

Survey and Analysis of the US Biochar Industry

Preliminary Report Draft; August 16, 2018

, WERC project MN17-DG-230

Executive Summary

A survey and analysis of the US biochar industry was commissioned by the US Forest Service, via a Wood Innovations Grant. Two surveys were generated; one for producers and one for users. The Surveys were composed using Survey Monkey and the US Biochar Initiative distributed invitations and follow-up requests. Out of an estimated 135 biochar producers in the US, responses were received from 61, a 45% response rate; 58 responses from domestic biochar users were received.

The surveys are complementary in their results with two trends standing out:

- Growth in sales supported by a general optimism in the strength of the marketplace.
- Desire for more information and support from all types of resource entities.

The producer survey indicated the expected growth in year-to-year production is supported by the expectation of increased sales, higher prices, and the availability of feedstocks at affordable prices. This outlook is also bolstered by the expectation of users to increase purchases.

The users survey provided a snapshot of an optimistic marketplace. Many of the smaller users left comments expressing their interest in learning more about biochar, about the broader marketplace, about how to market more effectively to grow their businesses, and for more in-depth information about research results (which could help both their understanding and marketing.) They also uniformly anticipated higher sales.

Responses to questions about what the industry/trade association, public policy, and the USFS specifically can do to support and grow the market provided particular insight. The most often cited historic support come from IBI and USFS Wood Innovation Grants. Cooperative research initiatives with universities were noted by larger producers as helping to advance their progress while there was widespread desire for more biochar-related research.

From a policy standpoint, producers cited recognizing biochar as carbon negative (and getting some financial credit for it) by almost 25% of the respondents. The second most repeated support need was to certify biochar as an animal feed supplement—by six of the responding 23 larger producers—and both USDA and FDA were cited as important players in opening that market. It was noted by a number of respondents that biochar as a feed supplement is allowed in Europe already.

Both users and producers see the need for much higher profile education efforts—in support of biochar as a desirable and sought after product. The new market segment of biochar as an animal feed supplement is considered strongly for its potential to have a significant impact on both producers and resellers; however resellers will likely see less effect since volume sales seem to be provided mostly from producers. More information on this market (current European experience, domestic customer interest, price points, and value added opportunities) is needed to better predict how significant the animal feed supplement could be. The same can be said for other currently minor segments with large potential markets: stormwater filtration, mine reclamation, and odor control.

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Introduction:

A survey and analysis of the US biochar industry was commissioned by the US Forest Service, via a Wood Innovations Grant in 2017. The survey was conducted by the project team consisting of:

- Kathleen Draper, Finger Lakes Biochar and Ithaca Journal; NY
- Harry Groot, Dovetail Partners, Inc.; Minneapolis MN
- Tom Miles, Tom Miles Consulting, Inc. and US Biochar Initiative; Portland, OR
- Martin Twer, Biomass Program Director, The Watershed Research & Training Center; Hayfork, CA

Methodology

Two surveys were conducted; one for producers and one for users. The Survey was composed using Survey Monkey and the US Biochar Initiative mailed the invitations and follow-up requests. The specific survey input was promised as confidential, however a field was provided to allow individuals to authorize follow-up—which was conducted with selected respondents by project team members.

Out of an estimated 135 biochar producers in the US, we received responses from 61, a 45% response rate, as well as 58 responses from domestic biochar users in a parallel survey. The analysis was based on these responses (survey questions attached in Appendix A and B) in addition to follow-up interviews by phone and in person.

All members of the project team participated in the data compilation, analysis, and reporting. Of the 69 responding producers, 7 respondents were Canadian and one was German. Their data has been segregated. All 58 of the users were domestic.

Note on data management:

Some of the data presented will be based on the entire response set; however, the focus will be mainly on the higher volume producers and users since the project team feels they reflect “the industry” most accurately. The smaller producers and users are frequently do it yourselfers (DIY) and skew the desired industry focus of this study.

The raw response data is not being shared to honor the promise of confidentiality to respondents.

Introduction

Prior to this survey, the US biochar industry production was estimated to be between 15,000-20,000 tons per year (TPY). This survey provides data to support an estimate of 35,000 to 70,000 TPY. Given that this estimate is based on a 45% response rate, it’s reasonable to project an industry-wide production of 45,000 TPY, which is the basis used in this report.

