Bringing Biochar Projects into the Carbon Marketplace

Biochar Protocol Development
Presented by John Gaunt – Carbon Consulting LLC
Moderated by Keith Driver – Blue Source
8 a.m. PDT Tuesday, June 15, 2010

We encourage you to participate in our polls and type in questions and comments during the webinar using the chat function in the GoToWebinar control panel. If we don't get to all of your questions today, we'll try to answer them in a follow-up email and on our website, www.biocharprotocol.org.

Thank you for joining us.

Introduction

A Multi-Stakeholder Effort

- Comprehensive GHG emission reduction and sequestration protocol development process
- Provide guidance and market infrastructure to biochar protocol developers
- Voluntary Carbon Standard (VCS) and Alberta Offset System (AOS) protocol submission
- Set stage for CDM protocol

Our goal is simple: to open carbon markets to biochar and pyrolysis technologies.

Outline

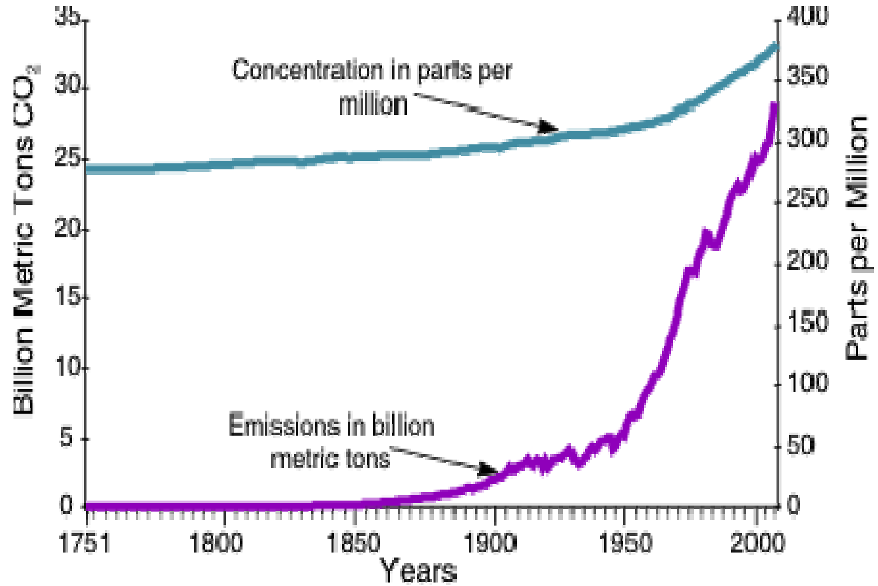
Focus on more technical aspects than our previous Markets & Policy webinar

- Introduce the climate change context, describe what biochar is, why it is important, and outline briefly what methodologies and protocols are
- Outline where the offsets come from – focus on carbon
- Outline next steps and path forward

Climate Crisis

Current CO_2 levels 393 ppm rising to 700 ppm by 2100

- Average temperature rises 1.1 to 6.4 ˚C (2.0 to 11.5 ˚F) by 2100
- Sea level rises at least 2 meters by 2100



Source: Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center.

The Solution

- Reduce our annual emissions ~25 Gt CO_2

  and
- Remove 344 Gt CO_2 from the atmosphere today to return atmosphere to 350 ppm CO_2

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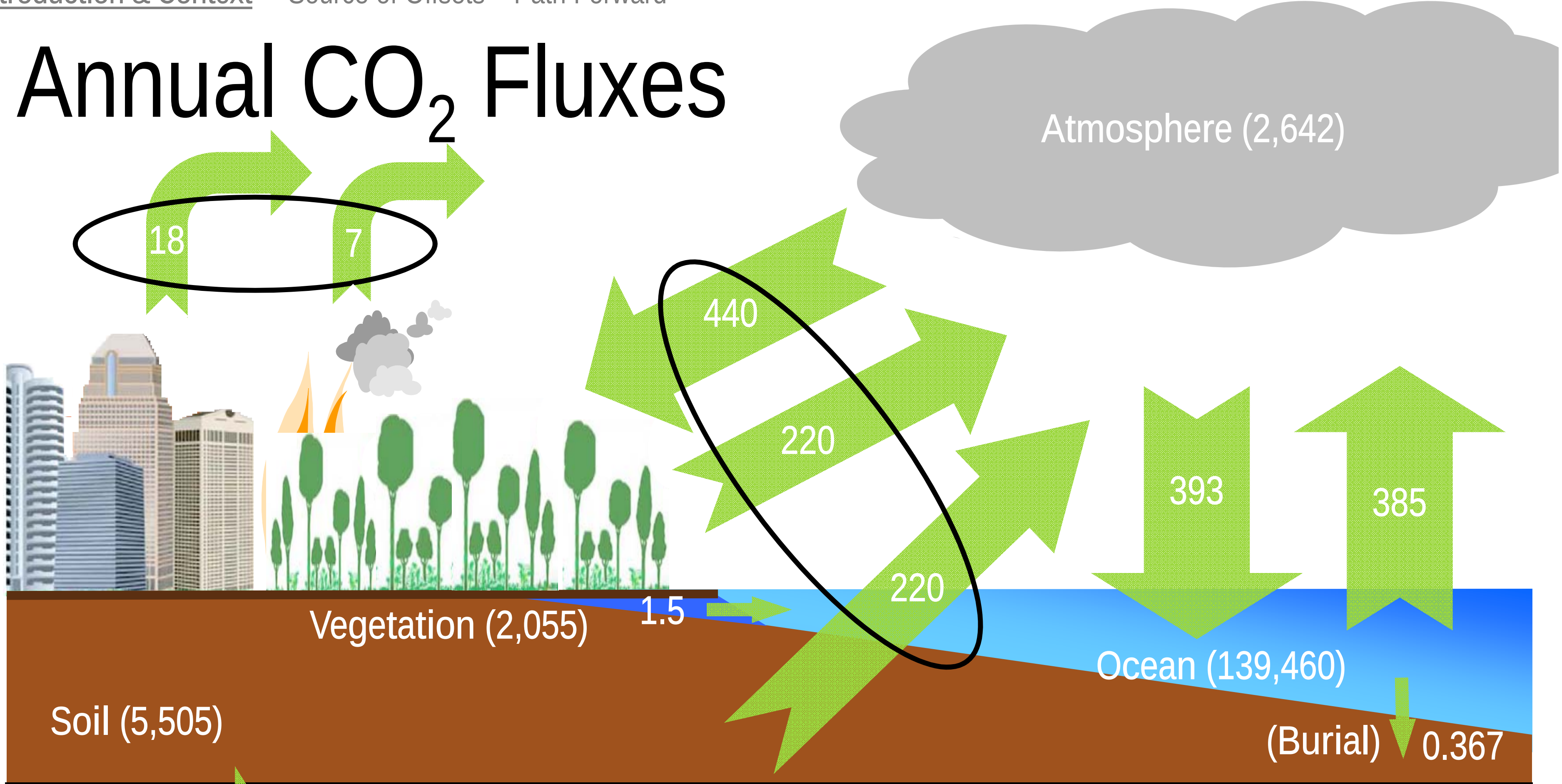
Annual CO_2 Fluxes



Flows
(Pools)

Gigaton (1 billion metric tons)

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The Opportunity

Leverage the natural carbon cycle to draw down atmospheric CO_2 – at a gigaton scale

- Great potential for GHG emission reductions and CO_{2e} sequestration
- One of few opportunities to take CO_{2e} from the atmosphere
- Incredible opportunity for expanding climate change mitigation strategies

An approved GHG emission reduction protocol must be developed to enable this opportunity.

