

Biochar and the Future of Carbon Zero

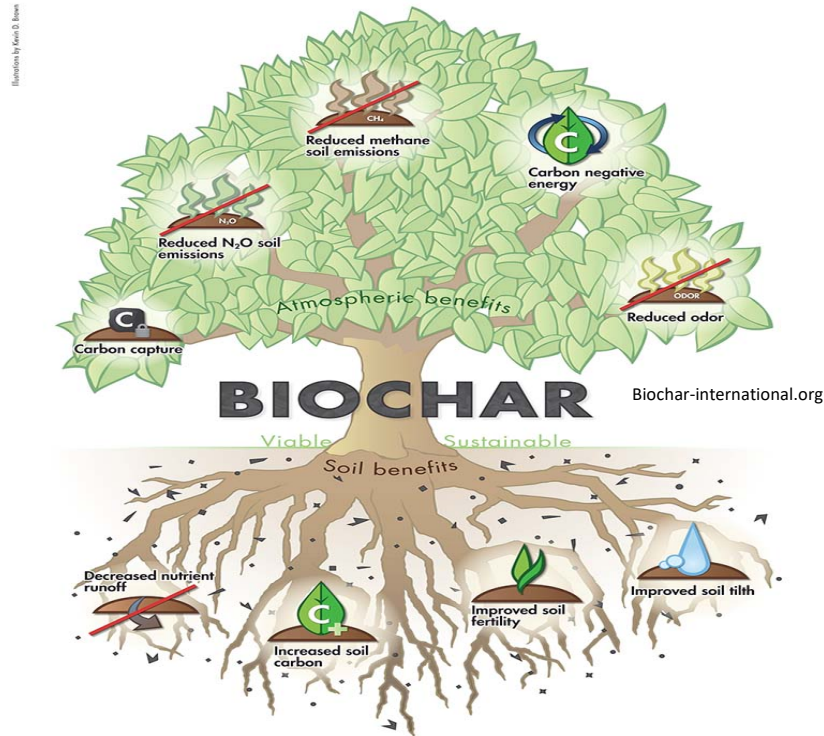


Purpose

Biochar has been utilized to promote soil health and mitigate the effects of our carbon footprints. In this document you will learn about the effects of biochar, the process of harvesting it in a way that limits any additional carbon footprint, stakeholders that can be involved, and how you can get involved in offsetting your carbon impact.

Although it is near impossible to eliminate our entire carbon footprint, there are things we can do to offset the effects of our daily use. One of these methods is through the use and investment in biochar. It is an easy obtainable way to utilize carbon sequestration in a way to mitigate the effects of climate change.

Biochar



Biochar is a charcoal form of carbon that allows it to stay in the soil for much longer and slows its release rate. According to biochar-international.org, biochar is produced through pyrolysis or gasification. It is a process that takes biomass to heat it without oxygen. Biochar is then formed and can be buried to release at a slower rate. Biochar has been studied for its benefits to help offset the carbon costs of everyday life. As we are seeing more of the effects of climate change increasingly becoming more aggressive, people are looking to ways to offset their carbon footprint. Biochar is offering a wonderful solution to those invested in making the world a better place.

Biochar not only can help us lessen our carbon footprint by investing in it, according to biochar-international.org, it can also enhance soil quality, lead to bio-oil and bio-gas products from the biochar that can be utilized as fuel that is clean and renewable. When it is used to help promote soil health it becomes carbon negative and is offsetting our carbon footprint. Overall, we can use biochar as a tool to better our lives, better our future, offset the effects of climate change, and change our fuel consumption to a more ethical and renewable supply of green energy.

Crops, yard waste, urban and rural alike can all add to produce biochar for fuel production. Instead of throwing away lawn clippings and other yard waste, it could be utilized to produce

biochar. Agricultural markets have an advantage of being involved because of the restorative properties of burying biochar and the potential for collecting plant litter once crops have been harvested, leading agricultural entities to potentially become the future of biochar.

