LEARNING to BURN and MAKE BIOCHAR, NOT SMOKE

A bottom-lit pile, left, produces smoke because cold, damp wood emits gas (smoke) before it ignites, while the top-lit pile, right, has flame present to burn the smoke. All photos courtesy of Wilson Biochar Associates.

By Kelpie Wilson

Tree care workers generate mountains of limbs and brush that must be disposed of. Chipping may be the first option, but it doesn't always pay. Forested properties with masses of material but poor road access, and small jobs that don't justify the cost of hauling equipment, are both candidates for a new technique – the clean biochar burn.

The clean biochar burn method is practically smoke-free. Not only that, it makes a valuable product out of waste: biochar. Biochar is just another name for charcoal that is used in soil. Biochar is a superior soil amendment for water and nutrient retention that can be left on site to help build healthy soil, or used in a client's garden on vegetables or flowers. (see "Biochar for Arborists," *TCI Magazine*, September 2012)

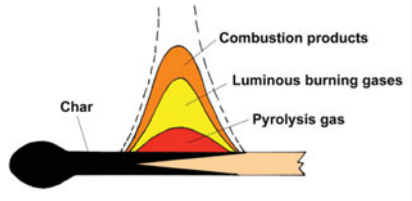
Well into a clean biochar burn.

On a sunny weekend this past November, a crew of volunteers who wanted to "learn to burn" came together at the Enchanted Forest, 450 acres owned by Jan and Brenda Patton outside of Grants Pass, Oregon. Forest contractor Lomakatsi Restoration Project had cut small firs and pines encroaching on a 10-acre oak savannah, and piled the debris for burning – the standard protocol for forest thinning. Open burning is often the only economically viable way to dispose of this woody debris, but nobody likes all the smoke it generates.

The essence of the clean biochar burn technique is this: contrary to what you may have learned in Scouts, light your burn pile from the top, not the bottom. Standard practice for forestry contractors is to build a "kindling box" about halfway down the pile and light it there, according to the belief that kindling must lie below to ignite the larger wood because "heat rises." But according to biochar expert and Burn School instructor Peter Hirst: "Heat does not rise and wood does not burn."

The truth of this statement is illustrated by the diagram of a burning match:

Wood does not burn directly, rather, heated wood emits gases that burn:



World's smalles biochar reactor

- Heat transfers by radiation into the wood
- Heated wood releases gases that rise
- When hot gases rise they are exposed to air and they burn
- Heat converts remaining wood to charcoal
- Charcoal will not burn if it is protected from oxygen by the gas flare
- If rising gases cool too fast or do not get enough air, smoke results

"Heat does not rise": A flame rises by convection, but the heat is transferred to the unburned part of the match by radiation, which proceeds in all directions. The other part of the statement, "wood does not burn," is true because heat first liberates gas – mostly methane and carbon monoxide – and it is the gas that actually burns.

What this means for our top-lit biochar burn is two things: first, the flame at the top will burn up all smoke. You don't see smoke from a match until you blow it out. Second, the flame acts to exclude oxygen, protecting the charcoal that is left after the gas is released from the wood.

That's how we burn the wood gas out of a burn pile, without making smoke and without burning up the charcoal in the process. Of course we have to put the coals out with water or dirt at the end, or the charcoal will burn up as the oxygen reaches it.

At the Biochar Burn School, we started by burning two piles side by side to compare the standard practice with the top-lit method. The difference was dramatic. We spent most of the weekend trying different sizes and shapes of pile construction, and seeing how little water we could use and still save the biochar.

Our crew included forest restoration workers, U.S. Forest Service soil scientists, local landowners and gardeners, and Matt Banchero, owner Matthew Banchero's Tree Service in Occidental, California. Banchero thought he might find a use for the technique with some of his clients. Since burning is time consuming, he thought it would be best to make the piles and leave the landowner with instructions for using the top-lit burn method.

"A lot of people we work for would love to hang out and tend a fire," he says. "They just can't swing the chain saws and do the heavy work we do to prepare the material."

Tree service professionals who want to use the clean biochar burn method should check with local fire departments to learn about regulations and safety requirements.

Burn school instructor Peter Hirst (www.newenglandbiochar.org) offers training workshops and does contract burning.

Use a small amount of accelerant misted from a spray bottle evenly across the top of the pile and then ignite with a propane torch. Avoid drip torches that will produce flame underneath unburned material.

If you want to save the biochar, you need some water for quenching. A light mist and some shovel work will do the job.

Notice all the smoke coming from one log that is sticking up from the pile, away from the heat.

Kelpie Wilson is a consultant working in biochar and renewable energy. Learn more about her work at wilsonbiochar.com.