CLIMATE ACTION RESERVE

Empowering Climate Action through Biochar: Insights into the U.S. and Canada Biochar Protocol V1.0

August 13, 2024

Housekeeping

- All attendees are in listen-only mode but will have the opportunity to ask questions throughout via the Q&A dialog
- We will follow up via email to answer any significant questions not addressed during the webinar
- The slides and a recording of the presentation will be posted online

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AGENDA

- Introductions
- Protocol Development Process
- Protocol Overview
- Q&A / Comments

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INTRODUCTIONS

Climate Action Reserve

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Works to ensure integrity, transparency, and financial value in the global carbon market

Establishes regulatory-quality standards for carbon offset projects in transparent, public process

Reviews project documents and oversees the listing, verification, and registration of projects

Issues credits and tracks the transaction of credits in a public registry

Creates tools, guidance resources, and trainings for stakeholders

Reserve Team

Jon Remucal, Director of Nature-Based Solutions
Protocol development lead

Holly Davison, Associate Director of Programs
Marissa Spence, Forestry Manager
Protocol development support

External support:
John Nickerson, Dogwood Springs Forestry

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PROCESS OVERVIEW

Protocol Development Timeline

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Workgroup Members

Organization	Organization
ACT Commodities	Placer County Air Pollution Control District
Aster Global	Shell
Biochar Solutions	Sonoma Ecology Center
Blue Forest	South Pole Carbon Asset
Cal Poly Humboldt	SUNY College of Env'l Sciences & Forestry
Cornell University	University of California-Berkley
GECA Environment	US Forest Service
Global Green Energy Solutions Corporation	Viresco Solutions
International Biochar Initiative	Woodwell Climate Research Center
Pacific Biochar	World Resources Institute

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Funding Support

U.S. Forest Service
Wood Innovations Program

CAL FIRE
Forest Health Grant

- Companion market analysis by Blue Forest Conservation (with additional funding support from the Doris Duke Charitable Foundation), **available on the Biochar Protocol webpage**
- Demonstration projects

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PROTOCOL OVERVIEW

Protocol Background

Carbon removal strategy

Provides co-benefits

Resource management solution

Opportunity for viability via carbon financing

Protocol Components

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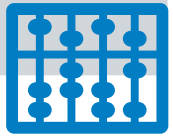
Project Definition & Eligibility

- Defining the project
- Ownership / aggregation
- Start date / crediting period
- Project location
- Additionality
- Regulatory compliance
- Permanence

