of a green building was to operate the structure as an exhibit element. The new $500 million structure opened its doors to the public in September 2008, with a free admission, welcoming over 15,000 visitors on its first day. The building's draw and capacity for sustainable thinking even influenced the Academy to update its mission statement to "Explore, explain and sustain life."

The public's response to the idea of using a building to inform and teach about our relation to the natural world has been astounding. This building has given the Academy's educators "a megaphone" to amplify other messages around sustainability. Two permanent exhibitions showcasing the building's sustainability features are part of that voice. One of these exhibits highlights the systems that helped it earn its LEED ratings. These include its passive heating and cooling, natural lighting and water recycling systems, which have resulted in a 50 percent reduction in the Academy's wastewater. The other exhibit focuses on the building's 2.5 acres of green roof, which is home to over 50 species of California native plants. The green roof is also used as a biodiversity research site for graduate students and researchers.

In its new home, the Academy has replaced the mindset of physical expansion and replaced it with one that reflects greater connection to the urban communities surrounding its park setting. These partnerships include community-based groups, schools, and the cities' public library system. Through the Teacher Institute on Science and Sustainability, the Academy supports cohorts of teachers from area schools to participate in a two year long professional development program aimed at spreading the message of sustainability across classrooms and into the homes of students. Another program sponsored by the Rock Family Foundation provides the financial support for every fourth- and fifth-grade student in a San Francisco public or parochial school to visit the Academy once a year. These and other educational programs aim to reduce the Academy's carbon footprint, while still expanding the reach of its message. The Academy's executive director, Dr. Gregory Farrington, best sums up the message of the new building in saying "It's about life, how we got here, the marvelous diversity of life, its preciousness, and the choices we face in learning how to stay."
(Photo credit: Alex Russ.)



28. Hudson River Sloop Clearwater: A boat and a river as tools for urban environmental education

Dave Conover

Hudson River Sloop Clearwater is a non-profit environmental organization founded in 1966 by folksinger Pete Seeger. Based in Beacon, New York, the organization owns and operates an historic tall ship, the sloop *Clearwater*, a 106ft sailing vessel that is used as a platform for environmental education programs on the Hudson River's tidal estuary. Clearwater sails to river cities from Albany to New York. Clearwater's programs serve a wide diversity and age-range of students. It might be fourth-graders from Yonkers one day, and high school students from Newburgh on another. While each city is unique, the Hudson River and the sloop have the potential to connect them.

Clearwater seeks to create "new first impressions" of the river. For many students, their only experiences with the Hudson may involve crossing over a bridge. They may not have made a personal connection to the river, or realize that it is a living estuary, or understand why their city was built next to it, and how their city affects the river today. The Clearwater program combines sailing with ecology and history, giving students a unique personal experience with the river, which can extend their sense of place beyond the confines of the neighborhood. When students learn the dramatic story of the American eel

and touch a fish that was born 1,400 miles away in the Atlantic Ocean and now swims in the streams flowing through their neighborhood, this exposure can promote stewardship of those urban streams by those students. Testing salinity and reading tide tables shows the Hudson's connection to the ocean, and can turn climate change and sea level rise into concrete concepts instead of abstract ones. Sampling the water for signs of microbead plastic pollution helps link consumption practices on land to the growing impact of plastic waste on the river and ocean ecosystems.

A key feature of the Clearwater program is student involvement. Turning passive spectators into active participants gets students invested in the program. Small group learning stations are led by Clearwater crew and volunteers who guide students in lessons on water quality, navigation, and history. Our standard three-hour sail program includes raising the 3,000 lb. mainsail. This requires working together as a team while singing traditional sea chanteys. Instead of simply telling students what kinds of fish live in the Hudson, a Clearwater-designed dichotomous key allows them to discover the fishes' identity. Our multi-day youth empowerment programs go further. Participating teens, most from nearby river cities, get an intensive three-day boat experience, receiving in-depth sail training, ecology studies and mentoring from the crew and guest presenters. They also learn about career, volunteer, and internship opportunities.

Clearwater runs a community outreach program called the Green Cities Initiative. This program assists Hudson River cities in incorporating principles of sustainability into all phases of municipal and community planning. Through training, technical assistance and hands-on activities, the initiative provides members of the community with information on how to prevent water pollution and integrate green infrastructure into their planning. Residents also learn about environmental hazards and health risks associated with polluted waterways. Clearwater is implementing an education program to raise the awareness of the health risks from consuming Hudson River fish, which are an accessible and inexpensive meal in urban areas but can be contaminated with toxins like PCBs. This program recruits volunteers from the communities where people are fishing to assist with the outreach work.

Clearwater is part of a water quality monitoring network (HRECOS.org). The sloop has an onboard sensor that uploads real-time data and makes it accessible to students and teachers. Before, during and after their sail, they can track the boat, graph water quality data such as dissolved oxygen and salinity, and see how this data changes over time along the length of the estuary. This system can help extend the impact of the sail program back into the classroom. Another way to extend that impact is to arrange pre-trip classroom visits. The students and teachers get familiar with Clearwater while at the same time our educators gain insights into the lives of the students. Developing good relationships with environmental justice and other community organizations is critical to learning the unique character of each river city. Clearwater remains a river-based organization, not connected to any one urban center. Getting regular feedback from teachers, parents and community leaders is important to ensure that our programs remain effective and relevant. We want to avoid simply implementing our own environmental education agenda and remain conscious of the complex issues affecting the students from our cities. We want to allow kids the space and time to develop their own relationship with the Hudson.

29. The Nature Conservancy's LEAF Network: Leaders in environmental action for the future

Brigitte Griswold
Joel Tolman
Mandy Breuer

With more than 80 million members – more than 80 percent growing up in cities – the Millennial generation is the largest, most diverse, and most urban in US history. Environmental challenges demand new leadership from this generation of young people. Yet many are disconnected from nature; only 10 percent of youth polled by The Nature Conservancy reported spending time outside every day. Since formative experiences with nature are key to lifelong conservation interest, on-the-ground conservation projects that happen in cities and engage urban populations are critical.

Leaders in Environmental Action for the Future (LEAF) – a project of The Nature Conservancy – combines environmental learning in urban high schools with real world environmental work experiences to empower the next generation of conservation leaders. For 20 years, LEAF has connected city students from across the nation with paid, month-long summer environmental internships.

Teams of students work alongside professional mentors, scientists, and naturalists to protect and restore habitat, save endangered species, and support science studies while exploring conservation careers.

Every LEAF intern is a student at one of 25 environmental public high schools in cities from Atlanta, to New York, to Chicago, to Seattle. These schools share The Nature Conservancy's commitment to helping city students grow into environmental leaders and successful college students. For instance, at Common Ground High School (New Haven, Connecticut), students must create and defend portfolios showing their growth as environmental leaders in order to graduate. These portfolios integrate academic and extracurricular experiences in Common Ground's unique learning laboratory: a 20-acre urban farm, on the edge of a forested state park, within the City of New Haven.

Environmental Charter High School, another member of the LEAF network, sits steps from one of the busiest freeways in the world. From ninth through twelfth grade, students are surrounded with unique learning experiences that use environmental service learning as inspiration to find authentic meaning in their studies. From the environmental advocacy class, Green Ambassadors, to the culminating senior thesis project, students generate real solutions to real issues throughout Los Angeles.

Through workshops and events of the LEAF Educator's Network, teachers and leaders from these 25 urban environmental high schools share effective practices in urban environmental education. The ultimate goal: to reach 20,000+ students with environmental education designed for urban students and settings. To expand impact and share innovative curricula, these educators have developed the LEAF Anthology of Urban Environmental Education -- available at www.nature.org/leaf.

LEAF's combination of a 4-year exposure to environmental issues and immersion in paid summer conservation work has had a tremendous impact on urban young people. Among alumni, 91 percent report increased awareness of conservation career paths, and 33 percent go on to pursue professional paths in environmental career fields. Other positive impacts include increased self-efficacy, awareness of their development as critical thinkers, and a growing sense of sense of self as an agent of change.

These results demonstrate the importance of the partnership model with innovative environmental high schools – combining classroom lessons on urban ecology with real world field experiences. Additionally, the partnership ensures sustained contact with environmental issues during critical adolescent years. Rich classroom experiences coupled with paid field experiences is motivating young people to pursue higher education and creating pathways to environmental careers.

