

WORKSHOP

BIODIVERSITY SOLUTIONS FROM
UNDERGROUND TO IN THE SKY

ERIC MAYER, NAPACHAR & STANFORD FELLOW
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PROF. MATTHEW JOHNSON, CAL POLY
HUMBOLDT





Napachar

Biochar for Vineyards

What, why, and how
to make and use biochar
in your vineyard

Eric Mayer, PhD and founder of Napachar, Stanford Fellow of Biochar for Wildfire Mitigation

Prepared for Mindset Symposium, June 9th, 2026

What is biochar?

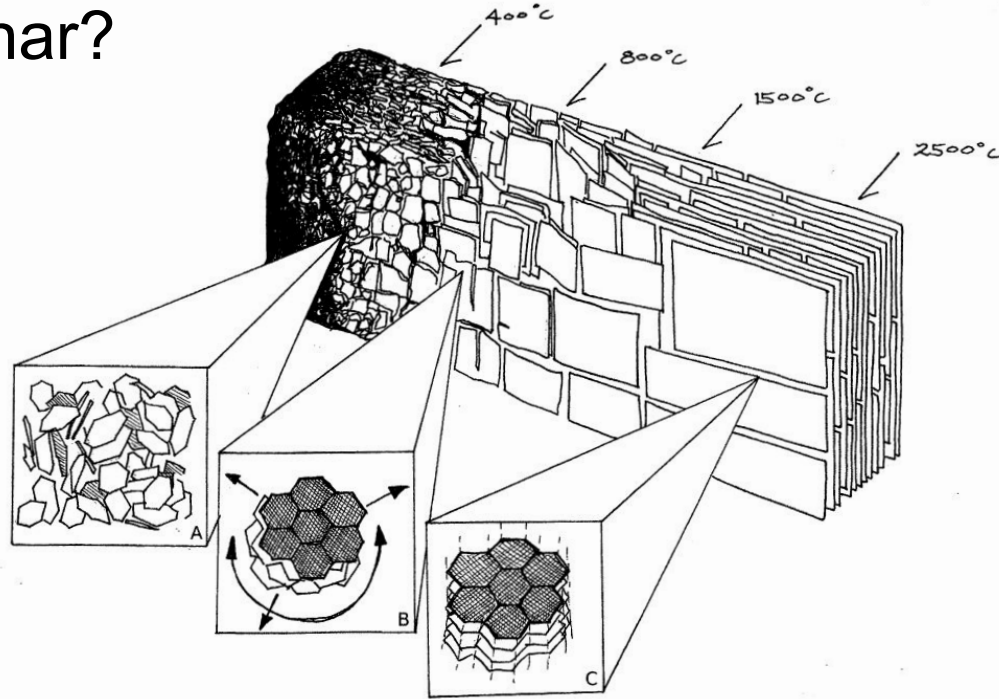


Figure 5.1 Biochar carbon structure relative to highest treatment temperature. Inset (a): Increased degree of aromatic carbon, highly disordered in amorphous mass. Inset (b): Growing sheets of turbostratic aromatic carbon. Inset (c): Structure becomes graphitic with order in the third direction

How is biochar made?