Quantification

- GHG assessment boundary
- Project emissions/removals
- Leakage
- Sampling



Monitoring / Reporting / Verification

- Chain of custody tracking
- Sampling and laboratory analysis

External Documents

- Eligible Biochar Feedstocks List
- Eligible Biochar End Uses List

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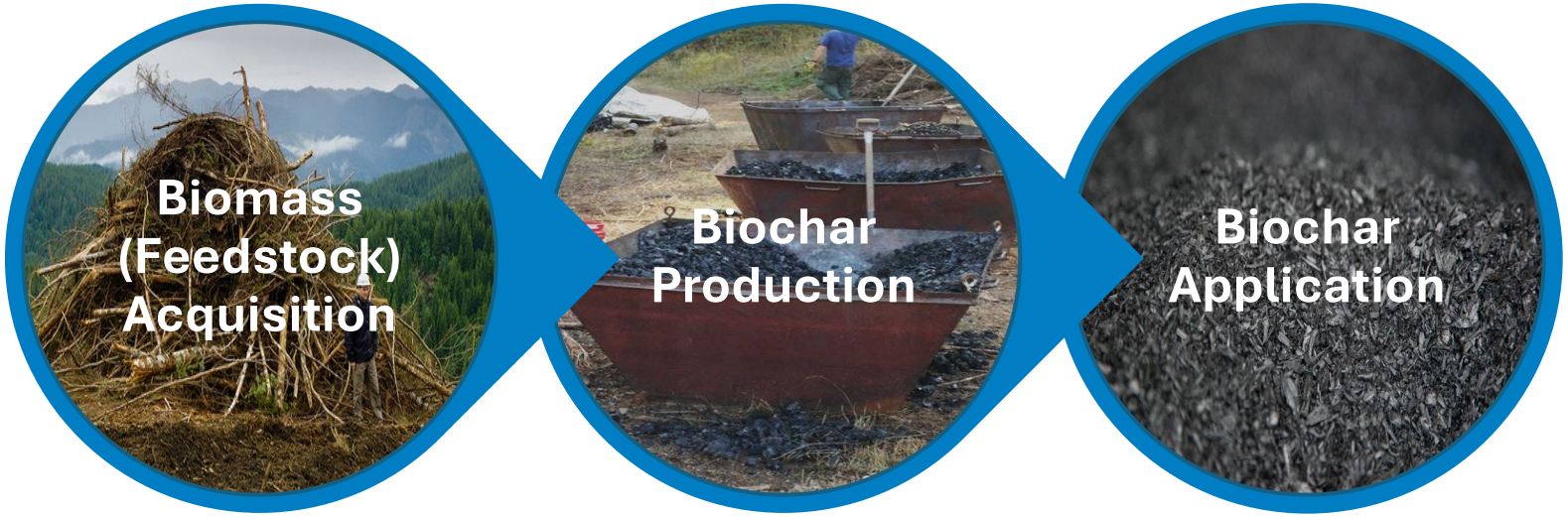
PROJECT DEFINITION & ELIGIBILITY

What Does a Biochar Project Involve?



The conversion of eligible biomass material into biochar, which can be used in soil and non-soil applications to facilitate the long-term sequestration of carbon

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Feedstock Eligibility

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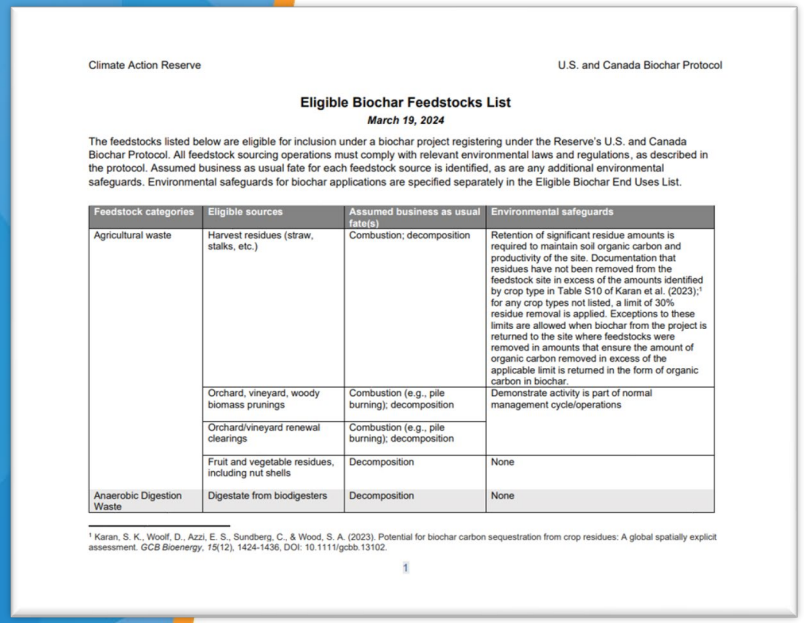


Climate Action Reserve U.S. and Canada Biochar Protocol

Eligible Biochar Feedstocks List

March 19, 2024

The feedstocks listed below are eligible for inclusion under a biochar project registering under the Reserve's U.S. and Canada Biochar Protocol. All feedstock sourcing operations must comply with relevant environmental laws and regulations, as described in the protocol. Assumed business as usual fate for each feedstock source is identified, as are any additional environmental safeguards. Environmental safeguards for biochar applications are specified separately in the Eligible Biochar End Uses List.