30. Central Park Conservancy's ROOTS service learning program

Brieanne Berry

Central Park is among the most well-known urban parks in the world. The 843-acre Park receives over 40 million visits each year and is an important link to the natural environment for many New Yorkers. Founded in 1980, Central Park Conservancy is the non-profit organization dedicated to restoring, managing, and enhancing Central Park in partnership with the public. Our staff works in a wide variety of positions to care for the Park and involve visitors as stewards. As the Woodlands Education Coordinator for the Conservancy, I work with high-school students to engage them in caring for the Park through service learning programs that teach them about the natural environment in an urban setting.

The Park includes 80 acres of woodland landscapes and woodland education is an important piece of the Conservancy's programming. Central Park's woodlands are designed landscapes, but they are managed by the Conservancy to look natural and function naturally. Because of this they provide a unique opportunity for students to learn about ecology and the natural world in the middle of Manhattan. Through ROOTS, one of our service-learning programs, students learn about urban forest ecology and urban park management through hands-on restoration projects.

ROOTS is open to current high school students. Participants are selected through a competitive application process, and the program is limited to 15 students. These students volunteer once a week for an entire semester in one of Central Park's woodlands. This longer-term engagement helps them develop a connection to the Park. Many

participants have never visited Central Park's woodlands before participating in the program and feel uncomfortable in this new and different environment. If we can get the students to feel comfortable in Central Park's woodlands, and to understand why they are unique and important, those same students will likely come back and use these and other urban open spaces responsibly.

A key component of the ROOTS program is the hands-on work that students do, including removing invasive plant species, maintaining trails, planting native species, and working on erosion control projects. Participants in the ROOTS program live in all five boroughs of New York City, and few have opportunities to do hands-on work like this at home or at school. For them, ROOTS is a chance to see concepts that they learn about in school applied in the real world, like connecting soil compaction and erosion to the spread of invasive plants.

One of our challenges is to meet the growing demand for program slots without risking damage to the Park itself, resulting in some limits to capacity. The flip side is a higher caliber of student and commitment to the program. That said, selecting participants is also a challenge as we aim to strike a balance between students with significant volunteer experience and a demonstrated interest in the natural environment and students who have never considered doing anything like this before, but for whom participation could have a very meaningful impact.

There are many ways for the program to evolve. We have begun to integrate technology by using a digital tablet to record phenological observations of plants throughout the semester. It is an exciting area to explore, but questions still remain about whether and how to engage students in analyzing the data they collect. It is also critical for students to place their work in Central Park in the context of the larger natural environment. As with all components of the ROOTS program, it is important that the content makes sense within the program, and for Central Park and the Conservancy.

31. Urban ecology center, Milwaukee: It's kind of fun to do the impossible

Ken Leinbach

Why does one person recycle while another person does not? What leads some people to make environmentally aware decisions while others ignore their impacts completely? It was a pivotal moment in my life when I began asking these questions in earnest. Discovering the "significant life experience" research that sought to answer these questions, compiled by Louise Chawla in the 1990s, has had a significant impact to my life path. When you think about it, this is *the* question. If we could answer this important question of human behavior, we could get to the root of our environmental condition. If everyone seriously considered the environmental impact of their decisions, the change in our collective activity would turn the negative environmental condition on its head!

What I divined from the research was pretty clear. In short, a child is highly likely to develop an environmental ethic of caring if she grows up with two elements in her or his life: (1) consistent contact to natural land, and (2) an interested friend or mentor who demonstrates respectful behavior toward the land and the environment. How elegantly simple – to create a society whose behavior is respectful to the living systems that

support this planet, all we need do is to make sure our children (all of them!) get outside in nature on a consistent basis and interact with adults who demonstrate respect for the land.

The Urban Ecology Center, located in Milwaukee, Wisconsin, addresses this challenge in the seemingly most difficult of places – high density, ecologically degraded urban areas with limited natural land and many complex social issues. It took time and experimentation, but the Center's model has grown from a rundown trailer in a high crime park during the 1990's into a rapidly growing, four million dollar a year non-profit, turning blighted parks into community assets throughout Milwaukee. Crime in our parks is going down, academic achievement of participating students is going up, health is improving, land is being healed, and the community is engaged and proud as seen in a high level of volunteerism. Currently, there are three active and vibrant "environmental community centers" under the Urban Ecology Center umbrella. Urban environmental education has become a proven catalyst for neighborhood renewal. The Center is turning the heads of many leaders in urban areas across the globe who are interested in achieving the same impacts being realized by this successful model. It is quite remarkable!

The Urban Ecology Center's model starts with a neighborhood base, working with schools, businesses and community members. Through its programs, the Center hosts over 100,000 visits each year. Additionally, over 100,000 people enjoy the outdoor green spaces that we manage. Our comprehensive suite of programming meets people where they are and increases environmental literacy in a fun and hopeful way. With the Center’s award winning school-based program, the Neighborhood Environmental Education Project, we partner with local schools to offer outdoor, science field trips spanning from ecology to physics to food. All programs include an outdoor component that helps develop a deep relationship between children and nature. The Citizen Science and Research program converts urban parks into field research stations where university and professional researchers come together with citizens to engage in research. Our community programs cover the gamut, from after-school programming to urban adventures (canoeing, biking, rock climbing) to lectures and workshops on sustainability, environmental issues, and food preservation. The Center’s robust membership enjoys these programs at a free or discounted rate along with the added benefit of a free outdoor equipment lending program, creating community and a sense of shared ownership. We offer an intensive internship program for high school students and adults – creating jobs and providing career training for tomorrow’s environmental leaders. Volunteerism is a huge component at the Center, providing person power to steward hundreds of acres across the city. In the last 20 years we have shown that the Urban Ecology Center’s mission to create positive change, neighborhood by neighborhood, works. It is important, it is exciting, and it is growing!

I believe the most important lesson of the Urban Ecology Center is that it is possible. It is possible for a small group of citizens to transform a city. It is possible for people like you and me to turn our current situation around. Take action. Learn more at www.urbanecologycenter.org. (“It’s kind of fun to do the impossible” in the title is a quote by Walt Disney.)

32. “What’s Good In My Hood”: Promoting community wellness through urban environmental education

Akiima Price

“Where do you live? Where does water in your community come from? Where do animals in your city find shelter? What is good in your neighborhood? What can you do to keep it good? What is not so good? What you do to make your community better?” – These are some of the questions that students answer through “What’s Good In My Hood” – one of the curricula I have developed specifically for low-income, underserved, and stressed urban communities.

Urban communities in the U.S. are often stressed and struggle to have their basic needs met. These needs include, for example, personal safety, economic prosperity, health services, access to healthy food, acceptable environmental quality, good education opportunities, open space, and adequate housing. Not always, but often these communities tend to be low-income, inner-city, and communities of color, which historically have been stressed by economic, social, and environmental factors, and still continue to bear this stress.

When we talk about the “environment” in educational context, to many people it means wild nature and undeveloped landscapes that are influenced by various biological, physical and social factors. The same factors influence cities and their residents too. But in poor communities, children grow up in the environment that also includes seeing homeless people, drug dealing, crime, and having little or no green space. Although this urban environment can be rough, it sustains life: plants, people, and other animals that share habitats.

