Biochar

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Biochar is nothing more than charcoal made from wood at about 450°C to as much as 900 C. About 30% of the wood can be made into biochar. Biochar has enormous potential for our culture and economy, including diverse things like water filtration, the absorption of electromagnetic energy, building construction, uses in clothing and electronics, air decontamination, pesticide remediation, heavy metal adsorption, medicines, sewage treatment, etc. It will also make an enormous contribution to creating a circular economy. The remaining 70% of the wood is a complex mixture of gases, called *woodgas* and oils, called *synoils*. The *woodgas* can be modified and used as a replacement for gasoline and the *synoils* can be used in diesel engines. Both will be a significant part of our future for clean renewable energy. In the schematic below notice how climate change, renewable energy and soils and agriculture are all interdependent. This is the future of sustainability for our environment, culture and economy. Hopefully, it happens before an environmental disaster.



✤Biochar appears to be the "low hanging fruit" we can implement in the near future to stall economic and ecological collapse.

Biochar is only one small part of the much larger issue of energy independence.

 Biochar replaces or improves some of the greatest uses for fossil fuel – heating and transportation.

Biochar has been shown to be the only effective technological tool for fighting global warming. Two recent studies.

The potential of biochar for environmental sensitivity and sustainability is also simply enormous. Although there is currently a lot of entrepreneurial interest in supplying biochar to the consumer, high quality biochar can also be made at home and on the farm for organic food production. Research shows woody waste from our forests, which is normally simply burned and wasted, plus clean woody waste from our municipal waste stream, can be used sustainably to make biochar. Used appropriately, biochar can solve several problems in our society simply because all of these applications operate synergistically.

There is enormous interest in incorporating biochar into our soils for two reasons. First, it has the potential to restore depleted agricultural soils and enhance organic agricultural productivity. Modern research shows several benefits - including crop production enhancement, methane reduction, nitrous oxide reduction, water holding capacity, greater fertilizer efficiency, and even heavy metal remediation and pesticide degradation in contaminated soils. Second and simultaneously, biochar has a half-life of approximately 1100 years. This means 100 pounds of biochar put into the soil, slowly degrades over 1100 years to 50 pounds and then to 25 pounds in another 1100 years. In terms of carbon sequestration to fight global warming, this is essentially forever. Every pound of biochar incorporated into this soil sequesters about 2.5 pounds of CO₂ from our atmosphere. It is the third best way to sequester carbon after planting forests and reforesting logged areas.

People often ask if common cooking charcoal can be used in place of biochar. Charcoal for cooking, biochar, activated charcoal are all somewhat different chemically and biochar is the only one that should be used in the soil for crop production and carbon sequestration.

Books on Biochar - Those books that have triple stars are especially recommended for people new to biochar. Other books are somewhat academic.

Woods, W. I and W. G. Teixeira, J. Lehmann, C. Steiner, A. M. G. A. WinklerPrins, L. Rebellato Editors. 2009. *Amazonian Dark Earths: Wim Sombroek's Vision.* Springer.

Bruges, James. 2009. *The Biochar Debate. Charcoal's Potential to Reverse Climate Change and Build Soil Fertility.* Chelsea Green Publishing. White River Junction, Vermont. <u>www.chelseagreen.com</u> 119 pages.

******* Taylor, Paul 2010. *The Biochar Revolution. Transforming Agriculture & Environment.* Published by global publishing group. <u>www.globalpublishinggroup.com.au</u> 360 pages. This book is recommended for a good introduction to the topic.

Bates, Albert. 2010. *The Biochar Solution. Carbon Farming and Climate Change*. New Society Publishers. <u>www.newsociety.com</u> 208 pages.

*Lehmann, Johannes and Stephen in Joseph (editors). 2015. *Biochar environmental management science and technology.* Earthscan. Dunston house, London, UK. <u>www.earthscan.co.uk</u> 928 pages.

Ladygina, N and F. Rineau. 2013. Biochar and Soil Biota. CRC Press, Taylor and Francis Group 270 pages.

Manya, J. and G. Gasco. (Editors). 2021. Biochar as a Renewable-Based Material. With Applications in Agriculture, the Environment and Energy. World Scientific.

