

# **WORKING COOPERATIVELY WITH SCHOOL SYSTEMS TO INTEGRATE CLIMATE CHANGE EDUCATION WITH A LOCAL CONTEXT INTO SCHOOL SYSTEM CURRICULUM**

*Jaime Bunting, Pickering Creek Audubon Center, USA*

*Krysta Hougen, Pickering Creek Audubon Center, USA*

*Mary Helen Gillen, Pickering Creek Audubon Center, USA*

*jbunting@audubon.org*

**In the Chesapeake Bay watershed, Audubon has worked with local school systems to integrate climate science units into upper elementary and middle school curriculum. Pickering Creek Audubon Center worked closely with public schools to implement grade-wide climate programming with students in fifth and sixth grade. Through participation in the Maryland and Delaware Climate Change Education, Assessment, and Research project and the National Oceanic and Atmospheric Association’s Climate Stewards Education Project we are sharing these successes with statewide partners and working towards implementing climate change curriculum more broadly across the state. Through academic and teacher professional development programs, Pickering Creek Audubon Center educators train teachers on integrating climate science into their current lessons and review and collaborate on parts of the program teachers will lead in the classroom. Students are connected to climate change through a series of engaging in class and field activities over the course of several weeks. With the term “global climate change” making climate change seem more like a global problem and less like a local problem, Pickering Creek educators use wetlands and birds as examples of local habitats and wildlife impacted by climate change. Through these lessons led by Pickering Creek Audubon Center educators and augmented by material covered by classroom teachers, students get a thorough introduction into the mechanism of climate change, local impacts of climate change on habitats and wildlife, and actions they can take as a community to mitigate the effects of climate change.**

*Key words: school systems, climate change education, partnerships*

## **I. INTRODUCTION**

Pickering Creek Audubon Center in Easton, Maryland, is a 400-acre wildlife sanctuary located on the Eastern Shore of the Chesapeake Bay. Found within the Chesapeake Bay Watershed and Atlantic Flyway, the sanctuary consists of a variety of habitats, including a tidal creek, restored freshwater wetlands, forests, agricultural fields, meadows, and shrub-scrubland. The Center is dedicated to community-based conservation of natural resources through environmental education and outreach on the Eastern Shore of the Chesapeake Bay and uses the surrounding landscape to connect people with the environment.

Operating under the umbrella of the National Audubon Society, Pickering Creek aims to meet national strategic goals relating to bird habitat and climate change. In 2015, Audubon published its Birds and Climate Change Report, which stated that climate

change is the single greatest threat to North American birds [1]. In response to this report, Audubon created its Audubon Climate Initiative to “encourage members to take steps to address the climate change threat in their backyards, in their communities, in the Important Bird Areas (IBAs) near their homes, and in the state houses” [2].

Pickering Creek’s mission to conserve natural resources through education is the foundation of the Center’s goals and, therefore, its programs. Meeting National strategic goals, such as those relating to climate, likewise plays an important role in the Center’s educational and outreach efforts in the local community. Pickering Creek wants students to connect to the natural world, understand local environmental problems and issues, and feel empowered to take action and make informed decisions. An increasingly relevant and important issue on the Eastern Shore of Maryland is climate change and sea-level rise due to climate change. To address this issue on a large scale, Pickering Creek Audubon Center staff works closely with local school systems and community groups to integrate climate change education into school curriculum.

By building on the existing relationships and the content from professional development trainings, Pickering Creek worked cooperatively with local schools to integrate climate change units into the science curriculum. Similarities are found within the strategies that made both the fifth and sixth grade programs successful, such as: working collaboratively with teachers and science curriculum supervisors to develop content; integrating climate change content into the existing curriculum; focusing content on local problems and issues; and encouraging student action and solutions.

## II. DEVELOPING SUCCESSFUL CLIMATE CHANGE EDUCATIONAL PROGRAMS

### *Developing Trusted Partnerships with Local Schools*

Pickering Creek has a long-standing relationship with Talbot County Public Schools (TCPS), among other local school systems, providing environmental education programs since 1981. For the past 34 years, Pickering Creek has provided environmental education programs on a wide range of topics suitable for students in kindergarten through 12<sup>th</sup> grade. Pickering Creek educators see every TCPS student in grades 1-10 at least once per school year through a series of in-class lessons and field experiences at the sanctuary.