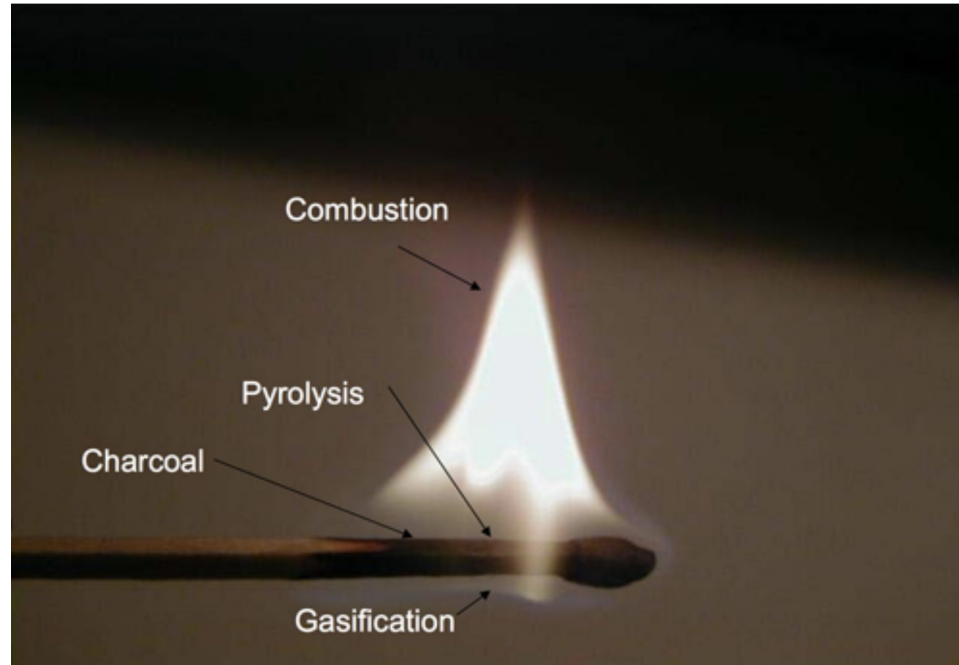
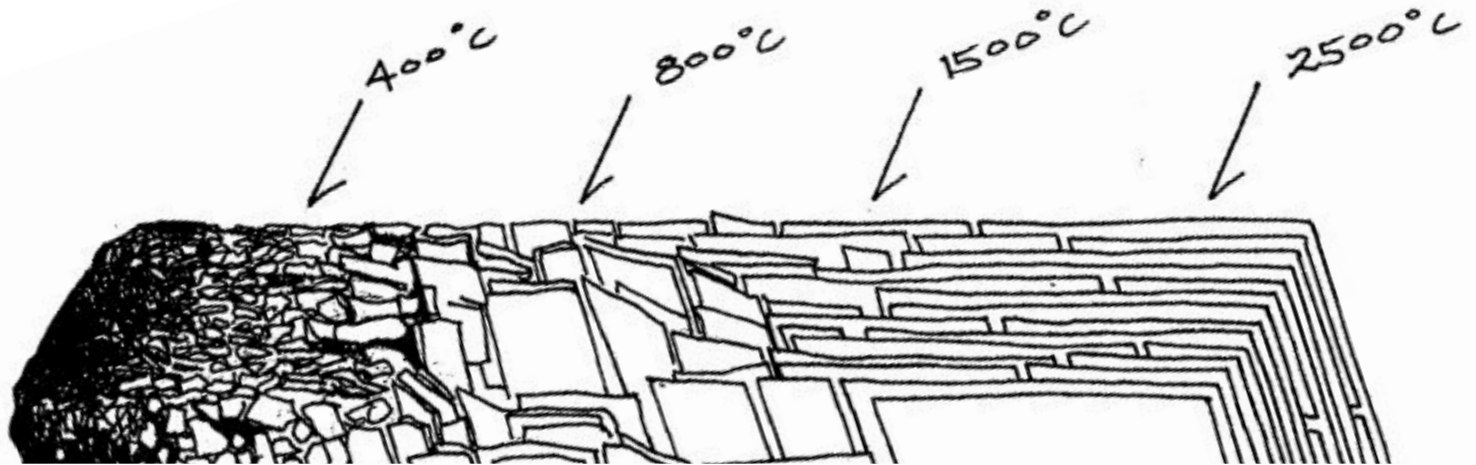


Fig. 2: The example of a match shows how the flame excludes oxygen allowing pyrolysis to take place (image: Thomas Reed)

How is it different from other charcoal?

