



Kelpie Wilson
Wilson Biochar Associates

BIOCHAR IN THE WOODS: WHAT TECHNOLOGIES ARE BEST FOR SMALL SCALE PRODUCTION?



Natchez Fire, Rogue Siskiyou NF

Ignition, July 15, 2018

Aug 1, the view
from my deck...





**View from my deck: October 2009.
Smoke fills the air from hundreds
of burning slash piles – fuels
reduction project.**

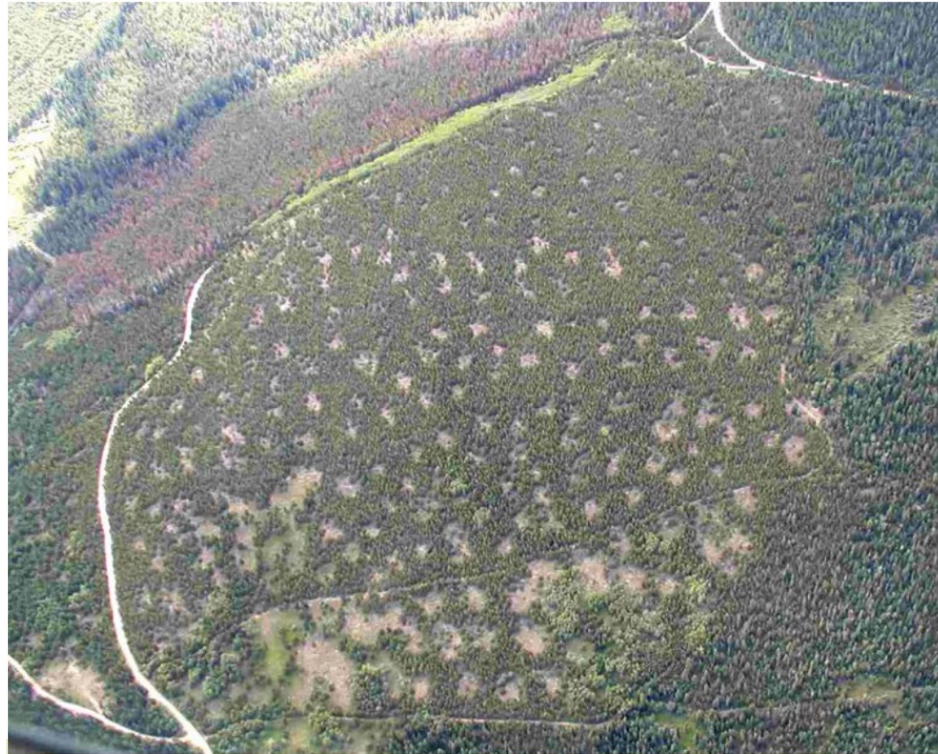
Jackpot piles burn hot & complete



- Tight piles don't fall apart
- Burn hot in the center
- Burn completely to ash
- **Generate smoke**
- **Burn forest soil**



Burn pile scars are long-lasting



Pile burning can create grass and forb-filled openings that often remain treeless for decades, as can be seen in this aerial photo of a 40-year-old regenerating lodgepole pine stand in Grand County, Colorado. (Photo by C. Rhoades)



Is there another way to treat problem fuels?

Bottom Lit vs. Top Lit Burn Pile



- Conventional: Flame under cold biomass makes smoke
- Top Lit: Light on top – heat transfers to pile by radiation
- Flame on top burns smoke



