Happy Coast

University of Michigan – Dearborn
2020 Fall Internship Focus

A Michigan based registered 501(c)3 non-profit organization

Topics

- Development of Waste Reduction and Recycling Process
- Carbon Sequestration
- Biochar
- Microbiometer Field Testing
- Collection of Invasive Species for Testing
- Material Preparation and Processing
- Pile Management & Testing
- Pellet & Grain Mill Operation
- Brewer’s Grain Pickups
- Contact Info

Development of Waste Reduction & Recycling Process

We are Happy Coast, and our goal is to seek out organic waste products and develop ways to reduce and recycle these materials.

- Benefits of our process include:
  - Pioneering healthier soil and fertilizer processing methods to help reduce fertilizer runoff
  - Reduction in landfill inputs
  - Reduction in out-of-state sourced materials
  - Reliance on local waste sources
  - Building relations with local businesses

Carbon Sequestration

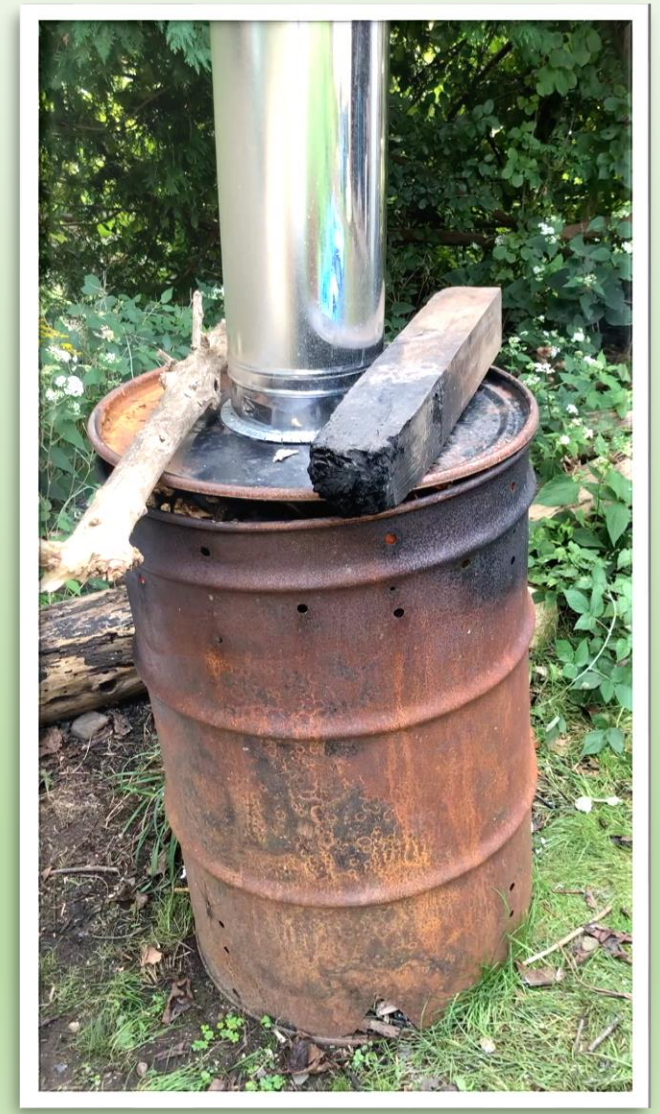
- Through our innovative process, we take in many sources of lignin rich waste and convert it efficiently into biochar.
- This process directly benefits the environment by reducing waste inputs that contribute to climate change.
- For example, we found that by removing the invasive Buckthorn plant which plagues our state, we can convert it into an environmentally conscious product that involves no fungicides, herbicides, or open burning.
- In addition, we have found that bone char may be used as an excellent fertilizer and can be sourced locally.
- Without this being done, these useful bones would be sent to the landfill or a boneyard.

Biochar

- Known to have been used for thousands of years by our South American ancestors as a part of their “terra preta” soils.
- Biochar results in a carbon-rich soil amendment with a high CEC, giving it the ability to attract excess soil nutrients and sequester them in the ground, as opposed to running off into our bodies of water.
- In Michigan, we are home to the Great Lakes which holds 20% of our Earth’s freshwater.
  - Our lakes’ greatest threat results from farmer negligence from their excessive use of fertilizers which then leads to excessive nutrient runoff.

Biochar

- Using a double barrel oven design, the carbon produced from the material being burned stays mostly within the apparatus and results in a much cleaner form of energy as heat and pressure.
- This is a great improvement to the traditional open-burn pit method that are known to release large amounts of their carbon and pollute the atmosphere.



