



US Biochar Initiative Exploring Biochar & Climate Opportunity



Exploring Biochar & Climate Opportunity - 2023



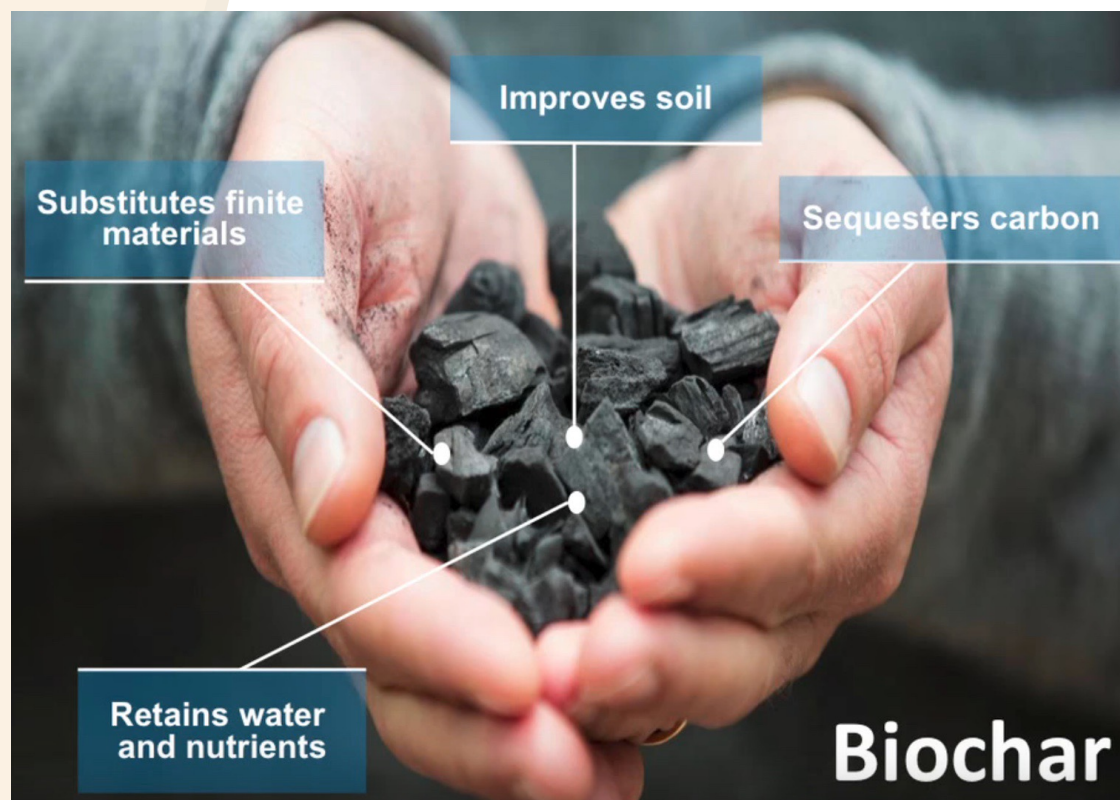


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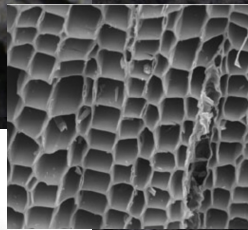
A STORY OF REGENERATIVE BAKING

- **Ancient Soil Conditioner** — Used in agriculture for thousands of years, biochar is gaining traction as a safe and scalable soil health amendment.
- **Waste Materials Solution** — Biochar is fine-grained charcoal suitable for biological systems made by pyrolysis, the process of heating biomass with limited to no oxygen.

Biochar: A solid material obtained from thermochemical conversion of biomass in an oxygen-limited environment. (IBI, 2012)



BIOCHAR IS BEAUTY



WHAT IS BIOCHAR?

- Granular black carbon, like charcoal
- Produced via pyrolysis: heating without oxygen
- Resistant to decay for 100's - 1,000's years
- Multiple beneficial environment applications such as stormwater filtration
- When produced from waste biomass it can be part of an approach to:
 - Produce renewable biomass energy
 - Remove carbon from the atmosphere
 - Create valuable environmental and agriculture materials



BIOCHAR CHARACTERISTICS

Physical Properties

Highly porous; surface area up to 500 m²/g

Three distinct pore types:

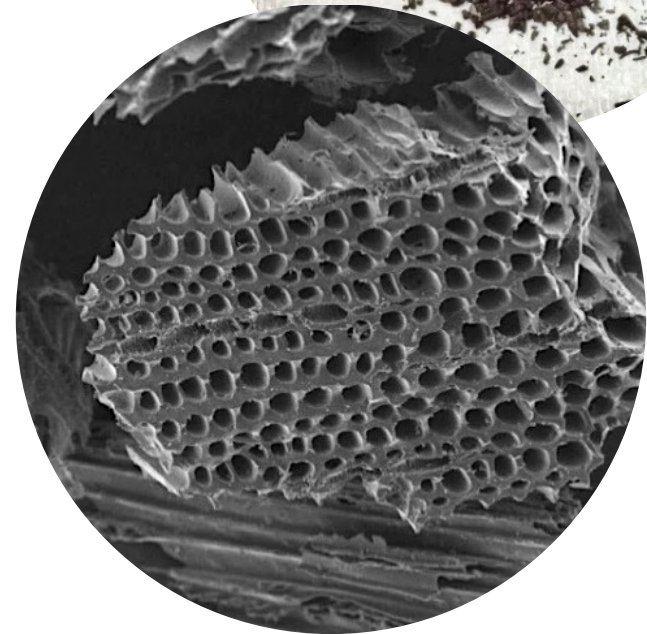
External pores: Dependent on particle size