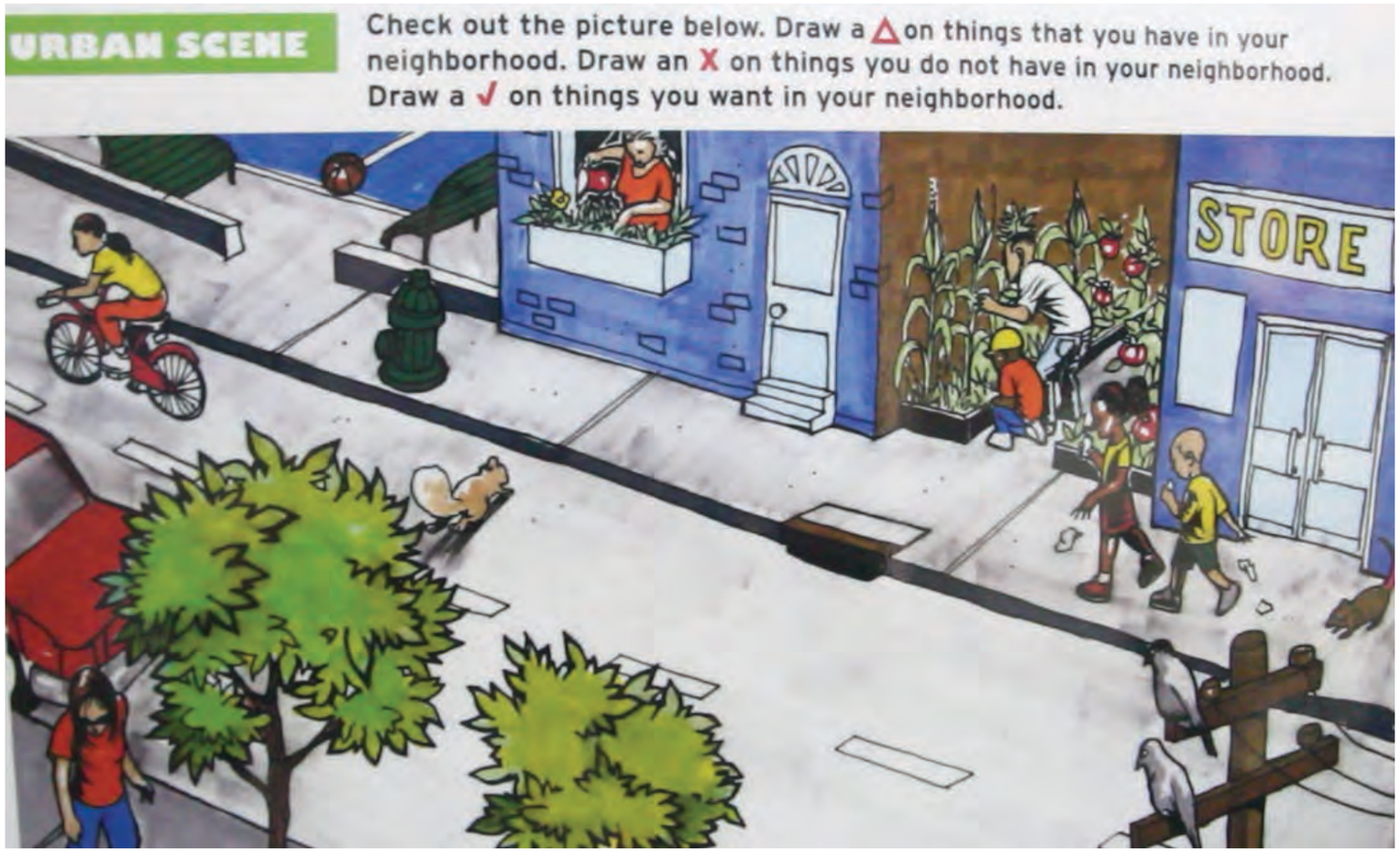
Making the connection between urban residents and the nature in their immediate environment can empower them to reflect on all aspects of their neighborhoods, and see for themselves what they can do to make their communities better.

As a woman of color, I grew up around such stressed communities in Washington, DC. This perspective benefited me as an environmental educator while working with numerous environmental organizations in Washington, DC and New York City, where I was often tasked with working with communities of color. I learned that you have to be considerate of different situations your students come from. Your students may be afraid of unfamiliar environments such as forests, but be comfortable in the most crime-ridden neighborhoods. You should be aware that sometimes students come to your program without having a breakfast or even a home. Many students may have learning disabilities, behavioral issues, polluted environment that affect their health, or few adults they can trust. Thus teaching these students is not only about pushing through your curriculum, it is also about building a certain level of trust and connecting your lessons to their situations.

Over years, I have developed a number of tips to work with these students, and just with any students, such as: (1) Make an effort to see your students more than just once to build relationships and a certain level of trust, so students can better learn from you and you from them; (2) Be kind, respectful, empathetic, and use your sense of humor; (3) Consider your audience, be sensitive to students' situations; (4) Be present with people in their environment, find nature and connect them to nature where they live; (5) Do not be afraid to work with people from stressed communities; just build a curriculum that is relevant to their environment, be authentic, and do not be afraid if lessons do not go as planned; be a learner yourself and keep going.

Using these principles, I developed the curriculum "What's Good In My Hood" that teaches students about food, water, and shelter sources in urban communities. Through a five-unit workbook, this curriculum teaches students to find, identify, and appreciate different living and non-living things in cities; it helps them to understand where their food comes from; it also helps students find good and not-so-god things in communities, and realize what they can do to sustain and improve their environment. This curriculum can be used by non-formal educators or school teachers to complement their lessons to make them more relevant to students' lives.

I believe that nature, including nature in cities, is a powerful medium to promote the peace and unity needed to heal not only people, but the planet as well. (Photo credit: Alex Russ; WGIMH illustrator: Aniekan Udofia.)



33. Chicago Wilderness and the Calumet region: Working together to leave no child inside

Laura Milkert

Located at the southern end of Chicago along the southern tip of Lake Michigan lies the Calumet region, a living laboratory for place-based learning where strong partnerships are working hand-in-hand to engage youth in community-based conservation efforts. From the late 1800's through the middle part of the 20th century, the Calumet region was a booming industrial hub including some of the largest steel producers in the world. Today, this urban region is in transition and is a matrix of manufacturing sites, communities with rich cultural diversity, and natural areas that include rare prairie habitats, woodlands, savannas, wetlands, and dune and swale systems, all with important biological significance. This area is home to thousands of native plant and animal species, and restoring and taking care of Calumet's natural areas has emerged as a key strategy for improving quality of life for all. Connecting youth in that process provides huge opportunities for positively transforming people and place. The ultimate goal is to leave no child inside, and for participants of environmental education programs to develop a personal relationship with nature that will grow into a generation of youth taking care of the broader Chicago Wilderness region.

Chicago Wilderness is not just a complex urban region; it is also a dynamic partnership at work. More than 300 organizations have joined together to connect people and nature as a part of the Chicago Wilderness alliance. This alliance is a model for how to achieve greater conservation impact working through partnership than if organizations were to work independently. In Calumet alone, The Field Museum, Chicago Public Schools, the Illinois Department of Natural Resources, the Forest Preserves of Cook County, the Dunes Learning Center, the Alliance for Great Lakes, Shirley Heinze Land Trust, parents, community volunteers, and others, collaboratively work to make two youth stewardship/youth conservation action programs possible: Mighty Acorns and Calumet Is My Backyard (CIMBY).

Over 6,000 students step off of buses into the tall grass prairies or oak woodlands of Calumet each year to participate in Mighty Acorns and CIMBY, some of them exploring nature like this for the very first time. Exclamations of “Come look at this!,” and “I never knew Chicago could be like this!” can be heard on the wind. Mighty Acorns, grades 3-5, and CIMBY, grades 9-12, both engage students in hands-on ecological restoration, exploration, and science lessons while using local natural areas as outdoor classrooms. Children and teens participate in multiple field experiences throughout the fall, winter, and spring in order to provide a lasting connection to the area and create the real-world, hands-on field experience that is at the heart of these programs. This, coupled with in-class curriculum, allows Mighty Acorns and CIMBY to foster true service-learning.