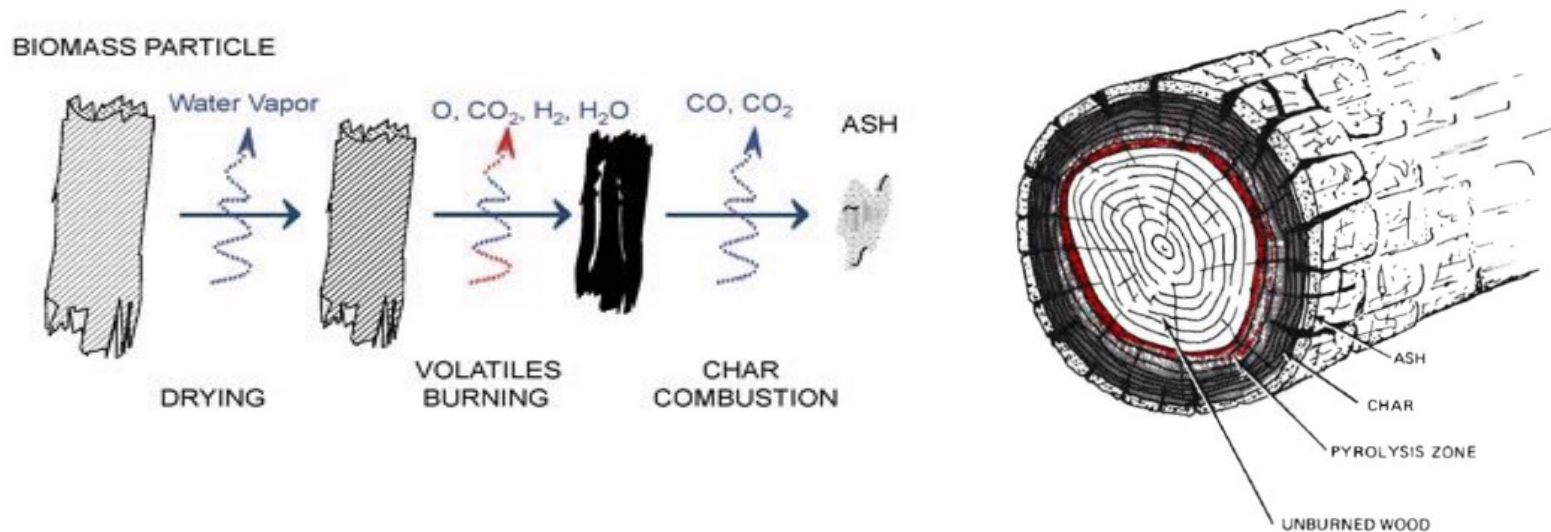
1. Light it on top
2. Quench with water to save char





Flame Carbonization

Making biochar in an open flame

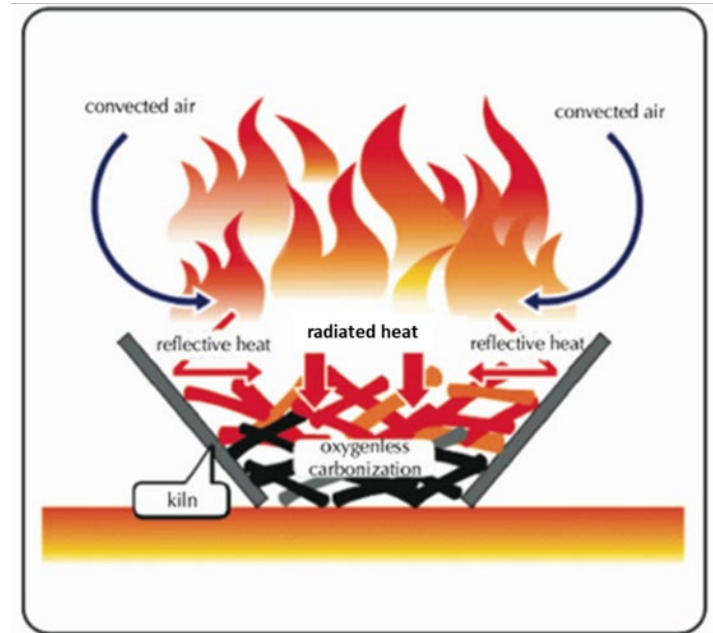


- Biomass burns in 3 stages.
- To make char, stop the process before it goes to ash.