Wood... Cooking charcoal - - - Biochar - - - Activated Charcoal



Wood Biochar

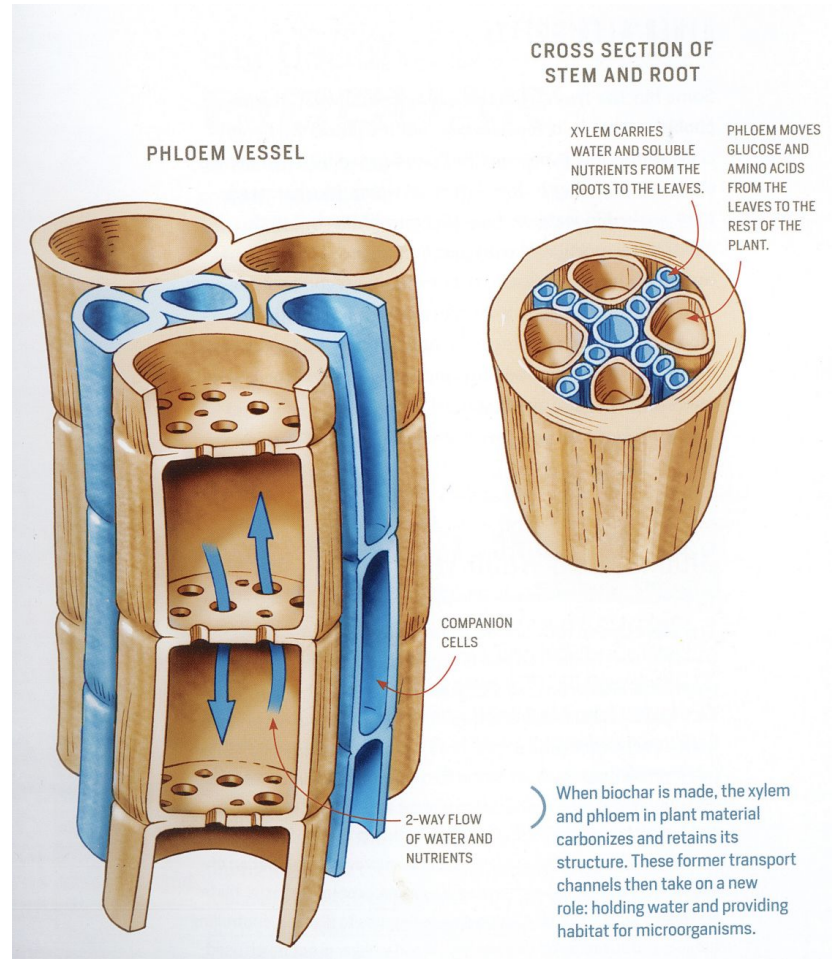
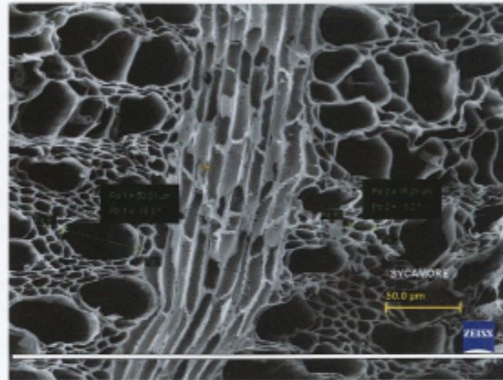
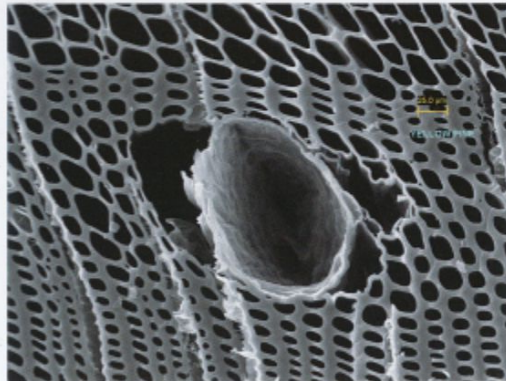
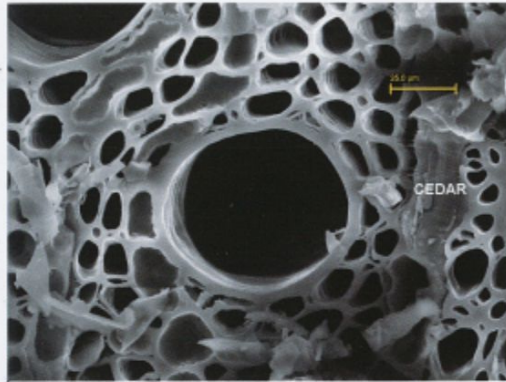


Image from Gardening with Biochar, Jeff Cox, 2019

Wood Biochar



These microscopic images of cedar, sycamore, and yellow pine biochar show how the cellular structure has been preserved.