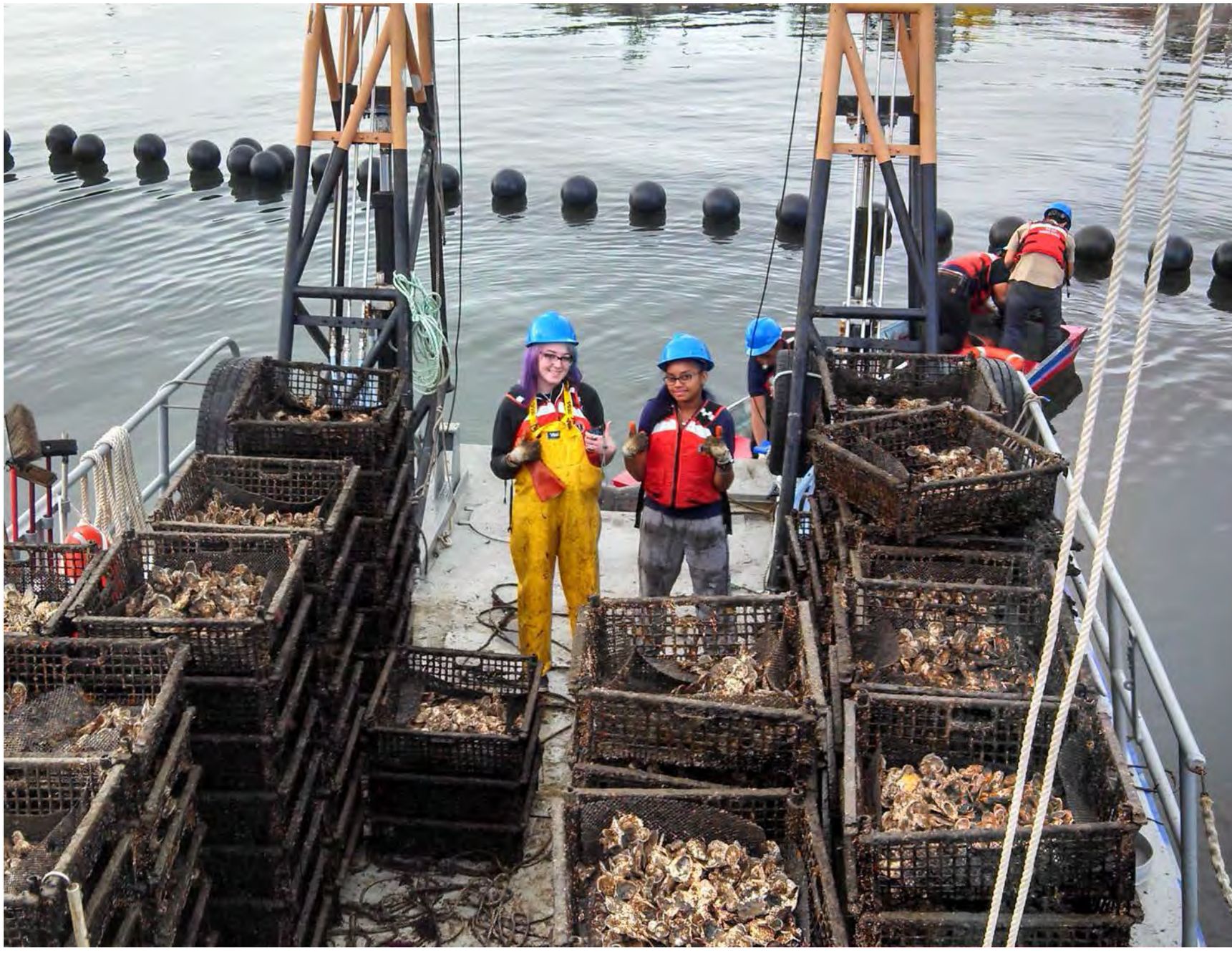
The programs are rounded out by professional development workshops for educators, and by building connections between these programs and other urban environmental education when possible to increase the overall impact. It’s working when we hear youth say things like, “I joined CIMBY because I remembered how fun Mighty Acorns was…I wanted to live again the experience [I had] with Mighty Acorns…I like to be outside…and to make a change in our environment.” CIMBY students also attend leadership training workshops throughout the year, and over 15 CIMBY students earn paid summer internships, where youth work alongside scientists and environmental organizations to develop long-term solutions to local environmental issues. These internships have inspired youth to pursue higher education and to seek out additional opportunities in the sciences.

Effective partnerships take hard work, so time to coordinate efforts, resources, and to debrief successes and challenges is critical to the future of Mighty Acorns and CIMBY. So is conducting ongoing evaluation and updates to these programs, and staying informed of the complex social issues at play with participants to ensure programs are relevant to students’ and teachers lives. Calumet environmental education partners are weaving a web of opportunities for youth so that they can be the next generation of Calumet leaders. By working together, environmental education partners are ensuring that today’s youth are a part of creating a sustainable vision for the future.

34. New York Harbor School: The Billion Oyster Project

Peter Malinowski
Murray Fisher
Sam Janis

The Billion Oyster Project is a long-term, large-scale plan to restore one billion live oysters to New York Harbor over the next 20 years and in the process educate thousands of young people about the ecology and economy of their local marine environment. The Billion Oyster Project is a partnership of schools, businesses, nonprofits, and volunteers all working together to grow oysters, restore the estuary, and make our city a healthier and more resilient place to live. Together with New York Harbor School (Harbor School) and our other partners, we have successfully grown more than 11.5 million oysters in New York Harbor over the past four years, all of which have been used to stock floating nurseries, dockside oyster gardens, and five experimental reef sites. Originally a project of The Urban Assembly New York Harbor School, the Billion Oyster Project has grown and now provides curricula and oyster gardens to ten high schools and twenty-six middle schools. Billion Oyster Project is based on two assumptions: (1) students flourish when given the responsibility for bettering their local environment, and (2) the tools needed to be an effective “eco-restorer” are complex, nuanced and match neatly with many of the mandated priorities for middle and high school teachers and students.



For thousands of years, 300 square miles of oyster reefs dominated the rich estuary ecosystem that surrounded New York City. These oysters are virtually gone. At the same time, the public school system continues to struggle to find methods for engaging students in their studies. New York City is home to 1.1 million public school students, attending 1,700 schools and taught by 75,000 teachers. Recently, pedagogical frameworks focusing on STEM education, place-based and inquiry led learning have emerged as priorities for the Department of Education. The Billion Oyster Project is a systematic tool for addressing both of these challenges. Through the Billion Oyster Project we will build a richer, more productive and more protective Harbor by engaging a generation of public school children and equipping them with skills and ethics of authentic scientific inquiry and environmental stewardship. These students will gain the confidence that comes with being valued and leaving their mark on the City and its Harbor. Restoring one billion live, adult oysters into New York Harbor is a crucial step towards estuary restoration and proactive planning for global climate change.

The Billion Oyster Project views students as active participants in the restoration process. Not only are students learning from their experiences, they are essential to the work of restoring oysters. It is the high school students at the New York Harbor School who grow the oysters, dive beneath the Harbor's surface to construct and monitor reefs, operate the vessels, maintain the vessels, construct reef infrastructure and design and implement long-term research projects aimed at increasing our collective understanding of the restoration process. Partner schools contribute by establishing breeding colonies at various locations around the Harbor that add to the reproductive potential of the Harbor each spring. These breeding colonies also serve as access points that bring math and science classes out of their buildings and down to the water's edge. Through oyster gardening these school groups learn the science of the estuary and the math of aquaculture and ecosystem restoration. In this way young people become active stewards of the Harbor. The data collected by these school groups forms a Harbor-wide oyster growth and survival study and a growing water quality data set that together help inform future restoration work.

New York Harbor is a massively degraded natural system, oysters are functionally extinct and every time it rains, billions of gallons of untreated household wastewater are allowed to flow directly into it. The visibility in the water is very low, often less than a foot. The currents are strong and commercial traffic is constant. In short the environment in the Harbor is not necessarily conducive to the work of restoring oysters. These challenges affect the ability of the Harbor School to produce oysters, dive, drive boats safely and effectively monitor the reefs. The result is that the students who can perform these tasks under these conditions are held to an extremely high standard. The result is slow but consistent progress towards the goal of one billion oysters restored by 2034.

35. Project Learning Tree in the city

Kathy McGlauflin

Project Learning Tree® (PLT), www.plt.org, is an international, award-winning environmental education program designed for teachers and other educators, parents, and community leaders working with youth from pre-K through grade 12. PLT teaches students how to think, not what to think about complex environmental issues, and develops critical-thinking and problem-solving skills. PLT increases students' understanding of the environment and actions they could take to improve it.

PLT believes that if all students, including urban students, interact with and connect to the environment in their own neighborhood, this foundation leads students to feel empowered to make a difference in their communities. We support educators in using local places for both teaching and learning, and provide a set of PLT GreenSchools! Investigations and other lessons such as Are Vacant Lots Vacant?, Planning the Ideal Community, Where does your Garbage Go?, and Communicating Risk, that engage students in investigating social, cultural, economic, aesthetic, and environmental issues in their communities.