It is all about controlling the oxygen to prevent the final stage of combustion – oxidation of the char

For greater efficiency: Flame Cap Kiln



Smokeless Carbonizing Kiln Charring Schematic
MOKI Manufacturing Co. Ltd.
Nagano, Japan

- Pan excludes air from the bottom
- Flame on top uses up all the oxygen and burns the smoke
- Char is protected from air and does not burn



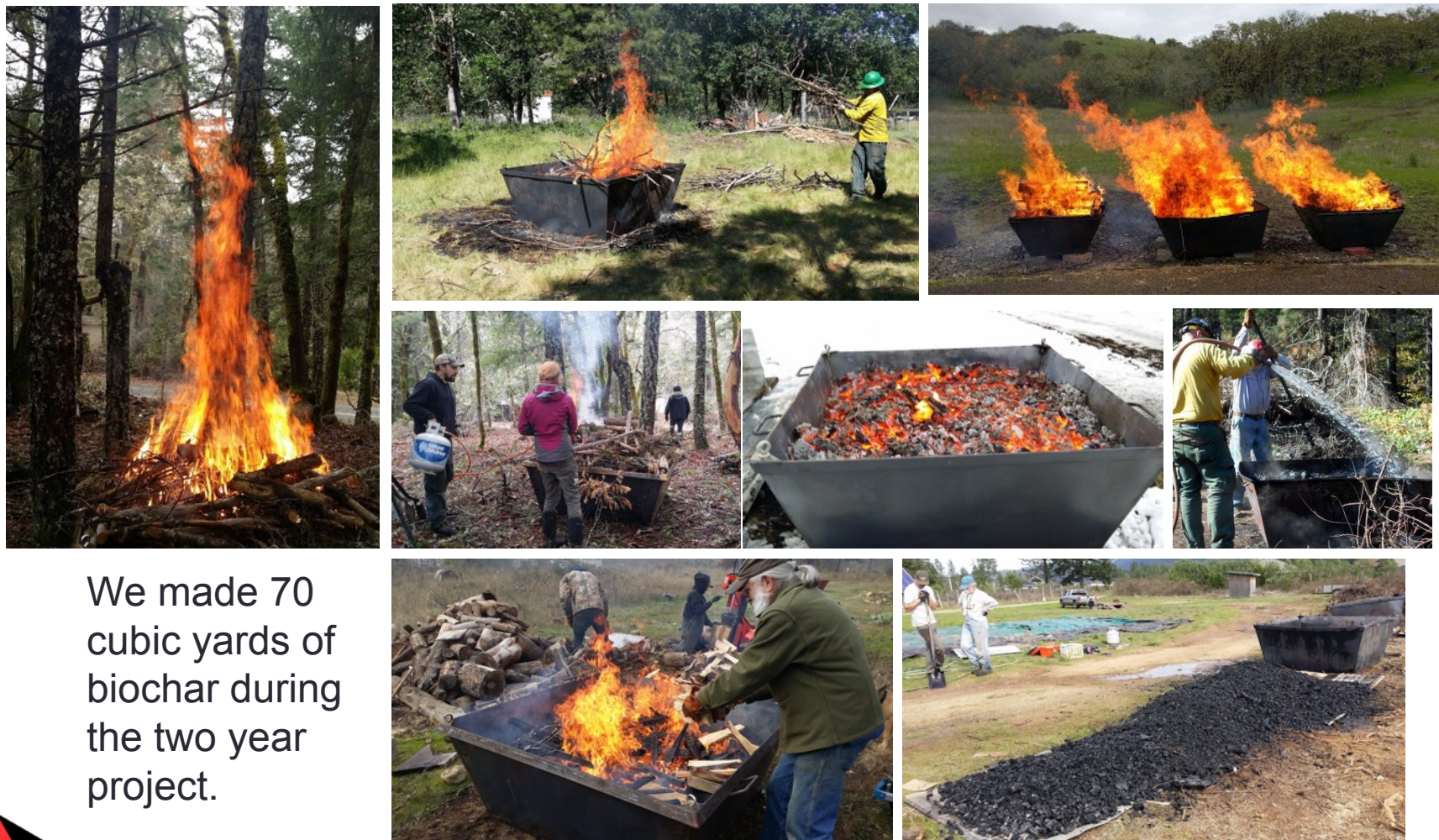
Can be any shape – pit, pyramid, cone, ring, trench, box



Super Cheap and Simple: Ring of Fire Kiln



Umpqua Biochar Education Team (UBET)



We made 70 cubic yards of biochar during the two year project.