Macropores: Dependent on feedstock

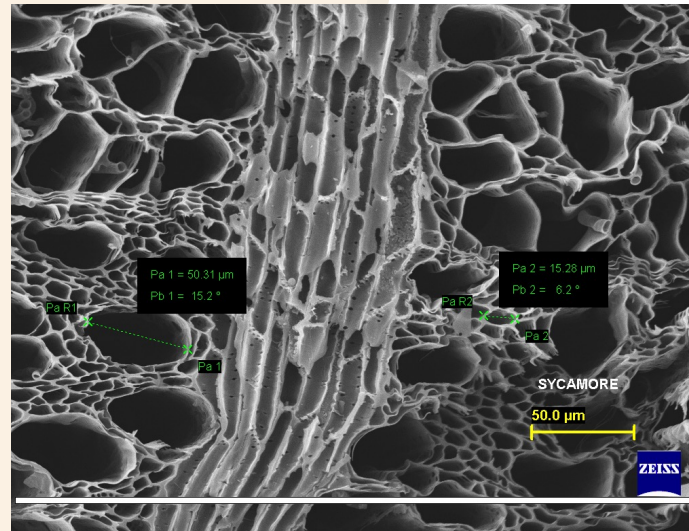
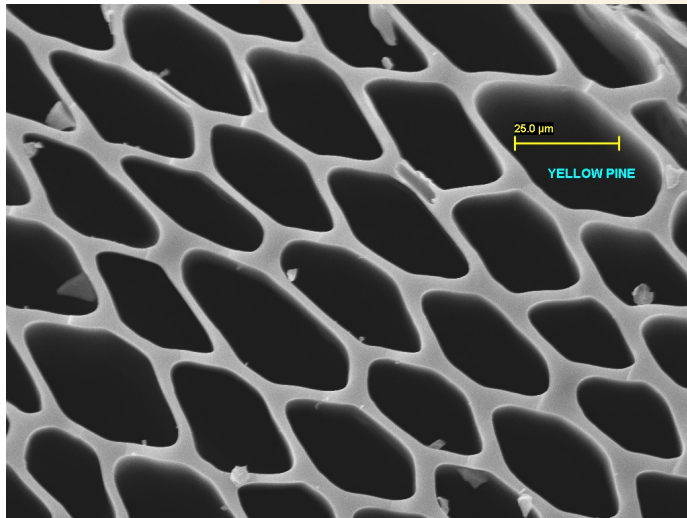
- 10-100 µm range for wood biochars

Micropores: Dependent on production

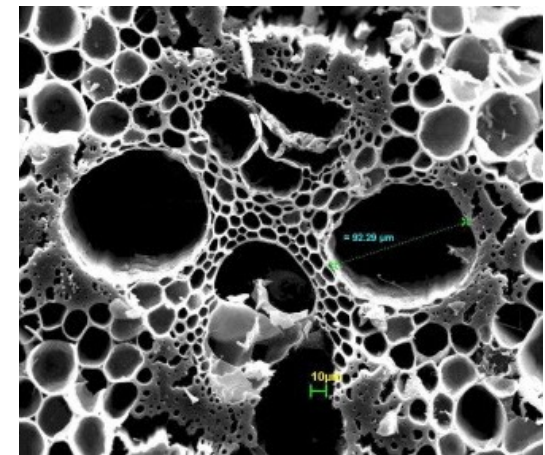
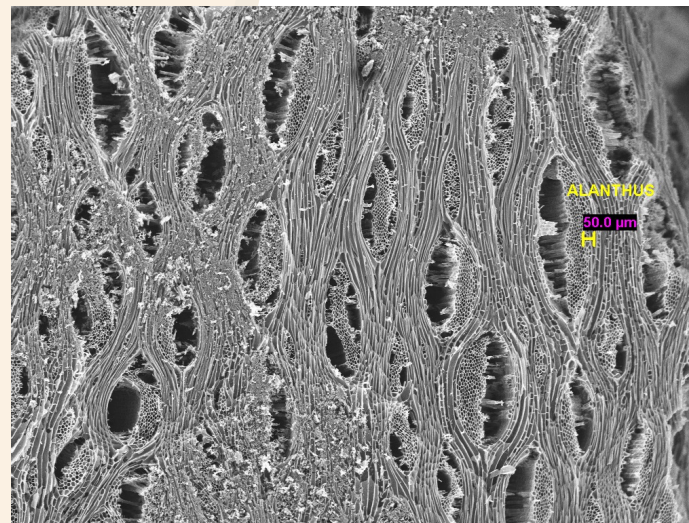
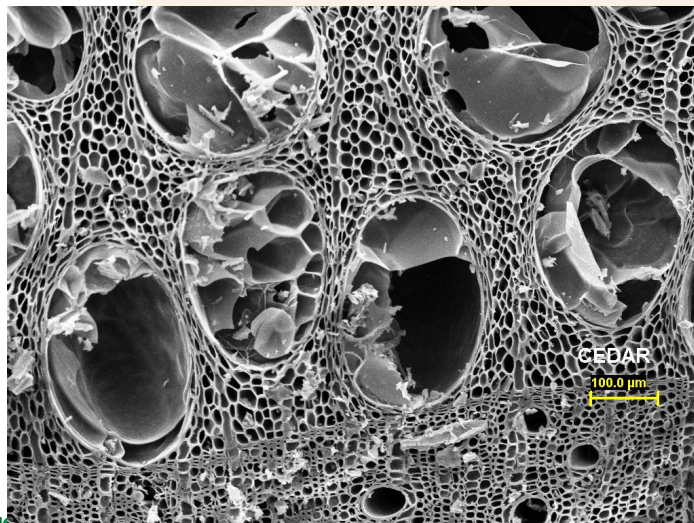
- 1-10 nm range = 10-100 water molecules!
- Majority of surface area with high potential sorption



