

Biochar in Urban Farms

Introduction

Hello- My name is Justin Beck and I'm very excited to be here. I am here to talk about biochar in urban farms and little about the biochar sector as business and some related issues. I come to you as a student of biochar in the urban farm as opposed to an expert. As we are seeing in this symposium, the potential benefits of biochar are impressive and many of us are anxious to see it adopted throughout the food economy.

A bit about me, I was part of the Community Climate Action Plan for Sonoma County, California. This is in the "wine country" an hour north of San Francisco. I was part of a group of community representatives reviewing and offering suggestions for climate change solutions for our region. Our plan turned out to be the most robust climate plan in the US and included plans for:

- Public transportation
- Limits to sprawl
- Creating an electric car share fleet
- Redirecting vehicle fees to pay for bike paths and public transport
- Reduction of regulatory barriers to "green" businesses
- Incentivize business leaders to implement telecommuting or any other method to minimize fossil fuel powered commuting
- Energy efficiency programs for new buildings and retrofits

Not all of these community suggestions has been implemented but I am proud to have been a part of the blueprint.

I also worked for WiserEarth.org a social media hub for environmentalists and other charities and social justice work. I was drawn to biochar while searching for ideas for my own "green" company and something to raise moral when looking at climate change's effects as well as population growth and food security concerns. It should be obvious that we are traveling through a unique period of history.

Urban Farms

What is an urban farm? An urban farm can be tomato plants growing on your balcony, it can be community garden, it can be an ambitious futuristic vertical farm (which seem very cool but where can I see one alive in operation?) or here in Germany the *Schrebergarten*. Urban farming is generally practiced for income-earning or food-producing activities, though in some communities the main impetus is recreation and relaxation. Urban agriculture contributes to food security and food safety in two ways:

first, it increases the amount of food available to people living in cities, and, secondly, it allows fresh vegetables and fruits to be made available to urban consumers. A common and efficient form of urban agriculture is the bio-intensive method. Because urban agriculture promotes energy-saving local food production, urban agriculture is generally seen as sustainable agriculture.

The recognition of environmental degradation within cities through the relocation of resources to serve urban populations has inspired the implementation of different schemes of urban agriculture across the developed and developing world. From historic models such as Machu Picchu to designs for new productive city farms, the idea of locating agriculture in or around the city takes on many characteristics.

Myself and some friends here in Halle have found a great way to test biochar in urban farming by adding biochar that had I ordered from a company called Swiss Biochar to our *Schrebergarten*. We added biochar to a few plots of vegetables including radishes and potatoes. We added biochar to the lawn grass areas which seemed to have responded quite positively. I am a biochar enthusiast so I know about the benefits of biochar and would be called in “marketing theory” an early adopter but it is in getting this wonderful material to farms and gardeners both urban and rural that we ought to be concerned. So let’s look at the benefits of biochar in the urban farm or urban garden:

Benefits

- Bio mass is recycled and reused in a useful way.
 - Urban farms which reduce GHG’s by limiting the distance food must travel to consumers are given an extra GHG benefit by sequestering carbon through the addition of biochar.
 - Biochar improves the yield and vitality of soil and vegetable crops.
 - A proliferation of urban farms would be a great source of rewarding employment.
- There may be specific benefits to biochar in how it relates to its use in the urban farm.

Questions

I had to order my biochar for use in our *Schrebergarten* here in Halle from a company, Swiss Biochar in Switzerland. Critics remarked about the GHG’s emitted from the production of the biochar and in its transportation. In response, over the very long lifetime of the usefulness of the biochar, the GHG’s emitted during production and transportation are negated. This does bring up a interesting question about biochar however; the economics of practical distribution. In fact this was my first business idea for biochar, not a company producing biochar but a company that distributes it or aids in setting up local biochar production facilities.

I have spoken to and researched a number of urban farm projects as well as community gardens and none of the people I spoke to or read about were aware of biochar. This reminds us that the benefits of biochar need to be communicated to the public in some manner to a much larger degree.

I suppose this is part of a larger question as to how we can enhance biochar’s economic viability.