Feedstock categories	Eligible sources	Assumed business as usual fate(s)	Environmental safeguards
Agricultural waste	Harvest residues (straw, stalks, etc.)	Combustion; decomposition	Retention of significant residue amounts is required to maintain soil organic carbon and productivity of the site. Documentation that residues have not been removed from the feedstock site in excess of the amounts identified by crop type in Table S10 of Karan et al. (2023);[1] for any crop types not listed, a limit of 30% residue removal is applied. Exceptions to these limits are allowed when biochar from the project is returned to the site where feedstocks were removed in amounts that ensure the amount of organic carbon removed in excess of the applicable limit is returned in the form of organic carbon in biochar.
	Orchard, vineyard, woody biomass prunings	Combustion (e.g., pile burning); decomposition	Demonstrate activity is part of normal management cycle/operations
	Orchard/vineyard renewal clearings	Combustion (e.g., pile burning); decomposition	
	Fruit and vegetable residues, including nut shells	Decomposition	None
Anaerobic Digestion Waste	Digestate from biodigesters	Decomposition	None

[1] Karan, S. K., Woolf, D., Azzi, E. S., Sundberg, C., & Wood, S. A. (2023). Potential for biochar carbon sequestration from crop residues: A global spatially explicit assessment. *GCB Bioenergy*, *15*(12), 1424-1436, DOI: 10.1111/gcbb.13102.

1

Eligible feedstocks

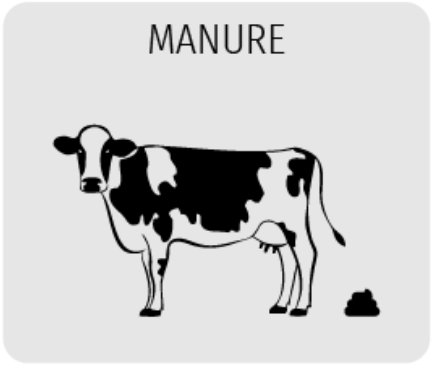
- Maintained separately from protocol
- Updated as needed, reviewed regularly
- Identifies eligible feedstock categories, business as usual fate, environmental safeguards

Focus

- Waste and by-product biomass sources
- Purpose-grown biomass

Eligible Biochar Feedstocks List

- Agricultural waste (e.g., harvest residues, orchard prunings)
- Anaerobic digestion waste
- Animal husbandry waste (manure)
- Aquaculture by-products
- Food processing residues
- Forestry (e.g., harvest slash, fuel treatment material)
- Sewage sludge
- Urban waste (e.g., green waste, lumber waste, wastepaper/cardboard)
- Wood processing (e.g., sawdust)
- Purpose-grown biomass (perennial, non-woody, native/sterile hybrid species)



Production Technology Eligibility

- No specific production technology is required nor prohibited
  - Provide flexibility for new/emerging processes and technologies
  - Relies on production with characteristics meeting protocol standards – including $H:C_{org}$ <0.7 – to limit eligibility

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End Use Eligibility

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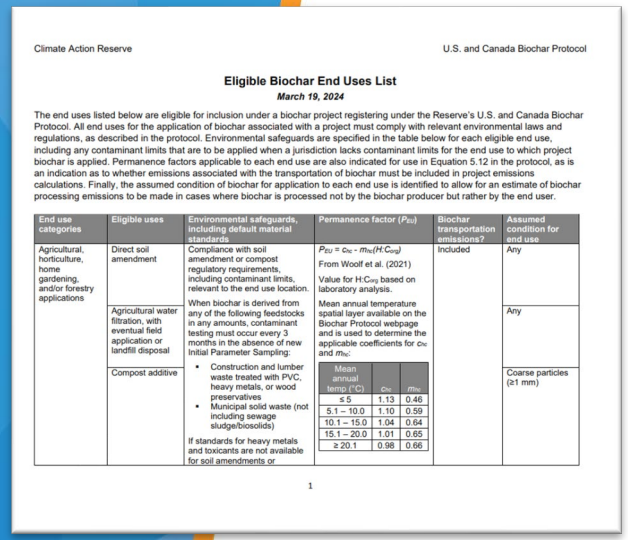