A Protocol

What a protocol does:

- It sets out the case, drawing on science and other evidence to substantiate the general claim that biochar projects result in avoided emissions
- Embeds methodologies, which outline a quantitative approach to analyzing the emission reductions
- Provides an overlay to methodologies – creating carbon offset system guidelines.
- Provides a basis for a project to justify the offset they wish to claim

What a protocol does not do:

- Does not have all the answers. The protocol sets the approach, it does not provide the numbers
- Does not substitute for regulations or best practice recommendations that may determine its application (e.g. fertilizer regs)
- Does not represent a sustainability protocol beyond ensuring appropriate boundaries and dealing with matters of additionality, leakage etc.
- Does not create a new carbon market

What is Biochar?

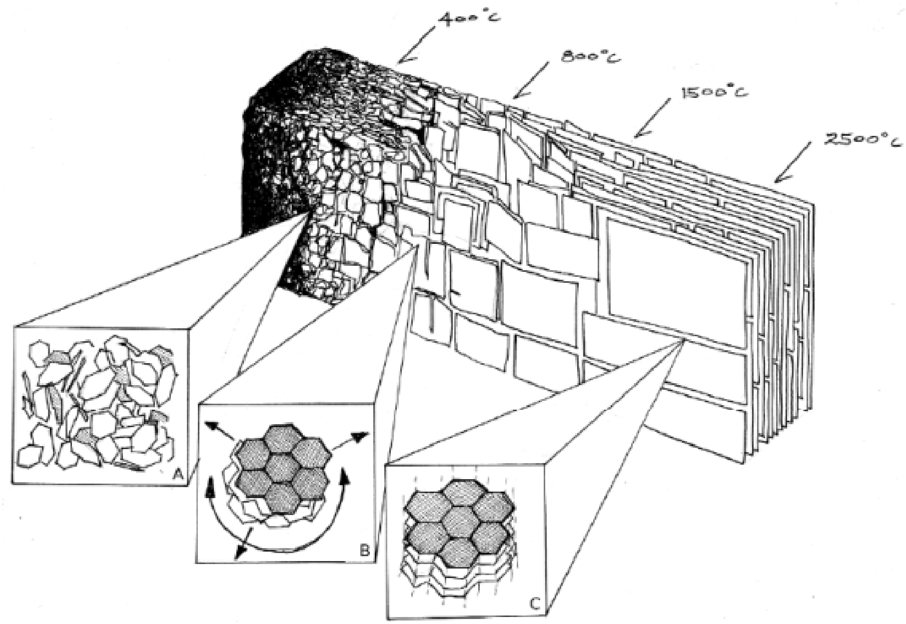
Some relevant definitions[1]

Organic matter that is thermally transformed, or modified, from its original structure.

Char: any carbonaceous residue from pyrolysis including natural fires

Charcoal: char produced from animal or vegetable matter for use in cooking or heating

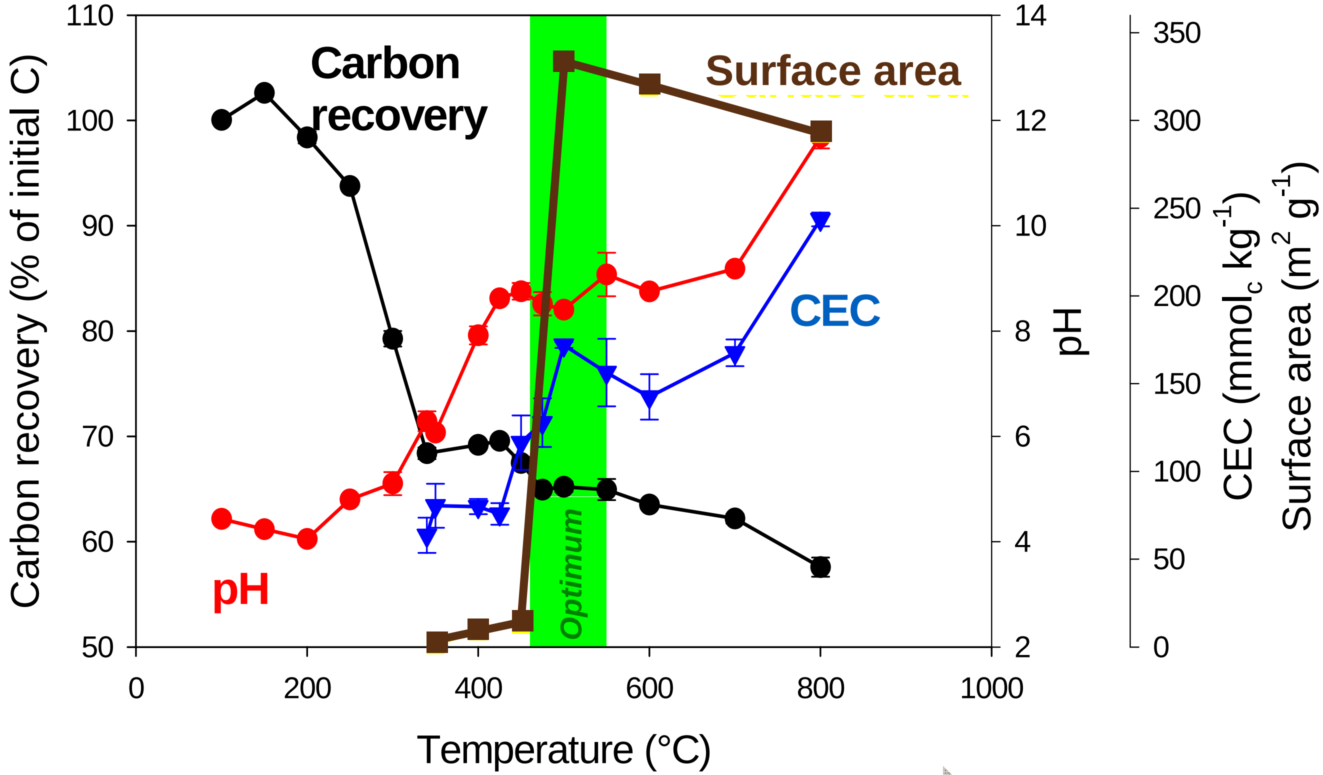
Biochar: carbonaceous material produced specifically for agricultural or environmental management



Source: Downie et al. 2009. © Johannes Lehmann and Stephen Joseph

[1]Brown R. 2009. Biochar Production Technology. In. Lehmann, J. and Joseph, S (2009) Biochar for Environmental Management. pp 127-146.