NRCS Conservation Innovation Grant 2015 - 2017

Design Parameters - the Oregon Kiln

- Sized for feedstock
 - Logs 4 to 5 feet long
 - Up to 6" diameter
- Portable but durable
 - Less than 200 lbs
 - 14 gauge steel
- Ergonomic for loading
 - Only 2 feet high
- Capacity
 - Makes > 1 cy of biochar in about 4 hours



How to operate a Flame Cap Kiln



- Pile loosely
- Light on top



Once the first pile burns down, add more



- Add new material, one layer at a time
- Make sure each layer has the same size material



Quenching Time



Quench when kiln is full and flame is gone



Snuff Quenching



Double-walled Ring of Fire Kiln



Oregon Kiln



Drew Biochar Project – Umpqua Biochar Education Team



- 17 acres of thinning
- Removal of small trees
- Umpqua National Forest



**Stewardship Contract awarded to South Umpqua Rural
Community Partnership – www.surcp.org**





Three days, 166 cubic yards of forest slash, 28 cubic yards of biochar



Project Planning

Based on Drew Veg Biochar Project

Project size and volumes	
project size, ac	17
tree/ac	800
volume of piled slash, cy	396

Labor crew size	
crew size, # of kiln tenders (each tender operates 2 kilns)	6
crew size, # of machine operators	1

Total crew size: 7 people



Labor Time and Machine Hours

Machines and machine hours	
loader to place kilns and move slash, hrs/day	6
water tender for quenching, hrs/day	2

Labor hours	
crew set up time, hrs	1
biochar burning time per kiln batch, hrs	4
quenching and unloading, hrs	2

Total daily job time, including setup and quench, 7 hours



Outputs

Production volumes	
assumed conversion efficiency, biomass to biochar, by volume	16.70%
volume slash consumed per kiln batch, cy	6
biochar output per kiln batch, cy	1
number of kilns	12

Daily output	
total biochar output per day, cy	12
total slash processed per day, cy	72

- 5.5 days to process all slash
- 66 cy of biochar produced



Climate Impact

- Assume one cubic yard of biochar weighs 200 pounds
- 66 cy x 200 pounds = 6.6 tons of biochar
- 6.6 tons x 80% fixed carbon fraction x 44/12 = **19.4 tons of CO₂ sequestered from one 17 ac thinning project.**