“Charging” biochar



Images from my garden

Biochar in soil

Enhances the mechanical and biological characteristics of the soil, increasing:

- Water holding capacity
- Water infiltration
- Nutrient retention
- Cation exchange capacity
- Habitat for microbes



Oasis Vineyard Trial

4 treatments:

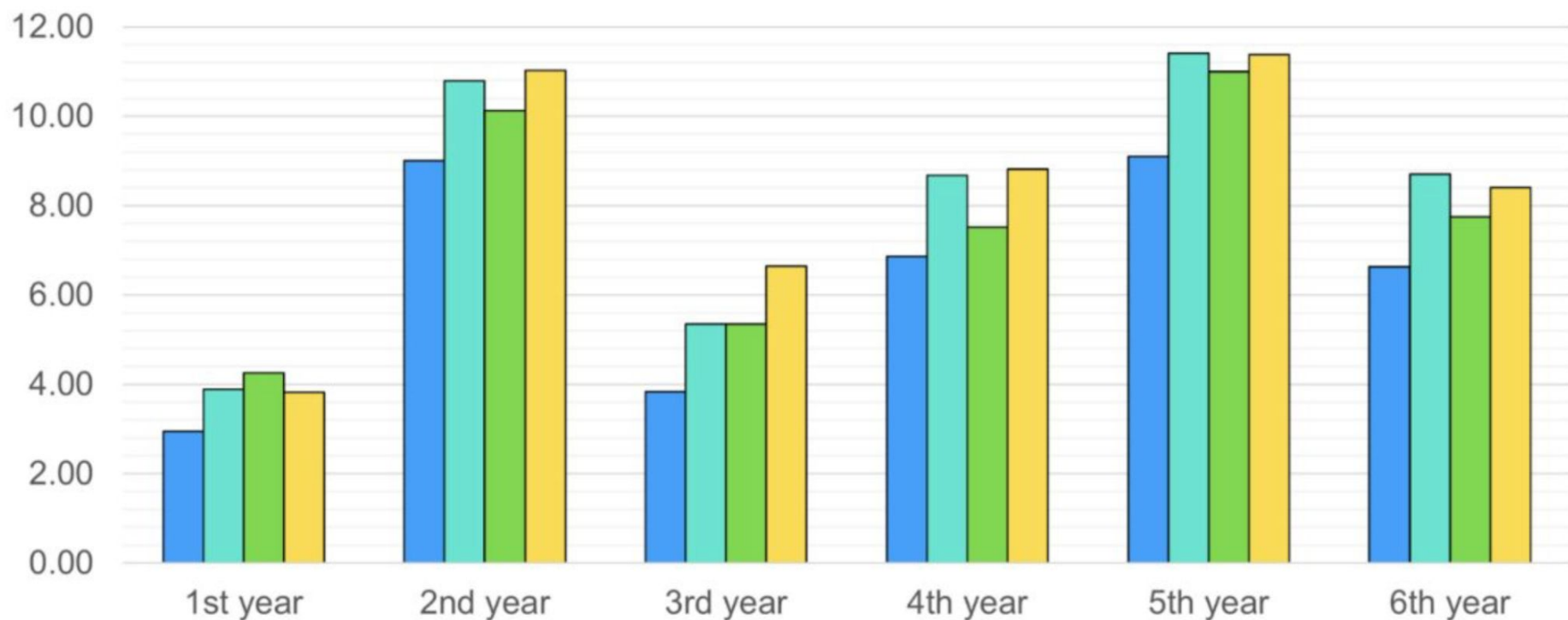
- 1) Control (conventional farming)
- 2) Biochar (10 wet tons per acre)
- 3) Compost (10 wet tons per acre)
- 4) Biochar + Compost



