When Nature Gives You Ticks, Create a Tick Curriculum

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Proper identification required close observation.

Photos: Robin Huntley

If there was ever a real-world problem needing to be solved to grease the skids for place-based learning in the United States, Ticks R It. Start a conversation about using the natural environment, or taking learning outside, or studying the bobolinks in the meadow, and ticks start crawling through the recesses of school administrators' and parents' minds. Can we just keep the children safely inside, away from the nefarious, disease-laden, creepy-crawly ticks?

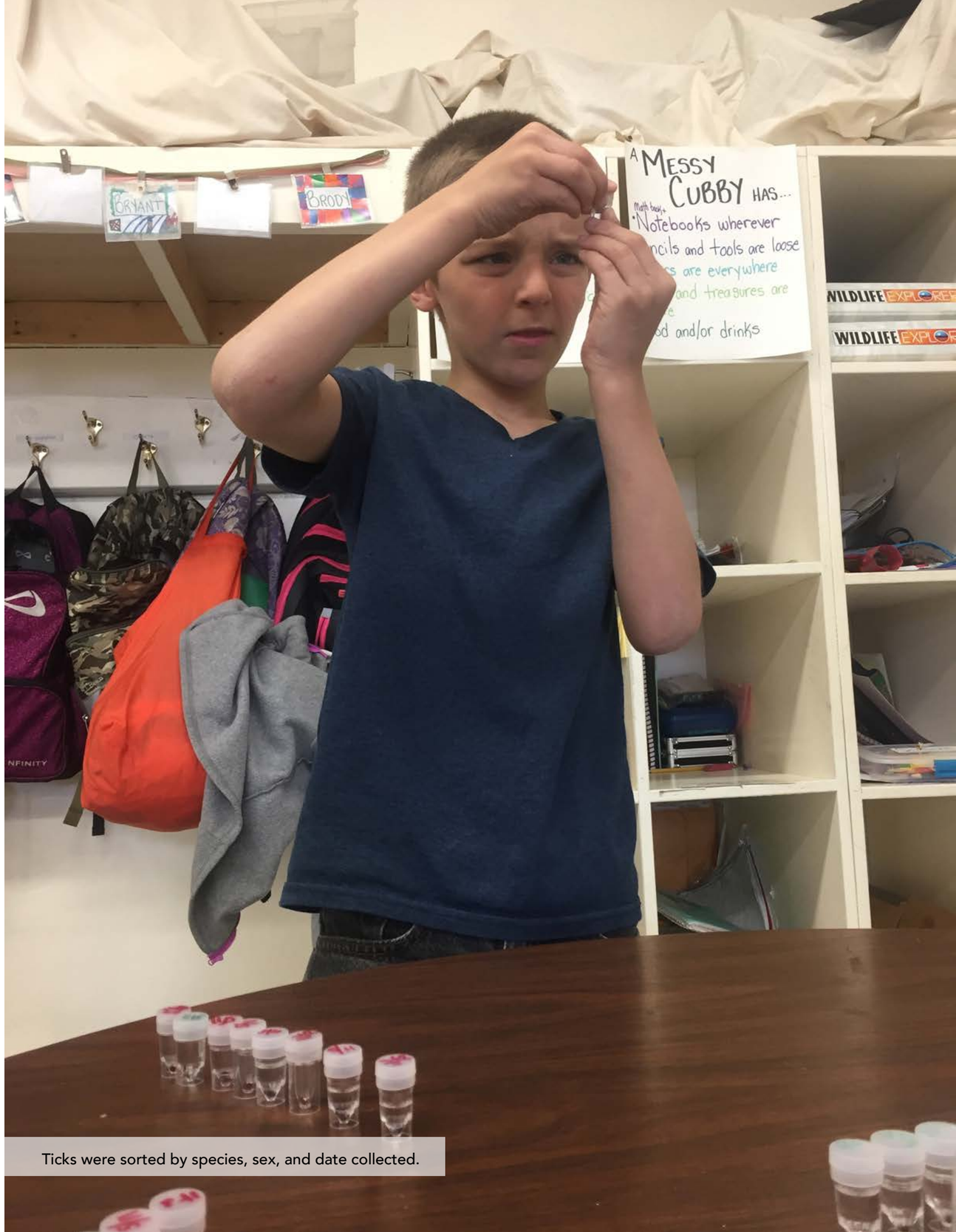
Ticks and their associated diseases are perceived as a scourge across the northeastern United States, and rightfully so. Lyme disease is no laughing matter. Over the past couple of decades, ticks have become comparable to the bacteria that cause cavities in your teeth. They are there all the time, we cannot avoid them, and we must learn how to live with them. This article describes how a surging tick population on the grounds of a rural Maine school inspired a class of third-graders to engage in a study of ticks, their habitat, and behaviors.

