

STEM Activities

Rich Earth Institute is offering free STEM activities for Vermont middle and high school classes, providing integrated learning about sustainable agriculture and environmental protection through the lens of the food nutrient cycle. Our activities can be tailored to your classroom needs, including adapting content for different learning levels, bringing activities to your school, or hosting them in tandem as a full activity day at our Brattleboro Research Center. Contact julia@richearthinstitute.org to discuss options and scheduling!



1. Urban Hydrolink: Interactive Water & Wastewater Model

Students will learn about the interconnection of natural water cycles and human infrastructure. In this discussion-based activity, students think critically about concepts such as nutrient pollution and water conservation as they use pumps and valves to trace the journey of water from river source to treatment, storage, household use, wastewater treatment, and back again.



2. Soil Microscopy

Students will learn about soil health with a focus on biology, including a discussion of species in the soil food web. Students will be trained in basic microscope use and soil sample preparation (optional), and assess the health of soil samples through qualitative observations of microbial activity. Samples used in this class may be collected from a classroom compost pile, worm bin, or garden soil.



3. Urine My Garden: Experimental Design in School Gardens

Students will learn about the scientific method and plant nutrient needs through designing and conducting their own experiments in school gardens or growing trays. Students investigate how lettuce seedling growth is affected by different fertilizers, including sanitized urine-derived fertilizer and synthetic fertilizers, while learning about the role of fertilizer production in sustainable agriculture. A simplified version of this activity can be hosted in Rich Earth's demonstration garden.



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Contact julia@richearthinstitute.org to inquire!

4. Pee Lab: Nitrogen in Urine-Derived Fertilizer

Students will learn about the types of nitrogen present in urine and manure-derived fertilizers and discuss strategies available to farmers to prevent nitrogen loss from these fertilizers. Through a hands-on lab component, students will take pH measurements of acidified urine samples and perform a titration to calculate the ammonia loss from those same samples.



5. Pee Lab: Phosphorus in Urine-Derived Fertilizer

Students will learn basics of plant nutrition, challenges facing the global phosphorus supply, and the potential of urine-derived fertilizers to address these issues. In a hands-on demonstration, students will perform a basic chemical reaction to precipitate struvite, a phosphorus-rich mineral fertilizer, from urine samples. For students with a basic chemistry background, reagents used in the precipitation reaction will be calculated using concepts of stoichiometry.



6. Peecycling Tour at Rich Earth's Research Center

See urine nutrient recycling in action! Rich Earth will provide a brief introductory presentation, screen a short animated video summarizing the science behind urine recycling, and then walk students through community-scale urine collection, transport, treatment, and application as fertilizer on farms. The tour features Rich Earth's laboratory, demonstration garden, urine transport truck, treatment technologies, and a "toilet museum" of urine-diverting and composting toilets.



Pair with a tour of the neighboring WSWMD municipal compost facility (contact Alex Lacy: projects@windhamsolidwaste.org) or Brattleboro's Wastewater Treatment Plant (contact Dan Tyler: dtyler@brattleboro.gov)!