United States Biochar Initiative

Developing Markets to Scale Biochar as a Carbon Removal Technology

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United States Biochar Initiative

- 501 (c)(3) non-profit dedicated to **increasing production and use of biochar** in North America
- Key Focus is market development for physical biochar
- Other Focus Areas:
  - Biochar standards development
  - Technical support for producers
  - Annual conference
  - Carbon Dioxide Removal advocacy

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Key Stakeholders and Partners

Partners

IBI

American Farmland Trust
SAVING THE LAND THAT SUSTAINS US

US Composting Council®

USDA Agricultural Research Service

USDA United States Department of Agriculture
Natural Resources Conservation Service

USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Instituto Latinoamericano de Biochar

U.S. Endowment for Forestry and Communities

GREAT LAKES BIOCHAR NETWORK

Other Stakeholders

Biochar Industry

Phoenix Energy

PYREG
NET ZERO TECHNOLOGY

OREGON BIOCHAR SOLUTIONS

Myno

TAKACHAR
TECHNOLOGY • EQUITY • ENVIRONMENT

SYNCRAFT®

PACIFIC BIOCHAR

VOW

ARTi BIOCHAR

BE&E

Wakefield BioChar

METZLER BIOCHAR

ASHWOOD BIOCHAR

Carbon Industry

puro.earth

Carbonfuture

GECA Environnement

GRAIN

CLIMATE ACTION RESERVE

VERRA

AIRMINERS

Conservation and Agriculture

- Conservation Districts and State Conservation District Associations
- State departments of agriculture
- Cooperative extension

Professional Organizations

- American Society of Landscape Architects
- American Society of Agricultural and Biological Engineers

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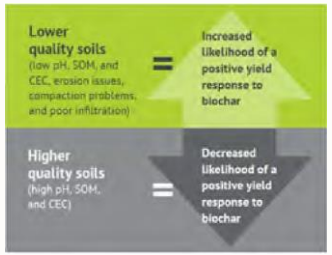
Right source

Selecting the best biochar for your crop

Right place

Applying biochar to the soils that need it



Right rate

Applying the right amount

Right time

Identifying when to apply

USBI
Building the future from the ground up.™

USBI Biochar Learning Center

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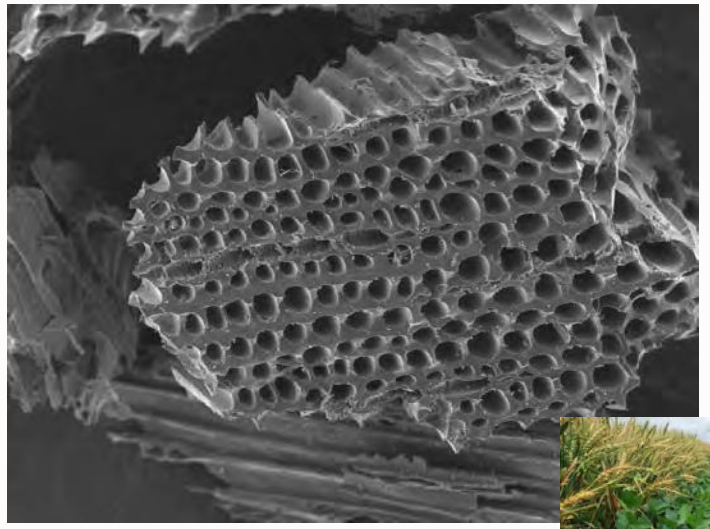
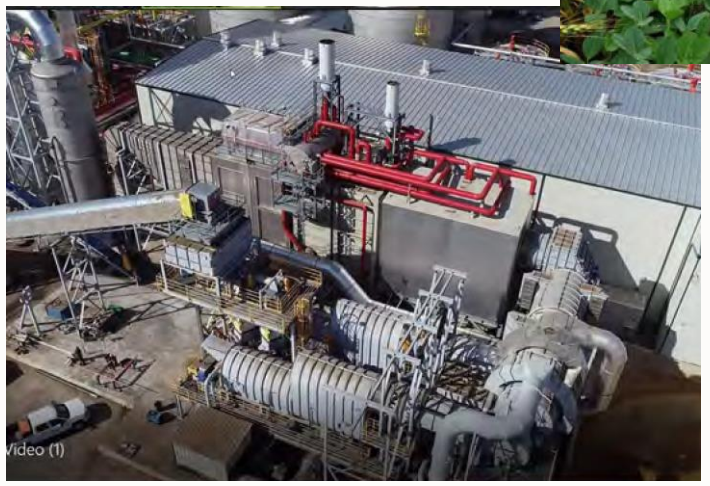
Biochar Production Technologies

