

Shelburne Farms Experiments with "Biochar" to Clean Water and Revitalize Soil

BY KEN PICARD, Local Matters

Marshall Webb is accustomed to getting his hands dirty. After all, he's the woodlands manager at **Shelburne Farms**, the sprawling agricultural estate on Lake Champlain that has been in his family for generations.

But his latest project, handling charred lumber, isn't as messy as you'd expect: A ton of biochar is remarkably clean, and holds the promise of purifying polluted water, revitalizing damaged soil, generating clean energy, even saving the planet from global warming, say scientists experimenting with the blackened wood.

"The problem with biochar is the potential is so great and exciting people tend to exaggerate what's known about it," Webb admits. "But, according to many people, biochar is one of the key discoveries that will enable humans to survive better in this century."

What is this miracle material?

Seated in his silo-shaped office in Shelburne Farms' farm barn north tower, Webb drops two discs on the table and explains. The first, he says, is a greenish-brown hockey puck of pressed switchgrass grown in Pennsylvania. The second, slightly smaller disc is charred, friable remains of that same switchgrass reduced to elemental carbon by heating it to 1000 degrees F in the absence of oxygen.

Webb picks up the second disc, which crumbles easily in his hands. Surprisingly, his fingers don't get very dirty at all—a good sign, he notes. Unlike the blackened remains found in a barbecue or fire pit, biochar contains few, if any, of the toxic byproducts left behind by incomplete combustion at lower temperatures.

Next, Webb explains how biochar is made. He takes out a contraption made from a coffee can stacked on a paint can with holes punched in the top. The paint can is filled with wood pellets, or any other biomass, and a fire is built in the top. As the fire burns down, it "pyrolyzes" the biomass below it, releasing gases like hydrogen and methane, which are then burned off. What's left in the makeshift retort is biochar, as well as a bio-oil that can be used as fuel.

Several weeks ago, Webb, along with two Cape Cod researchers, spent the



Adam retort, used for making biochar at Shelburne Farms

weekend at Shelburne Farms with a much larger version of Webb's coffee-can contraption making four 500-pound batches of biochar; they used scrap lumber left over from a saw mill. Webb sold a bag to a man across the lake in New York who wants to do experiments with it. The rest Webb gets to keep at Shelburne Farms.

His plan uses UVM **environmental studies students** to put several biochar filters in a nearby stream that empties into Lake Champlain. The students will test water above and below the carbon filters to see how effectively they remove phosphorus, nitrogen and *E. coli* bacteria, all of them pollutants that run off the farm and deteriorate water quality. If everything goes according to Webb's expectations, the biochar will capture these pollutants much the way activated charcoal filters do.

Next, Webb plans to take those nutrient-saturated filters and add them to test plots in Shelburne Farms' vegetable gardens. This not only returns nitrogen and phosphorus to the soil to be absorbed by plants; biochar also retains moisture and provide a fertile environment for billions of micro-organisms necessary for healthy soil.

"And the side benefit is that the carbon is sequestered for a thousand years," Webb adds. "It doesn't break down or go away."

The term "biochar" is new, as are its many uses for environmental management,

the idea has actually been around for centuries. Pre-Columbian Amerindian populations were known to have added a version of biochar to the soil in the Amazon Basin to increase its fertility. It was even named *terra preta de Indio*, Portuguese for "Indian black earth," which historians believe contributed to develop complex civilizations in that region.

Over the last two centuries, agronomists around the world have also recommended adding charcoal dust or similar charred material to the soil in order to retain moisture, boost soil chemistry and improve seedling growth. However, only recently have researchers begun to recognize the vast complementary potential of using biochar to lower greenhouse gases, generate heat and revitalize soils damaged from decades of logging or overfarming.

For his part, Webb says if the biochar lives up to its much-vaunted potential—Bob Wells from Cape Cod's Redberry Farm was able to increase the output of his farm by thousands of dollars per acre, he notes—Webb will eventually build an oven at Shelburne Farms to make biochar, and also heat animal barns or other buildings, all in a carbon-negative system.

"A small but very passionate group of individuals are working on this," Webb says, manipulating a lump of charred wood with his fingers. "And I could be one."