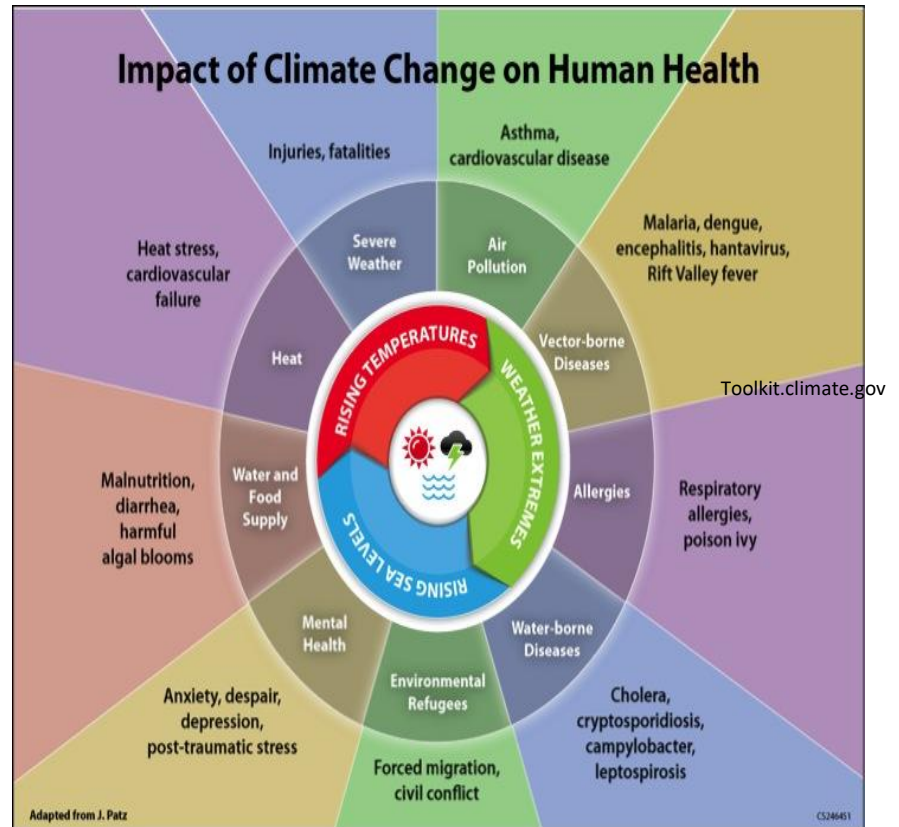
Importance of Mitigating our Carbon Footprint



As we see an increase in the effects of climate change, it is time for us to reflect on human impacts and our individual carbon footprints. The expanding of the era of technology has led us all to lead a more detrimental carbon footprint existence, in addition to a constant rising global population. Although, we may not be able to stop the current mass extinction of the Holocene which we are currently part of, it is true that we should note how our anthropogenic impacts are drastically accelerating those effects and how we as humans can help protect the world we live in.

Of course, our planet has been changing since the beginning of time, but the largest change has been due to human impact. This includes accelerated populations, fossil fuel usage, deforestation, large scale agriculture, aerosols, and other greenhouse gases. We see the biggest factors coming out of our food supply and our energy supply as contributors to accelerating climate change.

This is causing a threat to the human population as water resources, food security, soil fertility, and many other factors will be affected by climate change. It is in the interest of humankind to work together to offset the carbon footprint that is drastically adding to the problem. There are many ways technology can help us lessen the effects of climate change, but there are also many areas where technology lags and may take a while to adapt to green energy. This is true in the case of airplanes where the technology for green fueled travel is yet to be a safe and reliable reality. In the meantime, biochar is here to offset carbon emissions for those who wish to travel without the guilt. As much as humans have been contributing to the problem, together they can contribute to the solution. Becoming carbon free or even carbon neutral does not have to mean sacrificing the benefits of our modern world. It means adapting to more ethical forms of production and restoration to offset our usage.



Producing Biochar – Carbon Emissions Free

One of the biggest questions is how to harvest and heat to appropriate temperatures without adding to the carbon footprint. Even though the effects of biochar are carbon negative (meaning it is reducing the carbon emissions) there is a need to produce it without adding more to that detrimental impact. In the next few sections, we will look at how technology has advanced rapidly to allow for biochar's production to be carbon emissions free.

Robotics in Agriculture



Robotics are becoming a reality in all aspects of life, none more apparent than the use of it in agriculture. As we move towards better precision agriculture, there is a need to know more about the land using technology to produce better crops, save time, money, and overall improve farming experiences. As is, we see the use of drones becoming an important asset for farmers to keep another set of “eyes” on the fields as a management practice. In addition, new equipment for farming including battery powered robotics are gaining prominence and can be charged using solar panels or other green energy options.