Let's first place this story within the broader context of progressive education and this issue's focus on place-, problem-, project-, and phenomenon-based learning. John Dewey's notion that classrooms should be "laboratories of democracy" suggests that when problems emerge in the classroom, they can be solved using democratic principles to illustrate how to live in a democratic society (Dewey, 1916). Problem-solving naturally lends itself to classroom projects – let's set up a voting system to determine who takes care of the hamsters or whether we need to line up for lunch. That is problem- and project-based learning. Place-based learning takes this idea and broadens it into the school, the schoolyard, and the community. Given that our understanding of ecology and natural systems has evolved since Dewey's time, it is incumbent that we view not just the classroom, but the school and its surroundings as a laboratory for democracy and ecosystem health. Place-based learning takes problem- and project-based learning and rolls back the horizon of appropriate engagement. Same pedagogic principles, but with a dash of ecology and a pinch of systems thinking thrown in (Smith and Sobel, 2010).

Which brings us to rural Maine, where the landscape, geography, and climate dictate that life is lived in accordance with one's surroundings. The state's traditional industries rely heavily upon natural resource extraction such as logging and fishing. Many small communities are economically grounded in these resources. In the small schools found in these communities, curriculum that acknowledges and draws from the land-based nature of local culture makes for rich and meaningful learning opportunities. For instance, a 2013 Weather Blur project coordinated by the Maine Math and Science Alliance gave lobster traps to a small cohort of schools located in island communities in central and southern Maine. These traps were attached to local piers and classroom lessons were built around what children pulled up from the deep. The findings surprised everyone – a surge of green crabs, evidently moving north as a result of the Gulf of Maine's rising ocean temperatures. Tied to students' local lifestyle and culture, this example of place-based learning shows how this way of teaching engages students in the world around them, especially important at a time when an understanding of that world is rapidly diminishing.

The expansion of the green crabs' range is just one of the impacts of climate change evident in Maine's landscape. Across the northeastern United States, average temperatures have risen 1.5 degrees Fahrenheit since 1970 (Union of Concerned Scientists, 2007). This change is most pronounced during the winter, when average temperatures are now four degrees higher than in 1970. Without a significant reduction in carbon emissions, Maine can expect to see average temperatures rise as much as 13 degrees above historic levels by the year 2100. This change is accompanied by sea level rise, which, in the past 12 years, has led to $70 million of lost property valuation in Maine's coastal communities (Valigra, 2019).

Preparing students for life on this changing planet is an immense task, but an essential one. Engaging students in exploring real-life problems in their communities helps them to take ownership of their relationship with the natural world, develop a stewardship ethic, and learn problem-solving skills essential to adapting to a changing climate – all while working to hone a host of academic skills, too.



Ticks were sorted by species, sex, and date collected.

Students updated the graph daily; color-coding was included to indicate species.

At Ames Elementary School in Searsmont, Maine, place- and problem-based learning enabled students to investigate an ongoing climate-driven issue in their schoolyard: the presence of very large tick populations. A small, rural school educating roughly 120 students from three towns, Ames' student body is made up of children who spend a lot of time outdoors. Within the school community, a handful of children and adults have been diagnosed with Lyme disease (see sidebar). Some of those affected have experienced extreme and chronic symptoms, a fact that led a culture of fear to develop within the school community.