In all parts of the country, PLT brings together education and natural resource partners with a common purpose – helping children learn. Our local delivery model provides professional development, high-quality supplementary curriculum materials tied to state standards, and a robust service-learning program.

Over 1,200 face-to-face PLT professional development workshops take place across the U.S. every year that provide around 25,000 educators each year with training and resources to integrate environmental education into lesson plans for all grades and subject areas – and to use the outdoors to engage students in learning about the world around them. Since PLT began in 1976, PLT has trained 650,000 educators and an estimated 100 million PreK-12 students have participated in PLT lessons and activities.

Through GreenSchools! (www.greenschools.org), PLT's service-learning program, youth create greener and healthier schools – and save their schools money! More than 4,000 schools, many of whom serve diverse and underserved populations, participate in the program that gives youth a voice, develops youth leaders, and engages students in applying STEM (science, technology, engineering, and math). Every year since 1992, PLT has awarded GreenWorks! service-learning grants (www.greenworks.org) to support community-based, student-led environmental action projects.

In Washington, DC, for example, middle school students at Paul Public Charter School continually investigate their school's environmental footprint, analyze data, and make recommendations to improve their school. They have created vegetable and pollinator gardens, planted an orchard on the school grounds, found ways to conserve water in the restrooms, and saved energy by installing motion sensors to turn off lights when not in use. They painted a huge mural on a wall separating the school from the street to educate their community, presented at a National Science Teachers Association conference, were guest speakers on a webinar, and spoke at a Climate Change International Conference. In a local television news report, eighth-grader Nanci Reyes said, "It makes me feel like I'm a part of something really big."

After attending a PLT training and with help from a PLT GreenWorks! grant, Karen Trout, a middle school science teacher and volunteer with the Young Men's Educational Network, got youth interested in serving their community through reclaiming and repurposing vacant lots on the west side of Chicago. Young men took on leadership roles and worked with youth in their community to help ready the lots, plant a variety of fruits and vegetables that are shared amongst the community, and engage with their neighbors year-round to care for the garden and maintain the premises. They even hosted a block party where the kids collected the produce from the garden and a chef cooked a meal with the veggies for everyone to share. The Ward Alderman, the Chicago Police Department, and the City of Chicago secured the property with fencing in preparation for the "From Weeds to Seeds" community garden and provided mulch for beautification. Other city partners provided rain barrels, and education about composting and conservation. In addition to planting the seeds of health and nutrition, Trout says, "[Youth] are realizing their own opportunity and responsibility for making change wherever they see the need."

36. Adult education: Learning together in community gardens

Philip Silva

Is urban environmental education limited to young audiences? Do adults ever show up in urban environmental education initiatives? What are the aims and methods of urban environmental education when adults get involved – what is its pedagogy? This short essay addresses these questions through a specific case of urban environmental education involving community gardeners in New York City.

First a little bit of background. Adult education comes in many different forms, from the experiential education that happens on the job to the formal education that happens in workshops and classrooms. Both formal and informal adult education are vibrant and dynamic fields of theory and practice that include an eclectic mix of teaching strategies, philosophies, and even political leanings. But that's not all.

John Holt, a childhood education expert writing in the 1970's and 80's, argued that children are "learning all the time" through their everyday interactions with the world around them. Adults are no different. Any given day in the life of an adult is filled with challenges, puzzles, and predicaments that demand some kind of learning and adaptation. To live is to learn, according to this point of view.

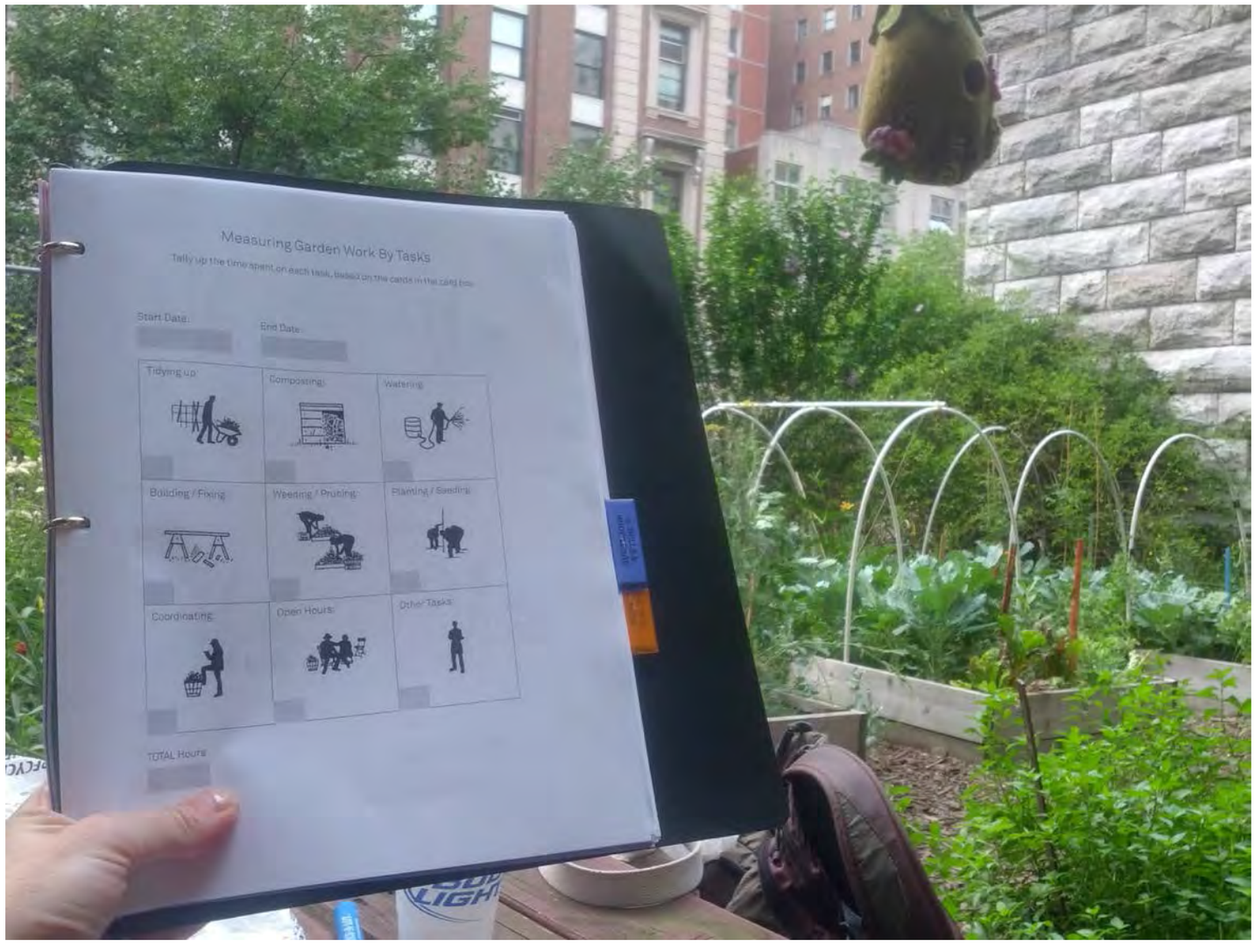
Adults sometimes come together in small groups to learn from each other as a strategy for problem solving. They pool their knowledge and, in dialogue, struggle to change an issue of immediate importance in their lives. This style of informal adult learning is often called "popular education," and its theories and practices are the work of well-known and widely loved educators like Myles Horton, Paulo Freire, and Jane Vella – to name just a few. Popular education has been applied to environmental issues in cities throughout the world. These issues may be as big and nebulous as persistent air pollution in low-income neighborhoods and as

tangible and specific as figuring out where to plant summer squash in a new community garden.

Community gardens in New York City have been a driver of popular education for decades. Gardening is, inherently, a process of learning-by-doing. A horticultural practice that works one year may fail in the following season as weather shifts, pests migrate, or soils degrade. Gardeners share tips with each other and keep up-to-date on the latest and greatest gardening practices through workshops, trips to the library, and visits to extension program websites. Community gardeners in cities like New York have also had to band together to preserve and protect gardens threatened by the pressures of real estate development. They have learned, over time, to become savvy collaborators in political and legal processes, developing new and practical knowledge that has gone a long way toward saving hundreds of gardens across the city's five boroughs since the late 1990's.