The Center’s programs are multi-faceted and build upon each other in successive years. For example, the content students learn about changing landscapes and forests in third grade expands on what the students learned about plants and soils in second grade. Programs are integrated into existing science curriculum within the schools (e.g. after learning about the water cycle in the classroom, first grade students visit the Center for a field trip that relates the water cycle to wetland habitats and wildlife). TCPS teachers have relied on Pickering Creek for over thirty years to provide curriculum-aligned environmental education programs. The Center is an integral partner in assisting the school system as it adjusts to changing science standards.

All public schools in Maryland are currently implementing the Next Generation Science Standards (NGSS), a new set of standards that encourages critical thinking,

engineering and design, scientific practices, disciplinary core ideas, and cross-cutting concepts found across scientific disciplines. Teachers are not told how to teach, but rather what their students should know and be able to do by the completion of a grade band (e.g. middle school). The NGSS are the first set of standards that specifically mention climate change as a concept to be taught in public schools. Pickering Creek tied National Audubon Society goals to changing science standards by developing new climate-focused programs for upper elementary and middle schools.

Prior to developing climate-focused programs aligned with NGSS, Pickering Creek Audubon Center educators participated in climate change education and training opportunities with the National Oceanic and Atmospheric Association's (NOAA) Climate Stewards Education Project (CSEP) and the Maryland and Delaware Climate Change Education, Assessment, and Research project (MADE CLEAR). CSEP and MADE CLEAR provided education on the science behind anthropogenic climate change, trainings on how to communicate that science to students, teachers, and communities, and funding for implementing climate change programs.

### *Working Collaboratively with Teachers and Science Curriculum Supervisors*

MADE CLEAR hosted a five-day summer workshop in July 2014 that brought together educators from across Delaware and Maryland. Jaime Bunting, Education Manager at Pickering Creek, attended the workshop as part of a team with two middle school science teachers, Leslie Sorrell and Matt McCowan, from Easton Middle School (EMS). Scientists and educators from NOAA, the University of Delaware, and the University of Maryland presented on the science behind anthropogenic climate change and strategies for teaching these concepts to students.

Bunting, Sorrell, and McCowan worked closely throughout the workshop to determine appropriate ways to integrate climate change into the TCPS sixth grade science curriculum. Together, they decided to update the sixth grade service-learning lessons. The existing service-learning program already focused on wetlands, but the program did not link to content taught in the classroom. Bunting, Sorrell, and McCowan created a new program taught by both Pickering Creek educators and the classroom teachers that shifted the focus to climate change and wetlands and required an ongoing teaching partnership by both classroom teachers and Pickering Creek educators. After a meeting with the TCPS science curriculum supervisor, Bill Keswick, the program was approved for all of the TCPS sixth grade science classes at EMS and St. Michaels Middle High School.

The program has been successful because of the initial partnership between Pickering Creek Audubon Center educators and sixth grade science teachers and continues to improve each year thanks to continued collaboration and communication between the two groups.

Teacher collaboration and support played an equally important role in the fifth grade program at Easton Elementary School (EES). Developed by Bunting and Pickering Creek EcoCamp Director and Teacher/Naturalist, Krysta Hougen, and supported by CSEP, the program introduced climate change to all fifth grade science classes at EES through a series of lessons led by Pickering Creek educators and augmented by teacher-led lessons and class research projects. Bunting and Hougen met with the fifth grade

team and EES principal at the start of the school year to discuss the program and receive teacher feedback. The teachers were enthusiastic and provided valuable insight into their science curriculum that ultimately helped shape the program. For example, the fifth grade teachers told Bunting and Hougen that the students were unfamiliar with elements and the period table, a necessary topic to understand the carbon cycle. In response, Pickering Creek Audubon Center educators wrote elements and the period table into the lessons to ensure the carbon cycle could be well-understood by students. Collaboration between the teachers and Pickering Creek Audubon Center educators prevented this critical link from being missed and creating gaps in student knowledge.

While Pickering Creek educators taught three in-class lessons to each of the fifth grade science classes, the teachers agreed to administer pre- and post- tests to gauge student learning, teach a Pickering Creek-developed lesson on carbon footprints, and lead a class research project about local plants and wildlife affected by climate change. “The partnership between informal environmental educators and the school made the program stronger... Classroom teachers provided much needed time outside of the Pickering Creek-led lessons to clarify any questions or prepare for the next lesson. Asking teachers to develop their own class research topic resulted in thoughtful and creative projects, which helped attract visitors to the fifth grader’s display at a local wildlife festival and allowed both students and teachers to take ownership of the project as a whole” [3].