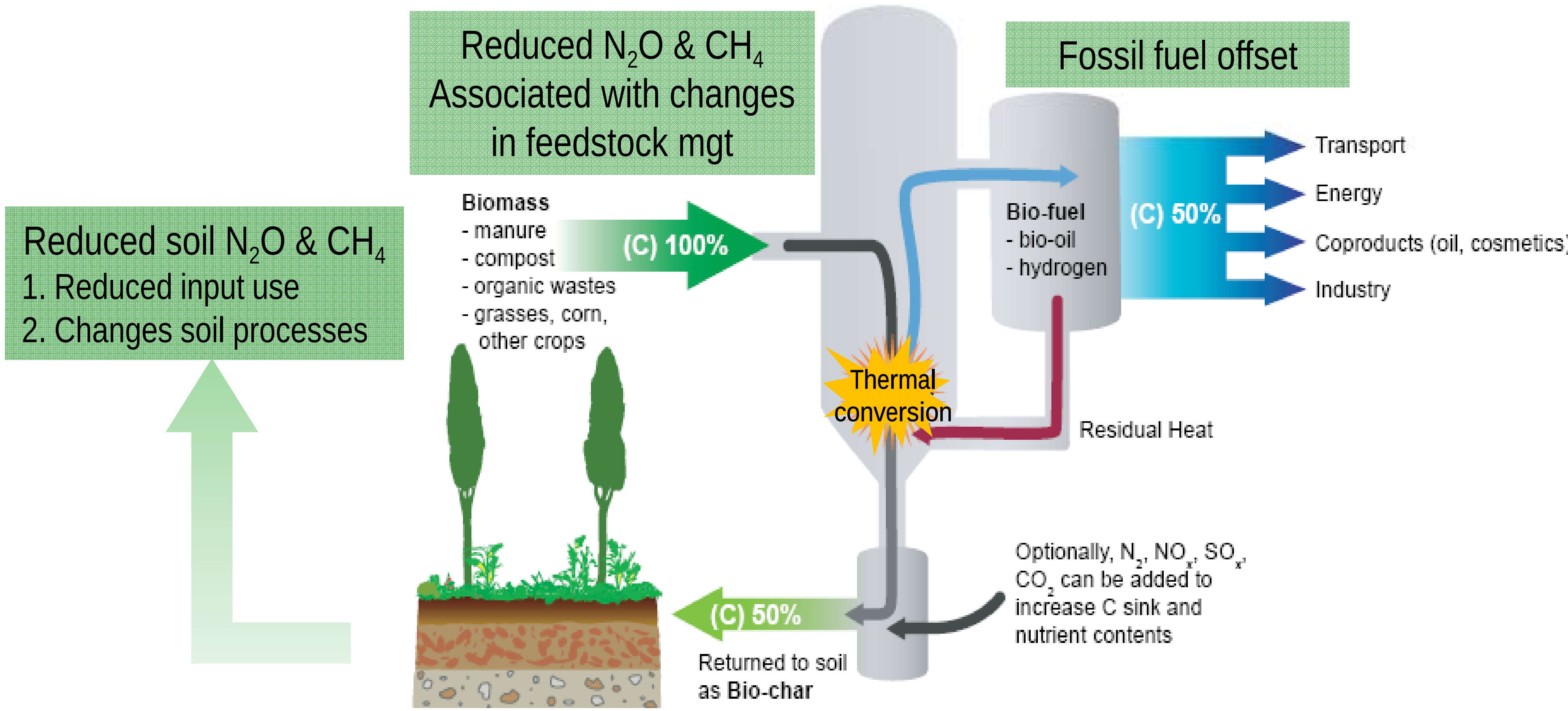
An Inherent Compromise in Biochar



C Stability →

← Biochar ag. performance

Sources of ‘avoided emissions’ in biochar and bioenergy systems



Carbon sequestration

1. Carbon stabilized in biochar
2. Stabilizes non-biochar soil carbon
3. Increased carbon in plant biomass and soil

Emission Reductions & Carbon Sequestration

Mechanisms	Description	Key issues
Waste diversion	Organic materials diverted from landfills would otherwise degrade anaerobically, producing methane emissions.	Various models exist for predicting the methane emissions from these sources. However, proving diversion can be challenging in some circumstances, thus adding complexity to establishing the baseline.
Avoided waste combustion	Organic materials that would otherwise have been combusted, producing carbon dioxide emissions.	Various models exist for predicting the GHG emissions from these sources. Emissions from the combustion of organic materials are considered as a biogenic source of emissions.
Carbon sequestration	Conversion of biomass to biochar sequesters carbon. Incorporation of biochar within the soil can lead to the enhanced sequestration of soil carbon.	Concerns that carbon sequestration within the soil is not permanent are being applied to biochar, where risks are significantly lower. Soil carbon sequestration is difficult to measure.
Fertilizer efficiency	Biochar may improve the efficiency of fertilizer usage relative to yield, resulting in lower N_2O emissions from fertilizers.	Difficult to measure changes in N_2O emissions at a field scale. Modelling of N_2O can be intensive.
Electricity displacement	Electricity produced from biochar projects may offset electricity produced from fossil fuels.	This is an indirect emission reduction and may not be considered under all programs.
Fossil fuel displacement	The heat, power, and biofuels produced from the biochar projects may offset fossil fuel usage downstream.	Indirect emission reduction and may not be considered under all programs. There may be difficulties in direct measurement given the downstream nature of the emission reduction and conversions between equivalent units of energy.

Most mechanisms have analogies into other markets/protocols

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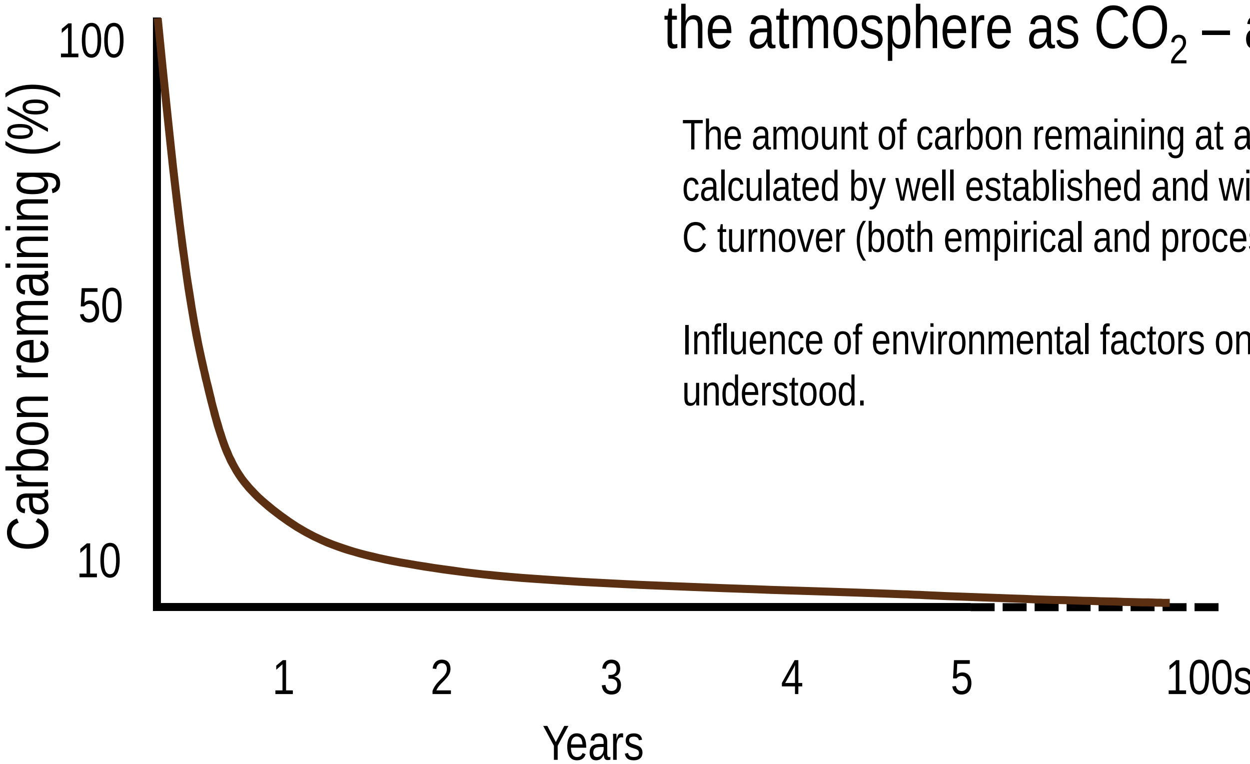
Carbon Sequestration in Soil



Carbon contained in biomass is returned to the atmosphere as CO_2 – a zero-sum game

The amount of carbon remaining at an time can be calculated by well established and widely tested models of C turnover (both empirical and process based).