Community gardeners in New York City recently engaged in a popular education initiative aimed at measuring all of the good things happening in their gardens. Members of thirty different gardens throughout the city came together in May of 2013 to collaboratively design and develop new methods for measuring things like the number of pounds of vegetables harvested each year or the extent to which children develop healthy eating habits after spending time in a garden. The gardeners worked together to identify what they wanted to measure, brainstorm methods that were accessible and affordable to use, and forecast how they would apply their findings to improving their gardening practices or advocating for more support from local funders and policymakers. They received coaching, technical advice, and a small stipend to support their work through the Five Borough Farm initiative, a multi-year research and advocacy project spearheaded by a local non-profit organization. The gardeners tested and refined their methods throughout the 2013 growing season and continued their efforts in 2014. The initiative helped many participating gardeners realize that they had the resources to ask challenging questions about their practices and, working together, devise strategies for answering those questions rigorously and empirically.

In short, environmental education is not limited to children – and adults arguably stand to gain from teaching and learning around environmental issues. Popular education is one style among many that has already taken root in the fertile ground of New York City's community gardens. (Photo credit: Liz Barry.)



37. The Bronx River Art Center: Environmental art for urban renewal

Gail Nathan

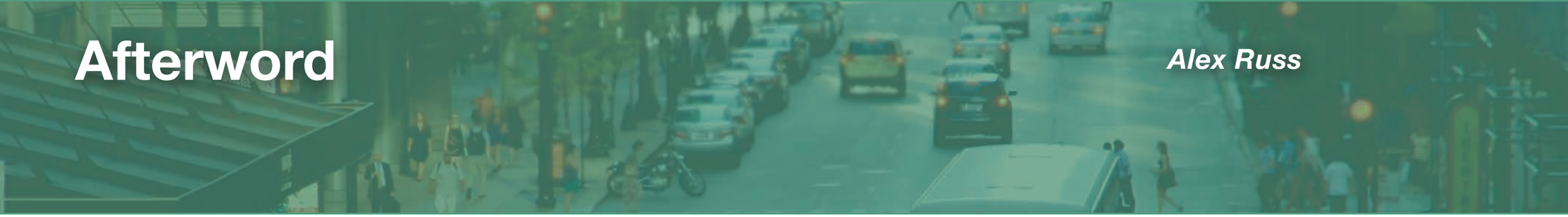
The Bronx River Art Center (BRAC), New York City, emerged in the mid-1980s as part of the first Bronx River Restoration Project – a resident-led initiative to restore the ecological health of this natural resource and the adjacent public spaces and neighborhoods. In 1987, BRAC self-incorporated as an independent arts organization with a mission to effect social and cultural change and wellbeing for the residents of the Bronx through innovative approaches to education, creative expression, communication and through building environmental awareness and stewardship of the Bronx River. For more than 27 years BRAC has been an anchor for urban revitalization, serving a culturally diverse, but economically challenged population of the South Bronx. Our mission guides our programs to ensure that the creative voices of our communities are heard, enriched and empowered. BRAC's core activities are: interdisciplinary art and environmental out-of-school-time programming for school-aged youth, classes for adults seeking an outlet for creative expression and civic engagement, and the creation and presentation of socially relevant contemporary art.

BRAC's signature program is its Teen Project Studio. Begun in 2005 as a summer program, called Eco-Media Institute, it was designed to engage youth in issues of environmental revitalization and urban design. Teen Project Studio became a year-round program in 2009 and its summer institute expanded to a four-day-a-week program with field trips to public sites, design studios, museums and galleries that expose students to current practices in sustainable urban design.

The thematic projects in the fine and digital arts help our students find creative expression for their personal outlook on their communities and the world.
A standout example of this is the "Virtual Monuments" project. Digitally designed sculptures are inserted into images of the local landscape using Photoshop™, then made available through QR codes printed on laminated tags strategically located throughout our community (tied to fences or pasted onto lampposts). These silent indicators offer not only aesthetic experiences, but also an awakening to the environmental potential of our area for the curious passerby with a mobile device in hand. One such work is of a monumentally scaled hand of shiny metal installed on the surface of the flowing waters of the Bronx River. The hand's gesture, silent and stoic, depicts a sentiment of hope and rejuvenation. Although virtual (it would cost hundreds of thousands of dollars to produce a real version of this work), viewers could stop to "smell the roses" with a simple tap on a smartphone.

Through such projects and others, like a biodegradable park bench for the Bronx River Greenway, of which students made a scale model produced through computer numerical control (a digital fabrication process), they learned and taught others to recognize and appreciate the natural world that is hidden among the housing projects, industrial sites and busy commercial thoroughfares of the Bronx. As they hone their skills in computer-based design practices, using applications and processes like Augmented Reality and 3D printing, they are also envisioning a better living environment for themselves, their families and their communities. In this way we also introduce our students to many professions and occupations in the creative and sustainable design industries, exposing them to new options for future careers they might not have considered without our program.

BRAC's 18,000 sq. ft. warehouse building, situated on the banks of the Bronx River, recently underwent an $11,000,000 City funded, sustainably designed renovation, in which BRAC has been able to reinvent itself as a 21st Century mecca for creative thought and production for environment preservation. Striking super graphics on all sides of the building invite the community to participate in the building of a healthier and more environmentally friendly South Bronx.



Afterword

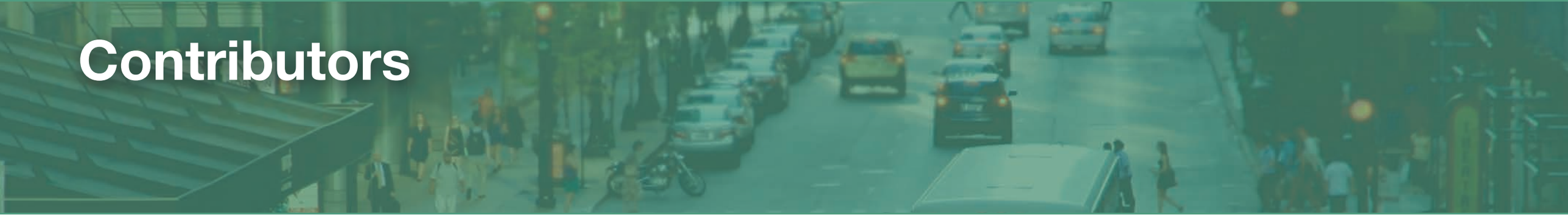
Alex Russ

This book advances our understanding of settings, audiences, teaching approaches and goals of urban environmental education. The authors of this book hope that it will help educators in the U.S. and elsewhere to reflect on their own work, and inspire new ideas to improve their educational programs.

This book shows that urban environmental education may contribute to both ecological and social dimensions of sustainability. On the one hand, urban environmental education is trying to develop urban residents' knowledge and community capacity to move towards cities that can be described as eco-efficient, zero-waste, carbon-neutral, biophilic, pedestrian-friendly, and resilient in face of climate change. On the other hand, urban environmental education also cares about positive youth development and human development in general, social capital, human equality, community participation in democratic environmental governance, social and environmental justice, generating new approaches to environmental governance, developing ecological identity, compassionate connection to urban places, and healthy lifestyles.

This book covers a range of relevant topics, but not all of them. For example, we do not emphasize enough adult environmental education in urban communities and industrial facilities; urban sustainability and resilience; urban environmental art such as filmmaking, installations, and murals; education related to environmental activism in cities; inclusion and diversity issues; urban environmental education related to community health and nutrition; and strategies for the integration of environmental education in urban environmental planning. The list of possible topics is always growing.

Urban environmental education is a very complex and exciting field. We encourage you to continue to explore and advance it by learning from publications in related fields, by visiting environmental education programs in different cities, and by exchanging ideas with other educators.



Contributors

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Adam works as an Outreach Naturalist with the Forest Preserves of Cook County which encompasses over 60,000 acres of Forest Preserves and the city of Chicago, Illinois. He has worked extensively in the development of culturally-based after school programs and culturally-based science curricula with the Indigenous community of Chicago, it is with this experience that he hopes to continue this work to design programs that respectfully explore the crossroads of culture and the environment.