Myles Gray



- Pine
- Sycamore
- Cedar
- Alanthus
- Bamboo

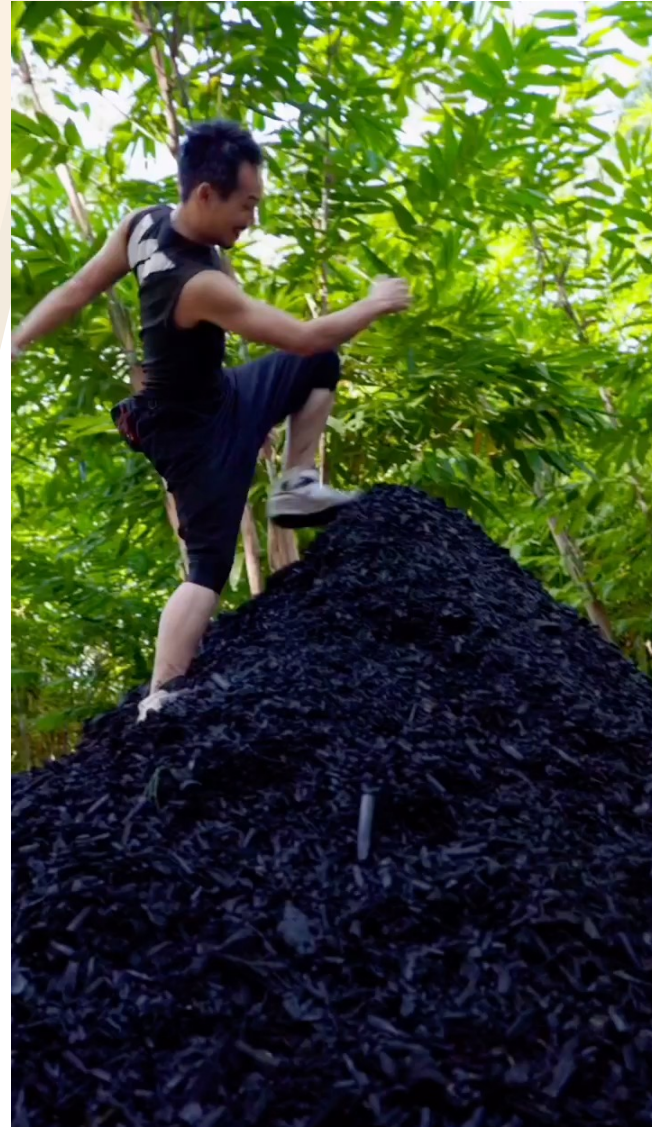


Copyright:
James Madison University
Wayne Teel

Art tells the story

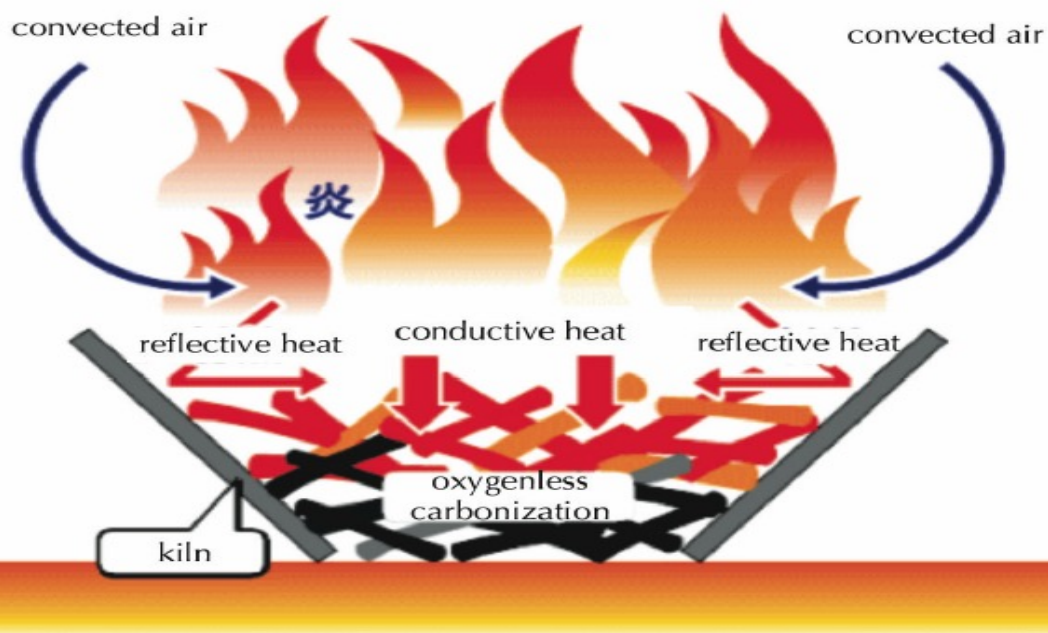
<https://instagram.com/p/C0orz2svYJo/>

100 KM = 62 Miles



Hello Pyrolysis!

(HIGH HEAT & ABSENCE OF OXYGEN)



Flame Cap Kilns Make Char by Limiting Oxygen at Base of Fire.



BIOCHAR IN SOIL HAS MANY WINS



Water holding capacity



Improves nutrient distribution



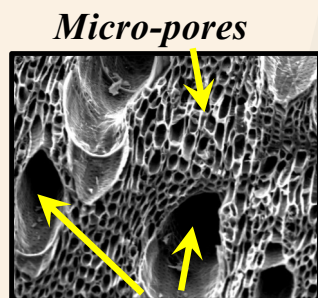
Increases soil organic matter and soil carbon



Reduces soil compaction



Luxury condo for microbes and fungi



Macro-pores



Existing Soil



Existing Soil + 4% Biochar

USBI Biochar Fact Sheets

Education ▾

Find on the Learning Center: biochar-us.org

BIOCHAR GUIDELINES FOR AGRICULTURE APPLICATIONS

Practical insights for applying biochar to annual and perennial crops



US Biochar Initiative

biochar-us.org

BIOCHAR INCREASES PLANT SURVIVAL



Use less water.
Increase yields.

BIOCHAR IMPROVES MANURE MANAGEMENT



Good for
the animals.
Good for the
environment.



METHANE!



METHANE!



Add biochar –84% GHG



Biochar enhances composting:

- **Greatly enhances the beneficial biological populations**
- **Increases nitrogen retention**
- **Reduces ammonia loss**
- **Accelerates the composting process**
- **Reduces odor**



Biochar In Soil

Education ▾



<https://www.youtube.com/watch?v=CZeWRHIALJQ>



IS BIOCHAR MAGIC?



NOPE



BUT IT IS SCIENCE!



***WITH OVER
32,000 PEER REVIEWED
TECHNICAL PAPERS
AND ARTICLES***



Biochar is beyond novelty.