Influence of environmental factors on carbon release well understood.

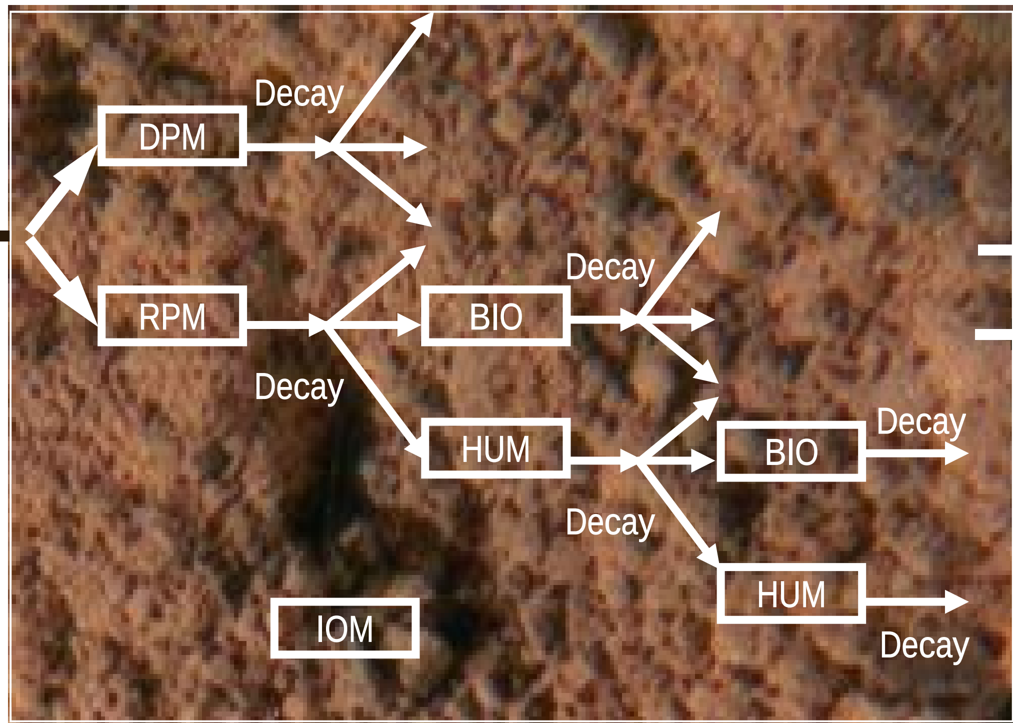
Dynamic Models of Carbon Turnover

Soil carbon stock

Variables

Inputs
- Quantity
- Composition

Soil factors, eg.
- Temperature
- Moisture



RothC

Outputs

CO_2

N supply

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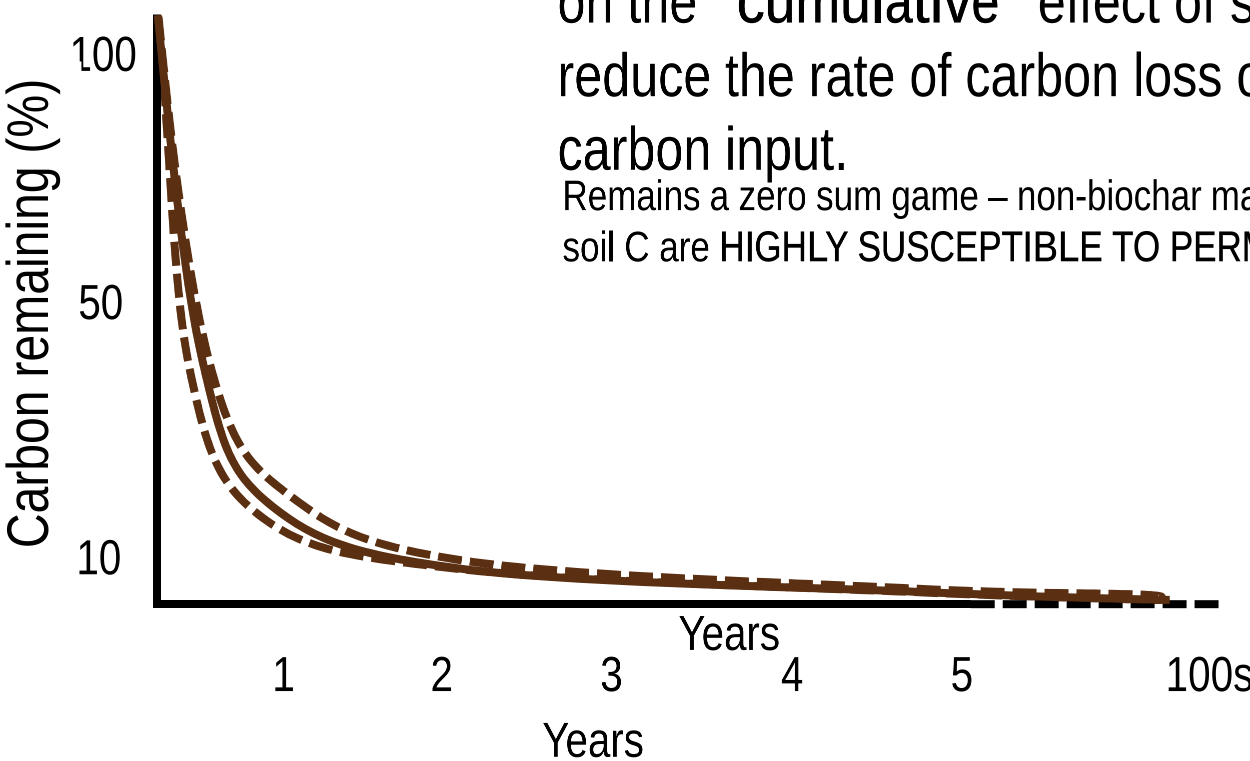
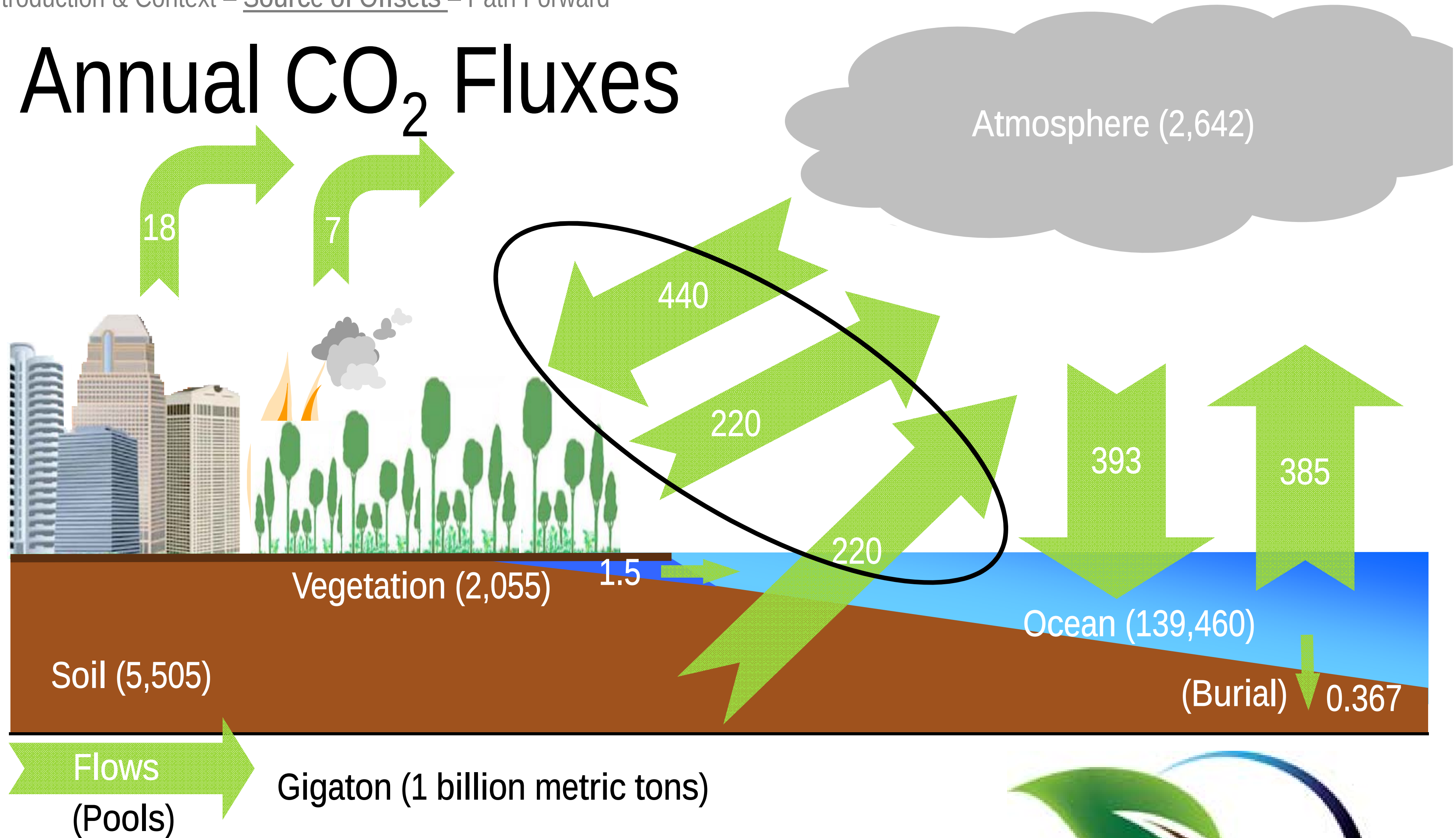
Carbon Sequestration in Soil