### *Integrating Climate Change Content into Existing Curriculum*

Collaborating with both fifth and sixth grade teachers at EES and EMS allowed for strong climate change programs in the classroom and the field. Sorrell and McCowan agreed to teach climate change lessons during each science unit throughout the school year, and to train the other sixth grade science teachers on communicating climate science. The multi-unit approach to teaching climate change ensures that students continually participate in climate-focused labs and activities throughout the year, building on each lesson. Pickering Creek programs are scheduled during corresponding classroom units. For example, the “Wetlands as a Natural Resource” lesson is taught during the Natural Resources unit, and the “Wetland Soils” lesson is taught during the Geology unit. Students keep a folder of all climate change labs and activities throughout the school year, and the program culminates in an end-of-year field experience and wetland planting at Pickering Creek Audubon Center. Integrating the climate change lessons into the existing unit structure allows for students to continually learn about climate change throughout the year from September through June.

The fifth grade climate program was delivered during the Ecology unit. After teachers taught about the relationship between organisms and their environment, Pickering Creek Audubon Center educators introduced climate change to the classes. Students learned the science behind climate change, how human activities are largely responsible, and how climate change is impacting local ecosystems. Building on their ecology unit, students researched how local animals and plants may be affected by environmental changes due to climate change.

Classroom teachers provided feedback and suggestions about classroom tools available to augment the lessons and activities, such as apps and programs on iPads already familiar to the students. Integrating familiar classroom tools and technology

allowed students to better visualize climate change concepts. Meetings with the TCPS science coordinator are currently underway on how to best continue the program with the possibility of changing grades to better integrate with the school curriculum.

### *Focusing Content on Local Problems, Issues, and Habitats*

Visualizing climate change concepts can be challenging; the use of technology and metaphors, such as referring to carbon dioxide and other greenhouse gases as “heat-trapping blankets,” was beneficial for helping students understand climate change in both programs. However, perhaps the most helpful aspect was focusing content on local problems, issues, and habitats. While it can be easy to focus on the “global” part of global climate change, that can be overwhelming for students. Pickering Creek educators want students to grasp exactly what global climate change means for wildlife and habitats on Maryland’s Eastern Shore.

To do this, Pickering Creek chose an important habitat to birds migrating and residing along the Atlantic Fly – wetlands. Fresh water, brackish, and salt marshes are found along the Eastern Shore and many students are familiar with these types of habitats through recreation, hunting, field trips to Pickering Creek Audubon Center, or simply living near them. Many Easton students are likewise familiar with many of the birds and wildlife that depend on wetland habitats. This connection to wetlands provided a logical context for investigating climate change on a local scale.

In the fifth grade program at EES, students began their climate change program with an introductory lesson on the carbon cycle and the impacts of a disrupted carbon cycle on global climate. Students learned the difference between carbon sinks and carbon sources, and the importance of carbon sinks in keeping the carbon cycle balanced. Students then narrowed their focus to how climate change is disrupting local ecosystems. With Maryland’s Eastern Shore experiencing sea-level rise at two to three times faster than the global average [4], students investigated the impacts of habitat loss due to climate change on local wetlands and the wildlife depending on those wetlands.

Sixth grade students similarly focus on wetland habitats and climate change, with a more in-depth focus on the mechanism of wetlands as carbon sinks. During a soil lab, students determine that anoxic wetland soil creates an environment that slows the process of decomposition of plants, effectively “trapping” carbon in the soil. The sixth grade field experience at Pickering Creek emphasizes the ability of wetland soil, in addition to the plants and the water present in wetlands, to store more carbon than it produces, thus acting as a carbon sink. During the field experience, students explore this carbon sink closely by wading through restored freshwater wetlands, surveying macroinvertebrates, planting native wetland plants, and playing games that connect wetlands, birds, and climate change. The focus is entirely on the impacts of climate change on local habitats and wildlife, and the importance of carbon sinks like wetlands.

### *Student Action and Solutions*

Climate change is an overwhelming global problem, especially for young students. Pickering Creek focused on local impacts and individual and community-based actions manageable for students in upper elementary and middle school grades. Students

learn about the problems caused by climate change, but spend an equal amount of time discussing, choosing, and implementing an action project. Pickering Creek encourages student action and emphasizes solutions, not just problems and issues. This is an important component of Pickering Creek programs so that students walk away with a greater understanding of local problems and issues, as well as ideas for how to address those problems and the skills necessary to take action or make informed decisions.

