Producing Biochar
(*What is it Good For?)*

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International Biochar Initiative

Farm Pilot Project Coordination, Inc.
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Presentation Overview

- What is biochar?
- What is it good for (what is it's purpose)?
- Biochar Standards Development
  - Priorities identified for experts
  - Issues that have come up
  - Status update
  - Our vision: intended outcomes

The International Biochar Initiative

- NGO supporting researchers, commercial entities, policy makers, farmers, development agents and others committed to sustainable biochar development and use.
- provide updates, analyses and original publications on biochar science, production, utilization, and policy.
- have 30 affiliated national and regional initiatives, including in Japan, China, India, Australia, Europe, and the U.S.
- advocate for domestic and international policies supportive of sustainable biochar systems
- Seek to promote commercial success of biochar industry at scale by 2015

What is Biochar?

- ***Biochar*** is a fine-grained, porous charcoal substance formed via controlled, thermal conversion of biomass in the partial or complete absence of oxygen

- ***Biochar*** is formed from incomplete combustion of biomass, and ***depending on feedstock and processing conditions***, can have significant agronomic and environmental benefits, including forming stable, long-term soil carbon pools

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To define biochar, we have to define it's *purpose*!
IBI: biochar is a soil amendment for…

- climate mitigation (GHG removals – stable C pools)
- soil enhancement (climate adaptation, food security)

Biochar: *What is it good for?*

The Problem:

- Not all “biochar” is biochar
- Not all biochar is the same: biochar is a spectrum of materials with some common characteristics
- Not all biochar is produced the same
- Not all biochar is utilized for same purpose

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Biochar: *What is it good for?*

The Solution:

- Define the product: what is biochar?
- Define use: primary use and/or anticipated materials uses
- Identify the characteristics, properties and unique qualities that make it effective
- Identify standardized tests to confirm that any given product is biochar, ID the quality
- Identify how you produce biochar – and for what purpose -- sustainably

Characterizing Biochar: Biochar Standards Development

Credible, science-based **standards** increase the technical and political integrity of biochar & production and utilization systems, and can enable their utilization for climate M/A – as well as for other purposes of value to society.

IBI is developing **biochar standards**. We need to know what the **product** is, & what it isn't. Markets, regulators need assurances.

Where are we with standards?

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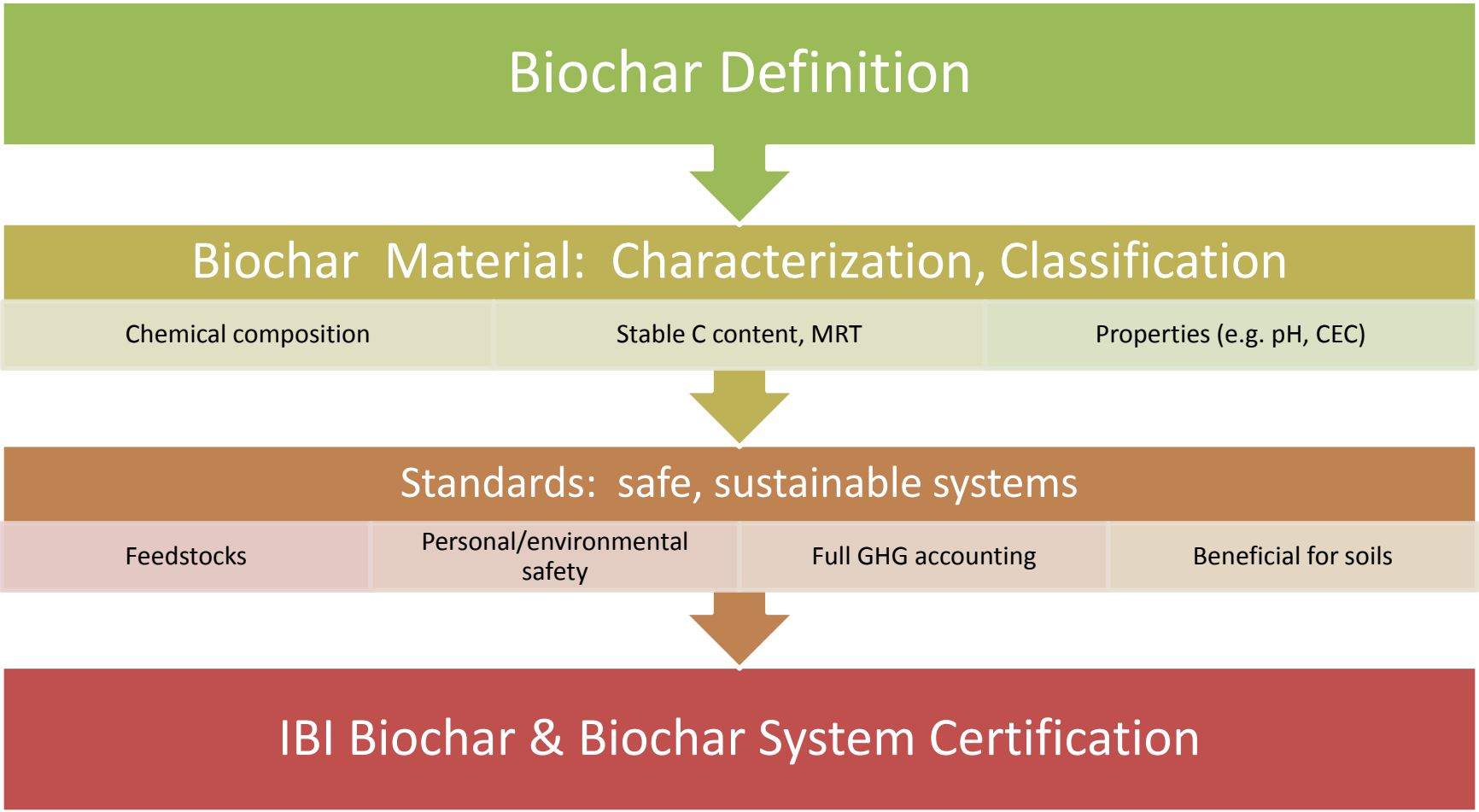
IBI Standards Development