Non-biochar strategies to sequester soil carbon rely on the **"cumulative"** effect of small changes to i) reduce the rate of carbon loss or ii) an increase in carbon input.

Remains a zero sum game – non-biochar management changes that increase soil C are HIGHLY SUSCEPTIBLE TO PERMANENCE ISSUES.



Annual CO_2 Fluxes



Gigaton (1 billion metric tons)

Carbon Claims for Biochar

There are three separate claims:

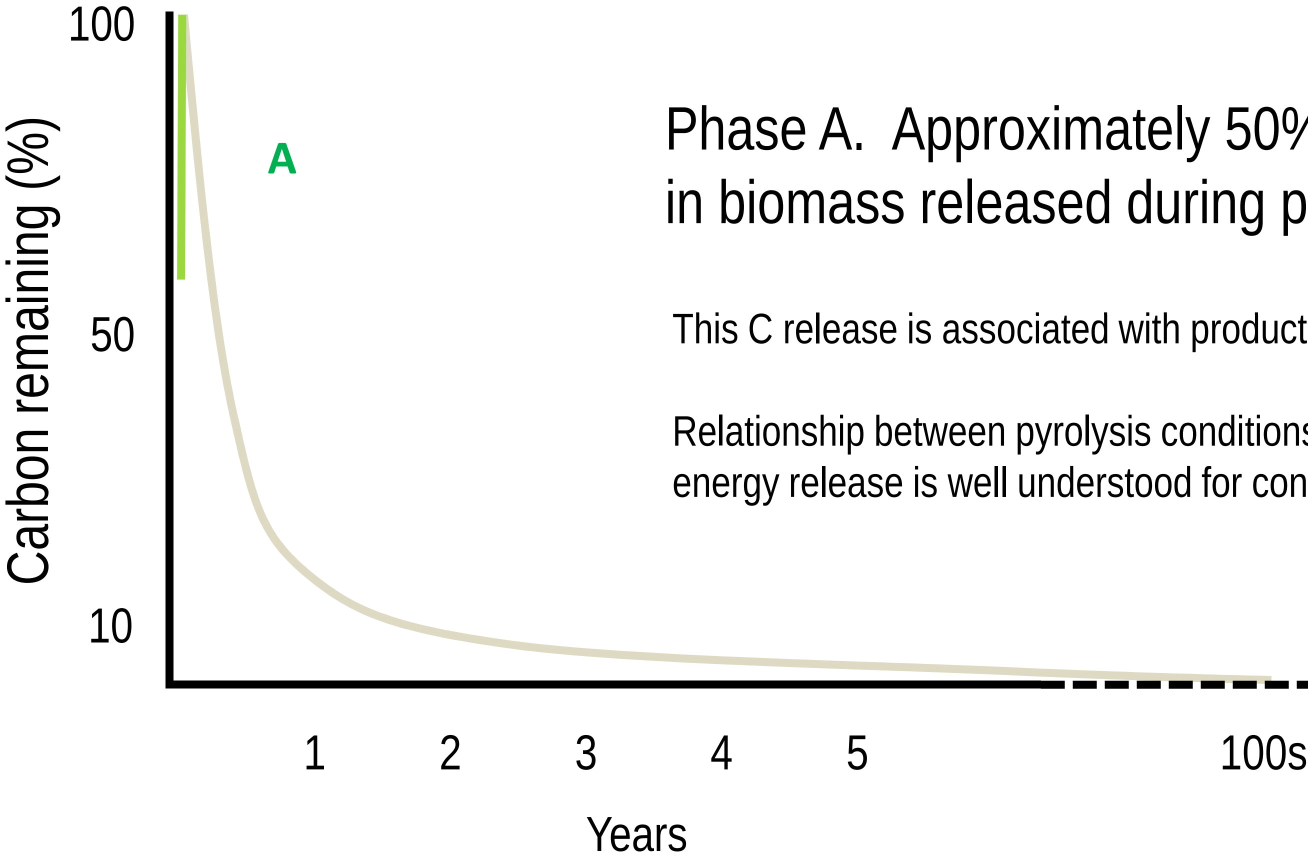
Claim 1. That thermal conversion of organic matter stabilizes C contained in the feedstock in a form that is substantially resistant to further breakdown.

Claim 2. That biochar acts to stabilize a portion of non-biochar soil C rendering it more stable than was previously the case.

Claim 3. That the application of biochar in certain environments accelerates biomass production and this leads to enhanced C sequestration in biomass and soil.

1. The proportion of organic matter added to soil that is resistant to decay has been changed due to a manipulation of the characteristics of the biomass.
2. Soil environmental conditions have been altered in a way that slow the rate of release of CO_2 from organic matter added to soil.
3. Increased production of biomass per unit area due to enhanced productivity.

