

Overview of Carbon Gold General Methodology for Quantifying the GHG Emission Reductions from the Production and Incorporation into Soil of Biochar in Agricultural and Forest Management Systems

**Comments provided by The International Biochar Initiative (IBI)
Saturday, August 29, 2009**

IBI RESPONSE SUMMARY

The International Biochar Initiative is pleased to submit comments on the Proposed Carbon Gold Methodology. We welcome and appreciate the development of methodologies for quantifying GHG emissions reductions associated with biochar projects, and commend CarbonGold for its work and initiative on this methodology. We will gladly clarify any of these comments, or provide additional comments if necessary.

IBI's comments fall into the following broad categories, with more specific comments articulated below:

- The suggested methodology for determining the carbon removals from biochar – which is described as an estimation of the stable fraction of biochar carbon -- is not an accurate test for this purpose. While there is not yet a universally approved test or methodology for this, the IBI is working on development of both an accurate test method and an accurate methodology for determining carbon removals for markets.
- Emissions from the production technology utilized to produce biochar – in this case, a kiln -- must be known and accounted for as part of any methodology.
- The carbon flows associated with soil organic matter, pyrolyzed matter, and matter burned in situ are all complex. The methodology simply refers to ‘a model in accordance with Tier 3 IPCC guidelines’ for the DOM fraction. To properly evaluate the proposal, a specific model must be developed and demonstrated; otherwise, it is subject to individual interpretation. Similarly, a model must be developed and demonstrated for the biochar component. The consequence of changing biochar carbon flows into the soil in any one year will be felt as a change in emissions over long periods of time. A rationale needs to be developed to deal with this and to account for those future changes (positive and/or negative) from a current year intervention, working beyond the project time horizon.
- There is no explicit mention of permanence, or justification that the changes in emissions achieved will be permanent. However, the mean residence time of biochar will likely qualify it as a real, permanent carbon removal.
- The methodology seems to overlook important factors which are potentially large contributors to the total climate change mitigation impact of biochar systems. It ignores, for example, methanogenesis in crop residue burning which could add significantly to the baseline emissions. The suggested methodology does not account at all for emissions reductions from displaced fossil energy carbon due to the bio-energy produced during pyrolysis. It explicitly ignores any fertilizer

effects, which over time could be significant, as well as avoided N₂O and CH₄ emissions from soils. These oversights will result in what may add to significant underestimations of GHG emissions reductions achieved by biochar projects. The methodology also makes no mention of the value of the biochar beyond carbon (such that it doesn't need to pay all its own costs). This is critical for determining the additionality of a CDM project, for example. The proposal mentions using the CDM additionality tool, but the purpose of the draft PDD (see below) is to make explicit these issues so that they can be considered and assessed.

- New methodologies in the CDM are required to be accompanied by a project example, submitted in the form of a draft Project Design Document [PDD]. This PDD is required to illustrate the complete workings of the methodology and any models used using real data. This would help to crystallize the necessary modeling described above and justify additionality.

Specific IBI Comments and Suggestions:

Project mechanism elements, and IBI Comments:

- Soil C stocks are increased by the addition of biochar produced through controlled pyrolysis of biomass from agricultural activities or forest management.
- Biomass must have otherwise been left to decay or burned in an uncontrolled manner AND not used for some other activity.
- Must be able to ensure that the pyrolysed residues are no longer prone to combustion or decomposition. They define this as volatile C/fixed C \leq 0.5.

- **Comment:** The pyrolyzed residues will be prone to combustion and decomposition if conducive conditions exist or are provided.
- **Comment:** The determination that: “pyrolysed residues will only be considered biologically inert if the volatile-carbon/fixed-carbon ratio is equal to or lower than 50%” is inadequate as a methodology to determine the stability and permanence of biochar for carbon sequestration. The recommended test is one specific to the use of charcoal as a fuel, and is burned at much too high a temperature (950 C) to be relevant to biochar production. Modified ASTM methods might be adapted in the future to determine the stable or fixed carbon component of biochar. Currently, and more accurately, the VC/FC ratio is determined through incubation studies relating actual degradation to a proxy lab analysis. Additionally, the VC/FC ratio, if utilized, must be determined based on an ash-free oven dry basis, utilizing a test that heats to just 300-450 C. In this case, the acceptable VC/FC ratio should be 100% until a better methodology is developed for this assessment. Finally, the “VC” is more appropriately labelled the ‘labile carbon’ component.

- "Production of biochar shall be undertaken in such a way that does not act to the detriment of sustainable management principles."

- **Comment:** There is no definition to determine what sustainable management principles constitute in the context of this document. For example, there is no biochar characterisation standard proposed or utilized to ensure that production

and application are appropriate to the specific soil and system in which the biochar is being applied.

Project boundary elements, and IBI Comments:

-Temporal boundary of the project is 10 years

- **Comment:** While a 10-year standard may be commonly utilized for biological C offset projects, it deserves acknowledging that a guarantee of 10 years of relative C stability is completely different than producing real and permanent C sequestration. Biochar will likely fulfil criteria for real and permanent C sequestration relatively well, but the entire concept, which is perhaps one of the greatest merits of biochar, is not even addressed here.

