

LIVING WITH WORMS IN THE FLOODING MACHINE

Amy Youngs discusses her experiences creating ecosystem artworks that use an experimental combination of hydroponics and worm composting (vermiponics). Multiple designs are created, which serve as functional models for reducing waste, greenhouse gas production and improving indoor air quality. As indoor, domestic scale systems, these projects challenge notions of home and our ability to share our space with other living things that serve functions outside of the pet relationship. Interdependence with the ecosystem is modeled on a small and comprehensible scale in the home, office or gallery in each of the waste-processing artworks discussed. The flexibility of composting worms to live in soil-based or water-based environments offers hope that humans can also learn to live more flexibly and symbiotically with non-human animals.

Author: Amy Youngs

After a night of rain, when the light of morning reveals the slick bodies of hundreds of worms that have surfaced from the earth, one cannot help but step carefully on the sidewalk. One might even notice the tragedy of death as they wriggle in puddles or become flattened by the feet of pedestrians. I was one of those kids who tried to save the worms by pulling them out of puddles, or off of the sidewalk to place them in the grass. Why do they put themselves in danger like that? Everyone I asked told me it was because earthworms would otherwise drown in their flooded homes. And it did appear to me that the worms were making a last ditch effort to save themselves by coming up and out where they were so exposed. This made sense. We would do it too; try desperately to make it to dry land in a flood.

This story is about the truth behind worms underwater and how it has helped me envision habitats for humans and worms to live symbiotically together in domestic spaces. Now I purposely and regularly flood the homes of worms and in return, I receive the benefits of a local waste processing system, plus the enrichment of my home and office environment with living, air cleansing plants.

Earthworms do not have lungs. They do not “breathe” like we do and they do not drown underwater. We might relate our own fear of drowning to our experience of seeing worms above ground in the rain, but somehow we don’t make the same connection to our fear of being buried alive. Underground. Where there is not enough air for us to breathe. Of course, worm biology is different from our own. Water is essential for their bodies



Amy Youngs

Worms living in a "vermionics" artwork, *Building a Rainbow* © Amy Youngs

as it allows them to absorb oxygen through their skin. Earthworms enjoy an environmental moisture content of 80% – 90% and will quickly dry out if the moisture level drops below 60%. This is why it is relatively safe for them to emerge out of the earth when it rains. The wet, two-dimensional surface above ground also allows them to move into new territories and to find mates more quickly than when they are moving through the three-dimensional space of the earth.

I learned the facts above from scientists, but have also learned other

surprising lessons from the colony of red wiggler worms I have kept in my eighteen years of vermicomposting (composting with worms).

DOMESTIC BLISS

Given the right conditions, some types of earthworms will coexist happily in the homes of humans. The red wigglers, or *Eisenia Fetida*, that I keep are ideally suited to a domestic situation; they thrive in the same temperature ranges as human humans and eat many of the same foods.



Ken Rinaldo and Amy Youngs
Farm Fountain, 2007 © Ken Rinaldo and Amy Youngs

When provided with a dark, moist enclosure, they remain unseen, unheard and undetected by smell, as they process waste generated by a typical home into nutrients that can be used to feed plants. They can eat half of their weight of food per day and, since they eat food and paper waste, they comprise one of the most efficient home waste processing systems known. They do not smell. In fact, one of the things worms eat are the offensive, smell-emitting microorganisms that grow on decomposing organic waste. Indeed, I have witnessed them transform smelly piles of rotting lettuce into odorless soil. Of course, the old lettuce is best offered before it starts stinking, in order to prevent any odors that offend humans from the start.

What if one travels a lot, or does not cook at home and has no food waste to offer worms? Luckily, worms are resilient. Their populations naturally shrink when they are fed less, grow when fed more, but never expand beyond the point of overwhelming their dark, moist habitat. They also survive on meager provisions like shredded paper and coffee grounds. I tested this for one year: I put a handful of worms in a plastic shoebox with holes poked into it, placed it under my sink and fed them only coffee grounds and newspaper. After a year there were about the same number of worms, they still looked good and performed their waste processing work healthily.

GLOBAL BLISS

Why would we even care to bother cohabitating with worms, when food and paper waste can be thrown in the trash so

easily? Doesn't it safely biodegrade in landfills? No. In fact, organic waste produces methane gas as it decomposes, which is one of the worst greenhouse gasses. In the US, landfills are emitting the largest amount of methane related to human activity. The United States Environmental Protection Agency reports that methane is a major problem as it produces 21 times the global warming potential of carbon dioxide. They also report that in 2010 the bulk of municipal solid waste arriving at landfills is comprised of organic materials, with the largest component being paper at 28.5% and food scraps as the second largest at 13.9%. This is not a problem for worms, as paper and food waste are what they live on. They turn it into fertilizer, and they do it without producing methane gas.