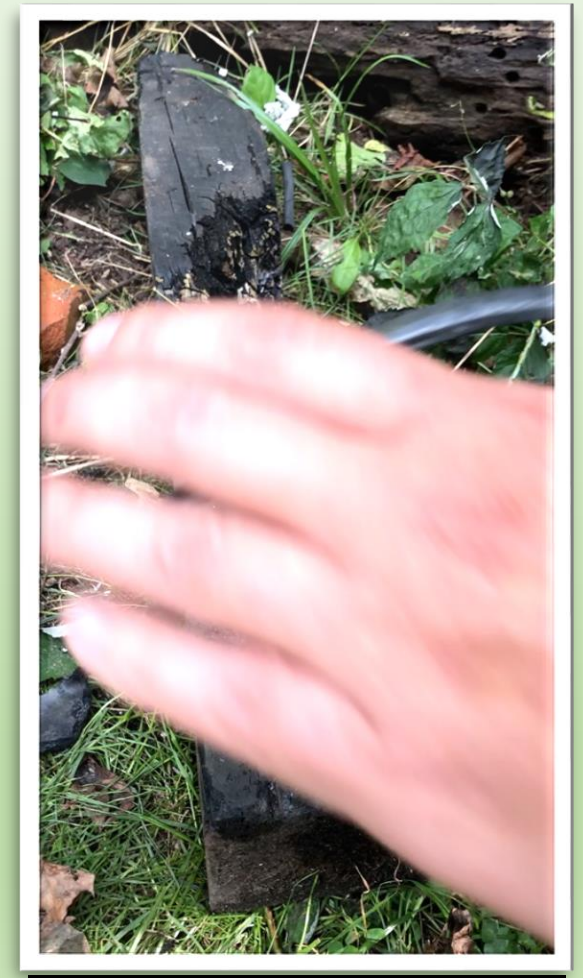
Biochar Oven in Operation

Biochar

Start to Finish

Biochar from Bones (Before)

Biochar from Bones (After)



Biochar is easily breakable afterwards.

Biochar Sifted and Pulverized

Biochar Oven Design

Biochar (Bones)

Biochar Applications

- After soaking our biochar in vinegar for a week, calcium phosphate can then slowly dissolve into the solution and be used as a liquid calcium phosphate fertilizer in the garden.

Biochar Mixed with Vinegar

Biochar Mixed with Vinegar (1 Week)

Microbiometer Field Testing

- Using the Microbiometer, we were able to broaden our understanding of the world around us.
- The Microbiometer allowed us to quickly evaluate numerous factors impacting the microbiome of various environments.
- We were able to differentiate between the microbiomes and draw our own conclusions using this valuable tool.
- In addition, we are able to use the Microbiometer to test when our compost is finished by using the fungal to bacteria ratio.
  - As it becomes more fungi dominated, it is closer to completion.

Microbiometer Data

Sample #	Test Site	Date	MicroBiometer Reading (ug C/ g)	Score	Fungi: Bacteria Ratio (F: 1)	F%/ B%	Sample Type	Sample Depth	Soil Class	Crop Type	Crop Quality	Mgmt	Notes	Score Chart	
1-T1	Soil in Pen	9/3/20	560	Good	1.1	52/ 48	Soil	5cm	Loamy	Crops	Excellent	Organic		< 200	Low
2-T1	Compost Turned	9/3/20	992	Excellent	2.1	68/ 32	Compost	5cm	Loamy	Crops	Excellent	Organic	1st Test when listed as soil = 916 ug C/ g F66/ B34	200 - 400	Fair
3-T1	Mushroom Compost Unturned	9/3/20	675	Excellent	1.2	55/ 45	Compost	5cm	Loamy	Crops	Excellent	Organic		400 - 600	Good
4-T1	Mushroom Compost Turned	9/3/20	566	Good	1	51/ 49	Compost	5cm	Loamy	Crops	Excellent	Organic		> 600	Excellent
5-T1	Living Compost	9/3/20	666	Excellent	1.3	57/ 43	Compost	5cm	Loamy	Crops	Excellent	Organic			
6-T1	Pine Forest	9/3/20	227	Fair	0.4	28/ 72	Soil	5cm	Loamy	Forest	N/A	None	2nd Test = 451 ug C/ g F41/ B59		
7-T1	Creek	9/3/20	102	Low	0.5	35/ 65	Soil	5cm	Loamy	Creek	N/A	None			
8-T1	Field	9/3/20	94	Low	0.5	35/ 65	Soil	5cm	Loamy	Pasture	N/A	Organic			
9-T1	Ravine	9/3/20	229	Fair	0.4	30/ 70	Soil	5cm	Loamy	Forest	N/A	None			
10-T1	Tarped Compost Turned	9/3/20	682	Excellent	1.3	57/ 43	Compost	5cm	Loamy	Crops	N/A	Organic	AKA "Tarped Vs Living Mulch"		
11-T1	Tarped 1 Year Unturned	9/3/20	776	Excellent	1.6	61/ 39	Compost	5cm	Loamy	Crops	Excellent	Organic			
12-T1	Hardwood Forest	9/3/20	105	Low	0.6	37/ 63	Soil	5cm	Loamy	Forest	N/A	None			
1-T2	Soil in Pen (Large Plant)	9/13/20	475	Good	0.9	48/ 52	Soil	9cm	Loamy	Crops	Excellent	Organic			
2-T2	Soil in Pen (Yellow Plant)	9/13/20	610	Excellent	1.2	55/ 45	Soil	9cm	Loamy	Crops	Fair	Organic			
3-T2	Store Bought Topsoil	9/13/20	1041	Excellent	2.2	69/ 31	Soil	9cm	Loamy	In Bag	N/A	N/A			
4-T2	Center of Mushroom Patch	9/13/20	394	Fair	0.7	41/ 59	Soil	9cm	Loamy	Forest	N/A	None			
5-T2	Store Bought Compost	9/13/20	559	Good	1	50/ 50	Compost	9cm	Loamy	In Bag	N/A	N/A			
6-T2	Garden (Near Pumpkin)	9/13/20	295	Fair	1.1	53/ 47	Soil	9cm	Loamy	Crops	Excellent	ORganic	Full Sun Area		
7-T2	Garden (Near Corn Stalks)	9/13/20	363	Fair	0.7	41/ 59	Soil	9cm	Loamy	Crops	Excellent	Organic	Full Sun Area		
8-T2	Stinging Nettle Patch	9/13/20	260	Fair	0.5	33/ 67	Soil	9cm	Loamy	Crops	Excellent	Organic			
1-T3	Soil Before Flower Pellets	1/5/21	550	Good	1	51/ 49	Soil	5cm	Loamy	Crops	Excellent	Organic			
2-T3	Soil After Flower Pellets	1/5/21	625	Excellent	0.9	46/54	Soil	5cm	Loamy	Crops	Excellent	Organic			