According to the Maine Center for Disease Control and Prevention, there were 1,373 cases of Lyme disease statewide in 2018. In 57% of cases, symptoms began in June, July, or August, and in 40 cases, hospitalization was required. Lyme disease is caused by the bacteria Borrelia burgdorferi, which is carried only by infected deer ticks. The most common symptoms found in reported cases include:

- Erythema Migrans, a migrating rash
- Arthritis or joint swelling
- Bell's Palsy and other neurological abnormalities

Rates of Lyme disease have increased significantly over the past decade in Maine and throughout New England. Untreated, Lyme disease can spread to other parts of the body for several months to years after infection, causing persistent arthritis and nervous system problems (Maine Center for Disease Control and Prevention, n.d.).

During the spring of 2017, tick populations soared on Ames' playground. After recess, ticks were found crawling on sneakers, scampering up legs, and meandering through hair. This made checks for the tiny arachnids part of the students' daily routine. The sudden population spike should have come as no surprise. While the preceding winter was cold and snowy at times, it never lasted long enough to keep tick populations at bay. Snow came before the ground had frozen hard, meaning that the snow acted as a blanket, insulating the soil habitat where ticks overwinter.

The school's response to the ticks was to chemically treat outdoor play areas and to log all ticks found on students' bodies, regardless of whether they had been bitten. It quickly became standard practice for students to pick ticks off themselves, wrap them in tape, and walk down to the nurse to have their tick documented.

In the spring of 2018, the Ames community again noticed conspicuously large numbers of ticks. Some teachers observed that portions of the playground were free of ticks and other areas were saturated. Other teachers observed that some students were much more likely to find ticks on themselves after outdoor time than others. Based on these anecdotal findings, the opportunity for a study became evident, and one of the school's third-grade classes led the effort.

This 16 student third-grade class had engaged in experiential, nature-, and place-based learning all year long through weekly Forest Fridays, numerous place-based studies, and lots of unstructured playtime in the school's small forest. Through this work, the group had developed a sense of ownership over the small woods that they used as their outdoor classroom. This space (a former gravel pit) included wooded areas of deciduous and evergreen trees, a grassy meadow, and some stretches of maintained lawn.

The first ticks of the season appeared on March 1st, when a thaw brought springtime temperatures that revealed large swaths of bare ground amongst the snow that remained. During the group's first academic block following recess, two distinct cries of, "Oh, I've got a tick!" rang out. After marveling at finding ticks when it was essentially wintertime, students wrapped their ticks in tape and went to have them documented. The tape-wrapped ticks were then added to the class' nature collection, a shared space filled with seasonally relevant specimens. The two samples were later identified as deer ticks and were the subject of lots of discussion and study during the following few days.

The occurrence of ticks was scant throughout the rest of March and April but in early May, after the weather had been warm for a few weeks, the number of ticks found on students increased significantly. Between recess in the woods, Physical Education classes

on the soccer field, and some reading time on the playground, the third-grade class was finding five to ten ticks per day. As a result of this sudden spike in sightings, the Tick Curriculum Study was born.

Materials for scientific specimen collection were provided and students quickly learned to gather, contain, and label each tick. Students expertly pinched ticks between their thumb and forefinger while patiently waiting for another student to fill a 1" tall plastic vial with isopropyl alcohol from a squeeze bottle. Then, the specimen was dropped into the alcohol, a lid snapped on, and the date written on top in permanent marker. Materials accompanied students during outside adventures for swift collection, and what began as an adult-assisted endeavor quickly became almost entirely student-led.

Lesson plans quickly shifted to be tick-centric to assist students in their investigation. Science blocks were spent poring over photographs and illustrations of deer and dog ticks to learn the identifying characteristics of male and female ticks of both species. Upon observation of enlarged images of deer and dog ticks, students were able to recognize the key identifying characteristics themselves. All dog ticks, they noticed, have a light, mottled pattern on their backs, while deer ticks have no such pattern. Male dog ticks have a fully patterned back, while females wear what the students called a "bib" of the pattern. Deer ticks are much smaller than adult dog ticks, and males are dark but have a light ring around the outer edge of their abdomen while females wear a dark "bib" and have an otherwise orange back. This was refined scientific observation.

After learning to expertly identify specimens, students compared and contrasted deer and dog tick appearance during writing time. Informational booklets on ticks were distributed as reading material, providing a relevant opportunity to strengthen nonfiction reading skills. Math lessons involved lots of data collection through specimen identification and updating the class' tick specimen graph. In their free time, students drew images of ticks biting human skin, ticks waiting for food on thin blades of grass, and ticks getting folded into tape or dropped into vials by humans.