GOING UNDERWATER

Earthworms typically process waste in dark, aerated environments, and while we imagine that as soil, these same conditions can also be found in water. The first experiments I did to test this were done in relation to a collaborative art project called *Farm Fountain*, created with Ken Rinaldo in 2007. This was an indoor, constructed ecosystem for growing edible fish and plants in our home. Our system was based on aquaponics, which is similar to hydroponics, where the roots of plants are immersed in nutrient-rich water. However, in aquaponics the nutrients are coming from the metabolic waste of fish and bacteria living in the system instead of from petrochemical-based fertilizers. The early tests were to place handfuls of red wiggler worms into the root area of the

plants to see if they would survive and if we could use them as food for the fish. We hoped they would periodically flow into the fish tank, providing a more sustainable food source than typical fish food. The worms survived, but we never figured out how to easily dispense them to the fish as food. On an aquaponics listserv, called S&S Aquaponics, I learned from others who were adding worms into their systems and I communicated with a helpful gardener, Jim Joyner, who reported on his experiments with “vermiponics”, an entirely worm-based version of aquaponics. In the searching I did in 2010 he appeared to be the only person who had eliminated fish altogether. The outdoor system he was in the process of testing promised to solve three of the problems associated with aquaponics: large tanks needed for the fish, fussy temperature ranges for keeping them alive and, most of all, how to feed them sustainably. As an artist interested in living with ecosystems, this inspired me to attempt to construct indoor systems for growing plants based on the nutrient inputs from worms instead of fish.

River Construct, was my first vermiponics artwork, built in 2010 for an exhibition at the RedLine Gallery in Denver, Colorado. It was an indoor composting and plant-growing unit that reproduced a natural system. Based on the model of a river, it was alternately fed and cleansed by a variety of organisms along its path. While most rivers flow over slowly sloping, horizontal planes, this artificial river flowed vertically, up and down a utility ladder, feeding and watering lettuces and herbs in a succession of buckets resting on the rungs.

Like a river, the inputs to this system were sunlight and organic waste. Leftover food scraps, newspaper and rabbit manure were put into buckets to feed the worms inside. They converted the waste into nutrients that flowed into and through the water to the roots of the plants. Sunlight from nearby windows helped the plants grow and also charged a solar-powered battery that drove a pump submersed inside a water reservoir at the base of the ladder. Small mosquito fish lived in the water basin where they would eat algae and any potential mosquito larvae. A domestic rabbit lived in an enclosure nearby to provide manure to the system. To conserve energy, this artificial river's pump was set on a timing cycle that turned on the water flow once every forty-five minutes.

The aesthetic of this work was inspired by utility, garage DIY, and big box hardware stores. The experimental nature of the system called for an openness in materials and structure. Though I had built a small version in my studio, I was unsure that the system would function for the five-week long exhibition. With the exception of a fruit fly infestation towards the end, I was pleased with how well it worked. The bright sunlight in Denver Colorado kept the power system running entirely off-grid, the gallery staff cared for and fed the rabbit and worms, the plants grew healthily, the mosquito fish multiplied, and Eddy the rabbit learned to leap in and out of his pen to nibble on the fresh greens and visit gallery goers.

River Construct
by, Amy M. Youngs



Amy Youngs
Sketch for River Construct, 2010 © Amy Youngs



Amy Youngs

River Construct as exhibited at Redline Gallery in Denver, CO, 2010 © Amy Youngs



Amy Youngs

Feeding the worms rabbit manure, corn husks, watermelon rinds and newspaper, in *River Construct*, 2010 © Amy Youngs



Amy Youngs

Eddie the rabbit in *River Construct*, 2010 © Amy Youngs

INTERDEPENDENCE

The domestic rabbit was used in this artwork as a way to point to the wide variety of interrelationships humans have with other living things. Rabbits are particularly transmutable; they can be pets, fur coats, food for humans or other pets, lucky foot charms, magic trick partners, trainers for hunting dogs, entertainment and show specimens. In the case of Eddy, he began his life as a purebred, pedigreed Himalayan born for the show table. After his first unsuccessful rabbit show, his breeder culled him out of the herd by putting him up for sale at the

“pet only, no pedigree” price of \$15. His next role was a manure producer for the *River Construct* artwork, and after that he became a house pet. The consideration of these domestic arrangements with rabbits caused me to seriously consider the possibility of new relationships with worms.