*** Pieplow, H., and H. Schmidt, K. Draper. 2016. *Terra Preta. How the World's Most Fertile Soil Can Help Reverse Climate Change and Reduce World Hunger. With Instructions on How to Make the Soil at Home.* Greystone Books. 210 pages.

*** Tindall, R., F. Apfel-Marglin, D. Shear. 2017. *Sacred Soil. Biochar in the Regeneration of the Earth.* North Atlantic Books. 238 pages.

***Bates, A and K. Draper. 2018. **BURN. Using Fire to Cool the Earth.** Chelsea Green Publishing. Vermont. <u>www.chelseagreen.com</u> 297 pages

*** Cox, J. 2019. Gardening with Biochar. Supercharge Your Soil with Bio Activated Charcoal. Storey Publishing. 128 pp.

For those who want a more in-depth approach to biochar should consult two recent more comprehensive publications. Copy and paste the internet citations into your browser. They are;

Joseph, S., Cowie, A. L., Van Zwieten, L., Bolan, N., Budai, A., Buss, W., ... & Lehmann, J. (2021). *How biochar works, and when it doesn't: A review of mechanisms controlling soil and plant responses to biochar.* GCB Bioenergy, 13(11), 1731-1764. https://onlinelibrary.wiley.com/doi/pdf/10.1111/gcbb.12885

Ok, Y. S., Palansooriya, K. N., Yuan, X., & Rinklebe, J. (2021). Special issue on biochar technologies, production, and environmental applications in Critical Reviews in Environmental Science & Technology during 2017–2021. Critical Reviews in Environmental Science and Technology, 1-9. <u>https://www.tandfonline.com/doi/pdf/10.1080/10643389.2021.1990446</u>

Websites and Discussion Groups on Biochar

Hundreds of YouTube videos are available online on every imaginable production method, use, and application for biochar. The universal problem for almost all of the quick and easy production methods is the enormous amount on health threatening smoke produced. International Biochar Initiative - http://www.biochar-international.org U.S. Biochar Initiative - <u>http://www.biochar-us.org/</u> Pacific Northwest Biochar – PNW Biochar. http://groups.google.com/group/pnw-biochar?hl=en Biochar Discussion List Web Site - http://terrapreta.bioenergylists.org/Making BioChar National Geographic - http://ngm.nationalgeographic.com/2008/09/soil/mann-text/8 Aprovecho Research Center - http://www.aprovecho.org/lab/home Wikipedia (Biochar) - http://en.wikipedia.org/wiki/Biochar The journal Soil Biology and Biochemistry has adopted the topic with a Virtual Special Issue on Biochar - http://www.journals.elsevier.com/soil-biology-andbiochemistry/virtual-special-issues/virtual-special-issue-on-biochar/ The Biochar Journal – newly created in 2013 - http://biochar-journal.org/en/home www.livingwebfarms.org - Has several very good videos that explain biochar and its use in organic food production. Yahoo Groups - biochar - biochar@yahoogroups.com The Promise of Biochar – Johannes Lehmann - https://www.youtube.com/watch?v=4wLaSQGyuIA Growing with Biochar - http://www.dyarrow.org/lulu/ Gardening with Biochar - www.dyarrow.org/CarbonSmartFarming/docs/BiocharUseInSoil.pdf Carbon Smart Agriculture - http://www.dyarrow.org/gateway-A.htm Mineral Balancing and Organic Gardening - www.growabundant.com and use Logan Labs for soil tests. CARBON-SMART NUTRICULTURE. Healthy Soil grows Healthy Food for Healthy Families. http://nutriculture.org/ About Biochar. Sonoma Biochar Initiative. https://sonomabiocharinitiative.org/resources/ Biochar 101 Living Soil; https://www.youtube.com/watch?v=MWk9GDcOZn4 Well done video on living soil and how to make it. Dozens of videos are available on You Tube but be careful because some are not entirely accurate or even useful. For further information about Sierra Club and Biochar, contact Norman Baker, 360-683-8046, ntbakerphd@gmail.com