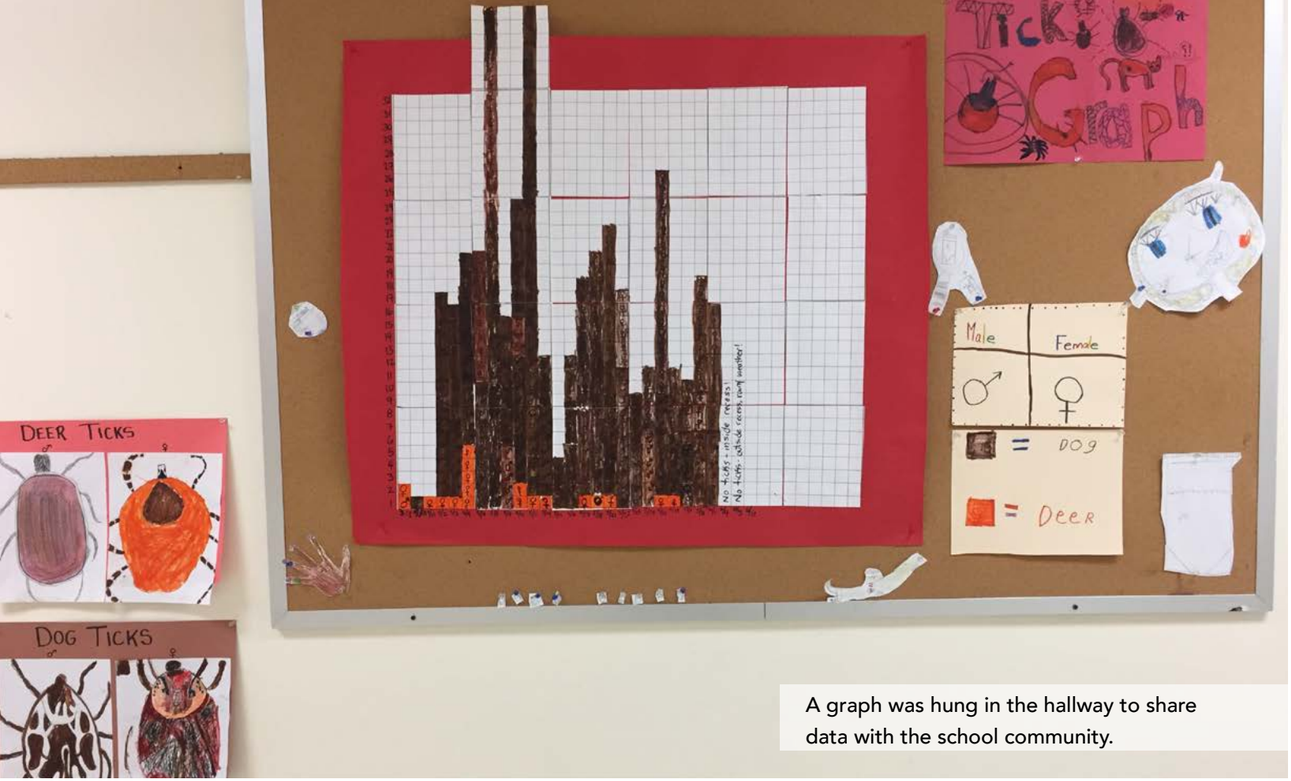
Word of the third graders' tick study quickly spread throughout the school, and after just a few days, students from other classes were stopping by to drop off ticks. In response, the third-graders requested to present their study at the next school assembly. Through researching tick habitat and behaviors, the class learned that much of what they thought to be true about ticks was based on common misconceptions. For example, ticks cannot jump onto a host organism, nor are they all carriers of disease. The class wanted to use the assembly as an opportunity to let the Ames community know the truth about ticks, and to ask students to share their tick specimens with them rather than throwing them away after they had been documented. Detailed posters were created to assist with species identification and lines were written for those who volunteered to speak. The third-graders presented like professionals, their expert knowledge and morbid fascination with the topic serving as motivation to help them rise to the task of a public presentation.

Students worked together to sort specimens and record data.