Carbon Stabilization in Biochar

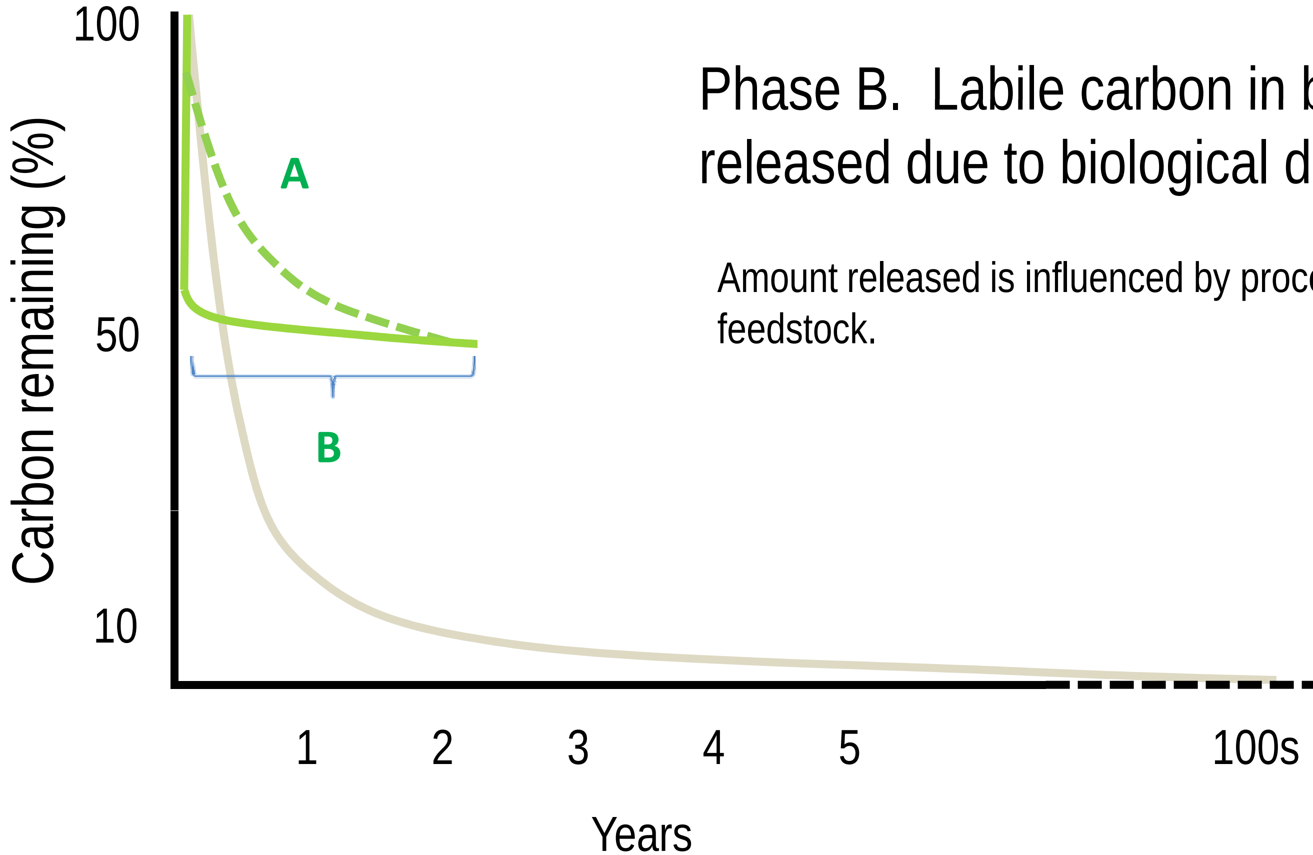


Phase A. Approximately 50% of carbon contained in biomass released during pyrolysis

This C release is associated with production of energy products.

Relationship between pyrolysis conditions, feedstock, carbon loss and energy release is well understood for conventional feedstocks

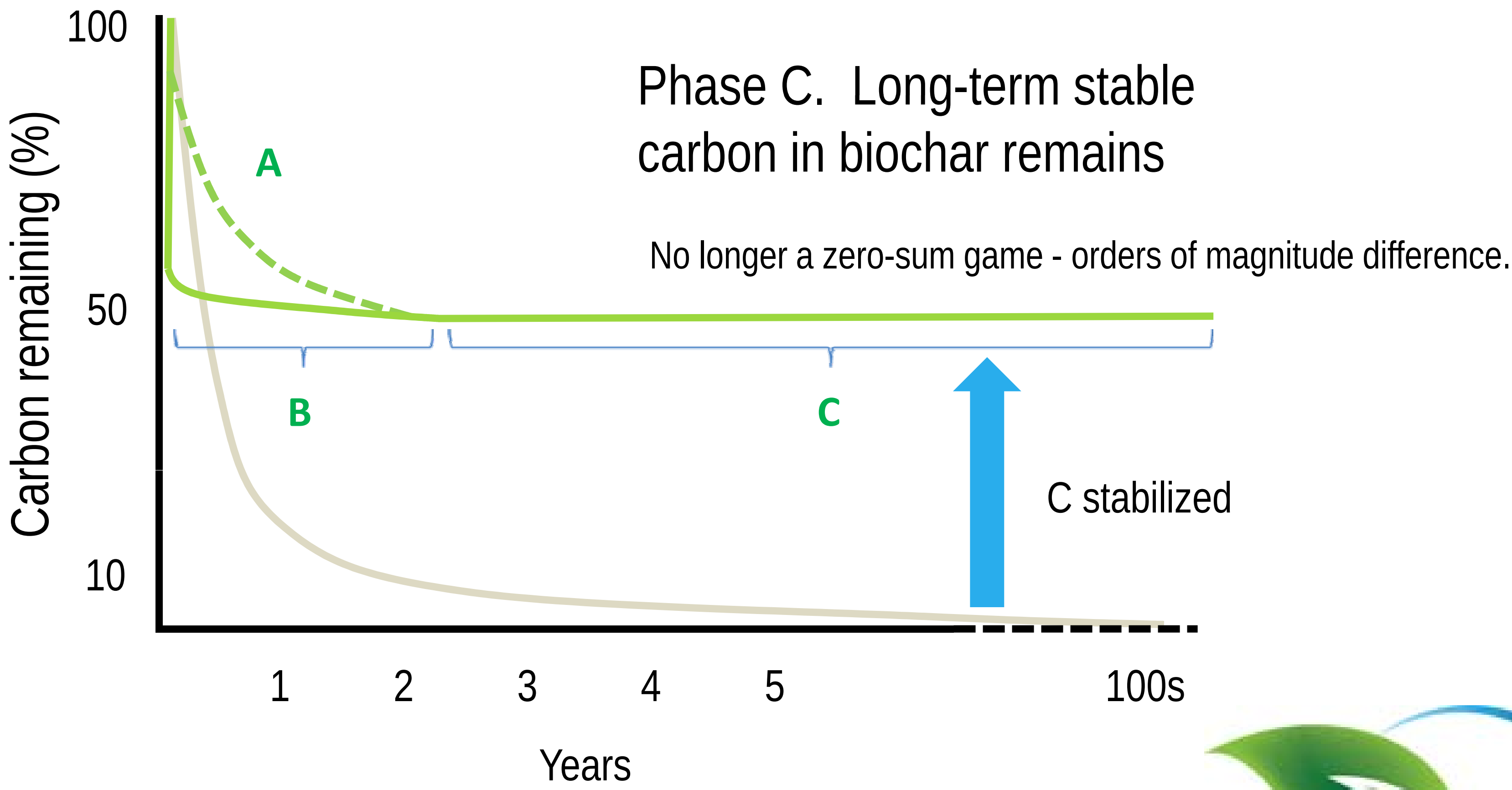
Carbon Stabilization in Biochar



Phase B. Labile carbon in biochar released due to biological decomposition

Amount released is influenced by process conditions and feedstock.