Students in the fifth grade program completed an individual and community/class-based action project. Classes created a display to educate the public about climate change for a local festival that draws thousands of visitors each year. As visitors walked the length of the display they learned about the carbon cycle, climate change, the importance of carbon sinks, the impacts of climate change on local wildlife, and suggestions for reducing one's carbon footprint. Visitors left the display with native plant seed balls made by the students that also contained messages about native plants, climate change, and solutions. Students joined the community effort to increase carbon sinks by expanding their school garden. Individually, students calculated their carbon footprints and signed a pledge to reduce them. After brainstorming ways to change their daily habits and activities, each class successfully reduced their carbon footprint by the end of the program [3].

While exploring wetland habitats at Pickering Creek Audubon Center, sixth grade students discussed potential individual and community actions to mitigate the effects of climate change, such as protecting existing carbon sinks or creating new ones. Planting native wetland plants in a restored freshwater wetland at Pickering Creek allowed the students to take tangible action and leave a lasting mark on a local habitat. Students completed reflections about ways to reduce their own carbon footprints, such as using less energy, using alternative forms of energy, reducing the use of "one use" items that require lots of packaging and are thrown away after one or two uses, and purchasing items that are made or grown locally.

### III. CONCLUSION

Neither the fifth nor sixth grade programs would exist without extensive training in climate science, climate change, and effective methods for communicating climate change. Educators must feel confident with the content to be able to explain climate change clearly and concisely to the public, especially to children, in ways that are meaningful and relevant. Pickering Creek educators completed multiple intensive climate change training programs through NOAA CSEP and MADE CLEAR, and likewise trained teachers on climate science and communication techniques. Pickering Creek staff continues to deepen their own knowledge and understanding of climate change through ongoing climate trainings and professional development while sharing this content with local teachers.

In addition to a solid background in climate change, successfully integrating climate change into schools takes time and a strong collaboration between educators. The collaboration between educators at Pickering Creek Audubon Center, Easton Elementary School, Easton Middle School, St. Michaels Middle High School, NOAA, and MADE CLEAR made the fifth and sixth grade climate change programs possible and provided opportunities for the partners to learn from each other. Pickering Creek

Audubon Center educators better understand the science curriculum structure, the needs of the teachers, and the changing science standards. Classroom teachers provided useful feedback, lessons, and enthusiasm that helped create more in depth and relevant content and activities for students. Classroom teachers learned about climate science and available educational resources and methods for communicating climate change to their students and peers. Fifth and sixth grade students not only gained knowledge about climate change in general, but a connection to the local impacts of global climate change through explorations of wetland ecosystems on the Eastern Shore, as well as opportunities to take action.

The initial, committed partnerships have ensured a continuation of the programs and created open lines of communication between educators so the lessons may continue to improve and adjust to changing curriculums over time.

#### IV. ACKNOWLEDGMENTS

Pickering Creek Audubon Center thanks the NOAA Climate Stewards Education Project and MADE CLEAR for their ongoing training and support of climate change education in local schools. We also thank Talbot County Public Schools and the fifth and sixth grade science teachers at Easton Elementary School, Easton Middle School, and St. Michaels Middle High School for their insight, teamwork, and enthusiasm.

#### V. REFERENCES

[1] G. Langham, J. Schuetz, C. Soykan, C. Wilsey, T. Auer, G. LeBaron, et al, "Audubon Birds and Climate Change Report: A Primer for Practitioners," *National Audubon Society*, New York, 2015.

[2] "Audubon Climate Change," accessed May 10, 2016.  
<http://www.audubon.org/conservation/climate-change>

[3] K. Hougen and J. Bunting, "Carbon Footprints, Carbon Sinks, and Carbon Stewardship: A Partnership Between Informal Educators and Classroom Teachers," *The Earth Scientist*, vol. 32, Spring 2016, pp. 14-18. Copyright *The Earth Scientist*.

[4] B. Goldner, "Rising Seas Part 1: Sea level, sinking land put Maryland's waterfront communities at risk," *Capital News Service*, July 28, 2013, accessed May 10, 2016. <http://marylandreporter.com/2013/07/28/rising-seas-part-1-sea-level-sinking-land-put-marylands-waterfront-communities-at-risk/>