Once the class began receiving ticks from the rest of student body, the numbers collected went way up. While the third-grade class had been logging five to ten ticks per day, after the rest of the school began to contribute, numbers jumped into the high teens and low twenties, surging as high as 38 more than once. At the same time, the class' recess space shifted. Thanks to a rotating schedule of shared staff duties, students were offered the option to spend recess in the woods during alternate weeks. During the first few days of serious collection, most of the class spent recess playing in the woods – a risky behavior, as far as the majority of the Ames community was concerned. When the group switched back to playground recess alongside their peers, they found more ticks on their bodies than when they played in the woods – a counterintuitive finding. Silently, most of them (their teacher included) had assumed that playing in the school's wild spaces would mean greater exposure to ticks. "Stay out of the woods, too many ticks," was the unstated assumption.

So how could they explain this surprising discovery? The students themselves put the pieces together based on things they had read. First, they had learned that ticks lay their eggs close to the ground, especially in areas where there is dead organic matter – like forest duff or landscaping wood chips – covering the soil. Second, ticks live close to the places where they will most easily find hosts. Third, ticks enjoy places with shade and appreciate places where two types of habitat come together, like the thicket at the edge of a lawn. The play areas utilized for recess included a large grassy lawn for ball games, a large wood chip covered area containing play structures, and a narrow strip of "woods" containing young deciduous trees and some thorny thickets. All three of the things that ticks need to thrive were present within the area frequented by students – the very same space that most people in the school community had assumed would be the safest.

Throughout the rest of May, the third-grade class continued to collect, identify, and record all tick specimens gathered. A graph was created in the hallway to share findings with the school community and informational drawings were added to further assist the community in learning about ticks. In late May, a chemical treatment was applied to the school grounds, killing off the majority of the ticks



A graph was hung in the hallway to share data with the school community.

and effectively ending the study. Regardless, the students' findings were remarkable. Of the 360 ticks documented by the group, 341 were dog ticks and only 19 were deer ticks. The general takeaway from the study was that while ticks were present in large numbers on the school grounds, the overwhelming majority of them were of a species that did not present a major threat to humans. While dog ticks can be carriers of Tularemia and Rocky Mountain Spotted Fever, the former is quite rare, and the latter has yet to be detected in Maine (Maine Center for Disease Control and Prevention, n.d.). Free of Lyme disease, Anaplasmosis, and the handful of other illnesses that deer ticks can carry, dog ticks are a nuisance, but not nearly as much of a danger to humans as deer ticks.

The overall impact of the students' work was impressive, and the confidence and enthusiasm accompanying their knowledge sparked an educational domino effect. First, the students taught their peers to identify ticks and gauge the level of risk associated with each species. Then, they extended their outreach to the adults in the Ames community. Everyone who learned about ticks at school then shared their new knowledge with family members and neighbors. School staff members reported feeling much better informed and, therefore, safer, and parent feedback echoed similar sentiments. While no official changes were made to how the school planned to deal with ticks, those tasked with managing tick discoveries felt much more confident in determining whether a discovery was cause for major concern. The culture of fear that had previously seeped throughout the school community was replaced with a new culture of empowerment. The ticks were still there, and yes, they were going to bite sometimes, but armed with information, students and staff alike were much more comfortable with the risks presented by ticks once they had been educated.

Overall, this was place-based education at its finest. Instead of a traditional textbook-based study of insects and their habitat preferences, this project enabled students to develop real scientific skills. They practiced close observation and taxonomic differentiation. They collected data and presented it in a clear way. They developed the ability to know which data was important to collect – where were you playing today? When did you find it? Where was it on your body? Then, they educated each other and the school community so that the undifferentiated fear of ticks was replaced with a more fine-honed understanding of which ticks were problematic and which more benign. The counter intuitiveness of their finding – students that play in the woods are less likely to pick up ticks than students who play on the playground – is a hallmark of place-based education (Sobel, 2003). There are always surprising encounters, unexpected realizations, and new ways of looking at the world when students engage with real people and places. Science educator David Hawkins often referred to the "bird in the window" as an opportunity to get nudged out of the mandated curriculum and to pay attention to real phenomena (Hawkins, 2007). He would approve of the "tick on the pant leg" as a similar kind of nudge. Curriculum in the service of community understanding and health – that is one of the benefits of place-based education.

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