BIOCHAR & THE NEW CARBON (Negative) ECONOMY





Innovative Biochar Products



Made of Air
www.madeofair.com
www.dezeen.com/carbon

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Drywall



Cement



Tile



Plaster



BUILT ENVIRONMENT

Examples of typical installations – Rural / Urban and Airport Installations



Let's Go Carbon Net-Negative Together

Advance Carbon Technologies & Green Carbon Industries



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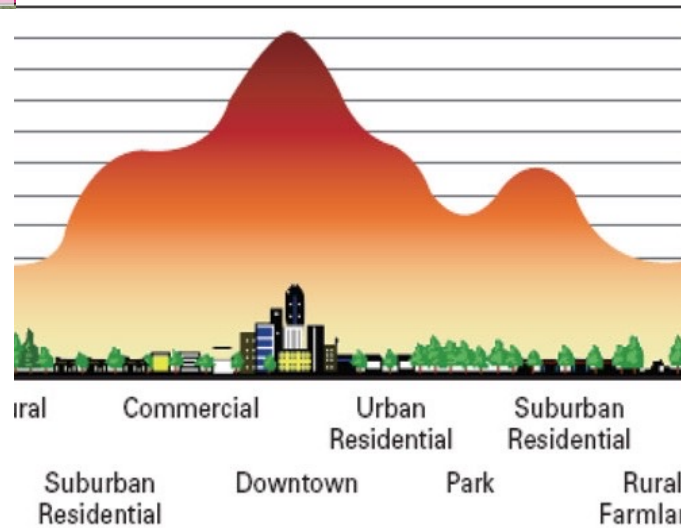
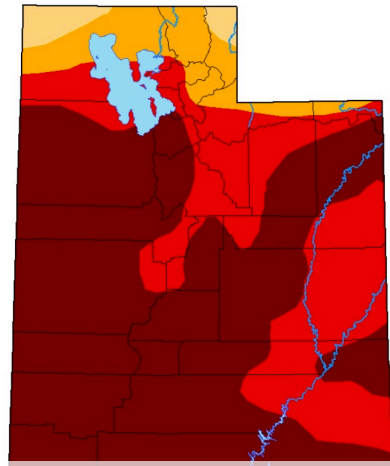
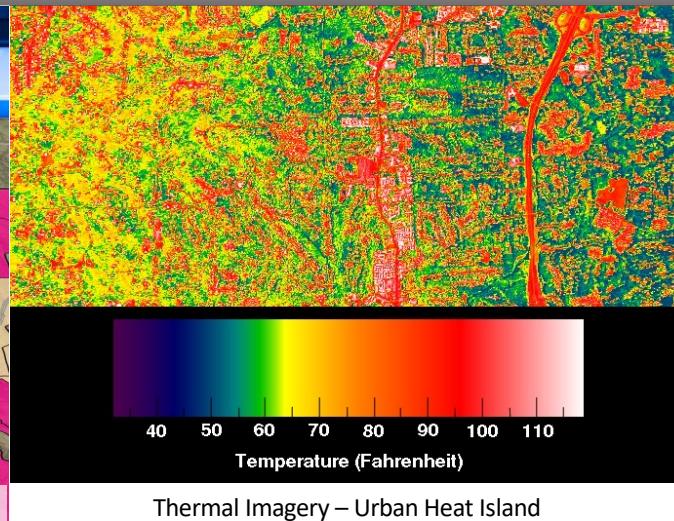