Using a 75% reduction in dry weight from raw feedstock to finished biochar, biochar production would consume about 200,000 bone dry tons of biomass as feedstock. Knowing that most

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feedstock ranges from 20 to 60% moisture content (for woody and ag biomass, the most common feedstocks) it can be extrapolated that the industry uses between 125,000 to 250,000 delivered tons of feedstock.

The users represent a usage of 163 to 200+TPY, less than 1% of industry's projected production capacity. There is no way to know what percentage of all consumers this represents, but the project team solicited their input to better understand issues rather than to gain a comprehensive picture of market demand.

Producers Survey Data

5 producers over 5000 Tons per year of biochar production (TPY)

7 between 1000 and 5000 TPY (with one being Canadian)

5 between 500 and 1000 (with one being Canadian)

6 between 100 and 500 (with one being Canadian)

1 between 50 and 100, and 45 respondents producing less than 50 Tons per year (with 4 Canadian and 1 German.) 21 respondents didn't state their production volume.

The domestic biochar production represented by the survey respondents is between 35,000 and 70,000 Tons per year. The Canadian production adds an additional 1,700 to 6,600 TPY for a North American total of 18,700 to 76,600 TPY.

A note about the following data presentation: The larger producers were relatively thorough in responding to the survey questions, so while there is a fairly consistent 25 to 30% non-response rate on a question-by-question basis, it affects the lower 10 to 20% of the volume of biochar produced for the most part. As a result, this analysis will focus large on the volume producers.

The larger producers have been in business on average, longer than most of the intermediate sized producers, however there were 9 firms producing less than 100 TPY with more than 5 years production experience.

57% of the respondents were biochar producers primarily, with 29% as a byproduct of energy generation and 8% as a byproduct of electricity generation. For 6%, biochar production was a form of waste disposal. 29% didn't respond to this question.

82% of the respondents were producers and only 18% were resellers. Of the 14 resellers, only two purchased between 1000 and 5000 tons per year while 4 purchased between 100 and 500 Tons, and 8 purchased less than 50 Tons per Year.

Producers sell most of their biochar for agricultural uses: gardens, field crops, orchards, horticultural applications, turf, and landscaping. The table below shows for which applications producers and resellers are selling biochar:

The highlighted uses below are aggregated under an "Agricultural" class:

| | |
|-------------------------------|-----|
| Garden | 62% |
| Horticulture, specialty crops | 47% |
| Field Crops | 42% |

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| | |
|------------------------|-----|
| Orchard or tree crops | 29% |
| Turf | 20% |
| Landscaping | 36% |
| Stormwater, filtration | 33% |
| Odor control | 27% |
| Other | 18% |

The “other” category includes concrete admixture and pigments.

Of the largest volume producers (23 in number), 43% (10) make biochar for no specific end use. 35% (9) make biochar for agricultural applications specifically, 9% (2) for drainage, 13% (3) for odor control specifically, and 22% (5) didn’t say.

Five of the largest volume producers sell their biochar as-is. Twelve of them process further (sizing, pelletizing, charging/inoculating/activating, neutralizing pH, and/or mixing with other soil amendments), and 5 didn’t answer.

Biochar is supplied as (in rank order):

1. Coarse chips
2. Fine powder
3. Fine screened chips
4. Pellets
5. Granules or prills
6. Liquid suspension.

Most of the large suppliers responding (39%, 9) do not pursue any independent certification, however 5 have OMRI listing or Organic certification and 5 use IBI standards. Nine of the 23 did not respond.

The majority of biochar is shipped locally and regionally (less than 500 miles), however exports are being made to Europe, Asia, Australia and the Middle East by producers in all production classes.

Responding producers and resellers were evenly split on customer requests to know if the biochar was locally sourced, with the smaller scale producers most often asked.

Most all producers provide information to customers about their biochar—from analysis results to how-to-use instructions. Only 1 of the large volume producers provided no information, with five not responding.

None of the biochar producers—of any size—expect there to be a decrease in demand, with almost 60% of respondents expecting prices to increase more than 10% as a result of that demand. Most of the larger tier producers expect demand to grow modestly to significantly. Only 4 of the 23 upper tier producers anticipate needing to expand capacity to meet growing demand and only three of them expect to have a problem obtaining feedstock. The feedstock sourcing is predominantly woody in nature, but a wide variety of materials are viewed as

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potential sources, including manures, grasses, ag waste, construction waste, fiber, and food waste.