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Akiima Price has a BA in Communications and over 23 years of on-the-ground experience leading environmental education in urban communities across the U.S. She is the Chief Principal with Akiima Price Consulting in Washington, DC, and is currently working with Outdoor Afro to develop cutting edge programs that engage stressed, low-income communities with nature for empowerment and healing.

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Bernadette is an Associate Professor of Biology at Loyola University Maryland, where she teaches and does research in plant ecology and is spearheading the start of a new minor in Environmental and Sustainability Studies. She obtained her BA in Biology at University of Virginia, where she developed her passion for outdoor education at the Mountain Lake Biological Station across many summers, and her PhD is from UNC-Chapel Hill, where her dissertation was on the role of behavior in a pollinator-mediated plant-fungal interaction.

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Caché Owens is a graduate student studying community planning and geography at University of North Carolina–Charlotte, with research interests in urban farming, farm preservation, social justice, and ethnic enclaves. In addition, Caché graduated with a dual BS degree in environmental planning and public administration from University of Wisconsin-Green Bay, and is currently a research assistant with the Charlotte Action Research Project working with neighborhoods to foster participatory community development strategies.

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Candice Russell, Director of Environmental Education and CREEC-LA Coordinator at TreePeople, has more than 10 years of experience in environmental education. She specializes in youth development, sustainability, and environmental justice.

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Cathy is a certified Montessori teacher and outdoor educator who specializes in teaching stream ecology, helping urban students of all ages discover a sense of awe and wonder for their natural world. She is currently working on becoming a Certified Master Naturalist with a concentration on the Coastal Plains region of Maryland.

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Christina has worked in the field of environmental education for over 13 years at various nature centers, outdoor learning centers, 4-H centers, and at three zoological institutions accredited by the Association of Zoos and Aquariums. Christina holds a BA in Anthropology, an MSc in Primate Conservation, and is currently the Manager of Community Education at the Jacksonville Zoo and Gardens in Jacksonville, Florida.

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Christine is finishing her doctorate at NYU, focusing on the relationships between environmental educators and learners, and the impact of these relationships on environmental decision-making. She's also a graduate of NYU with a Master's in Environmental Conservation Education, and works as a consultant on both local and national environmental education projects.

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Cynthia Thomashow is currently the Director of Urban Learning at IslandWood in Seattle, Washington designing a new M.A.Ed. in Urban Environmental Education that will launch in June, 2015. She directed the Masters program in Environmental Education at Antioch University New England (Keene, NH) from 1983 to 2007 and at the same time, directed the Center for Environmental Education, an online teacher resource center in environmental and sustainability education.

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Dr. Dara Nix-Stevenson, Ph.D., is a Teacher-Scholar-Activist who teaches high school biology and environmental science at the American Hebrew Academy in Greensboro, NC and blogs as Sincecombahee. Her research interests include critical environmental literacy, critical media literacy, and disaster education as it relates to the biopolitics of disposability embedded in post-disaster contexts and as it defines disaster response and recovery.

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Dave Conover is Clearwater's education director, overseeing Hudson River environmental education programs onboard the 106 ft. historic sloop *Clearwater*. He has a BS in forest biology from SUNY ESF and an MS from Antioch New England in environmental studies.

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Diane Krug has a B.A. in biology from Warren Wilson College and is the department chair of the science department at Greenwood School where she has taught biology and environmental science for 15 years. Diane spent 25 years working in various zoos and uses her experiences working with students to conduct citizen science projects on the school's 14 acres of wetlands in conjunction with the Jacksonville Zoo.

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Elizabeth Padilla is a Coordinator Educational Projects at Para La Naturaleza, a unit of Conservation Trust of Puerto Rico. She has an MS of Arts in Environmental Study/Environmental Education. Before she was a Coordinator Educational Projects, she was a Regional Superintendent to Para La Naturaleza. As facilitator and coordinator of educational projects, she assists others in the Puerto Rican population in achieving ecological literacy.

Emlyn James
Greenwood School

Emlyn James is the head of social studies and photography at Greenwood School in Jacksonville, Florida. where he has developed a series of short environmental films that compliment and promote the school's ongoing environmental education program. He has run education programs in five different countries, has his B.A. in History and is working on his Masters in Education where he is concentrating on the benefits of environmental education as it pertains to overall academic performance in middle and secondary school students.

Gail Nathan
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Gail Nathan is an interdisciplinary artist with expertise in arts administration, arts education and arts-based community development. Throughout her career she has advocated for cultural, environmental and educational justice, supporting the position that the arts can be an equalizing factor in the revitalization of underserved communities.

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Gretchen Abrams is a science teacher who has worked at camps, in community centers and with scouting troops in the Detroit area for ten years. While pursuing her masters degree in environmental education, gardening in school yards, and promoting environmental stewardship, she currently oversees after school programs for the school district in which she lives.

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Jim Quigley, PhD, is the faculty Director for the Environmental Design, Policy and Planning major of the Sustainability Studies Program at Stony Brook University, SUNY. He served as Director of the Center for Sustainable Energy at Bronx Community College, CUNY from 2003 to 2007, Director of the New Jersey Higher Education Partnership for Sustainability from 1998 to 2002, taught environmental studies at Ramapo College of New Jersey and Portland State University in Oregon, and from 1987 through 1994 was a researcher at the Center for the Biology of Natural Systems headed at the time by the late ecologist Barry Commoner at Queens College, City University of New York.

I. Malik Saafir
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Malik Saafir is the President & Founder of Janus Institute For Justice, Little Rock, Arkansas. Malik works collaboratively with civic and community organizations to end racial, economic and health disparities in low-income communities through social and environmental justice projects.

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Ilya Shmulenson is the Education Programs Manager at Keep Austin Beautiful He holds a Masters in Education from the University of Washington and has been involved with numerous environmental education and conservation organizations in New York, Seattle, Argentina, and Equatorial Guinea.

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Konrad has been Ex. Dir. of the Pittsburgh Regional Center for Science Teachers (Pennsylvania) for over 30 years providing professional development programs for K-12 teachers with current, accurate, and relevant information with a focus on the environment. After completing a MA in Clinical Psychology and teaching at all levels K-graduate school, she was actively involved in development of the Pennsylvania State Office and Pennsylvania Standards for Environment/ Ecology and in 2013 she received the Keystone Environmental Education Award from the Pennsylvania Association of Environmental Educators (PAEE).

Jennifer Brown
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Jennifer is an Environmental Education Specialist with the Texas Mid-Coast Refuge Complex in southern Texas. She grew up in urban Miami, Florida and found her love of connecting people with the natural word through her studies in college. She has worked as an interpretive park ranger for Louisiana State Parks and the US Fish and Wildlife Service in Louisiana and Ohio.

Jillian Agnello
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Jillian graduated with a Master of Arts in Environmental Conservation Education from New York University in May 2014 and has 4 years of experience as an informal educator. She is currently the full-time lead Teacher/ Naturalist for Audubon New York's "For the Birds!" program in New York City.

Joel Tolman
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Joel Tolman is Director of Impact & Engagement at Common Ground – an environmentally themed charter high school, urban farm, and environmental education center located in New Haven, Connecticut. He came to Common Ground as a classroom teacher in 2003, after 5 years of work managing school reform, youth development, and youth leadership projects at national non-profits.

Juliana Collier
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Juliana Collier is a certified Montessori teacher and school-wide environmental coordinator who, designed outdoor programs, wrote grants, and collaborated with the Maryland Department of Natural Resources, Fisheries Service to introduce urban students to nature-based academic programs. She facilitated an after-school “Green Team” of students from third through sixth grade who created posters with “green” themes, encouraged students to recycle, and performed skits promoting the importance of caring for the earth and all living things.

Justin Smith
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Justin is a postdoctoral fellow with EECapacity at Cornell University and the Civic Ecology Lab. His work focuses broadly on community resiliency, and the formation of communities of practice through digital technologies to address wicked problems.