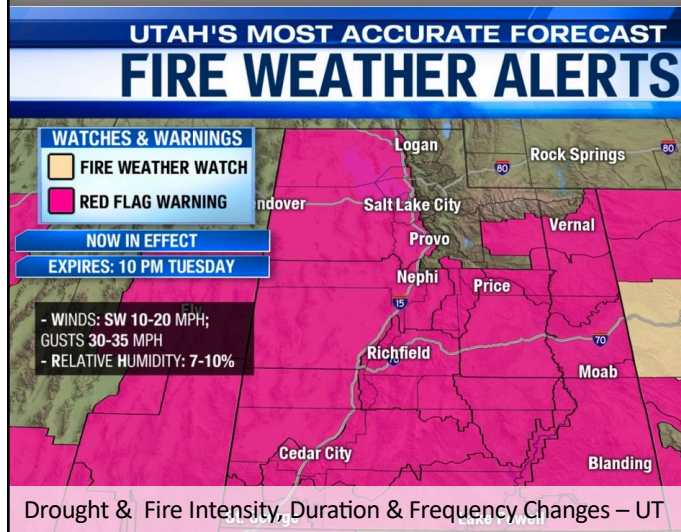
Biochars Improve Urban Environments Building and Non-structural materials



<https://4cornerscarbon.org>
Identified biochar as key CCS
opportunity in cement grant program



NEWS SAYS → World of Challenges



PROBLEM STATEMENT

"Water promises to be to the 21st century what oil was to the 20th century: the precious commodity that determines the wealth of nations."

(from Fortune Magazine, Shawn Tully, May 15, 2000)

Record Drought Driving Biochar Interest

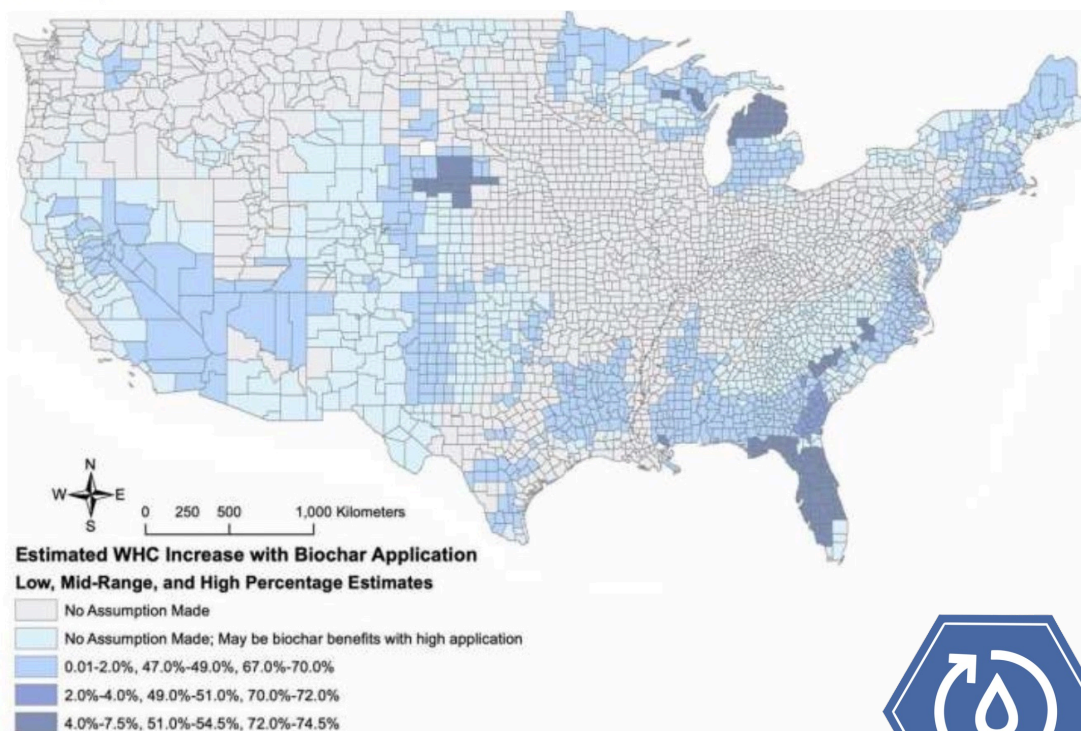
**Potential Improvement
in US Water Holding
Capacity.**