Biochar Standards: How to go about developing them?

IBI defines biochar as a stable C product formed from thermochemical conversion of biomass that is suitable for use as a soil amendment and for climate M/A.

Q: What is it about biochar that we need to know to utilize it for these purposes?

A: We need to identify the functional impacts of importance for climate mitigation and for use as a soil amendment.

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Biochar: Key Characteristics (functional impacts of importance)

Climate change mitigation: GHG emissions mitigation, stable C sinks

Soil enhancement: Biochar can increase the resilience and fertility of agricultural soils – particularly degraded, dry soils – through other functional impacts of importance:

- increased crop productivity
- enhanced nutrient retention and bioavailability
- enhanced water retention
- enhanced fertilizer use efficiency, etc.

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Biochar Standards Development

Biochar properties are a product of ***feedstock*** & ***pyrolysis processing*** conditions

Process of standards development:

- identify which characteristics, properties & functions of biochar are important for climate mitigation, and soil enhancement (adaptation);
- quantify these qualities with standardized, cost-effective tests; and ***ultimately***
- develop *predictive capacities* to produce biochars with desired characteristics

Priorities for Developing Biochar Product Definition and Standards

Source Material and Processing;

Properties and Contaminants;

Classification Framework

- Focus on commercial scale production
- Not intended for back-yard, developing country applications
- Address issues of trade, handling, soil application (role, chemical effects in soils)

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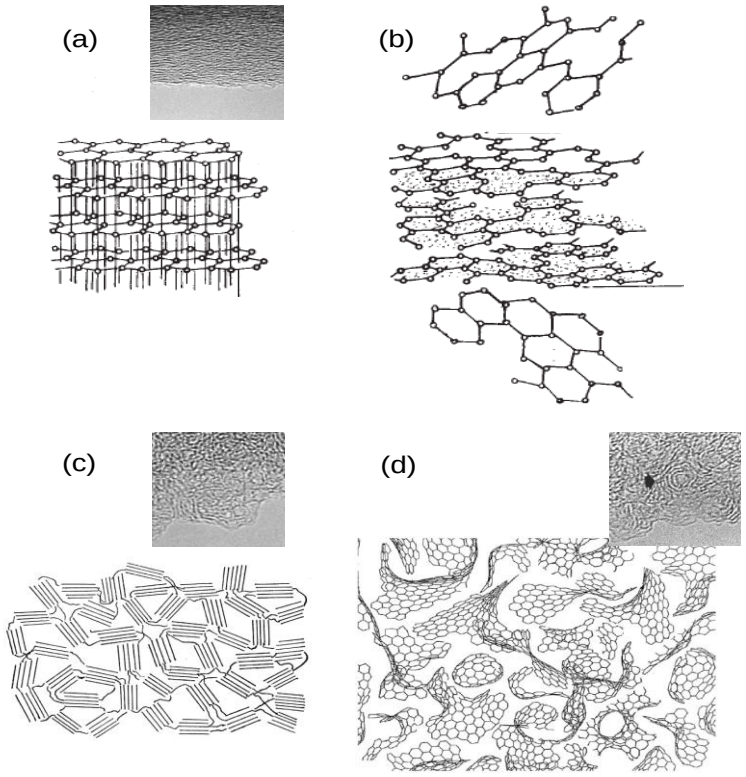
Biochar: Stability is Key

Chemical stability of C in biochar:



