

# Guide for Making Biochar on Gabriola

Blue Heron Learning Society

<http://blueheronlearning.ca/>

## What is Biochar?



Biochar is created by burning of any organic matter in the absence of oxygen, called 'pyrolysis', through a very hot and smokeless fire. It is an ancient technique that is being revived to improve soils and sequester carbon. Using a 'kiln' with specific characteristics makes the burning process more efficient. **After taking a workshop you can borrow the Blue Heron kiln to make biochar.**

- Making biochar sequesters carbon effectively instead of burning it off into the atmosphere, helping to mitigate climate change effects. It's a great way to clear woody debris from your property and help *firesmart* your home. As an ethical principle, it should only be made from waste organics.
- Biochar is a super soil amendment that some have called 'permanent fertilizer' because it increases soil productivity and lasts for hundreds to thousands of years.
  - Biochar doesn't provide nutrients itself, but it holds nutrients like potassium, calcium, magnesium, and ammonium (one form of nitrogen) in cation form.
  - Biochar provides "housing" for beneficial soil microorganisms, thus increasing life in the soil. Looking at biochar through an electron microscope, one sees an incredible amount of tunnels and holes. Perfect housing if you're a microbe!
  - Biochar is highly porous and holds water, so it is helpful in drought-prone areas.
  - Biochar provides air spaces to prevent soil from becoming compacted, something else that is important for plant growth.
- The factors that affect the pH of the biochar are the materials used in the burn and temperatures achieved during the burn. Biochar made on Gabriola with local woodstock is generally alkaline. The drain water after quenching the fire is high in potassium and high in pH. Soils on Gabriola are acidic (low pH), and biochar addition will help ameliorate this, but it is always a good to have an idea of the pH requirements in your particular application.

## How to make Biochar

**Step 1.** Gather your organic waste materials. Ensure they are reasonably dry, especially to start the burn. Avoid painted, stained or plywood materials in the mix. Occasional metal such as nails are ok as they can be removed after burning.

**Step 2.** Obtain a fire permit (time-frame is approximately October to May) from the Gabriola Fire Department at 250-247-9677 (<https://www.gabriolafire.ca/>). The inspector will likely arrange a visit to your site to examine materials, review safety and select a location for the burn.

**Step 3.** Book the kiln with Blue Heron [[info@blueheronlearning.ca](mailto:info@blueheronlearning.ca)]. Plan on least 5 hours for the burn from start to finish to produce a good amount. The day before, check the ventilation index (on the fire department website) and ensure conditions will be satisfactory, then go ahead and get the kiln.

- You will need two people to move the kiln and a pickup truck or trailer to transport.
- Ensure that you sign and submit the Blue Heron waiver stating you have read the safety instructions, have obtained a fire permit, will follow fire regulations, and return the kiln by the date agreed upon.

**Step 4.** Prepare the site by having the following supplies on hand:

- Metal rake, shovel, and pitchfork
- Heavy, non-flammable gloves (wear old, low-flammable clothing -cotton or wool)
- Water hose hooked up at the site for safety
- Chair to relax, drinking water and snacks



**Step 5.** Hook up a second water hose to the input on the bottom of the kiln. Build a 'rick' of crossed small to medium sticks in the bottom of the kiln several layers high (up to about 16 inches). Then build the fire on top using dry kindling and crunched-up newspaper. **Light the fire** all over as quickly as possible to create a hot, smoke-free fire. *Option - use a tiger torch to get it burning hot very quickly all over.* Once the wood has turned black and the fire is established, use the rake or fork to stir areas and add layers of wood evenly over the top, one layer at a time, trying to keep a nice uniform flame across the surface.

**Step 6.** In this flame-curtain kiln, air enters from the top and the first thing it encounters is the flaming surface, which consumes the oxygen and keeps the lower levels in a low- oxygen state. The level of hot coals gets deeper and deeper.

Monitor the fire constantly. After half an hour or so, knock it down and level it out a bit. As the fire gets very hot, add bigger pieces.

NOTE: every time white ash develops on top, it's time to add more fuel.

NOTE: save some small-diameter wood to finish the fire later.



**Step 7.** Start the end of the burn when you begin to run out of time, room in the kiln, or fuel. It will take at least another 1 hour to complete. Only add smaller materials and break up the chunks. Stop adding fuel as you wind down the burn.