**Up to 37% water
savings in drought
environments.**

**Sandy soils show the
most benefit.**

Biochar helps hold water, saves money

by Rice University



Trials Show Drought Tolerance



2 weeks no watering



Control

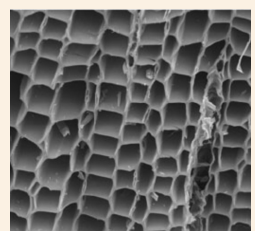
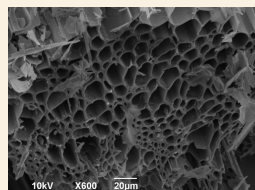


Biochar

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Drought Buster: Biochar Pores Hold Water



Iowa corn did better during the 2012 drought because the soils are high in natural biochar. Test plots with added biochar at Iowa State showed ~15% better water retention.





Utah using biochar in wildland grass restoration, weed abatement, and soil remediation practices.



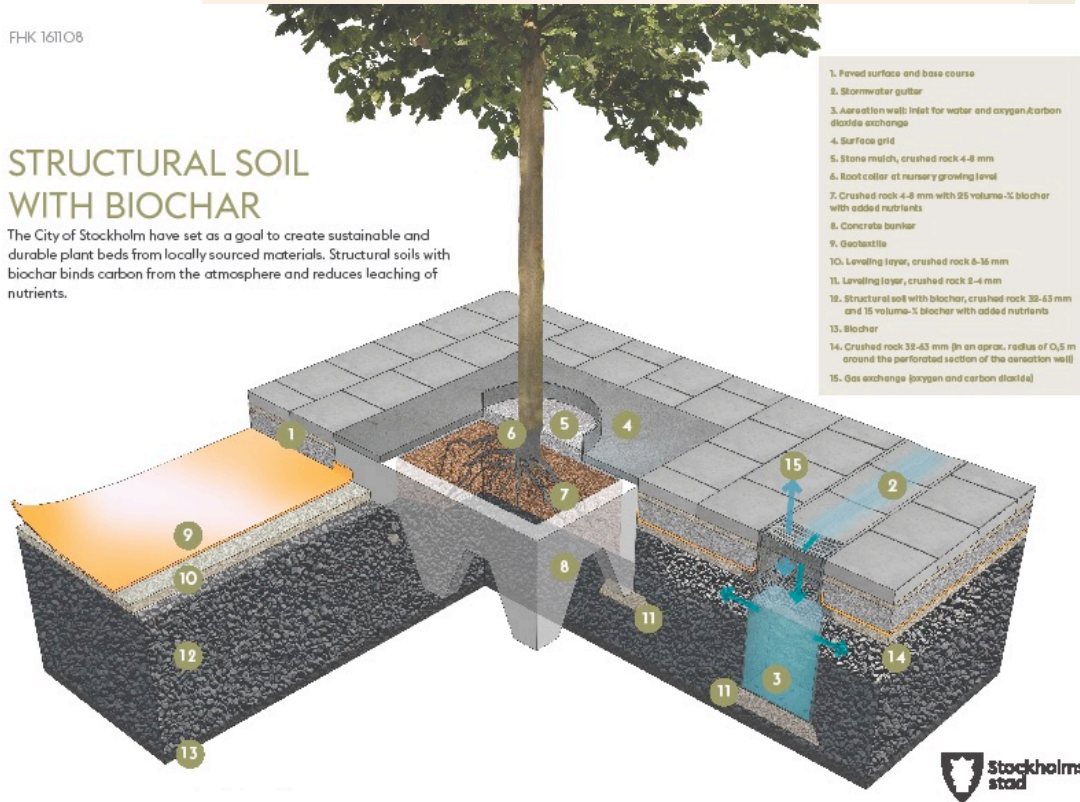
Resilient trees & Green spaces



FHK 161108

STRUCTURAL SOIL WITH BIOCHAR

The City of Stockholm have set as a goal to create sustainable and durable plant beds from locally sourced materials. Structural soils with biochar binds carbon from the atmosphere and reduces leaching of nutrients.