As technology rapidly expands, farmers already have many pieces of equipment for use in agriculture in the form of robotics. According to robotics.org, equipment for harvesting and picking, weed control, autonomous mowing, pruning, seeding, spraying and thinning, phenotyping, sorting and packing already exists. Harvesting, using robotics fueled by green energy, would be essential to running a carbon emissions free operation to harvest for biochar.

Solar Furnaces & Green Energy to Produce Biochar



www.slac.stanford.edu

The next key component would be heating the biochar in a way that is emissions free, without adding more to our air pollution. Currently a lot of systems are still heating biochar with the use of fossil fuels, however, there are ways to avoid the use of our addiction to fossil fuels. Solar panel furnaces have been studied for their use as heating systems for homes, as well as their use for biochar.

Biochar needs to reach a high temperature to be effective and used as a resource. On average that can be around 450°C or higher. In accordance to solarpaces.org, solar furnaces and solar fuels can provide temperatures of up to 1500 °C, which provides more than enough heat to utilize solar panels for the use of biochar.

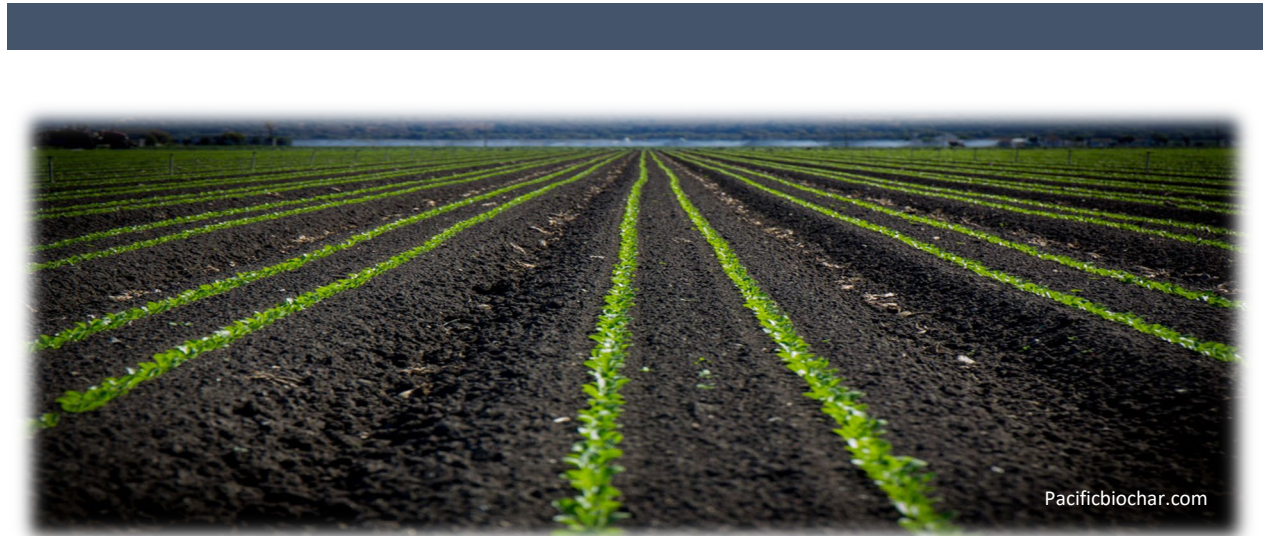
In addition to solar furnaces, there are many energy options to fuel the furnaces needed, to create biochar without the necessity of fossil fuels. Green energy sources such as solar, wind, and others, can generate enough power to operate furnaces with enough energy to create biochar, leading the production of biochar to further eliminate any carbon footprint.

Marketing Biochar

Many companies are becoming increasingly aware of the negative impact their business has on the environment. We see it more on display as the effects of anthropogenic climate change are no longer deniable, and daily feel the impacts. Even though technology is advancing rapidly, we still have not perfected it to allow us to run completely green lives with complete green energy with 100% sustainable practices. However, those companies and individuals wanting to do something good while they are in the transition phase, can invest in biochar and offset carbon footprint in that manner.

Microsoft is making a commitment to the environment. According to their website, they plan on going carbon negative by 2030. Biochar would be a great asset along with other plans they have set forth, to not only offset their own carbon emissions but continue work to become carbon negative. As more companies realize the dire need to combat climate change, I believe the market for biochar will increasingly grow. Our ethics and value of our natural resources will lead us there.