**Step 8.** Quench the fire by turning on the hose attached to the bottom of the kiln. Fill the kiln with water until the entire volume is quenched. Dig and turn the pile until it is a wet slurry.

Check back in a few hours in case of remaining hot spots. The char should be brittle and sound like glass when breaking, shiny and crystalline, with little or no smell.



*(Photo shows a different style of kiln being quenched from above)*



**Step 9.** Next morning, drain the kiln or scoop out the quench water, and use it to water gardens or trees (it is high in potassium and quite alkaline). Put the bare biochar somewhere (eg. on a tarp) to drain and dry for later sizing (grinding) and inoculating.

**Step 10.** Rinse out the kiln and return to Blue Heron Learning Centre.

## Step 11. Preparing the char for the soil.

- **Optional.** If there were nails in the original materials remove as many metals as possible by picking them out or using a magnet sweeper.
- **Drying the char.**
  - It will initially be very wet so letting it dry for several weeks to months is ideal.
- **Sizing of the char.**
  - After drying the biochar for some time, the next step is to grind it to a useful size. Water retention is affected by both the size of the pores within the biochar and the size of the spaces between the particles of biochar and other components in the soil. If it is ground too fine you will reduce the porosity inside the biochar! Research has shown that a particle size of about 2 mm will promote water retention and also increase available water for plants.
  - Some ways that people grind their biochar:
    - put it in a bucket and pound it with a mallet or other heavy tool
    - put it on a tarp, cover with another tarp and drive over it with a car repeatedly; this is most effective on a firm surface like concrete
    - Blue Heron has experiments underway using wood chippers!
- **Inoculation of the char.** The 'bare biochar' once crushed will need to soak up nutrients and start building a microbiome to enrich the soil. Putting *bare* biochar into the garden requires at least 6 months to a year before the microbiome can establish, and could actually reduce yield at first as the biochar soaks up nutrients. You can instead inoculate the biochar by mixing it with both nutrients and microbiome. This way it will benefit the soil sooner. The following are 5 suggested methods of inoculation:
  1. **Mix biochar with finished compost** up to a ratio of 1:1. Compost is an excellent nutrient and microbiome inoculant for biochar. It's full of organic matter, nutrients, and microorganisms that can quickly populate biochar's porous structure, accelerating the benefits to your soil. Leave it for about 6 weeks or more before applying the mixture to your soil. This is a very effective way to inoculate biochar.
  2. **Mix biochar with compost tea.** Use an aerator in the tea to boost the microbial activity enormously for a few days to one week, then add the tea to the char. This is widely considered the fastest way to inoculate biochar.
  3. **Mix biochar with aged animal manure** up to a ratio of 1:1. Well-composted animal manure (such as from cows, chickens, or horses) adds nutrients like nitrogen, phosphorus, and potassium while introducing beneficial microbes.

4. **Mix biochar with Seaweed/Kelp Extracts.** Seaweed or kelp extracts contain a variety of nutrients and trace minerals which can aid plant growth, health and vitality.
5. **Molasses.** Many sources suggest mixing molasses with water to create a microbial-rich solution that feeds and activates beneficial bacteria in the biochar. This method supports microbial activity and soil health.

**Step 12.** Congrats **Bioburner**, your biochar is done and ready to add to the soil!

### **Ratio of biochar to soil - how much should I put in my garden bed?**

This is an area of research. Many of the experiments being undertaken for scientific papers use ratios of 2% to 15% to the soil. However, most of this work is being undertaken to improve agricultural practices at a commercial level and achieving results with as little inputs as possible is beneficial to their goals. More local research (thank you Mary from Blue Heron!) has shown that in a comparison between 5%, 10%, 15% and 20%, **20% created the most benefit.**

Rake in or mix the biochar into the soil and keep moist for at least a week.

**Most people will only need to apply the biochar once.** It will generate the necessary nutrients itself and not require reapplication. The biochar is going to help the soil hang onto nutrients you added as well as hang on to water, so you should be able to use less of either in the future. That's why biochar is considered a soil amendment, not a fertilizer.

Please let us know your results! See the Blue Heron Learning Society website for testing suggestions and opportunities to contribute to the knowledge base on best practices with biochar through citizen-science projects.