The next ecosystem artwork I created had no rabbit. Instead, it focused on building a relationship between worms, waste and the homes of humans, with a bathroom theme. In this installation, called *Building a Rainbow*, I reconfigured used consumer products into a colorful indoor water feature that grew edible plants. All parts of this installation were sourced and



Amy Youngs
Building a Rainbow, exhibited at Space Gallery, Cleveland, OH, 2011 © Amy Youngs

constructed in Cleveland, Ohio as part of an artist residency at Spaces Gallery. Waste streams consisting of uneaten food, old tea bags, newspapers, throwaway plastic household objects, an old sink and bathtub were interrupted and turned into a system for growing lettuce, basil, wheatgrass and herbs. The plants – growing in plastic containers sourced from thrift stores – were fed nutrient-rich water recycling throughout the system via a submersed water pump and periodic timer. The fertilizing nutrients were all derived from food and paper waste transformed by composting worms and bacteria living within the system. To avoid the past problems with fruit flies, the gallery staff refrained from adding any fruit-based waste. They fed the worms by peeling back the live wheatgrass mat “lids” growing above the worm containers and depositing shredded paper, coffee grounds, carrot tops, leftover lunch salads and sandwich crusts.

Exhibiting artworks with worm ecosystems in galleries are one way to demonstrate the possibilities of domestic worms. I have also lead workshops about designing habitats for worms and have used the closing of these exhibitions as an opportunity to disperse worms into other people’s homes. Gallery staff and/or interested visitors have taken them home to start their own vermicomposting systems.

MACHINE FOR LIVING INTERDEPENDENTLY

In the design of my most recent vermiponics artwork, it was important to offer a direct experience of the concept of

interdependence by translating a person’s physical activity into the circulation of the water in this system. Human beings are also interdependent with the system when we feed our waste to worms and exchange our carbon dioxide for oxygen from the plants, but those activities are not as obvious as seeing the active flow of water. In the *Machine for Living Interdependently*, the plants and worms are watered by the leisurely activity of rocking. A manual siphon pump bulb attached to a rocking chair works to translate a person’s rocking into pressure that pushes water seven feet up a pole, where the first house plant rests with it’s roots in a perforated, stainless steel cone. The series of plants and worms in the cones beneath are all watered in succession, as gravity pulls the water into the last cone, where a small volume of water rests, until pumped up to the top again. This piece takes a stance as a permanent, indoor fixture. It was recently installed in my office, after its five-week life in an exhibition in Columbus, Ohio. Instead of constructing and then dismantling a work just for a gallery show, I designed it specifically for my windowed, first floor office/studio space located at the Ohio State University, one of the largest universities in the country. Similar to my home, in my office I desire the aesthetics and air-cleaning benefits of living plants and the convenience of worms for on-site recycling of paper and coffee grounds. In my office however, many more people will be able to see and interact with it. I am looking forward to the ongoing experience – and discussions with visitors – of the benefits of living, working, breathing, eating, reading, and rocking with worms.



Amy Youngs
Building a Rainbow, exhibited at Space Gallery, Cleveland, OH, 2011 © Amy Youngs



Amy Youngs

Building a Rainbow, detail, exhibited at Space Gallery, Cleveland, OH, 2011 © Amy Youngs



Amy Youngs

Machine for Living Interdependently, 2010, exhibited at Urban Arts Space, Columbus, OH. © Amy Youngs

Amy M. Youngs creates biological art, interactive sculptures and digital media works that explore relationships between technology and animals – human and non-human. Research interests include: interactions with plants and animals, technological nature follies, constructed ecosystems and seeing through the eyes of machines. She has created installations that amplify the sounds and movements of living worms, indoor ecosystems that grow edible plants, a multi-channel interactive video sculpture for a science museum, as well as videos and community media projects.

Youngs has exhibited her works nationally and internationally at venues such as the Te Papa Museum in New Zealand, the Trondheim Electronic Arts Centre in Norway, the Biennale of Electronic Arts in Australia, Centro Andaluz de Arte Contemporáneo in Spain and the Peabody Essex Museum in Salem, MA. She has published articles in *Leonardo* and *Nouvel Objet* and her work was profiled in the book, *Art in Action, Nature, Creativity & our Collective Future*. She received her MFA from the School of the Art Institute of Chicago in 1999. She is currently an Associate Professor of Art at the Ohio State University, where she teaches new media and eco art courses. <http://hypernatural.com>