# LIVING SYSTEMS FIELD TRIP CURRICULUM: NATURE and

# HUMAN ACTIVITY

Grade Levels: Elementary School (Can be modified for Middle and High School)

2016 Massachusetts Science and Technology/Engineering Standards Achieved:

Grade 2, 4 & 5: ESS3. Earth and Human Activity Grade 3 & 4: ETS1. Engineering Design Grade 5: ESS2. Earth's Systems

**Topics covered:** Water and the water cycle, runoff, erosion, human energy resources and their extraction, land use change, biodiversity loss, climate change and engineered environmental solutions

## ABOUT THE LIVING SYSTEMS LABORATORY

The Blackstone River Corridor Living Systems Laboratory (LSL) is a nonprofit organization that seeks to engage people in the socioecological history of the Blackstone River and create effective solutions to environmental contamination. The purpose of the LSL is to connect people with the River, help them to appreciate the benefits of a healthy ecosystem on society in the context of development, and be a part of the restoration of the Blackstone through education, research, and community outreach. The LSL hopes to engage students by offering them an experiential leaning opportunity to engage with the past, present and future of the Blackstone River, and to better understand the complex relationship that humans have with nature. The LSL provides an opportunity for students to see natural cycles up close, and invites students to explore the intersection of human activity with these cycles. As some present human practices are at odds with the cycles upon which we depend, the LSL encourages students to consider ecological engineering solutions to some of our most pressing environmental problems.





**DURING THE TRIP,** students review the water cycle in an outdoor environment, using the Fisherville Mill site to help identify how different factors will affect how water flows through the ecosystem. They will see the legacy of an industry that relied on both fossil fuels and renewable energy, and consider how these practices have affected the water cycle and other ecosystems in the area and globally. Finally, students will explore the Eco Machine and Canal Restorers and begin to consider how human engineered solutions may play a role in mitigating some of the water and weather related challenges that we face today.

**AFTER THE TRIP,** students will have a better understanding of how water moves through an ecosystem and how organisms (including humans) depend on the healthy cycling of water. They will consider how different energy uses, extraction processes and land uses affect the water cycle and, and explore ecological engineering solutions to address the effects of some of the problems caused by human activity.



#### BACKGROUND

The Blackstone River, birthplace of the American Industrial Revolution, is also assumed to be one of the largest sources of nutrient and pathogen pollution in the watershed. The long history of development along the river has left a legacy of antiquated infrastructure and development practices that continue to discharge nutrient laden stormwater and pathogens as well as inadequately treated sewage into the river and ultimately the Narragansett Bay. This area of the canal and river has been further degraded by oil and other toxins from the area's industrial past.

The Eco Machine and Canal Restorers were built in 2012 by John Todd Ecological Design, LLC in Grafton, MA, on the banks of the Blackstone Canal. They utilize the theories of ecological design and induced biodiversity to harness the abilities of native plants, animals, fungi and bacteria and other microorganisms to metabolize waterborne contaminants. By creating engineered microenvironments that induce biodiversity and amplify surface area, a diverse ecosystem of organisms metabolize nutrients and contaminants at higher rates than the compromised ecology of the canal and river.



**BASIC PRINCIPLES OF CYCLES AND HUMAN ACTIVITY.** Students will get the most out of a trip to the LSL if they have had exposure to the principles of the subject of Natural Cycles and Human Activity prior to the excursion. Topics that they should be familiar with include:

### The Water Cycle

Steps: evaporation, precipitation, absorption, surface runoff, and condensation Global water pools (salt and fresh): oceans, groundwater, glaciers etc Factors affecting how water is cycled: temperature, groundcover



### Fuel Use and Extraction

What fuels are used for Nonrenewable fuels and sources How nonrenewable fuels pollute Renewable energy sources



**NAVIGATING THE LEARNING LANDSCAPE.** Now that students have a background in the tenants of the water cycle and human activity, they can use the Blackstone Canal, Eco Machine and Canal Restorers to evaluate these processes in motion. The questions below are a tool for teachers and are meant to guide the learning of students before and during their tour of the LSL.

## Before the Tour

#### The Water Cycle

Where is water found in this landscape? Can you identify where evaporation occurs? Infiltration? Runoff? How do the different surfaces that you see affect runoff? Evaporation? Infiltration?

#### Energy and the Direct Effect of Human Activity

How has the use of hydropower affected the River? The Water Cycle? How has the use of fossil fuels affected the River? The Water Cycle? What other sources of fuels are there, and how would they affect the River and Water Cycle?

## During the Tour

#### The Water Cycle and Ecosystem Health

What happens when more water precipitates than evaporates? Than infiltrates? What does that mean for organisms? For humans?

How does temperature affect precipitation, evaporation and infiltration?

#### **Runoff and Erosion**

What happens to water as it runs across the landscape? What happens to the surfaces? What does that mean for river organisms? For humans?

How did the Fisherville Mill affect the nature of runoff? How about Worcester? What phenomenon are seen in the River and Canal because of this? How do changing temperatures affect this phenomenon?

#### The Eco Machine

What natural processes are taking place in the Eco Machine? Where in the Water Cycle would these processes happen?

## After the Tour/Reflection

#### Nature and Human Activity

Why do plants and animals depend on a normally functioning Water Cycle? How about humans? How has human activity directly affected the Water Cycle? How do disruptions in the Water Cycle affect humans?

#### Using Ecological Engineering to Solve Problems

What problems is the Eco Machine solving? How? How could we expand on the Eco Machine's success? Is this addressing the root cause of the problem? What are some other ways that we can address these root problems?

## **Resources on Nature and Human Activity:**

NASA's Precipitation Education Resources: <u>http://pmm.nasa.gov/education/browse?field\_article\_edu\_aud\_tid=77</u> Humans and the Water Cycle: <u>http://sciencelearn.org.nz/Contexts/H2O-On-the-Go/Science-Ideas-and-Concepts/Humans-and-the-water-cycle</u> PowerPoint on Humans and the Water Cycle: <u>http://westernreservepublicmedia.org/earthmotion3/images/Human\_Impact\_on\_water.ppt</u> An activity to demonstrate runoff: <u>http://watermonitoring.uwex.edu/pdf/level1/curriculum/WisStreamCurriculum-UrbanRunoffModel.pdf</u>

## **RESOURCES ON THE BLACKSTONE RIVER:**

Map of the Blackstone Watershed: <u>http://www.thebrwa.org/map.htm</u> River History: <u>http://www.nps.gov/blac/index.htm</u>

## Be sure to check out our guide "LSL Field Trip Prep Tips"



## Help us make the experience better for you!

**WE ALWAYS LOOK TO IMPROVE.** Let us know how we can help you achieve your teaching goals on this trip. Email us with any questions or concerns at <u>livingsystemsintern@gmail.com</u>.

Laboratory

Raised Boardwalk

Curriculum by: Jacquelyn Burmeister