

LIVING SYSTEMS FIELD TRIP CURRICULUM:

BIODIVERSITY

Grade Levels: Middle to High School

2016 Massachusetts Science and Technology/Engineering Standards Achieved:

Grade 7: ESS3. Earth and Human Activity

Grade 7: LS2. Ecosystems: Interactions, Energy, and Dynamics

Grade 8: ESS3. Earth and Human Activity

High School: LS2. Ecosystems: Interactions, Energy, and Dynamics

High School: ESS3 Earth and Human Activity

Topics covered: Biodiversity, ecosystem services, land use change, habitat degradation, protected areas management, pollution, ecological restoration, the Industrial Revolution, ecological design

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 in society in the context of development, and be a part of the restoration of the Blackstone through education, research, and community outreach. The LSL especially hopes to engage students by offering them an experiential learning opportunity to engage with the past, present and future of the Blackstone River, better understand the complex relationship that humans have with nature. Biodiversity is a key theme in understanding this relationship, and the LSL provides a platform for interactive learning around this topic.

DURING THE TRIP, students will see firsthand the effects of human activity on ecosystems and consider the connection between nature and human society. Specifically, students will consider biodiversity and ecosystem services provided by the Blackstone River, and how industrial and urban contamination affects them. Students will then experience a novel restoration project that demonstrates how biodiversity can improve ecosystem resiliency and restore a damaged landscape.



AFTER THE TRIP, students will have an appreciation for the importance of biodiversity on healthy ecosystems and the threats to biodiversity and thus human well-being. Students will have considered an ecosystem approach to restoring a damaged landscape, having applied the principles of ecology and biodiversity to a real world contamination issue. They will understand the role of humans in the functioning of ecosystems and know how the Blackstone River has affected both the economy and ecology of the area. They will also consider possible solutions to anthropogenic threats to biodiversity.



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 BIODIVERSITY. Students will get the most out of a trip to the LSL if they have had exposure to the principles of the subject of Biodiversity prior to the excursion. Topics that they should be familiar with include:

What is Biodiversity?

The variety of life!

Genetic vs Ecological Biodiversity

The Importance of Biodiversity

Ecosystem and Species Resiliency- recovering from disturbances and disease

Medical discoveries- the uses of species not yet discovered

Ecosystem Services- high biodiversity supports ecosystem functions

Biodiversity creates the variety of life!

The Threats to Biodiversity

Habitat loss- land use change

Exploitation- over hunting and fishing

New and non-native disease

Humans can indirectly contribute to these threats through *climate change* and *pollution*

Protecting and Restoring Biodiversity

Ecological Restoration- The recovery of an ecosystem that has been degraded

Protected Areas- Preserve the natural habitat of species and protect them from threats

The difference between an engineered and natural ecosystems and implications for biodiversity.

NAVIGATING THE LEARNING LANDSCAPE. Now that students have a background in the principles of biodiversity, they can use the Blackstone River and Eco Machine as an example of how biodiversity can be threatened, the risks to humanity, and to see how degraded ecosystems can be repaired. 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

Geography of the Blackstone River

Through what regions does the Blackstone River flow?

What communities have a connection to the Blackstone River?

Ecology of the Blackstone River

What kinds of organisms are supported by rivers?

What kinds of services do humans depend on rivers for?

During the Tour

History of the Blackstone River

How did the Blackstone River shape the economic history of the region?

How did industrialization and urbanization affect the river physically? Chemically? Ecologically?

The Effects of Pollution

How has the industrial and urban pollution affected the organisms living in and around the Canal? The River? Narragansett Bay?

How has the pollution affected humans living around the Canal? The River? Narragansett Bay?

What is Ecological Design?

How are the Eco Machine and Canal Restorers different from typical engineered ecosystems?

Protecting the Blackstone

With the previous discussion of biodiversity in mind, how could we begin to protect the biodiversity and ecosystems of the Blackstone River as an industry? As a community? As an individual?

How does the Eco Machine and Canal Restorers create protected areas? What are they and how do they protect biodiversity?

After the Tour/Reflection

Restoring the Blackstone

With the previous discussion of biodiversity in mind, how could we begin to restore the biodiversity of the Blackstone River as an industry? As a community? As an individual?

How does the Eco Machine and Canal Restorers remediate canal water?

What is the role of bacteria? Fungi? Plants?

Why is it important to include all of them inside the Eco Machine?

Why is it important to have different types of plants, fungi and bacteria inside of the Eco Machine?

What is the role of animals?

What part can we play in the protection and restoration of biodiversity?

RESOURCES ON BIODIVERSITY:

National Wildlife Federation: <http://nwf.org/Wildlife/Wildlife-Conservation/Biodiversity.aspx>

Convention on Biological Diversity: <https://www.cbd.int/protected/overview/>

Society for Ecological Restoration: <http://www.ser.org/resources/resources-detail-view/ecological-restoration-a-means-of-conserving-biodiversity-and-sustaining-livelihoods>

RESOURCES ON THE BLACKSTONE RIVER:

Map of the Blackstone Watershed: <http://www.thebrwa.org/map.htm>

River History: <http://www.nps.gov/blac/index.htm>

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 livingsystemsintern@gmail.com.