-GHG inclusions: mostly conservative (e.g., ignore N₂O emissions from unburned biomass).

- **Comment:** There is no accounting for the potential of changed GHG emissions from soils upon biochar application. Baseline emissions of N₂O and CH₄ are not measured on the basis that they are insignificant, or if they do occur, they will not change as a result of biochar application project. This is very conservative, and does not take into consideration the scientific data showing reduced emissions of N₂O and CH₄ from biochar-amended soils. However, if any changes to non-biochar C cycling occur upon biochar application, or if biochar represses N₂O emissions from soil (evidence is being developed, but not yet conclusive) then this will not be considered or captured. Thus, measurements of N₂O and CH₄ should be included, or should not be excluded from consideration, at the very least.

Quantifying Net Emissions Reductions elements, and IBI Comments:

-Figure 1:

- **Editorial comment:** Regarding use of the term "baseline GHG emissions removals," suggest instead that the term "baseline GHG emissions or removals" be utilized.

Project Emission Quantification elements, and IBI Comments:

-Standard project minus baseline calculations, but of note:

-C sequestered in soils via biochar is calculated as the proportion of biomass residue that becomes "fixed carbon" (FC), based on the ASTM wood charcoal analysis. Furthermore, it must be at least 50% FC to be included, even though it is only the FC that is considered stable.

- **Comment:** To our knowledge, volatile carbon (VC)/fixed carbon (FC) under ASTM analysis has not been successfully correlated to decomposition rates over time in different environments by field-testing and long-term studies. Thus, the assumption that what is measured as FC in the ASTM test will not decompose over 10 years, let alone the time scales truly necessary for real, permanent C sequestration, may be faulty. Also, this assumes that 100% of biochar is applied to the soil. While escape to water may not be an issue for carbon sequestration, airborne loss could be, depending on handling and soil application methods.

- Only the emissions from the equipment used to apply BC are included in emissions calculations

- **Comment:** It may be important to account for the effects of or prevent the loss of biochar to the air, depending on application method. Also, as previously indicated, any soil-based emissions changes from altered non-biochar organic matter cycling or changes in N₂O emissions are not acknowledged or accounted for.
- **Comment:** It is unclear what "non-biogenic OM" is (9.1). It is specified later as just non-biogenic material. Perhaps "OM" in 9.1 is a typo.

-Baseline Emission Quantification elements, and IBI Comments:

- **Comment:** The methodology does not consider total C stocks/flows in the system, but, rather, considers only how much more C would have been stored had the project not been implemented. This, again, overlooks more dynamic soil processes as previously described.

-It appears to assume that there are no transportation costs associated with the baseline scenario - i.e., biomass is only burned in situ.

- **Comment:** Scenarios in which biomass is transported before burning should explicitly account for the associated emissions.

-Recommends use of the Century model or SCUAF SOM model 8 to estimate how biomass additions would have increased soil C under baseline.

- **Comment:** Models may be robust, but while the establishment of a comparable "baseline" plot that does not receive biomass removal or BC additions may be impractical, it would be ideal, at least for early projects.
- **Comment:** There is no accounting for the different functional roles of different forms of C in soils. For example, stable biochar will likely not fulfil the same ecological function in soil as volatile carbon. This could be in contravention of the principle of sustainability established at the outset. However, we recognize that this may be beyond the scope of the VCS.
- **Comment:** There is no biochar characterization beyond VC/FC ratio calculation, which only accounts for C stability. This may be simply because it is focused on GHG budgets, and it may be adequately covered by including the requirements of sustainable management principles in (3.9), but it may be important to outline basic tests for biochar before soil application, based on characterization methods currently being developed through the IBI.

Leakage elements, and IBI Comments:

Assumes no leakage is expected. This is based primarily on the fact that the biomass was being left alone or burned under the baseline scenario, thus nothing will be used to take its place. The strength of this assumption partly rests on the strength of the established additionality.

- **Comment:** This assumes that the biomass previously left on the land provided no benefits to the soil, for example, labile carbon or nitrogen that would be lost if the

material is removed and used for pyrolysis. If increased inputs or a shift in soil carbon pools result from the loss of the biomass in a particular area, they may be temporary, but consideration should be given to accounting for those changes.

Monitoring elements, and IBI Comments:

-All pyrolysis plant and transportation fuel use must be monitored, and Once the project is established, the participants must prove that biomass would have been burned or left to decay every year.

- **Comment:** This is important for additionality, but once the BC project is established, or other value streams for agri-waste develop (as is highly likely), this proof may become more tenuous.

- There is no requirement for monitoring of the site where biochar is applied- only the char produced is measured.

- **Comment:** As previously noted, this relies on assumptions not specified regarding the stability of biochar over time, use of successful application methods (*e.g.*, with minimal release of biochar particulate matter into the air), and ignores the potential for any on-site changes in soil organic matter or GHG dynamics. While biochar in soils may not need to be monitored over the long term, there should be site-specific tests assuring that a given biochar will be stable in a given soil under specific management practices.