Producers for Biochar



As previously stated, I believe that farmers would be great candidates for producing biochar, if they are operating in ways that continue offsetting carbon emissions and not add to it in the production phase. It could also be collected as yard waste as an extension of garbage/recycling pick up.

A perfect candidate would be an example I have based out of Harmony Township near Casselton, ND. There is a group of farmers in the Township that have leased their land to the renewable energy company Geronimo, <https://geronimoenergy.com/>

which is a large Minneapolis based company, developing solar and wind farms. Specifically, the Casselton site will be getting solar arrays on the land. The height above ground of solar panels has been raised over time to allow for grazing and angle adjustment of the solar panels. This has led for an opportunity to grow native plants/crops beneath the solar panels. With the use of robotic agriculture for planting and harvesting and the use of excess solar energy that is on sight to heat solar furnaces, biochar could be produced carbon emissions free on one site. The biochar could then be distributed for restoration projects to help soil production or fuel that burns clean.

Biochar & Soil Health



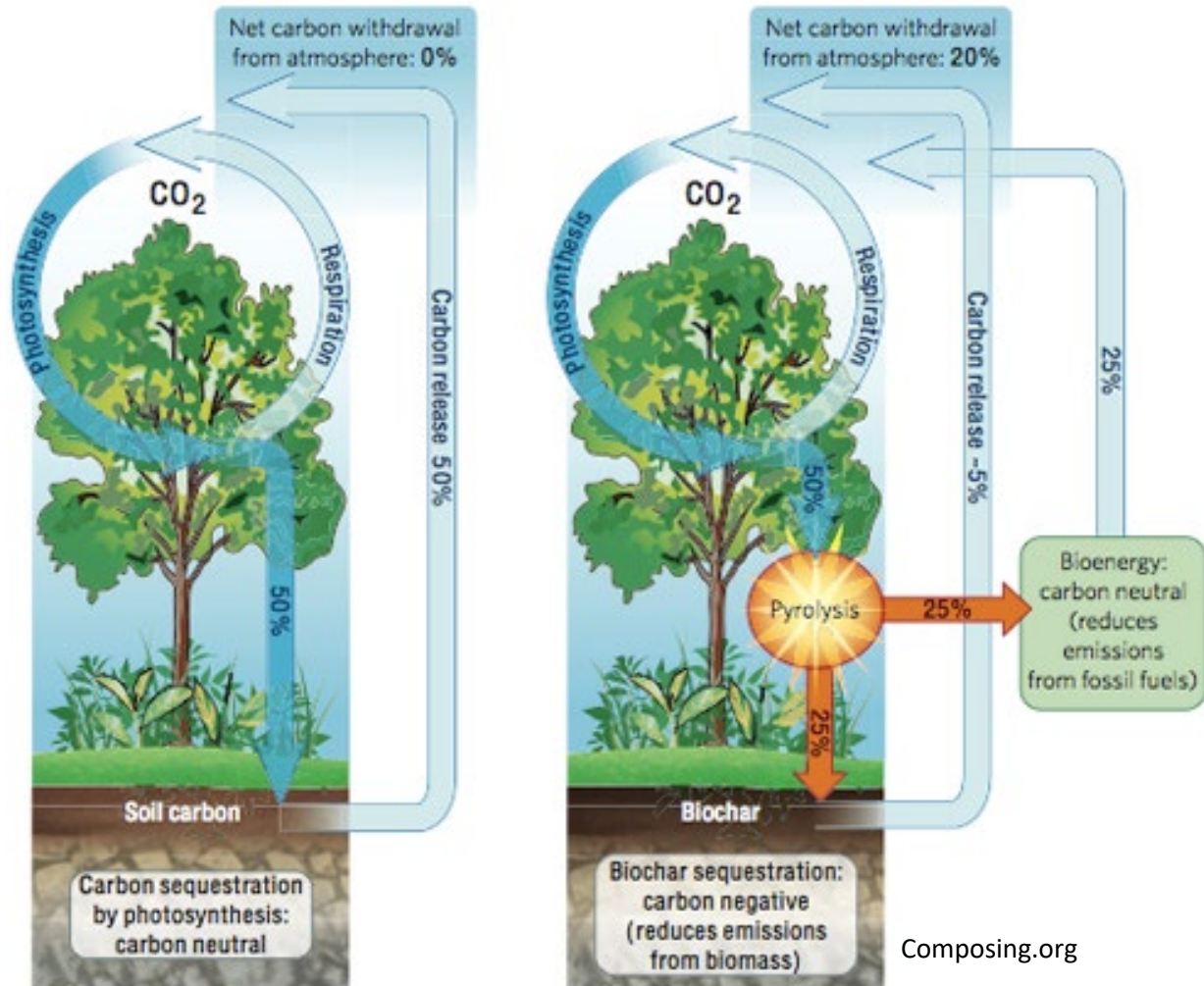
Biochar has been used to modify and increase soil quality. This has been mainly done in agricultural practices, where the crop residue is used to supplement the soil, hold more carbon, and make the soil more fertile to enhance food production. In accordance to biochar-international.org, research has confirmed the many uses and benefits of biochar for agricultural purposes. This includes the following;