Stockholm Tree Pits

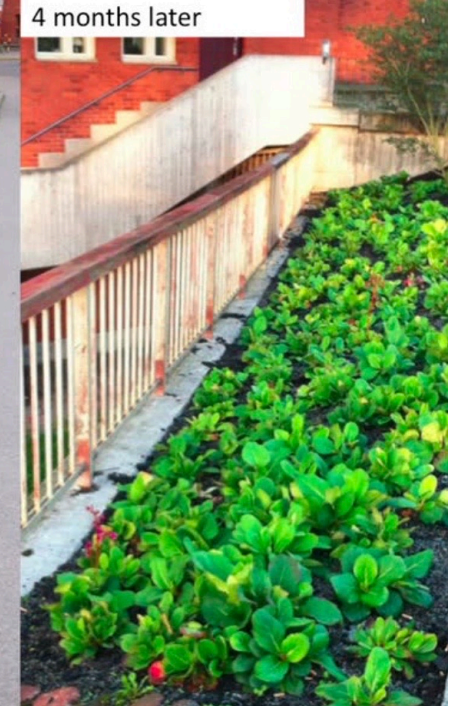
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Perennials planted in
Biochar and stone chips =
crushed granite (2-5mm)
and nutrient-enriched
charcoal 50/50 volume



4 months later



Stockholm Bioretention Structural Soils with Biochar



☀️ **LATEST WEATHER NEWS FROM ABC4** / Red flag warning now includes portions of northern Utah

LOCAL NEWS

'Not a war against lawn': Ornamental grass in Utah



Remediate Mine Sites



- 160,000 abandoned mines in the West
- Biochar reduces acidity, absorbs toxic metals
- Good for mine sites, fracking pads, brownfields



Biochar to Filter Toxic Stormwater

- In the Pacific Northwest, biochar filters keep water clean for salmon
- Biochar removes zinc, copper, iron, oil and other pollutants that harm salmon eggs
- Biochar is 4x less expensive than activated carbon



Tile Drains



Construction of a bioreactor with alternating layers of woodchips and biochar for nitrogen and phosphorus removal – Michigan State University



LET'S TURN UP THE HEAT!

(IN THE ABSENCE OF OXYGEN)

Flame Cap Kilns Char

Small Diameter Wood From Pruning, Land Clearing



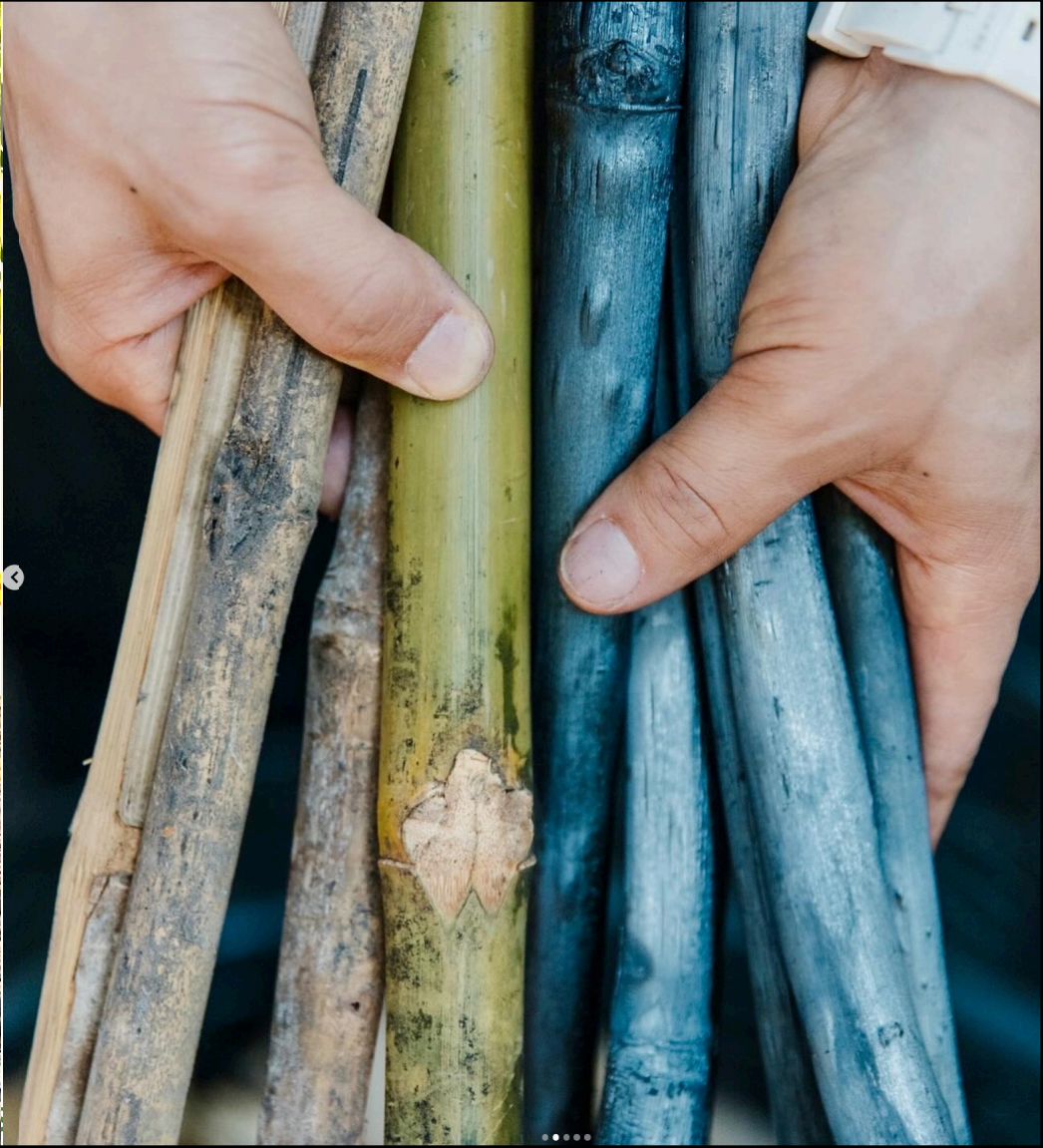
Ring of Fire Kiln: Youth Empowerment. Biochar. Cleaning up neighborhood burn piles. Takilma, OR, April 2020