Australia's national science agency, the Commonwealth Scientific and Industrial Research Organisation in a report from 2009 called *Biochar, Climate Change and Soil: A Guide to Future Research* noted some factors in biochar's worldwide adoption:

- The economics of biochar production will be fundamentally altered once methodology has been proposed and adopted with regard to carbon offset values.

- A streamlined regulatory framework may be essential to avoid stifling initial interest in the use of biochar products in mainstream agriculture. Government policies to help ensure continuity of feedstock supply to pyrolysis enterprises could assist in establishment of the industry; subsidy arrangements could be adopted that favour rather than discriminate against the use of biochar in soil.

- A routine standard method to quantify biochar in soil is essential to realise the research agenda. Supply of biochar material from commercial pyrolysis facilities is currently extremely limited and localised, inhibiting research activity. Biochar is highly heterogeneous, so standards and quality control need to be defined and certified. (An organization called the International Biochar Initiative is working on the adoption of biochar standards. I believe there might be a few representatives here..)

- Association of pyrolysis with wider bioenergy technology and specifically the biofuel debate presents an image problem in the wake of diminished global grain stocks and rising commodity prices. However, this could also present forums where the principle and multiple benefits of biochar-based strategies can be discriminated and promoted.

- Funding for testing commercial products may be borne by companies producing the products, but such activities will need to be integrated with public sector science to address the wider climate change agenda.

What is the model for biochar production and distribution for the urban farm?

- Should biochar be something that is simply bought or ordered from a producer such as I have done for our Schrebergarten? I am not sure how quickly this will be adopted worldwide in this fashion in order for us to get the kind of GHG sequestration we need. Would this be somehow be achieved through conventional marketing techniques as any other garden supply?

- Should biochar production equipment be sold to urban farmers for them to make their own biochar using their own bio-waste? Medium and small sized production equipment is beginning to come online.

- Or should there be some sort of municipal model where bio-waste is collected as part of a city service, brought to a central location and turned into biochar where the urban gardeners and farmers come to get it? I also imagine biochar used to contribute to any green urban space, from adding it to the soil of parks to the small areas of grass near on-ramps.

I encourage all of us to look not just at the wonderful science of biochar but also how we are going to scale the adoption of this amazing substance worldwide so that we can get a thriving, green GHG sequestering economy that we long for.

Urban Farming and Urban Restoration

What excites me is killing as many birds with one stone as possible or as you say in Germany, swatting as many flies as possible with one swatter. Looking at the world today we are awash in flies. So we can grow more food for more people closer to where they live, create jobs and sequester GHG's with biochar and urban farms. Biochar production, or pyrolysis can also produce energy. We can add urban renewal or urban restoration to the mix. One of the things that first struck me about east Germany is the abandoned buildings. Some very nice old ones as well. I wondered if any of them could become verticle urban farms with stores on the bottom floor. All of them using biochar of course and employing people.

How biochar aids intensive agriculture

Urban farming must of necessity be a type of intensive farming. Intensive agriculture has a well-understood history intertwined with the development of civilization itself. Intensive agriculture is the primary subsistence pattern of large-scale, populous societies. It results in much more food being produced per acre compared to other subsistence patterns. Beginning about 5,000 years ago, the development of intensive farming methods became necessary as the human population grew in some major river valleys to levels beyond the carrying capacity of the environment using horticulture and pastoralism. The transition to intensive agriculture was originally made possible by water management systems and the domestication of large animals for pulling plows. This allowed farmers to get below the top soil to bring buried nutrients up to the surface. It also allowed farmers to maintain much larger fields of crops. The first intensive agricultural societies were the ancient civilizations in Egypt, Mesopotamia, India and Pakistan, North China, Mesoamerica, and Western South America. Today, intensive agriculture is the primary food production pattern in all developed nations except those that are too arid or too cold for any form of farming outside of greenhouses. Over the last century, large-scale agricultural techniques spread rapidly throughout the world with the introduction of farm machines driven by internal combustion engines and the availability of commercially produced fertilizers, pesticides, and herbicides.