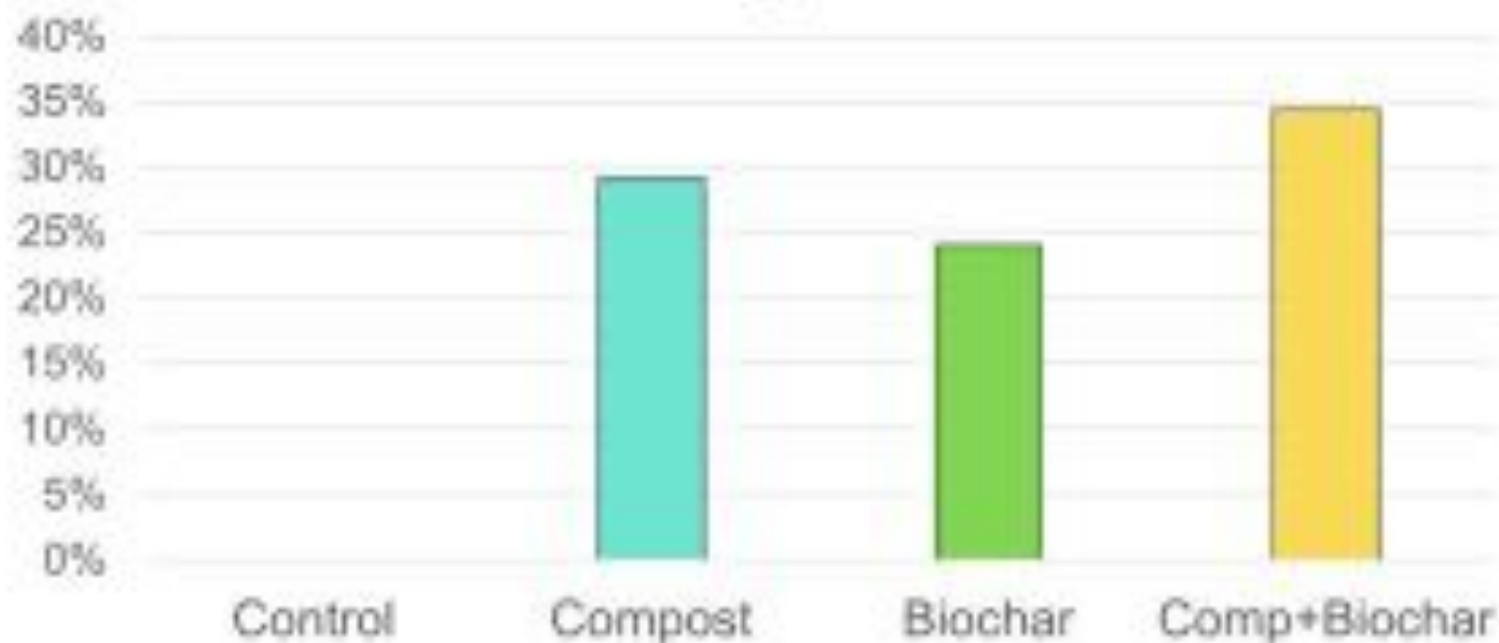
Images of biochar and compost application. Photo credit to Doug Beck