The market segments showing the highest expectations for growth are, in rank order: crops, filtration, odor control and other, with biochar as an animal feed supplement the most mentioned market segment.

Advertising biochar was direct, relatively traditional, and unsophisticated:

| | |
|------------------------------------|-----|
| Word of mouth | 68% |
| Direct response to inquiries | 46% |
| Google Adwords | 2% |
| Print media | 10% |
| Website and other electronic media | 44% |
| Conference and trade show displays | 29% |

The top producers claim to have spent millions on research annually, with the level of support declining proportionately as production levels decreased. The degree of decrease was not linear; however without more specific details the relative percentages and trends cannot be determined.

The data last section asked open ended questions about policy and opportunities for support provided wide ranging responses. There were many thoughtful suggestions and a few common threads, which will be captured and discussed in the analysis section.

Users Survey Data

The breakdown of users was:

5 users consuming more than 20 Tons per year of biochar (TPY)

10 users consuming between 5 and 20 TPY

11 users consuming less than 1 TPY

25 users consuming a few gallons per year (at 7.5#/gal.)

6 users didn't specify quantity.

As noted above, the users represent less than 1% of the estimated domestic production of biochar.

Most respondents classified themselves as gardeners, farmers or landscape contractors. In the larger users, most were resellers. The motivation for using biochar was fairly consistent and multi-faceted, including: modifying soil texture, improving air/water porosity, improving water management, and increasing soil carbon. There was modest motivation to change soil chemistry or modify pH, and to improve disease resistance.

The majority of respondents (55%) use the biochar dry. 38% use it inoculated and 39% blend it, most commonly with soil and/or other soil amendments.

The biochar users bought the material in the following forms (in rank order) :

1. Fine powder
2. Fine screened chips

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3. Coarse chips
4. Pellets
5. Granules or prills
6. Liquid suspension

As seems reasonable, larger volume users have been in business longer than smaller users, however 49% of all respondents have been using biochar for at least two years and most of the top tier have over 5 years' experience.

Of the 54 respondents, there was a notable increase in current volume used versus expectations for the coming year:

| Usage | Last Year | This Year |
|------------------------|-----------|-----------|
| Less than a ton | 49% | 28% |
| More than a Ton | 23% | 31% |
| A Semi-Truckload (20T) | 19% | 26% |
| Multiple Truckloads | 9% | 15% |

There seems to be broad satisfaction with suppliers in that 81% of users have not changed from whom they buy; 10% had changed suppliers due to quality issues and 8% due to availability issues.

Organic/OMRI Certification was important to 31% of respondents; IBI to 9%; State-level certification to 15%; and no certification was noted as important by 36%. 92% of respondents said the climate impact of biochar was of importance to them. Only 4 of the 26 upper tier producers (15%) said climate impact was unimportant.

Most top tier users get their supply from 100 to 500 mile shipping distance, but 27% of them experience shipping distances of over 1500 miles. With few exceptions, respondents indicated the fact the biochar is produced locally was an important criteria (94%).

When asked whether they knew or cared from what or how their biochar was made only one respondent answered "no." Four percent said that information was not disclosed and 85% said they knew the details despite responses to a question about receiving an analysis where 43% responded yes. All the recurrent large volume buyers received analyses of their biochar while only 40% of the truckload volume buyers received analyses.

Reported prices paid for biochar ranged widely depending on the packaging and volume purchased. For the larger scale users the lowest cited cost was \$75/CY, the average price was \$129/CY, with \$200/CY FOB the most often cited price¹ (or \$1600/Ton.)

As with the Producers, the input offered from open ended questions will be discussed in the analysis section.

¹ Conversions used: 8CY/ton or 216 CF/ton; 9.25#/CF; 1CY = ~22gallon

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Analysis of Producers Survey Data

Two trends stand out: the growth in production and general optimism about the strength of the marketplace. Secondly, is desire for more information and support from all resource providers.

The growth in year-to-year production is supported by the expectation of lower prices and the potential availability of feedstocks at affordable prices. This outlook is also bolstered by the expectation of users to increase purchases.

Responses to questions about how the industry/trade association, public policy, and the USFS specifically can do to support and grow the market provided particular insight. The most often cited historic support come from IBI and USFS Wood Innovation Grants. Cooperative research initiatives with universities were noted by larger producers as helping to advance their progress.