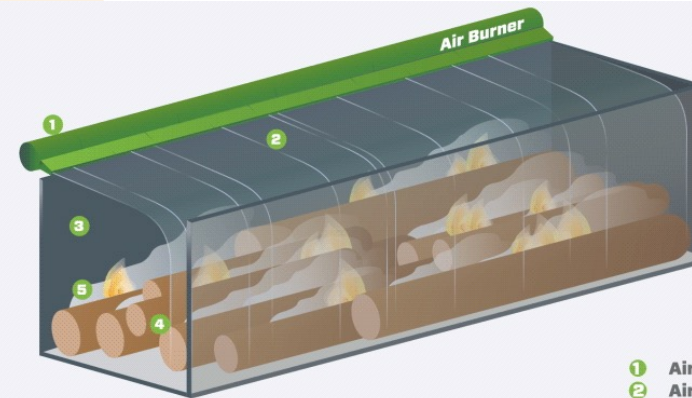
Oregon Kiln:
Paradise Fire cleanup,
Butte Community
College Students
January 2020

Big Box Biochar: Utah
State University,
Darren McAvoy
January 2020





Mobile Carbonizers Recover Biochar from Wood



- 1 Air Manifold
- 2 Air Curtain (left to right)
- 3 Firebox Refractory Wall
- 4 Wood Waste or Wood Fuel
- 5 Smoke (PM or Black Carbon)



Biochar Recovered From Wildfire Debris
Oregon 2020

Biochars are Produced in Modular & Industrial Systems

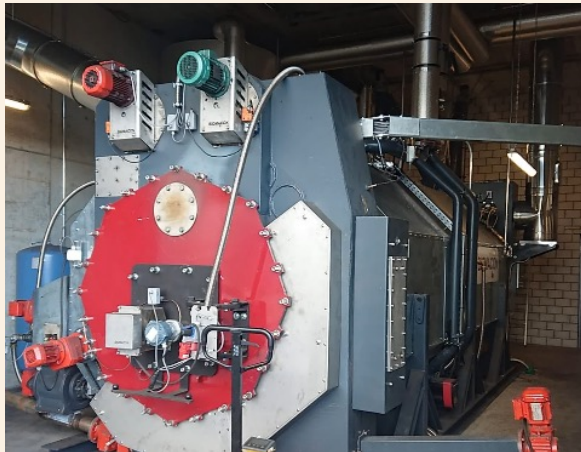


ARTIchar
artichar.com

Pyreg 500
Pyreg.de



Biomacn
Biomacn.com



(Deltak Coyote Boiler)



Oregon Biochar Solutions
Chardirect.com



 **PACIFIC
BIOCHAR**



Biochar can
potentially **remove**
up to 6% of global
emissions 



Biochar For Climate



As we approach COP28, this research presents an urgent call to action for world leaders to ensure biochar is in every country's climate change strategy.



Wendy Lu Maxwell-Barton
Executive Director, International Biochar Initiative.



Climate change is here but so are solutions.

Biochar is **affordable, scalable,** and **available** now.



Biochar Benefits

Optimism

Hope

Attainable Solution

Satisfying

Community!

Safe, Scalable, Now!



US Biochar Initiative



US Biochar Initiative

Q&A



Exploring Biochar In Crops



<https://biochar-us.org> info@biochar-us.org



THANK YOU!

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Youtube.com/@USBiocharInitiative



#biocharcode336

#biochar #pyccs

#biocharsaveswater

#biocharfixescarbon

#biochar2024

@3SpringsUtah



BIOCHAR IS A SOLUTION

<https://biochar-us.org/climate-smart-green-corridor-biochar-dlueckenhoff>