USDA ARS-AFT-USBI Practical Biochar Implementation





November 29, 2023 https://bit.ly/47kufav

Tom Miles

American Farmland Trust
US Biochar Initiative
USDA Agricultural Research Service

American Farmland Trust
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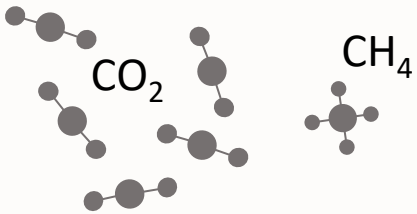
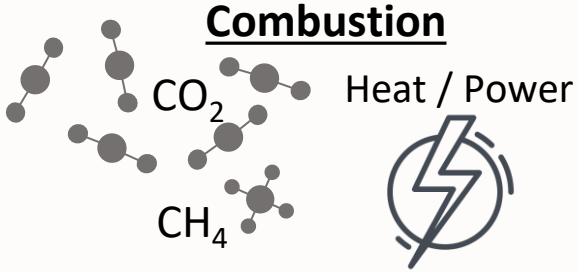
CDR Approach: Waste Biomass to Biochar

Typical Management

Natural Decomposition



Combustion

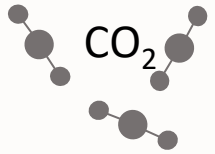


90%+ carbon equivalent emitted

Biochar Approach

Pyrolysis / Gasification

~20-25% biomass -> biochar
~40-50% carbon -> biochar
Remainder -> pyrolysis gas



Heat / Power

Biochar

Biochar is carbon removal to better manage waste biomass including:

- Forestry residuals
- Agricultural wastes
- Manure and biosolids
- Construction debris

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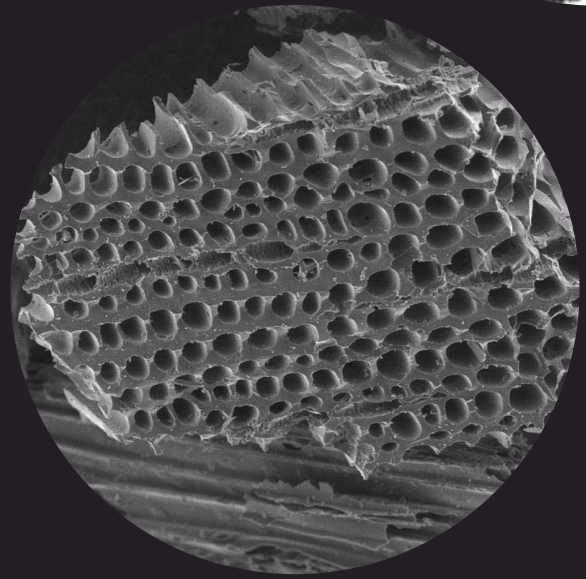
Biochar: A Physical Material

- **Granular black carbon, like charcoal**
- **Chemical structure is resistant to decay, with majority of C stable for 500+ years**
- **Properties depend on feedstock and production conditions**
- **Multiple beneficial end uses:**
  - **Soil health amendment**
  - **Ingredient in biochar-enhanced fertilizers**
  - **Potting soil media to replace peat**
  - **Environmental remediation and restoration**
  - **Media for water filtration**
  - **Additive to materials including concrete**



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Biochar Business Models

Most biochar producers have at least two revenue streams

Feedstock
- Typically a cost; up to $75/ton
- Can generate revenue from difficult feedstocks

Pyrolysis / Gasification
4+ mt feedstock/mt biochar

Pygas
Multiple uses / values
- Heat
- Electricity
- Fuels
- Chemicals
- Hydrogen

Carbon Credits
~$100-$400/ton biochar

Physical Biochar
~$50-$600/ton biochar

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Global Survey: Key Takeaways

Global survey completed with IBI received over 1,000 responses globally; ~400 in USA

1. Biochar leads the way in delivering durable CDR with global production of at least **350,000 mt of biochar, equivalent to 400,000-800,000 mt CO_2**
2. Market for physical biochar are growing, but **developing high value, high volume end-use markets is a key obstacle to growth.**
3. Biochar producers use **a range of production types and business models.**
4. Respondents expect **biochar organizations to focus on:**
    - Developing end-use markets for biochar
    - Advocating for biochar in CDR space and in government policy
    - Improving access to capital and grant funding