Lehmann et al, 2009, in: Earthscan Publ

Lehmann et al, 2008, *Nature Geoscience* 1, 238-242

Source: J. Lehmann, 2009

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Biochar Stability and Storage Time

***MRT in soil*: hundreds to thousands of years**

About 1.5 to 2 orders of magnitude greater than *uncharred* biomass

Lehmann et al, 2008, *Nature Geoscience* 1, 832 - 835
Liang et al, 2008, *Geochimica et Cosmochimica Acta* 72, 6096-6078
Cheng et al., 2008, *Journal of Geophysical Research*, 113, G02027
Baldock and Smernik, 2002, *Organic Geochemistry* 33, 1093-1109
Kuzyakov et al., 2009, *Soil Biology and Biochemistry* 41, 210-219

Source: J. Lehmann, 2009

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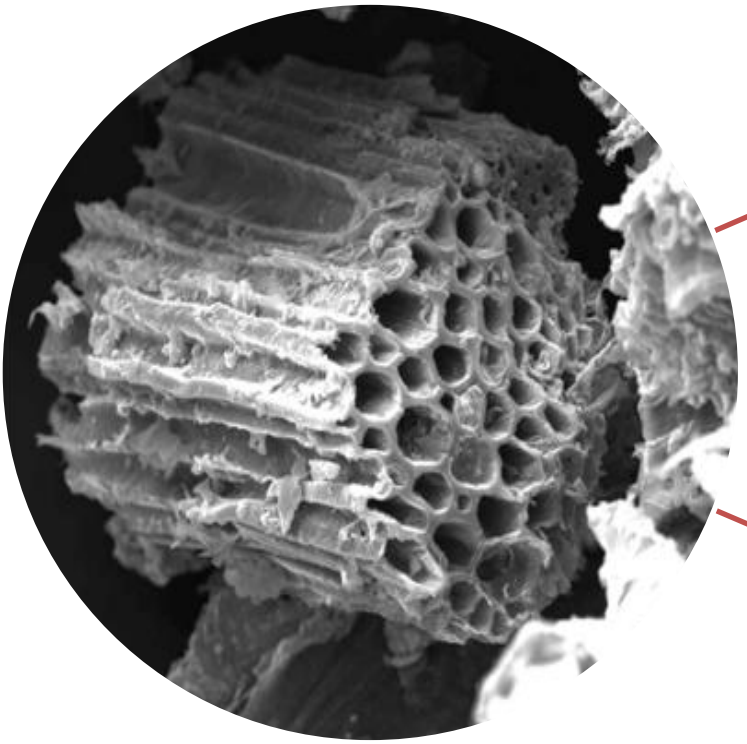
Biochar Characterization and Classification Issues



Production conditions affect biochar properties

- Rate of heating of feedstock
- Final temperature of charring process, and time held at this temperature
- Pressure of reactor – if any
- Heat and mass transfer mechanisms used in reactor ('turbulence')
- Amount of air or steam added to kiln, and biochar temperature at point of addition

Biochar feedstock have different chemical and physical properties

- Percentage lignin, cellulose, hemicellulose, etc.
- Percentage and composition of inorganics (incl. contaminants)
- Bulk and true density (and porosity)
- Particle size
- Compressive and tensile strength
- Moisture content

Standards Work: Some Issues we have grappled with

Possible Approaches

- ***Define how biochar can be used*** – e.g. characteristics that make biochar useful in particular applications
- ***Ensure that biochar is suitable for use*** – e.g., ensuring biochar is safe to use, and that it's (important) properties are known

Methods

- Many experimental test methods being developed – not widely available, reviewable, or understood
- Some standardized, accessible, cost-effective tests are available – but very few specific to biochar, per se

Standards Work: Status update

Version 1 –

- ***Ensure that biochar is suitable for use*** – e.g., ensuring biochar is safe to use, and that it's (important) properties (for identified uses) are known
- Identify ANSI or ISO or ***standardized*** tests for commercial applications in developed countries
- Durable framework

Future plans --

- These standards will evolve over time
- Review/revise after 2-3 years, then again after 3-5 years, then every 5 years
- Biochar-specific tests will become standardized
- With time, predictive capacities of biochar will evolve, we can characterize 'fit-for-purpose' biochar

IBI will certify biochar that has been tested in an approved lab, using the standards. We will also closely monitor efficacy & utility of published standards once in use in the marketplace, and will gather feedback for future versions.

Standards Work: Utility and Intended Outcomes

- ***Provide reliable, accessible, necessary information for the markeplace, and for regulatory bodies***

Outcomes of addressing these issues

- Meaningful metrics, information provide certainty in marketplace
- Known impacts inform uses, users: remove risks
- Increase value, increase demand
- Regulatory bodies assured of product safety

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