Microbiometer

In Use

A

B

C

D

E

F

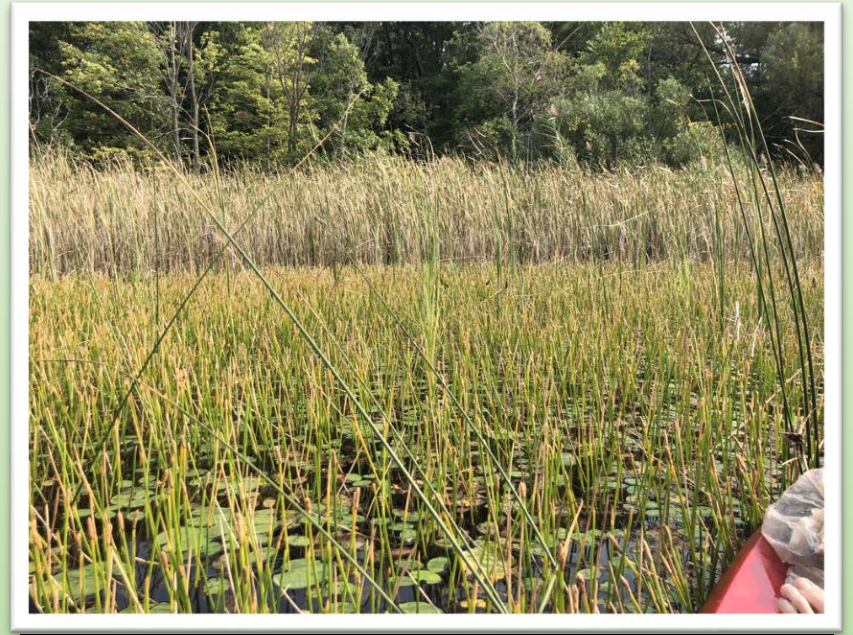
Photo A, B, E, F: Showing areas that were tested with the Microbiometer.
Photo C, D: Show samples being collected and then tested using the Microbiometer.

Collection of Invasive Species for Testing

- Protecting Michigan's environment results from many factors on top of waste pollution, such as invasive species.
- During the internship, we collected numerous invasive species samples to assess their nutrient content and further understand their beneficial applications.
  - Such as, Common Buckthorn, Purple Loosestrife, Common Reed, Pickerelweed, Water Milfoil, etc.
- Samples were dried and milled to see if they could be used for fertilizer and/or biochar production.
  - Relying on a system free of harsh chemicals and open burning.

Invasive Species

Collection



Common Reed

Purple Loosestrife

Water Milfoil

Collection via Kayak

Material Preparation & Processing

- Developing a system that does not currently exist has many unforeseen challenges, processing materials properly greatly affects the quality of the outcome.
- Properly drying materials before bacteria sets in is essential for proper testing and high-quality end products.
- After drying, we then grind down the material using a grain mill to increase surface area for proper testing and applications.
- These are then soaked in a solution to see what nutrients become available and then soaked in weak acids.
  - Testing methods include Mehlich-III, Morgan, Bray P1, ammonium acetate, Olsen.
  - These acids will help determine nutrient availability in the coming weeks.

