Climate Change in the School Yard: Monitoring the Health of Acer Saccharum with A Maple Report Card

Martha Carlson1, Barrett N. Rock1, Ann Diller2

1, Natural Resources and Earth Systems Science Program, 2, Department of Education

Introduction
Maple Watch, a pilot program at the University of New Hampshire, involves students and teachers, K-12, in monitoring climate change as it affects the health of sugar maples, a common and much-beloved tree across its 31-million-acre range.

Maple Watch gives students, Figure 1, opportunities to improve their skills in observation, analysis, communication, experimental design and critical thinking. Inquiry-based activities and partnerships with university scientists may inspire students to pursue more STEM studies and to consider careers in STEM fields.

Maple Watch will help make climate change locally apparent and it will help citizens differentiate between the normal “chaos” of weather and environmental stresses and the impacts of climate change (Hansen et al., 1998). As students consider their actions and possible management strategies to help the maple, they are learning the skills they will need as citizens and policy makers.

Phenologic Change
Maple Watch schools and UNH are developing innovative communication technologies for measuring, reporting and sharing phenologic data. Sap season is arriving two to three weeks earlier than usual. The season may last only 2 to 3 weeks rather than 6 weeks typical in the 1950-60s.

Students will also report bud burst, the first fall color, and leaf drop. Maple Watch schools will soon use PicturePost to photograph these changes. Photos and supporting data are posted on-line (picturepost.unh.edu). An interpolation Map (Fig.2) will soon allow teachers to watch their reports color the state green in spring, gold in autumn.

Students are learning to monitor and rate tree health in tests of the following:

- quality of buds.
- spring development of chlorophyll.
- texture, size and water content of leaves.
- longevity of leaves.
- predation on leaves by insects and fungi.

Students will assign their tree grades of 1 (like a C), 2 (B), and 3 (A) for each test, Figure 3. Additional spectral and biochemical measures of foliage and sap are done at UNH.

At the end of the year, maple grades are averaged to give the tree a Maple Report Card. When graphed in parallel with the Common Sense Climate Index (Hansen et al., 1998), the maple’s annual grade point average can help discern climate change stress from stresses caused by other factors. Over time, the Maple Report Card will document change in maple health and help understand particular stresses, Figure 4.

Educational Philosophy
In Maple Watch, students learn science and math by doing it. Can the lesson go beyond one sugar season?

Alfred North Whitehead, Harvard philosopher and educational theorist, 1861-1947, developed a three-part theory of how children learn best. Children are first brought to the lesson by the “romance” of the subject, a stage of discovery. Then, students need “precision,” practice in using simple tools to solve problems and to build skills. Third, “utilization” demonstrates the “usefulness” of the content and the student’s own newly gained skills. If all three conditions are offered, the student will continue learning in a repeating cycle of romance, precision and utilization, Figure 5 (Whitehead 1929).

Philosophy in Climate Change
Climate change studies and discussions of the possible impacts of climate change may confront today’s students with moral and ethical dilemmas. For example, in 2012 the maple sugaring season came a month earlier than expected and 6th graders at the Bartlett School got only one flow, rather than 6 or 8. They drilled wounding holes in their trees for no benefit. “Maybe we shouldn’t have tapped this year,” teacher Jon Marshall mused.

Philosophy is a compass that can help us navigate unknown paths. Both teachers and students will benefit from knowing that philosophers are already applying theories to climate change debates. Discussions of choices and guiding norms might prepare today’s 6th grader to be tomorrow’s policy maker.

References


Acknowledgements
Many thanks to Sarah Larson-Dennen, Jon Marshall, Valerie Ford, Tracy Vokey, Jenn Barton and other Maple Watch pioneer teachers.

Contact
1 = Martha Carlson at martha.carlson@unh.edu, and Dr. Barrett Rock, Professor emeritus, Natural Resources, UNH, barrett.rock@unh.edu.

2 = Dr. Ann Diller, Professor emerita, Department of Education, UNH, adiller@unh.edu.