International Biochar Initiative

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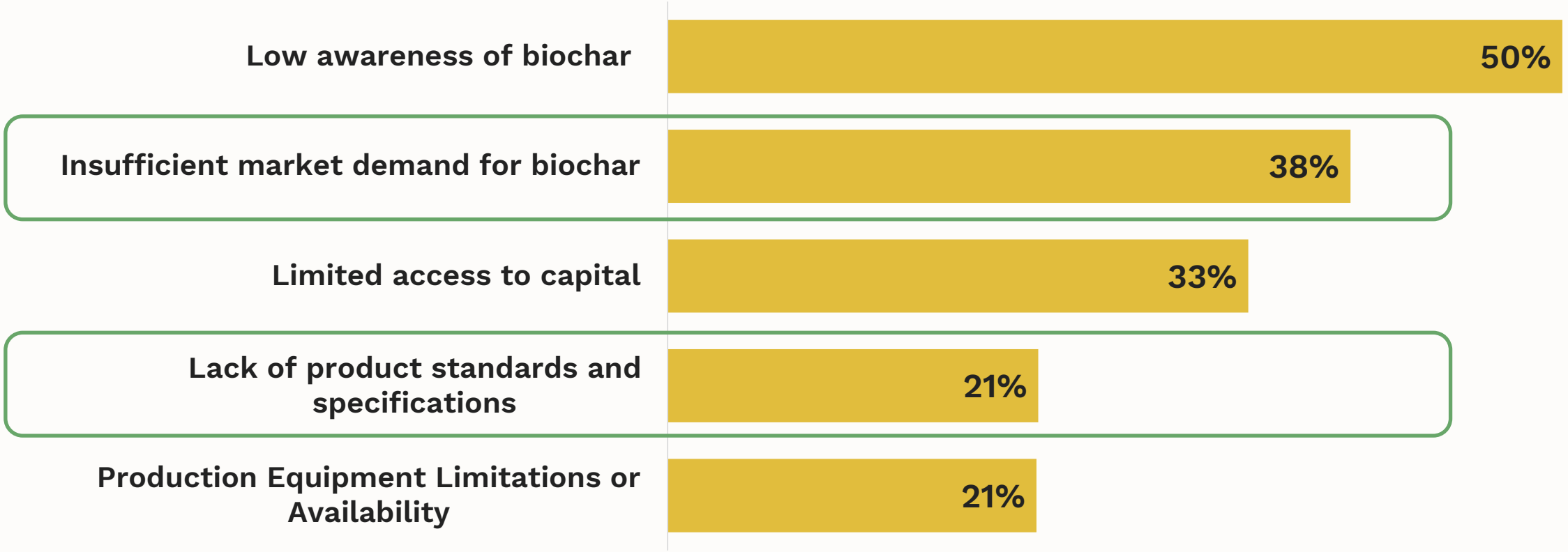
Global Survey: Key Obstacles to Further Growth

What are primary challenges or obstacles for the industry? (Select top 3)



International Biochar Initiative

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Standards and Certifications

Background

- Existing standards for biochar are privately held and are based on German laboratory techniques (DIN standards)
- Few US laboratories offer biochar analysis services, creating backlog
- Standards are consistently listed as a key need by industry members

USBI Approach

- Leading process to develop an American National Standard (ANSI) for the analysis and characterization of biochar
  - Technical committee is developed and bi-weekly meetings starting August 8th
  - Developing standard through the American Society of Agricultural and Biological Engineers (ASABE)
  - Goal is to release standard by Q2 2025
- Future updates to ANSI standard may include end-use standards
- USBI also engaged in process to develop an ISO standard for the analysis and use of biochar but process is very slow

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Biochar as a Soil Amendment

Market Overview: Priority near-term and long-term market

- Likely largest market by tonnage, with climate relevant potential
- Leading end-use market to-date
- Market readiness is low to high, depending on agricultural system

Market Needs	Background and Details	USBI Approach
Scale up USDA cost share programs	• USDA programs provide cost share for farmers that use biochar • **Key obstacle is awareness of biochar among NRCS and adjacent organizations (e.g., extension, conservation districts)**	• **Develop and implement a nationwide "Train-the-trainer" approach to educate NRCS and adjacent organizations** • 10+ events in regional cropping systems
Demonstrations	• Farmers need to see large scale demonstrations at local / regional farms in specific cropping systems	• Coordinate and facilitate demonstrations • Help farmers secure cost share incentives • Integrate with "Train-the-trainer"
R&D	• Focus R&D efforts on economic impacts to farmers including crop yield, crop rotation changes, input requirements for fertilizer and water, biochar application approaches	• Coordinate and partner with universities to increase impact of R&D on biochar industry

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Biochar Enhanced Fertilizers

