RICH FARTH INSTITUTE

Our Mission: Rich Earth Institute engages in research, education and technological innovation to advance the use of human waste as a resource.

Overview

- Overview of Rich Earth Institute
- Intro. to our Spinoff, Brightwater Tools
- FAQ's
- Current challenges
- Current and upcoming projects
- Q&A



Rich Earth Institute

Fertilizer from Urine: Clean Rivers. Sustainable Farms.

Intro to Urine Nutrient Reclamation



Why Urine?

Urine contains most of the nutrients and half the pharmaceuticals in domestic wastewater



Every day, our bodies produce enough fertilizer to grow the wheat for a loaf of bread.

Demonstration Project

Urine Nutrient Reclamation Program

13,500 gallons of urine collected annually

2.7 M gallons of *clean water* conserved since 2012 First & largest community-scale program of its kind in the US

Platform for our research & education





Using Urine as a Fertilizer



Fertilization



**All activities (collection, transport, treatment, and application) are fully permitted through VT DEC Waste Management and Prevention Division

Spin off Company Brightwater Tools

- <u>Mission:</u> To design, build and sell technologies for nutrient-recovering wastewater treatment.
- Rich Earth is focused on Research and Demonstration
- Brightwater Tools is focused on Product Development and Commercialization

<u>A few highlights:</u>

- Have pilot units in MI, VT, WA, MA, and Europe
- Team of 9, including 6 engineers
- Beginning to branch into other waste streams such as food waste resource recovery
- Attracted \$1.5 million of NSF funding and an additional \$1 million of private investment funds







BUILDING-SCALE TREATMENT TRAIN

Brightwater Tools' equipment works together as a Treatment Train to process waste into a concentrated, sanitized fertilizer.



*patented

Research



Major Research Funding and Partners







- NSF (National Science Foundation)
- USDA SARE (Sustainable Agriculture Research and Education)
- FFAR (Foundation for Food and Agriculture Research)







- University of Michigan
- Cornell University
- Cornell Extension
- University at Buffalo

FIELD TRIALS









ANTHRO-VERMIPONICS



Grow Food Everywhere, Without Extraction, Without Exploitation





Education



Webinars

What happens to the pharmaceuticals in our urine?

When you take medicine or drink coffee and then flush your pee, what happens to it?

Most of the time our pharmaceuticals end up disrupting aquatic life...



When reclaimed as fertilizer...

By collecting urine and keeping it out of the wastewater stream, we can contain pharmaceuticals before they reach sensitive aquatic ecosystems and water supplies.

But that raises new questions:

Do these compounds end up in edible crops? How do they affect long-term soil health?

What we found...

Rich Earth Institute conducted a 6 year study in collaboration with:



CROP

Eat one pound of urine-fertilized lettuce every day for 1,000 years to ingest the equivalent of one large cup of coffee.

The pharmaceuticals we detected were extremely small – in the nanogram per gram (or parts per billion range.)

SOIL

We found small levels of pharmaceuticals in the soil (parts per billion range).

GROUNDWATER

Pharmaceuticals were detected in the groundwater in even lower levels (parts per trillion range.) Lower than rainwater

What about the ick factor?



Social Research

Results from buyer and consumer interviews will be helpful to us in our future communication and education efforts, to farmers with whom we share the guide, and those who read this report. Key among these insights were the following:

- 1. Buyers want educational materials to share with both the farmers they buy from and the institutions they sell to.
- 2. Buyers feel that some type of certification would help achieve more widespread acceptance among the farmers they buy from. Approval by VOF was seen as likely to be very helpful.
- 3. Buyers and consumers both indicated food safety concerns, but generally felt these concerns could be alleviated with education about treatment methods.
- 4. Both buyers and consumers were generally supportive of the use of urine fertilizer for a range of reasons. As one buyer put it, "I find it to be really important to use what we have and what we produce everyday so that it doesn't have to go through waste water treatment. Then it can be utilized instead of end up in waterways inevitably.... So it, it makes so much sense to take care of what we do, what we need to do everyday, many times a day, in a more useful sense."
- 5. A key motivation for consumers was learning about the nutrient value of urine, something many were unfamiliar with prior to these conversations.
- 6. Participants were generally most comfortable with the use of urine on non-edible crops (flowers, ornamental plants, animal forage), and on fruits and berries, as opposed to leafy greens.
- 7. While ideas about where and how urine-fertilized crops should be labeled varied, both buyers and consumers felt that transparency was important. They would like access to information about what amendments and fertilizers are used by farmers, while acknowledging that information about currently used fertilizers is not always readily available.

Challenges

- Creating new Regulatory Pathways
- Consistent Funding
- Creating Alternatives within embedded infrastructure

Current Projects

- Field Trials with Biochar
 - PFAS, soil health, and social research
- Pitribon stabilization of ammonia
- Upgrades to local infrastructure
 - Depot, Research Center, farm equipment, Portable toilet processing
- Consulting and Developing resources for New Communities







Resources for New Communities

Guide to Starting a Community-scale Urine Diversion Program







Farmer Guide to Fertilizing with Urine



richearthinstitute.org/urine-diversion-guide/

What's next?

- Supporting new Community Projects
- Regional Solids composting and Disaster Preparedness
- Blackwater Source Separation

Supporting Adoption in New Communities

VERMONT:





Importance of Disaster Preparedness

VERMONT:



'Total destruction': Flooding knocks out Johnson's wastewater plant, disrupts operations elsewhere

Across Vermont, flooding has affected operations at 33 wastewater treatment facilities, state officials said.



This photo shows a damaged wastewater treatment plant on Aug. 2, 2023, in Ludlow, Vt.



Peecycling Around the World

Swiss Institute of Aquatic Science and Technology (EAWAG)

- Research institute that ignited academic interest in the field of urine diversion
- Startup company VunaNexus installs urine treatment technology





Fertilizer product sold to gardeners

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Peecycling Around the World

Paris, France

- Paris: Seine-Normandie water agency **subsidizes up to 80%** of urine collection projects with its "Water & Climate" program
- Urine diversion in Saint-Vincent-de-Paul complex will divert **538 gallons** of urine per day



Circular Sanitation in the USA



Upcoming Events/Ways to Get Involved

• Become a Urine Donor

- Home installations or Depots located in Brattleboro and Rockingham
- Attend an upcoming webinar to learn more
- Reach out to Schedule a Tour of the Research Center
- Donate Supportive Funds
- Global Summit
 - Sponsorship Opportunities

Rich Earth Institute

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Pee the change you want to see in the world!

