Installing Native Shade Trees to Absorb Excess Water
Pennsville Memorial High School, Pennsville School District

**Teacher:** Robert D. Belding PH.D., Science Department

**Grade Level:** High School

**Target Content Areas**
Ecosystems: Interactions, Energy and Dynamics

**NJ Student Learning Standards in Science (NJ SLSS) and Next Generation Science Standards (NGSS):**
As students engage in the lessons and activities in this project unit, they will be developing proficiencies in the following standards (NJSLSS) and performance expectations (NGSS):

- **HS-LS2-7:** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

**Student Relevance:** The town of Pennsville, New Jersey, is located on the Delaware River and the school as well as the surrounding community is frequently affected by flooding, both from rainfall and from high tides.

**Problem(s) identified by students:** In the past, some of the rainwater had been absorbed by mature Red Oak trees that previously thrived on the school grounds. However, many of the trees have died from Bacterial Leaf Scorch (BLS), which is a new disease in this part of New Jersey. In addition to increased flooding (excess water), the absence of the shade canopy from these trees is exposing the school roof to increased sun and heat exposure. Student logs of classroom temperatures indicated rooms with south facing windows frequently reached 90 degrees (F) or hotter. The school was built in the 1950’s and classrooms are not air-conditioned. Students had previously written letters to their school board requesting mediation of the heat.

**Student Actions:** Students developed a plan to install shade trees on the south and west sides of their classrooms. Once mature, the trees in front of these classrooms would cool the rooms in spring and summer and will allow the sun to pierce through the leafless canopy during the winter months. In addition to providing comfortable temperatures for the classrooms, the school would reduce its dependency on fans for cooling, thereby reducing its energy consumption and costs. Furthermore, the root systems would soak up rainwater runoff and the native tree species would provide a new habitat for a diverse array of bird and insect species. Students investigated trees for planting that were resistant to BLS and selected Nyssa Sylvatica, whose red color in autumn contrasts with the yellow brick walls of the school. Students studied
the biology of Bacterial Leaf Scorch and the physics of heat and then created scaled drawings of their planting plans to determine the locations and quantity of trees needed, as well as the overall canopy cover. Students also determined the volume of mulch that was required to cover 12 circular beds that are 6 inches deep and ten-feet in diameter.

**Tools, Programs or Resources:**
- [i-Tree Tools](https://www.itreetools.org) for Assessing and Managing Forests and Community Trees
- [Planting Trees and Shrubs Poster](https://www.ars.usda.gov)

**Lesson Plans, Rubrics or Activities:**
- [Tree Planting](https://www.edu.com)

**Learning Objectives:** Students will be able to (SWBAT):

1) **Identify causes and “symptoms” of climate change, as it pertains to the school and community.**

   Students were asked to create a design that would address the planet’s changing climate and investigate how climate change may be affecting the school, conditions within the school, or conditions on school property. Students discussed the loss of several sixty-year-old Red Oaks that have died or will soon die from a recently introduced tree disease (Bacterial Leaf Scorch (BLS), which may be a “symptom” of the changing climate for this region.

2) **Identify a problem on school property, investigate it, and design a solution and plan to address it.**

   Students were challenged to design a solution before all the trees at the school were removed because of this disease. Students decided to select new trees for planting, based on three criteria:
   a. Shading potential;
   b. Resistance to Bacterial Leaf Scorch (BLS); and
   c. An autumn leaf color that would be attractive in front of the yellow brick school building.

   The students determined their own objectives for a tree planting plan, which included design aesthetics as well as temperature mitigation. The students realized that the benefits of this project would not be measured for 10-15 years and needed to plan for forecasted temperate rises. Students worked without short-term rewards but ‘for the good’ of the school.

   Students were then asked to create scale drawings of the school and to determine the tree locations, optimal number and spacing for the trees that they selected. Finally, students calculated the volume of mulch needed to cover twelve 10-foot diameter circles to a depth of 6 inches for each tree base. Students also created a plan to care for and nourish the trees, long-term.

**EFS Actions:** Ecological Systems, Climate Change, Energy, Health and Wellness and the Built Environment

**Enduring Understandings:**
- A Healthy and Sustainable Future is Possible
- We Are All In This Together
- Create Change at the Source Not the Symptom
- Think Far into the Future
- Live by the Natural Laws
- We Are All Responsible
Eco-Schools USA in New Jersey: Biodiversity, Schoolyard Habitats, and Watersheds, Oceans and Wetlands

Students measuring area around tree base

Students marking tree location

Students planting one of the new trees