- Less leaching of nitrogen through to ground water and run off.
- Potentially less emissions of nitrous oxide
- A better cation-exchange volume that can lead to better soil fertility
- Balancing soil acidity
- Better water retention
- More beneficial soil microbes

Regenerative agriculture is seeing a spike in the use of biochar for restorative potential and purposes. Regenerative agriculture, although not a new idea, has become widespread as more and more farmers are looking for better health of their families, the land, soil, and overall more ethical farming practices. As biochar-us.org states, close to 80% of soil carbon has been lost in very heavily farmed areas due to unethical overutilization of farmland. The constant overgrazing and carbon-depleting applications of certain fertilizers and pesticides have led to less carbon present in the soil, along with other damage from modern agricultural practices.

The process of adding biochar back into the soil, restores imbalance from carbon depletion and by using carbon sequestration, it can reduce the amounts of carbon dioxide present in the atmosphere. It will also help restore destructive agricultural practices. This is furthermore true for prairie and forest restoration projects. As land has been highly disturbed for a multitude of reasons, carbon sequestration using biochar, can help restore the balances within the soil and lead to a better biodiversity for plant growth. For agriculture, this means better crop yields. For natural prairies and forests, this means better habitat for all its inhabitants.

Biochar & Carbon Sequestration



Research still needs to be done to properly calculate just how effective biochar is at offsetting carbon dioxide emissions. However, one study from Environmental Analysis & Outcomes Division, has estimated this at about 1.23 tons per acre. In addition to the initial offset costs of carbon from burying biochar, the soil remains a sink for more carbon to be absorbed. This leads the potential of biochar to be above and beyond the initial effects of burying and makes it harder to pinpoint just how much of an impact it is making.

Conclusion

Biochar has the potential to better our world and all those who inhabit it, without the need to lessen our energy usage. Biochar connects individuals with a common goal, providing a better future for coming generations. Combining innovation, technology, producers, consumers with ethics, can lead us all to a strong network of making energy green, thereby promoting the health and biodiversity of our planet, all while weaning humanity off its fossil fuel dependence.

References

- Biochar Stoves - biochar-international. (n.d.). Retrieved January 18, 2020, from <https://biochar-international.org/stoves/>
- Ciborowski, P., & Hunter-Larson, L. (n.d.). Greenhouse gas Reduction Potential of Agricultural Best Management Practices. *Minnesota Pollution Control Agency*.
- 'Dirt Rich' - The Importance of Biochar and Regenerative Systems for Soil Health. (n.d.). Retrieved January 24, 2020, from ['dirt-rich'—importance-biochar-and-regenerative-systems-soil-health](https://biochar-us.org/)
- Jones, D. (2020, January 8). JetBlue plans to go completely carbon neutral on all U.S. flights. Retrieved January 18, 2020, from <https://www.washingtonpost.com/travel/2020/01/08/jetblue-plans-go-completely-carbon-neutral-all-us-flights/>
- Kraemer, A. S. (2019, November 3). Designing Solar Furnaces to Make Biochars without Air Pollution. Retrieved from <https://www.solarpaces.org/designing-solar-furnaces-to-make-biochars-without-air-pollution/>
- Repowering America. (n.d.). Retrieved January 18, 2020, from <https://geronimoenergy.com/>
- Robotics Online Marketing Team. (2017, December 12). Robotics in Agriculture: Types and Applications. Retrieved January 18, 2020, from <https://www.robotics.org/blog-article.cfm/Robotics-in-Agriculture-Types-and-Applications/74>