Annual Yield, tons/acre

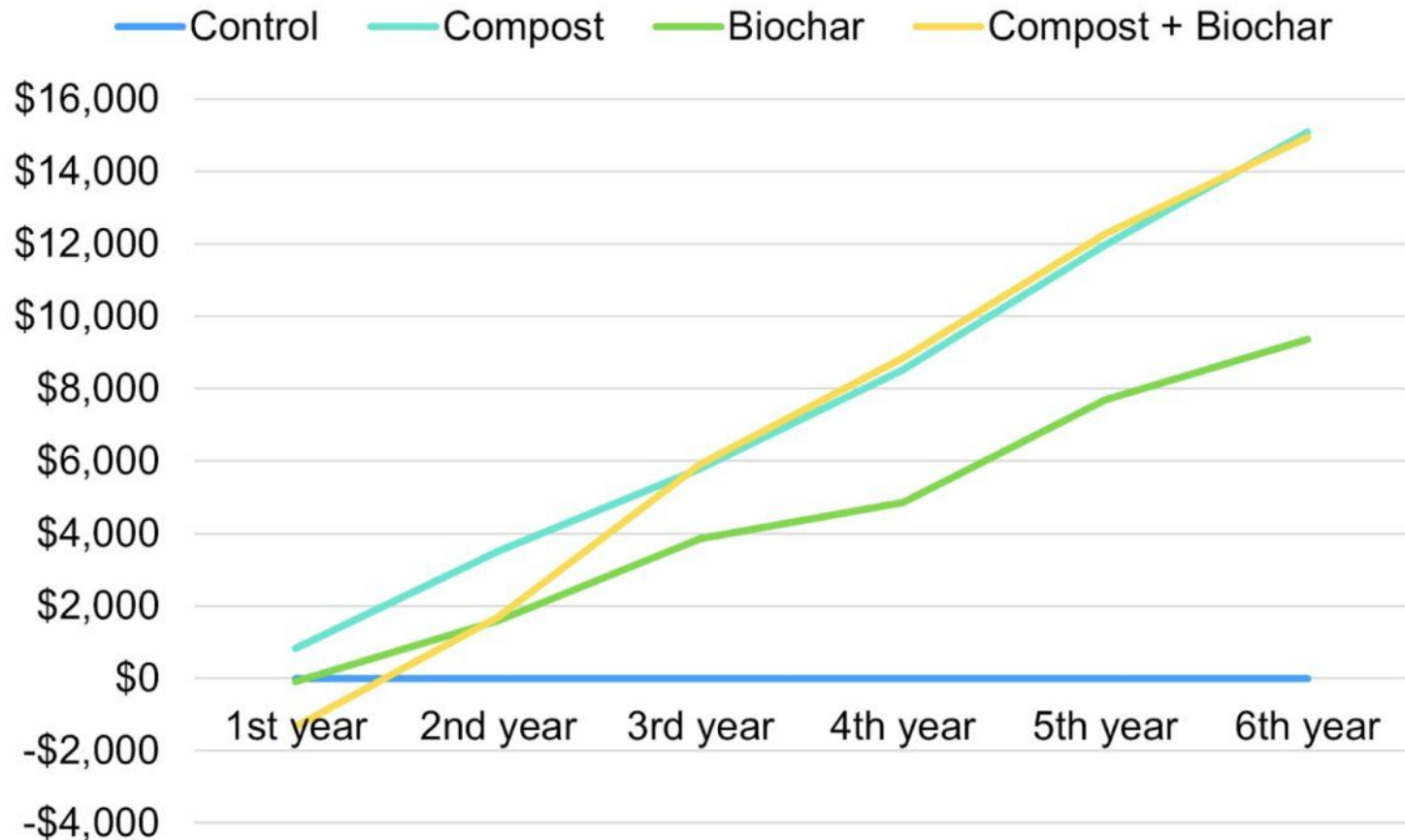
Control Compost Biochar Compost + Biochar