Carbon Stabilization in Biochar



Carbon Sequestration

Proving the claims:

Claim 1. That pyrolysis of biomass stabilizes C contained in that material in a form that is substantially resistant to further breakdown.

Claim 2. That biochar acts to stabilize a portion of soil carbon rendering it more stable than was previously the case.

Claim 3. That the application of biochar in certain environments (e.g. perennial crops or forest) accelerates biomass production and this leads to enhanced C sequestration in biomass and soil.

1. Focus on demonstrating stability of biochar in its end use, not on measuring soil carbon.
    1. Measure C over time in representative situation.
    2. Measurements that predict stable C component, e.g. modifies ASTMS methods for *proximate* and *ulitimate analysis.*
    3. Measurements that predict the labile proportion of C, e.g. *accelerated decomposition* and *measurements of labile components.*

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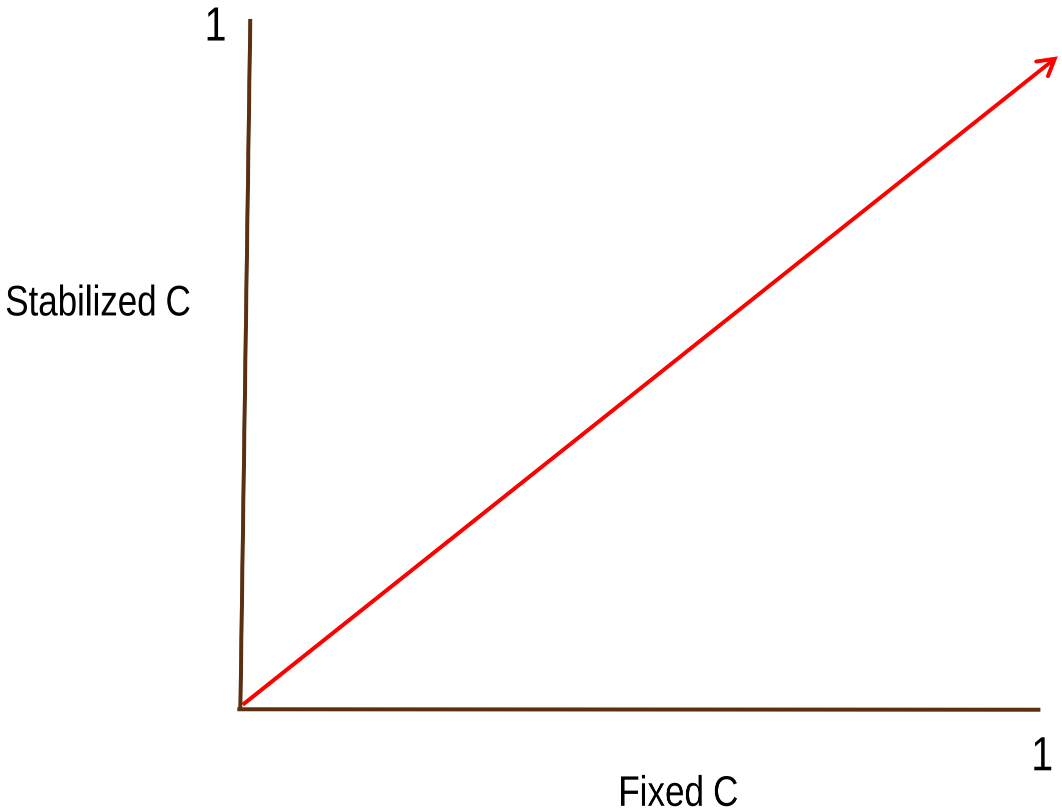
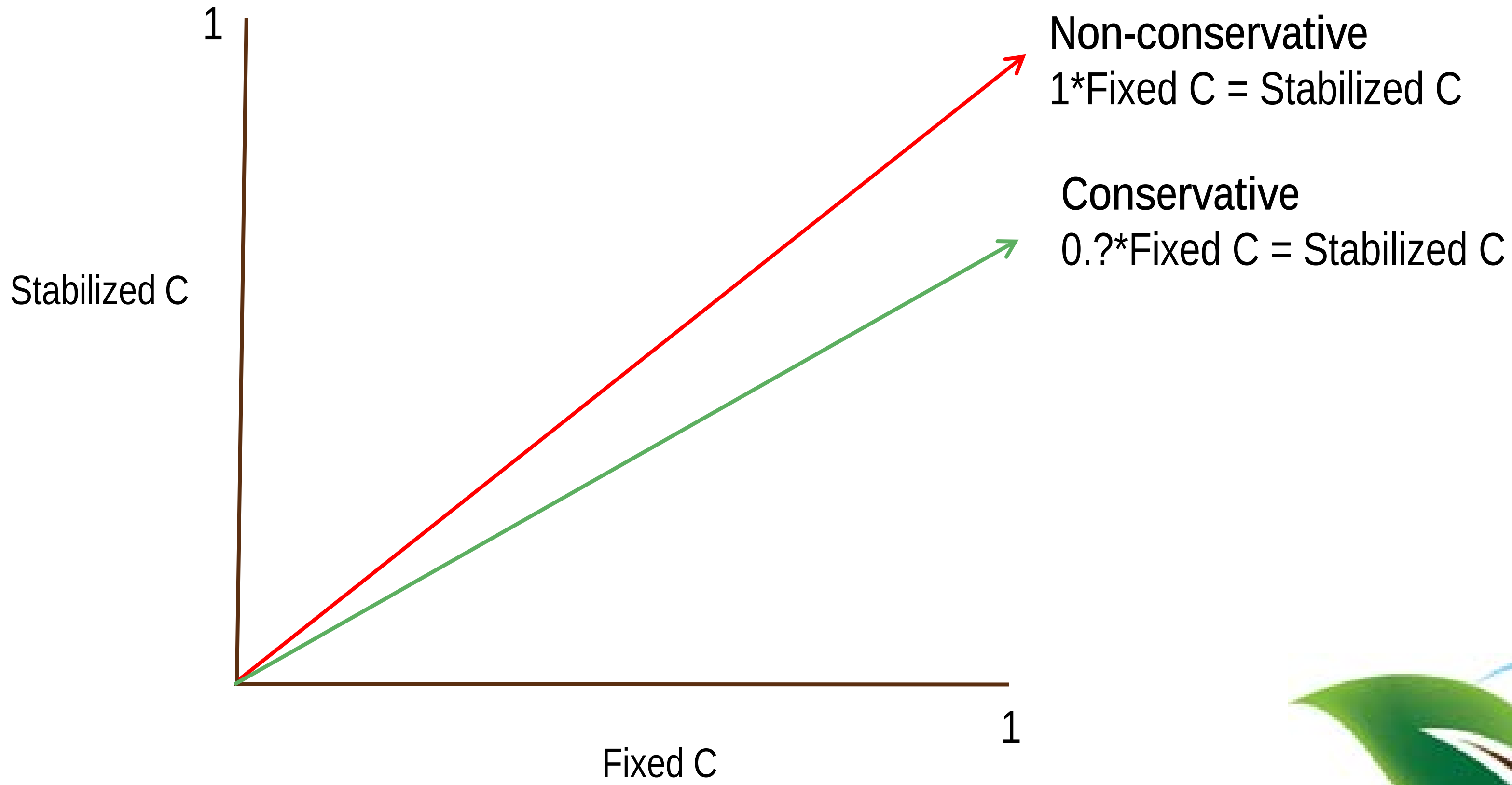
Example of how we could use a measure of Fixed C



1. Is the use of a suitably modified proximate / ultimate analysis a reasonable measure of stable C in biochar?
2. Is there evidence that fixed C measured by proximate / ultimate analysis predicts long term stable C when biochar is used in agriculture and environmental management?
3. If measure is reasonable but evidence is lacking what would be a conservative approach?