Market Overview: Priority long-term market

- Among largest markets by tonnage, with climate relevant potential
- Benefits: Simplifies application approach for farmers; optimizes impact at low application rates; reduces fertilizer needs
- Market readiness in US is moderate for home & garden, low for commercial agriculture but higher in Asia

Market Needs	Background and Details	USBI Approach
USDA cost share programs	• Cost share for biochar-enhanced fertilizers is not clear but would drive adoption and demonstrations	• Coordinate with USDA on practice standards
Demonstrations	• Demonstrations in different cropping systems to drive grower uptake	• Coordinate and facilitate demonstrations

R&D	• **Early-stage R&D needs are significant related to:**
	  • **Viable recipes for biochar <> fertilizer <> binders**
	  • **Effectiveness of micronized biochar for liquid applications**
	  • **Effect of biochar incorporation on nitrogen fertilizer needs**
		• Coordinate and partner with universities and biochar companies to increase impact of R&D on biochar industry

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Horticultural Growing Media

Market Overview: Priority short / medium term market

- High market readiness as a partial replacement for peat
- Benefits: Partial replacement for peat and perlite equal performance and better sustainability / climate impacts
- Market is moderate, but value and readiness are high

Market Needs	Background and Details	USBI Approach
Demonstrations	• **Large-scale demonstrations in collaboration with consumer facing potting media suppliers and plant nurseries**	• **Coordinate and facilitate demonstrations** • **Present and highlight successes**
R&D	• Targeted R&D focused on effect of biochar in potting media when growing common nursery and horticultural crops	• Coordinate and partner with universities and biochar companies to increase impact of R&D on biochar industry
Carbon impact quantification	• Biochar can reduce value-chain emissions for corporations • Quantifying impact of biochar vs. peat / perlite is key	• Develop defensible estimates with technical experts
Guidance	• Guidance manuals for biochar and soil industry	• Develop guidance manuals in collaboration with industry organizations

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Stormwater Management

Market Overview: Secondary, short to long term market

- Medium market readiness as a stormwater filtration media
- Benefits: Improved pollutant removal; Increased infiltration; Improved plant health in vegetated green infrastructure systems
- Market is moderate in size, but value and readiness are medium

Market Needs	Background and Details	USBI Approach
Demonstrations	• Large-scale demonstrations in collaboration with leading stormwater municipalities	• Coordinate and facilitate demonstrations • Present and highlight successes
R&D	• Targeted R&D focused on effect of biochar in stormwater filtration media on pollutant removal and vegetation health	• Coordinate and partner with universities and biochar companies to increase impact of R&D on biochar industry
Guidance	• **Guidance manuals and specifications for stormwater regulators and designers**	• **Develop guidance manuals** in collaboration with industry organizations

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Landscaping, Turf, & Tree Care

Market Overview: Secondary, short medium term market

- High market readiness in tree care and general landscaping
- Benefits: Improved plant health and survival; Reduced irrigation and fertilizer needs; Reduced embodied carbon of landscapes
- Market is moderate in size, but value and readiness are high

Market Needs	Background and Details	USBI Approach
Demonstrations	• Demonstrations with municipalities and companies focused on deployment techniques and outcomes • Educational events focused on landscape architects	• Coordinate and facilitate demonstrations • Present and highlight successes
Guidance	• **Guidance manuals and specifications for landscape architects** • **Guidance manuals and specifications for landscaping contractors**	• **Develop guidance manuals** in collaboration with industry organizations

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Concrete Additive

Market Overview: Secondary, medium to long term market

- Low to medium market readiness
- Benefits: Reduced embodied carbon; Improved performance
- Market is very large in size, but value and readiness are lower

Market Needs	Background and Details	USBI Approach
Demonstrations	• Small-scale demonstrations with municipalities and companies focused on deployment techniques and benefits	• Coordinate and facilitate demonstrations • Present and highlight successes
R&D	• **Basic R&D for both concrete related to biochar specifications, performance impacts, workability, etc.**	• Coordinate and partner with universities and biochar companies to increase impact of R&D on biochar industry

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Other Markets

Not currently USBI priorities, but all have potential

Early-Stage Markets

- Asphalt
- Activated carbon replacement
- Carbon black
- Building materials
- Anaerobic digester additive
- Animal feed additive
- Industrial pigments and dyes
- Biocomposites
- Energy storage & batteries

Significant R&D needs for each including basic, technoeconomic, and applied

Near-Term, Lower Value Markets

- Compost additive
- Aggregate
- Landfill applications
- Animal bedding

Lower value markets may still be suitable for lower value biochar produced from certain wastes

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Thank you!

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