From a policy standpoint, recognizing biochar as carbon negative (and getting some financial credit for it) was mentioned by almost 25% of the respondents. The second most repeated support need was to certify biochar as an animal feed supplement—by six of the larger producers—and both USDA and FDA were cited as important players in opening that market. It was noted by a number of respondents that biochar as a feed supplement is allowed in Europe already.

There was frustration expressed with EPA regulations by two mid-sized operations, but no specifics were provided as to what actions would help ease their concern.

A number of producers noted the need for stronger definition of biochar “grades” and improved standards. Others made mention of the desire for more support to get the word out to users (the public and farmers specifically) about the benefits of biochar.

Responses to a question about how USBI or a trade association could best support producers were very similar to the question about what policy initiatives would help most: advocacy for carbon credits, education of the public and farmers specifically, marketing, and research leadership.

Two notable actions were suggested for USBI. The first is to participate more in long-term research which (hopefully) shows the benefits of biochar in soil and mixed amendment systems. The second notable suggestion was for market research which “compares biochar to existing products (like AC, compost, and soil blends) to determine price points and pain points of buyers that use other [soil amendment] products.

In response to a question how the USFS and Federal Agencies could support the biochar industry a number of responses cited purchasing biochar for forest and mine reclamation. Improved accessibility to, and the increased use of stewardship contracts to provide feedstock was mentioned by a number of producers while compliments were given to USFS for the use of stewardship contracts by other producers. Streamlined regulations to acquire woody biomass were mentioned by multiple respondents. One insightful respondent suggested a cost/benefit analysis: “Quantify in \$ terms the benefits of avoided slash piling burning, irrigation water

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availability from juniper treatments and thinning.” As well as “Economic and enterprise models that help build an investment case for biochar production.”

One interesting response was the amount spent on research internally. Three of the five largest firms claim to be spending in excess of \$1M/year, with and 2 currently mid-sized operations spending similarly, and four others in the \$250K to \$500K range. These commitments are impressive and, for a relatively young industry with a relatively small market, can be interpreted as indicative of optimism for stronger demand for biochar products.

Analysis of Users Survey Data

The users survey provided a snapshot of an optimistic marketplace. Many of the smaller users left comments expressing their interest in learning more about biochar, about the broader marketplace, about how to market more effectively to grow their businesses, and for more in-depth information about research results (which could help their understanding and marketing.)

One respondent expressed interest in using biochar as a concrete additive and as a component in other building materials (unspecified) which is being done by one of the large producers, suggesting a potential for collaboration.

Shipping and handling costs were cited by a two users as being of more concern than the raw biochar costs even though their shipping distance was less than 500 miles for truckload volumes.

As in the producers’ survey responses, users wanted more information about the animal feed and stormwater filtration markets.

Conclusions and Next Steps

The surveys are complementary in their results. Both producers and users see a growing demand. There are different expectations in price points between the two groups, which is typical and will be worked out over time as production is balanced with usage.

Both groups see the need for much higher profile education—in support of biochar as a desirable and sought after product. The new market segment of biochar as an animal feed supplement is considered strongly and its potential could have a significant impact on both producers and resellers, however resellers will likely see less as volume sales seem to be provided mostly from producers. A value added opportunity may exist for resellers to produce a branded or customized end-product, which producers could be reluctant to take on. More information on this market (current European experience, domestic customer interest, price points, value added opportunities) are needed to better predict how significant it could be.

There was a difference between the form of the biochar being provided by producers and the form being purchased by the users. This may be useful to producers in aligning better with buyers of their finished product. Future research should explore this facet more closely.

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Biochar as a confirmed carbon sequestering product was expected to have the greatest potential to enhance its demand. However, it's an unlikely driver in the near term without a solid scientific claim (and/or legislation.) There are a wide variety of production technologies and, therefore, a wide range of carbon balances to consider. This variability complicates the certification of carbon sequestration capability and considerable collaboration, funding, and effort will be necessary to establish a credible calculation schema. Political considerations also come into play considerably in this process as there are already a number of skeptical organizations actively questioning the entire system of woody biomass production and conversion. Collaborating in the biomass energy producer's efforts to quell and quantify could be a cost effective strategy.

For updated information on this project check the USBI website: <http://biochar-us.org/news/us-biochar-market-survey-0>.

And for information on this project and other explorations of our land use decisions, visit the Dovetail Partners Report website: <http://www.dovetailinc.org/reports>.

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