Karen Morrison
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Karen is a Marine Corps Veteran, Master Gardener, Master Recycler, Master Food Preserver, and "Head Dreamer of Dreams" for the "Feed Thy Neighbor" Garden Project. She is currently the Nutrition & Wellness Specialist for the Family Tree Relief Nursery in Albany, Oregon where she has created an "Edible Community Ecosystem" that feeds the body and soul of all who enter.

Karen Siddall
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Karen Siddall retired from the City of Irving, Texas, in October 2014 after almost 20 years as the stormwater program coordinator, and currently serves as the Public Relations and Education Administrator for the Prairielands Groundwater Conservation District covering Ellis, Hill, Johnson, and Somervell counties in rural north central Texas. She has a Bachelor of Science and Master of Arts in Criminal Justice with a minor in Biology, and is a volunteer water quality monitoring trainer with the Texas Stream Team program.

Kathy McGlauflin
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Kathy McGlauflin is Senior Vice President of the American Forest Foundation and national director of Project Learning Tree, based in Washington, DC. She is co-author of Living Lightly in the City, an urban environmental education curriculum. She formerly directed youth programs for the National Audubon Society and worked as education coordinator for the National Wildlife Federation.

Ken Leinbach
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Ken Leinbach is a nationally recognized educator and leader in community-based environmental education who for the past 16 years has been a catalyst for the creation and growth of the award winning Urban Ecology Center in Milwaukee. Ken's contagious energy makes him sought after as a public speaker on a broad array of topics ranging from urban environmental education, community organizing and sustainable design to fundraising, the power of story, leadership, and green living.

Laura Milkert

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Laura is the Stewardship Coordinator in the Science Action Center at The Field Museum of Natural History in Chicago, Illinois. She has worked extensively in the environmental field, designing and implementing experiential programs in the Chicago Wilderness region for over ten years.

Mandy Breuer

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Mandy Breuer has worn many hats at Environmental Charter High School since 2006 – as a teacher, a counselor, and now the Principal of this award-winning high school. She is a passionate environmental educator who spends her time designing learning spaces that build the whole student academically, socially, emotionally, mentally, and physically.

Maria Moreno

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Maria works in the Multicultural Outreach for Earth Partnership program at the University of Wisconsin–Madison Arboretum. In addition to assisting with teacher professional development in restoration education, she designs and coordinates service-learning courses as well as international internships on environmental education for college students while coordinating the Indigenous Arts and Sciences and the Latino Earth Partnership programs that reach out to communities and schools with the goal of building the next generation of land and water stewards.

Marianne Krasny

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Marianne Krasny is Professor and Director of the Civic Ecology Lab in the Department of Natural Resources at Cornell University; her work connects environmental education and social-ecological systems in urban and other settings in the U.S. and internationally. She is the Principal Investigator for the EECapacity project, which funded this book.

Marijke Hecht

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Marijke is Director of Education with the Pittsburgh Parks Conservancy, where she leads the organization's efforts to engage people of all ages and backgrounds in urban environmental education using public parks as classrooms. She is also project manager of the effort to rebuild the Frick Environmental Center in Pittsburgh's largest city park, which will be a living laboratory for community education and is designed to meet both the Living Building Challenge and LEED Platinum standards.

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Michael Cruse is a writer and educator focusing on the intersection of green infrastructure, school sustainability and Career and Technical Education (CTE). He teaches in Arlington County Public Schools' CTE program (VA), and serves on the board of Gearin'Up Bicycles, a Washington, DC non-profit, teaching urban youth mechanic skills and cycling safety.

Michelle Byron

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Michelle, a native of rural northeastern Pennsylvania, is an environmental educator for The Horticultural Society of New York and creator of a forest and garden preschool co-op in Manhattan. She is pursuing a Masters degree in Natural Resources/ Environmental Education and Interpretation at University of Wisconsin Stevens Point and has a BS in Liberal Studies (environmental science) from Misericordia University in Pennsylvania.

Monica Elser

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Monica Elser is the Education Manager at the Julie Ann Wrigley Global Institute of Sustainability at Arizona State University where she engage K-12 students and teachers in inquiry-based sustainability science projects that link urban communities with ASU research. She holds an M.S. in Ecology and an M.Ed. in Curriculum and Instruction.

Murray Fisher

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Murray Fisher is the Founder of the Urban Assembly New York Harbor School, the founder and President of the New York Harbor Foundation and the co-creator of the Billion Oyster Project. Prior to starting Harbor School, Murray worked for the Hudson Riverkeeper and the Waterkeeper Alliance.

Peter Malinowski

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Pete Malinowski is the co-founder and director of the Billion Oyster Project for the New York Harbor Foundation. Before the Foundation, Pete worked founded the Aquaculture program at Harbor School where he was a teacher for 5 years.

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Philip Silva is a PhD candidate in Natural Resources at Cornell University and the co-founder and director of TreeKIT, an initiative to measure, map, and collaboratively manage urban forests. His work focuses on informal adult learning and adaptive co-management in urban ecosystems.

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As the Education Resource Specialist at Madison Audubon Society Rebecca develops environmental education programs for audiences of all ages throughout south-central Wisconsin, with a focus on youth in under-served communities. In her spare time, she leads education programs at Madison's AZA-accredited Henry Vilas Zoo.

Robert Hughes

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Robert is the founding Executive Director for the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR), a regional organization whose mission is to reclaim land and water impacted by past mining practices, and build coalitions to educate students and community leaders on watershed issues in Pennsylvania's Northern Appalachian Coalfields. Robert has 22 years of experience in the field of Anthracite mining, mining history, watershed restoration, and environmental education in Pennsylvania with a background in hydrogeology and water pollution control technologies and has coordinated 15 state-wide Conferences on abandoned mine reclamation and historic preservation of cultural and environmental resources within the Coalfields of Pennsylvania.

Robert Withrow-Clark

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Robert Withrow-Clark is a 4-H Youth Development Advisor for the University of California, Cooperative Extension, serving San Joaquin and Stanislaus Counties. He holds an MA in Educational Administration and Leadership and is a candidate for an Ed.D in Curriculum Instruction (emphasis in Outdoor/Environmental Education and Human Ecology) with a cognate in Educational Psychology, both from the University of the Pacific.

Sam Janis

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As the restoration program manager for the New York Harbor Foundation Sam worked to expand the Billion Oyster Project's (BOP) shell collection and middle school programs as well as develop the brand and the project's website. Now, as the BOP schools Project Manager Sam implements the National Science Foundation funded BOP Curriculum and Community Enterprise grant to develop a BOP curriculum for middle schools and teacher training class at Pace University.

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As an Urban Park Ranger, Sunny currently educates the citizens of New York City about the natural environment they currently share with a variety of wildlife. She graduated from the University of Nevada, Reno with a BS in environmental science and received her Masters from New York University in 2010 for Environmental Conservation Education.

Susan Baron

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Susan works on a grant at the Missouri Botanical Garden exploring the potential for location-based, educational smartphone games to encourage pre-teen kids to engage with science at institutions and in their communities. Previously, Susan has worked with community gardening projects and earned an MS degree in Environmental Education from Antioch University New England.

Timothy Goodale

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Tim Goodale is an Assistant Professor of Science Education and the program coordinator for the Masters of Art in Teaching (MAT) in STEM Education Program at NC State. Tim earned his BS, MS and PhD from Old Dominion University in Norfolk, Virginia. His research interests include marine science and environmental education, effective use of engineering design in teaching and learning, and teacher efficacy and pedagogical content knowledge in the STEM fields.

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Tom is a hybrid professor-adviser-trip leader at Bard College in upstate New York. Tom has worked with several excellent environmental education programs like Hudson River Sloop Clearwater, New York State Department of Environmental Conservation camps, University of Vermont's Environmental Program, San Mateo Outdoor Education, the University of Michigan's Program in the Environment, and The Nature Conservancy's LEAF program.

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Twila is the Manager of Scholastic Outreach & Education for the Allegheny County Sanitary Authority (ALCOSAN) located in Pittsburgh, Pennsylvania. She has been an environmental educator since 2002 and holds a master of arts in curriculum & instruction, and a master of science in counseling psychology.

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Vivian Masters received her masters in elementary education at University of Northern Colorado. She enjoys working outdoors with children of many ages at the Plains Conservation Center in Aurora, Colorado.