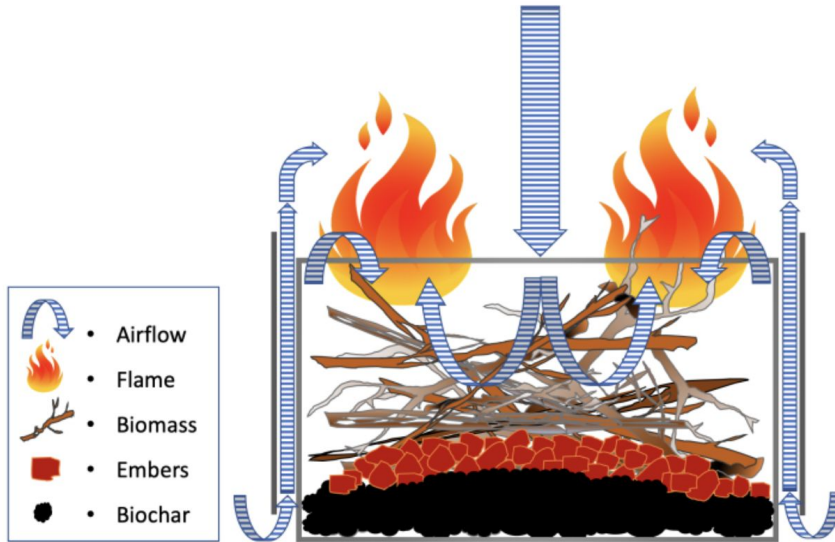
Yield, Percent Above Control, 6 Year Average



Additional Revenue Above Control & Input Costs



Flame Cap Kilns



Ring of Fire Biochar Kiln

Airflow and Flames – Counter-flow air from the top keeps embers contained and flame lengths low.



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The Napachar Model

- On-site production with flame-cap kilns
- Clients pile wood to cure
- We feed wood into kiln by hand
- Leave biochar in quench patches for clients to integrate into soil
- Average 6.5 cu-yds biochar per kiln
 - ~ 1 dry ton grapevine biochar
 - ~ 1 acre of pulled vines processed
- High-quality biochar (> 80% Carbon, and H/Corg < 0.32, average of 23 samples)



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Videos



A semi-trailer of biochar made on site

(more than 80 cubic yards - 20 moist tons - in 6 days)



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Transforming organic waste into resilient ecosystems. Our network of biochar practitioners bring carbon, and beneficial fire, back to the local landscape.

Fact Sheet: Flame Cap Kilns

*Tools for turning woody debris into biochar
for lasting soil health and landscape resilience*



Flame cap kilns are a simple, portable, affordable tool to transform woody debris to biochar on-site.

Biomass—like branches, brush, and other woody debris—is often so widely scattered across landscapes that it is not practical or cost-effective to collect and haul it to a commercial facility for processing. This is especially true in forest management, where wildfire mitigation projects and timber operations create large amounts of low-value, leftover wood for disposal as waste, as well as agricultural properties with significant woodlands. Fortunately, there's a better solution: **we can turn this stranded material into biochar with flame cap kilns and use the biochar on site** – saving money, increasing resilience, and keeping carbon in the landscape for hundreds of years or more.

Flame cap kilns were first engineered in Japan, where farmers have long used simple, open containers to turn wood and bamboo into a carbon-rich material that improves soil. Often described as a “burn pile in a bin,” the flame cap kiln limits airflow just enough to turn biomass into captured biochar instead of ash. **This clean-burning process is called flame carbonization**, and in carbon markets, it's recognized as Biochar Carbon Removal (BCR).

While modern large-scale biochar systems often use afterburners or advanced controls to reduce polluting emissions, flame cap kilns work differently. They burn the smoke and volatiles in the flame, acting like a natural afterburner. Once the pile is reduced to glowing coals, it's quickly quenched with water to stop the burn and preserve the carbon. **This charred material isn't meant for fuel—when it's used to build healthy high functioning soils and landscapes and store carbon, it is called biochar.**



 **Biochar On Site**



BUILD A BETTER BIOCHAR BURN PILE

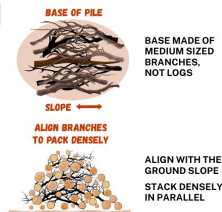
HOW TO GUIDE



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IN PARTNERSHIP WITH


1. BUILD THE BASE AND INNER PILE



2. STACK TEEPEE POLES AROUND INNER PILE



3. LIGHT ON TOP



MAKE A POCKET OF DRY KINDLING NEAR THE TOP COVER WITH PLASTIC* TO PROTECT FROM RAIN. LIGHT THE KINDLING POCKET USE PROPANE TORCH, DRIP TORCH, OR PITCH WOOD. STRONG FLAME WILL BURN THE SMOKE. FLAMING COMBUSTION FINISHES FASTER THAN SLOW SMOLDERING.