If you can forgove my fancifulness, perhaps the urban farm is part of the next phase of civilization's evolution. Intensive urban agriculture that sequesters GHG's via biochar

helps to aid in the self-sufficiency of the city, allowing it to decouple from the fossil-fuel, GHG intensive, wasteful, chemical and GMO laden globalized agricultural model. The current economic and environmental crisis has been named by some as the end of an era. I hope that urban farms are a big part of the civilization's next stage.

In particular, how does biochar behave, enhance or demonstrate unique characteristics in the urban farm or how does biochar perform in intensive agriculture? Or, how does biochar address the particular concerns of urban farming?

The Environmental and Resource Studies Department at the University of Waterloo, Canada is currently working on a study of using nitrogen-enriched biochar as fertilizer. Research student Matt Dil writes, "Loss of soil organic carbon resulting from intensive agriculture practices has impacts on both climate change, through emissions of greenhouse gases, as well as food security because of declines in soil fertility. One promising solution for rapidly restoring soil organic carbon is through additions of biochar to soil. Biochar can be enriched with nitrogen by pre-soaking in urea ammonium nitrate and then applied annually at lower application rates. The objective of this study is to determine the effects of low biochar- urea ammonium nitrate (Char+) application rates on soil fertility, mycorrhizal fungi and plant growth. A pot experiment with maize will be conducted in a climate-controlled chamber. There will be four treatments: 3 with different levels of mixture between biochar and in urea ammonium nitrate and a control (no biochar or urea ammonium nitrate). Each treatment will be combined with two soil textures (coarse and fine) and have ten replicates. Following a six week growth period plant dry weight, soil Carbon and Nitrates, and mycorrhizal fungal biomass will be determined. Finally, these results will be compared to a parallel field study conducted by ABRI-Tech." After reading this, I am looking forward to Jim Hammond's talk on the Reduction of Nitrogen Fertilizer through biochar application. Perhaps there are other additives to biochar that can be used.

And soil organic carbon loss is just one area of study of biochar in intensive agriculture.

Another is logistics and process optimization. This is also where I see business opportunities for biochar. The region of the Araucanía in Chile produces more than 60% of the country's cereal crops, 90% of the country's legumes and, in the past, about 90% of the industrial oil crops. Crop yield is an important factor for the development of the agricultural industry and farmers invest extra revenues in logistics and process optimization. Any reuse of agricultural and forestry waste biomass can add value to the process—thus, researchers are investigating the production of biochar from this waste. The overall goal of this project is to produce biochar from agricultural and forestry biomass, and to test it in soil. This biochar will be used in the manufacture of a controlled-release nitrogen fertilizer involving polymeric coatings to control the nitrogen release. These biochar-based products will be tested and compared in field experiments. The researchers are also evaluating the possible use of pyrolysis by-products as alternative fuels—and will analyze the properties of syngas and bio-oils produced during pyrolysis.

And in another case, for some time Higashiomi City in Japan has been working on Biochar and the “recycling society” or the Nanohana Project. And this is really the term I have been searching for. The idea is linking up biochar production with other existing eco-friendly, waste-recycling movements at the local and regional level. This project started in 1996 as a recycling project before the addition of biochar, Higashiomi City's Aito municipality opened a test plant to convert household cooking oil into Bio Diesel Fuel. Each of the households received a five-liter drum in which to collect their used oil and mass collections took place twice a month. The Bio Diesel Fuel produced from the plant was used in city vehicles and local buses. Then the next stage was to produce the cooking oil plants, in this case rapeseed locally. And in the current stage they now convert rice husks into biochar to add it to the growing process. I am very excited about the “recycling society” concept here and the move towards a self-sufficient city.

I believe that the adoption of biochar is due and the urban farm is one place where this can occur. Thank you-





Justin Beck would like to thank and acknowledge the following people and organizations for this paper and talk for the European Biochar Symposium in Halle/Saale, Germany in September 26 and 27, 2011 :

John, Lydia and Robert for getting the *Schrebergarten* together. Jeff Cox for his crucial knowledge of this field, David Richey for hearing me out, and the University of Waterloo, Canada, Martin Luther University, Halle/Saale, Germany, Australia's national science agency, the Commonwealth Scientific and Industrial Research Organisation, the International Biochar Initiative, the Climate Protection Campaign, Sonoma County, California, US and WiserEarth.org, CA, US