The Black Ripple: Off-Grid Low-Tech Biochar Production in Southern Humboldt County, CA

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Abstract

This low-tech biochar system has four parts: trail building, for access to steep terrain; a portable kiln, to make biochar where the brush is; a hand-powered charcoal grinder designed to pass up to 0.25" char; and a powered wheelbarrow, to assist transport.

The kiln design is licensed from Vuthisa in South Africa. It is a flame cap type, consisting of a steel cylinder in three flanged sections joined by bolts, plus a lid. Suffocating the fire with the lid makes water unnecessary for extinguishing the char. Most of the forest is too far from water sources.

The grinder is my own design, based on an obsolete compost grinder (Rotocrop). It makes very little dust and converts all the char to a suitable size for biochar using the least work. The hopper holds a wooden cylinder with a 1/4" gap on either side, studded with decking screws and turned by hand. It fits on the lid of an ordinary 5-gallon bucket. It releases very little dust and converts all the char to a suitable size for biochar using the least work. A scale drawing (STEP file) will be available on my website.

To move the kiln, char, and other materials in the steep terrain, I built carefully graded trails and retrofitted a wheelbarrow with a powered hub from China and a 24V battery that recharges from the house solar system.

Douglas-fir, a pyrophyte that displaces native oaks and meadows under fire suppression, is the principal substrate among many. Reclaiming oak woodlands and meadows is part of the purpose for this project. Fuel reduction costs are defrayed by utilizing the char locally as a soil amendment.

This low-tech system can be adapted to other places, in whole or in part, according to their needs and constraints.

The Problem:

Fuel buildup and habitat loss from fire suppression

Photo credit: sacbee.com (Sacramento Bee, 12/21/18)

The Solution:

Manual fuel reduction
Making biochar from this fuel for use on site defrays labor costs of fuel reduction

Unique Conditions:

Steep terrain
Remote location
Logging damage
Off-grid homesteading
Cannabis cultivation

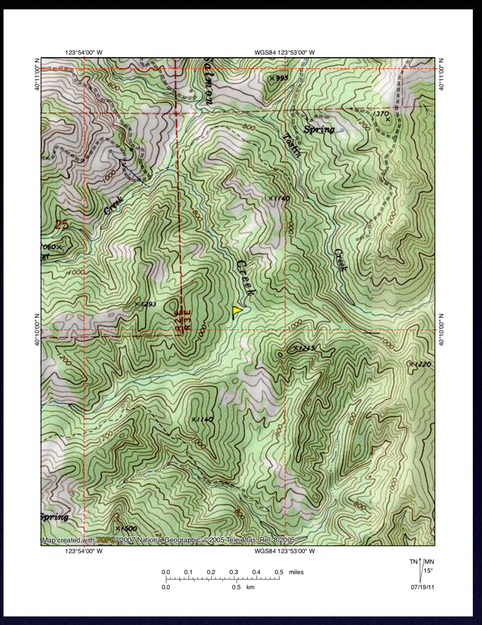

Photo credit: rootsofmotivepower.com (Coombs Family collection)

History

Southern Humboldt has been exploited in waves for beaver pelts, tanbark, sheep, logs, and finally cannabis.

Fire suppression began in the early 20th century, promoting Douglas-fir from an occasional species to a dominant one.

Our 300-acre parcel was logged with bulldozers in the 1970's. Hippie homesteaders bought it cheap, built homes and planted weed. The forest was mostly left to recover on its own. Douglas-fir resurged and forest litter accumulated.

Tying It Together

Families that live in the woods now nearly all grow cannabis and are being required to address the legacy impacts of logging. By making biochar from excess forest fuel, the problem of fuel buildup can be a solution for local soil improvement. This new incentive contributes to the economy of these local stewards, furthering restoration.

Douglas-fir, a pyrophyte that propagates invasively under fire suppression, is the principal char substrate among many. It shades out native oaks and takes over meadows. Wildfire in fir-dominant forests will incinerate all species. Manual fuel reduction is required to prevent catastrophic loss of stored living carbon. Reclaiming and conserving oak woodlands and meadows is part of the purpose for this project.

As the green rush of cannabis cultivation subsides, additional revenue streams will be sought. Biochar production provides one, while also driving local forest restoration. Sensitive and endangered species live here, fuel continues to build, and logging damage remains. Biochar production addresses all these concerns. We need to stabilize our land and our lives, not start another wave of exploitation. Instead of a wave, biochar represents a ripple — a Black Ripple of healing for the economy and the forest.

Scale

Commercial production of biochar is possible here. But most of these original family farms are less than an acre. My goal was to design a biochar system to match the existing scale of operations and power sources (solar and human power).

1. To approach the problem at this scale, the first step was to build trails, paying careful attention to grade for wheelbarrow access. This was begun in year one (2010).

2. The kiln design is licensed from Vuthisa in South Africa and built by a sheet metal fabricator in Berkeley, CA. It is a flame cap type, consisting of a steel cylinder in three flanged sections joined by bolts, plus a lid. The parts are easily transported. Snuffing the fire with the lid and sealing air leaks with mud makes water unnecessary. Most of the forest is too far from water sources. (Inaugurated in 2015)

The system I designed has four parts:

1. trail building, to access steep terrain
2. a portable kiln, to make biochar where the brush is
3. a hand-powered charcoal grinder
4. a powered wheelbarrow, to neutralize the terrain

This system was designed to be affordable and accessible. It can be adapted for other conditions, in whole or in part.

4. To move the kiln, char, and other materials in the steep terrain, I retrofitted a commonly available wheelbarrow with a powered hub from China and a 24V battery that recharges from the house solar system. (Completed in 2019)

3. The grinder is my own design, based on an obsolete compost grinder (Rotocrop). It makes very little dust and converts all the char to a suitable size for biochar using the least work. The hopper holds a wooden cylinder with a 1/4" gap on either side, studded with decking screws and turned by hand. It fits on the lid of an ordinary 5-gallon bucket. A scale drawing (STEP file) will be registered on the creative commons and made available on my website. (Built and placed in service in 2018)

Char is made during the winter rainy season, left outdoors and co-composted in the spring, by which time rain has left the char with an ideal moisture content for grinding with minimal dust.

Inoculation

Local compost sources are limited in the forest. To inoculate char with few external inputs, I add compost tea from worm castings made from food waste and recycled cannabis waste from oil extraction.

Top-Lit Piles

My kiln was built on commission from the plans for about $900. As my neighbor demonstrates here, this expense can be avoided, along with the time and effort of moving, assembling and dissembling a kiln, by stacking and burning the fuel, provided that water can be brought to the site. She used a backpack water pump. The choice of methods will depend on priorities and tradeoffs among cost, labor, and productivity. Notice that Douglas-fir burns quite well while still green.

Restoration

Once the fuel is sufficiently reduced, fire can return to the landscape relatively safely, intentionally or not. Prescribed burning can follow manual fuel reduction.

Photo credit: Kai Ostrow