Material Preparation & Processing

Collected species are spread across drying racks and well-ventilated until dry.

Materials Milled Down and Ready for Lab Testing

Pile Management & Testing

- Consistent pile turning is essential for the quality of compost and ensuring efficient speed of production.
- Using the Microbiometer we tested our mushroom compost pile, regular tarped compost, untarped compost, and living mulch compost for differences in micro bio life within turned and unturned piles.
- We found it interesting to see that the unturned mushroom compost pile had a higher carbon/g score and fungal to bacteria ratio than its turned counter part.
  - Further testing may show that carbon-based composts may do better undisturbed due to the subterranean mycelium growth and how it breaks down lignin-based materials.
- We found that food-waste dominated compost does break down faster when constantly turned, but unturned still allows for more micro life to develop and reproduce larger numbers.
  - Also resulting in more fungal dominated soils.

Pile Management & Testing (cont.)

- Our best compost (what Happy Coast offers to the public) was a combination of both mushroom compost and food waste aged for three years, resulting in incredible Microbiometer scores of 992 and 68:32 fungal to bacteria ratio (*refer to page 10, "Microbiometer Data")*.
- Because of the Microbiometer, we are able to conclude that rapidly turning piles at first and then aging them results in the highest quality end-product.

Pile Management & Testing

Turning Compost Piles with Tractor

Compost Pile Releasing Steam When Turned

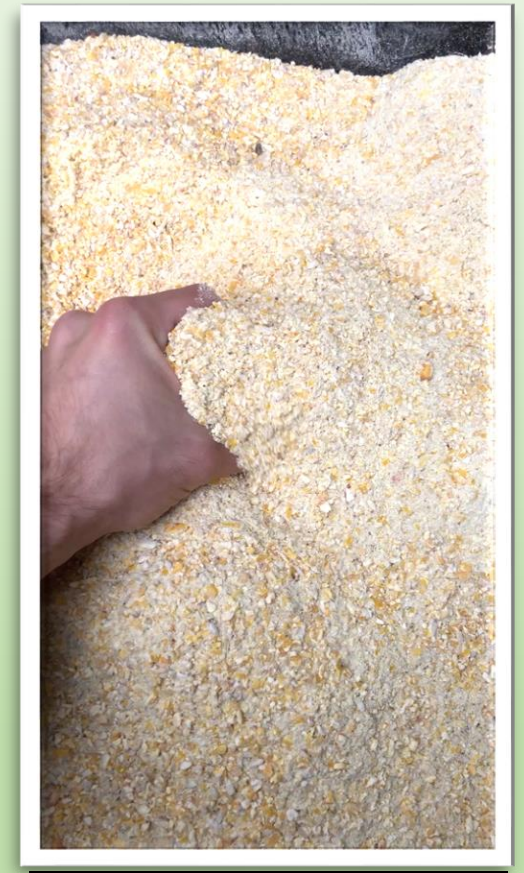
Compost Piles Can be Used to Recycle A Variety of Organic Wastes

Pellet & Grain Mill Operation

- Combing all our efforts, we are able to produce a high-quality, plastic free, locally-sourced, no-waste product, that removes waste from landfills and cleans up Michigan's environment.
- This product is in the form of a fertilizer pellet, carefully balanced to meet Michigan farming needs.
- These pellets include biochar, mushroom waste, spent brewer's grains, used coffee grounds and much more, creating a sustainable circle of life. Something that our humanity desperately needs.
- Using the Microbiometer, we quickly and easily tested our pellets and noticed their quality by measuring the increase in micro life and increase in bacterial growth, showing that compost is being broken down into the soil immediately.
- Reference the Microbiometer data before and after pellet application for observable improvements in C/g scores.

Grain Mill Operation

Various Materials Milled Down



Corn Kernel Milled Down

Materials Milled Down and Ready for Lab Testing

Pellet Mill Operation

Pellet Mix Prior to Pelletizing

Finished Pellets

Variety of Finished Pellets

Brewer's Grain Pickups

- Making field trips to local breweries, we collect used brewer's grain that is otherwise commonly thrown away and ends up in landfills.
- We developed a system to arrange with businesses to schedule weekly waste pickups.
- Grain was dried and milled to be recycled into a valuable fertilizer that can be used within a comprehensive mix or sterilized and used as a mushroom substrate to further compost materials like woodchips and sawdust.

Brewer's Grain After Recent Use, Ready for Pickup

Contact Info

Feel free to contact us for any questions or comments you may have; we look forward to hearing from you.

Happy Coast

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