Average American emits approx. 20 tons CO₂ per year



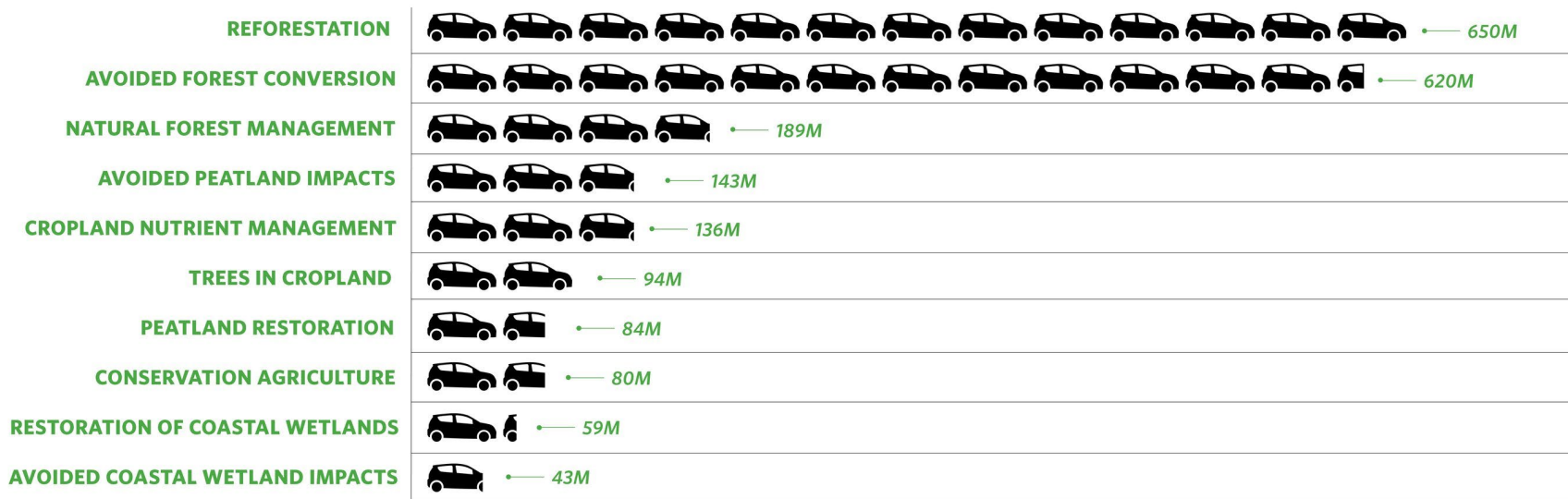
Restore Nature, Restore Climate



NATURAL CLIMATE SOLUTIONS

TOP 10 MITIGATION PATHWAYS¹ WITH CO-BENEFITS

Natural Climate Solutions have the same impact on emissions as taking millions of cars off the road



Global Mitigation Potential: Approximate Number of Cars Removed Each Year in Millions

= 50M cars
¹Cost-Effective



We need to Scale It UP!

Big Box Biochar

Yew Creek Land Alliance, OR



Menoken Farm, ND



GO BIG – Boots on the Ground



Civilian Conservation Corps

- President Franklin Delano Roosevelt proposed the CCC program to Congress on March 21, 1933:

I propose to create [the CCC] to be used in complex work, not interfering with normal employment and confining itself to forestry, the prevention of soil erosion, flood control, and similar projects.



Carbon Conservation Corps

- A service year for young people
- Improve forest health and protect communities from wildfire
- Pay them to sequester carbon in biochar
 - PHYSICAL FITNESS
 - A SENSE OF PURPOSE
 - HOPE FOR THE FUTURE



Planting trees in biochar – Ashland Forest Resiliency Project



Cut, Pile & Burn vs Cut, Char & Quench

Item	CP&B	CC&Q
Cut (chainsaw work)	\$350	\$350
Pile (5-8 piles/hr per worker)	\$600	
Burn (20 piles/acre, using drip torch)	\$150	
Biochar Kilns (3 - 4 kilns per acre, 1 person feeds 2 kilns)		\$600
Quenching water (water truck & operator)		\$150
Total cost/acre	\$1100	\$1100



Growing Number of Projects and Partners

- NRCS
- USFS
- USDA-ARS
- Oregon Department of Forestry
- North Dakota Forest Service
- Nebraska Forest Service
- Kansas Forest Service
- Utah State University Extension
- Oregon State University Extension
- South Umpqua Rural Community Partnership
- Long Tom Restoration Council
- Yew Creek Land Alliance
- Illinois Valley Community Development Organization
- Two Rivers SWCD
- Ridge to Reefs



Charring Pinyon-Juniper in Utah





Questions?

Kelpie Wilson
Wilson Biochar Associates
Home office: 541-592-3083
Mobile: 541-218-9890
kelpiew@gmail.com
www.wilsonbiochar.com



Wilson Biochar Associates specializes in biochar technology and market development. We provide strategic advice and services to businesses and organizations.

- Technology Assessment
- Research and Analysis
- Project Development