Example of how we could use a measure of fixed C



Carbon Sequestration

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Claim 3. That the application of biochar in certain environments (e.g. perennial crops or forest) accelerates biomass production and this leads to enhanced carbon sequestration in biomass and soil.

Same overall strategy underpins claim 2 and 3.

1. Measure over time in representative situations.
2. Claim 2 modifies existing soil organic matter turnover models.
3. Claim 3 use of existing models to describe biomass : soil C relationship is conservative – incorporate any modification made at Claim 2.

Platforms

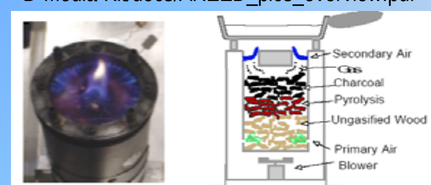
Configurations of feedstock, technology, bio-energy and biochar products

Sugar cane ethanol mill

Green waste

Agriculture waste

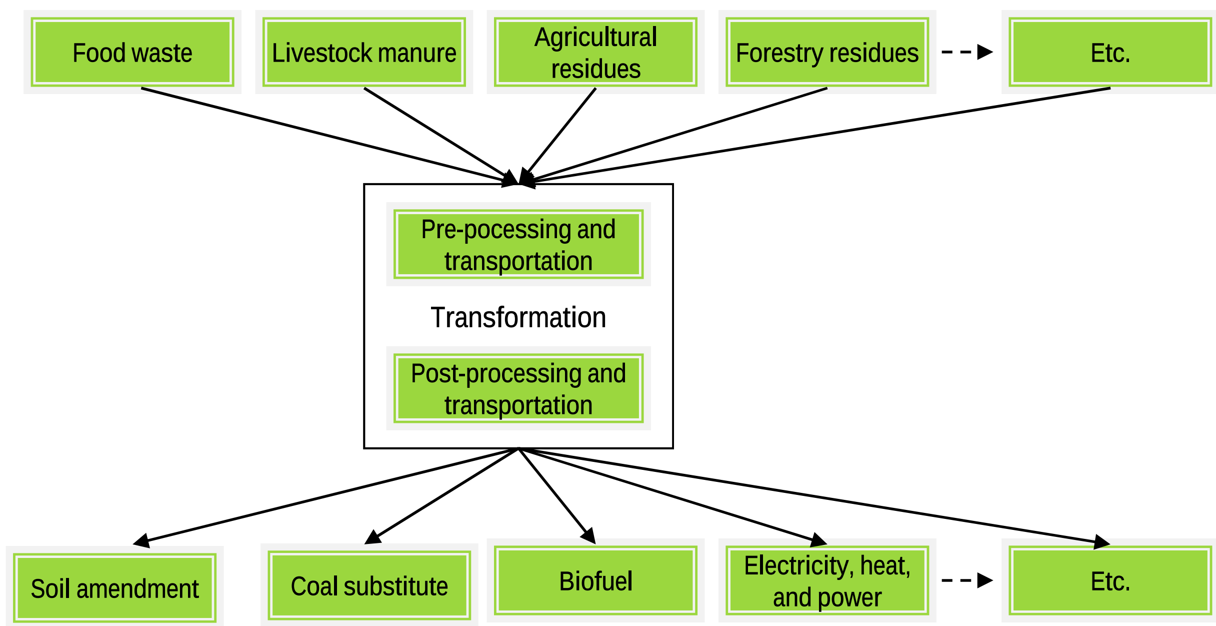
www.uneptie.org/enrgy/projects/REED/REED-Media-Kit/docs/AREED_pics_overview.pdf



Picture by J. Hunt - source IBI

Project Configurations and Platforms

Conceptual framework



- Structured approach to emission reduction assessment.
- Streamline protocol design process.
- Provide flexibility between feedstocks and outputs.
- Fit with IBI Resources such as the "Biochar Pathways Matrix."

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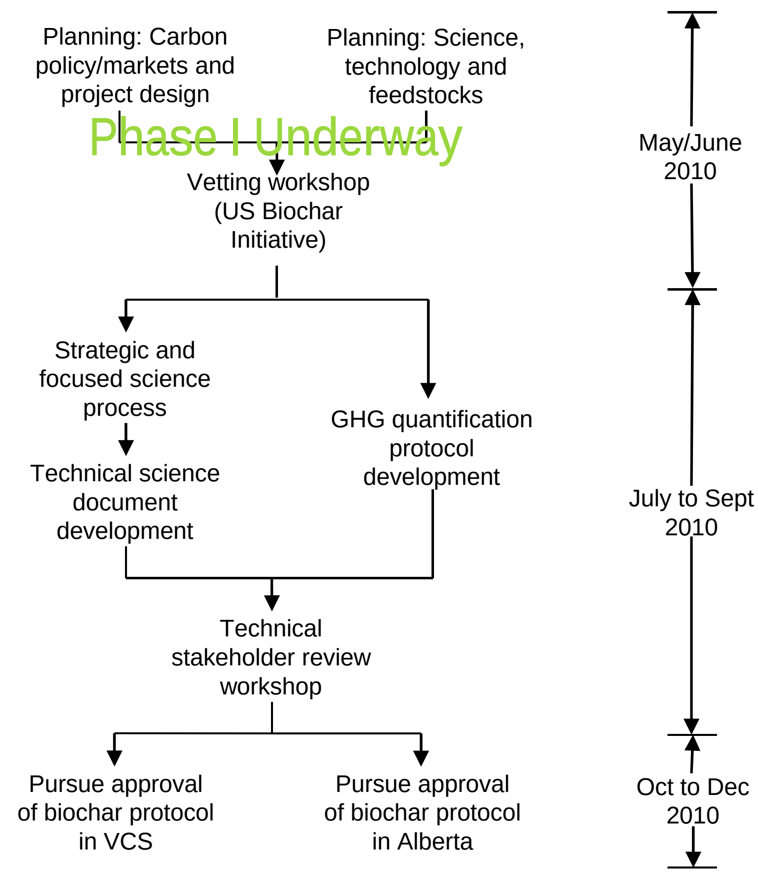
Proposed Path Forward

Protocol Development Process

- Launch protocol development at Biochar 2010 Conference
    - Clarify issues from webinars
    - Seek further stakeholder input
    - Outline work plan and confirm project timeline
- Review and drafting (July – Sept, 2010)
- Discussion draft to be prepared for 2010 IBI conference in Rio De Janeiro (Sept, 2010)
- Link to CDM activity as key technical, science and protocol issues resolved

$150,000 being sought to support protocol development initiative (includes VCS double validation)



Questions and Contact

Protocol Initiative Sponsorship

Please submit your questions using the chat function in the GoToWebinar control panel

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