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BIOCHAR BURN PILE
FACT SHEET



[BIOCHARONSITE.ORG/FACT-SHEETS](https://biocharonsite.org/fact-sheets)



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Mobile Biochar in CA - Potential CO₂e Drawdown

Each year:

- Napa and Sonoma vineyards: **0(10,000) tons**
- California vineyards: **0(100,000) tons**
- California forests today: **0(1 to 10) megatons**

Not considered, but viable:

- *Municipal green waste*
- *Other orchard crop prunings*
- *Anything else that burns on a bonfire*



Napachar

Thank you!



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digital business card:

website

www.napachar.com

instagram

[@napa.char](https://www.instagram.com/napa.char)

linkedin

[linkedin.com/company/napachar](https://www.linkedin.com/company/napachar)

email

eric@napachar.com

Eric Mayer, PhD and founder of Napachar

Extra slides for questions



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Rocky Mountain Research Station

RMRS-GTR-439

July 2024

Mobile Biochar Production by Flame Carbonization: Reducing Wildfire Risk and Improving Forest Resilience

Kelpie Wilson, Wihan Bekker, James Archuleta,
Darren McAvoy, and Deborah Page-Dumroese



Table 6—Biochar productivity comparison (based on one 8-hour shift).

Technology type	Typical scenario	Hand crew per shift	Machine operator for loader per shift	Biomass processed per shift by dry mass, tons (metric tonnes)	Biochar production per shift by volume, cubic yards (cubic meters)	Total water required per shift, gallons (liters)
Conservation burn pile (CBP)	Hand piles (150 piles)	5	N/A	22 (20)	11 (8)	1,000 (3,800)
	Machine piles (30 piles)	4	1	99 (90)	27 (21)	9,000 (34,000)
Flame-cap kiln (FK)	Ring of Fire Kiln® (4 kilns)	5	N/A	8 (7)	12 (9)	600 (2,300)
	Oregon Kiln (6 kilns, 2 batches)	5	N/A	8 (7)	12 (9)	600 (2,300)
	Big Box Kiln (2 kilns)	2	1	11 (10)	16 (12)	600 (2,300)
Air curtain burner (ACB)	BurnBoss® (1 unit, 2 batches)	1	1	12 (11)	6 (5)	500 (1,900)
	CharBoss® (1 unit, continuous)	2	1	5 (4)	6 (5)	300 (1,100)
	Tigercat 6050 (1 unit, continuous)	2	2	56 (51)	16 (12)	3,000 (11,300)

Table 9—Emission factors (grams per kilogram dry biomass) for wildfires, burn piles, flame-cap kilns, and air curtain burners.

Type	PM10	PM2.5	Nitrous oxide (NOx)	Methane (CH4)	Carbon dioxide (CO2)	Carbon monoxide (CO)	Source
Wildland fire	—	23.2	2.00	7.3	1,600	135.0	Urbanski 2014
Burn pile, flaming	4.0	—	—	1.0	—	28.0	Springsteen et al. 2011
Burn pile, smoldering	7.0	—	—	8.5	—	116.0	Springsteen et al. 2011
Burn pile, dry	—	4.5	—	1.1	1,785	29.0	Aurell et al. 2017
Burn pile, wet	—	18.0	—	5.7	1,689	82.0	Aurell et al. 2017
Slash pile burn	4.4	3.9	2.50	4.5	1,690	65.3	Puettmann et al. 2020
Flame-cap kiln	1.3	—	0.14	2.6	780	2.6	Puettmann et al. 2020
Large air curtain burner	—	0.6	—	0.7	1,808	1.3	Susott et al. 2002
BurnBoss® air curtain burner	2.1	—	1.00	0.3	—	7.1	Montrose Air Quality Services 2023

— Indicates no data.

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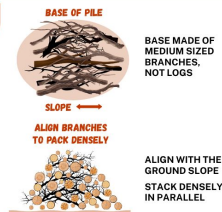
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