Climate Action Reserve — U.S. and Canada Biochar Protocol

Eligible Biochar End Uses List

March 19, 2024

The end uses listed below are eligible for inclusion under a biochar project registering under the Reserve's U.S. and Canada Biochar Protocol. All end uses for the application of biochar associated with a project must comply with relevant environmental laws and regulations, as described in the protocol. Environmental safeguards are specified in the table below for each eligible end use, including any contaminant limits that are to be applied when a jurisdiction lacks contaminant limits for the end use to which project biochar is applied. Permanence factors applicable to each end use are also indicated for use in Equation 5.12 in the protocol, as is an indication as to whether emissions associated with the transportation of biochar must be included in project emissions calculations. Finally, the assumed condition of biochar for application to each end use is identified to allow for an estimate of biochar processing emissions to be made in cases where biochar is processed not by the biochar producer but rather by the end user.

End use categories	Eligible uses	Environmental safeguards, including default material standards	Permanence factor (P_{EU})	Biochar transportation emissions?	Assumed condition for end use
Agricultural, horticulture, home gardening, and/or forestry applications	Direct soil amendment	Compliance with soil amendment or compost regulatory requirements, including contaminant limits, relevant to the end use location. When biochar is derived from any of the following feedstocks in any amounts, contaminant testing must occur every 3 months in the absence of new Initial Parameter Sampling: • Construction and lumber waste treated with PVC, heavy metals, or wood preservatives • Municipal solid waste (not including sewage sludge/biosolids) If standards for heavy metals and toxicants are not available for soil amendments or	$P_{EU} = c_{hc} - m_{hc}(H{:}C_{org})$ From Woolf et al. (2021) Value for $H{:}C_{org}$ based on laboratory analysis. Mean annual temperature spatial layer available on the Biochar Protocol webpage and is used to determine the applicable coefficients for c_{hc} and m_{hc}: Mean annual temp (°C) / c_{hc} / m_{hc} ≤ 5 / 1.13 / 0.46 5.1 – 10.0 / 1.10 / 0.59 10.1 – 15.0 / 1.04 / 0.64 15.1 – 20.0 / 1.01 / 0.65 ≥ 20.1 / 0.98 / 0.66	Included	Any
	Agricultural water filtration, with eventual field application or landfill disposal				Any
	Compost additive				Coarse particles (≥1 mm)

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Eligible End Uses

- Maintained separately from protocol
- Updated as needed, reviewed regularly
- Identifies categories, environmental safeguards, and whether emissions from transportation of biochar to end use must be accounted for

Environmental safeguards

- Tend to rely on laws/regulations applicable to each end use

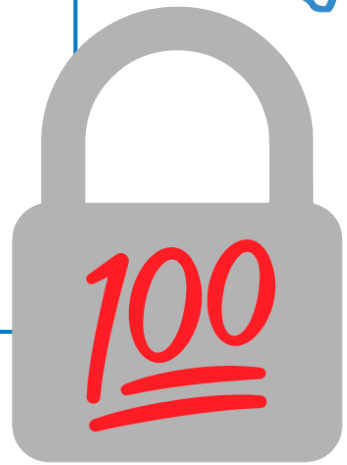
Eligible Biochar End Uses List

- Agricultural, horticulture, home gardening, and/or forestry applications
  - e.g., soil or compost amendment, horticultural growth media, animal bedding
- Construction and engineered materials
  - e.g., cement additive, gypsum additive, asphalt additive
- Environmental remediation, stabilization, and wastewater sanitization
  - e.g., soil remediation, stormwater management, erosion control
- Permanent storage structures
  - e.g., spent oil/gas wells, subsurface mine remediation, landfill disposal
- Urban applications (non-food/-feed soil applications)

Permanence

End use eligibility also based on having reasonable assurances about the long-term persistence (i.e., permanence) of C sequestered in biochar

- Permanence defined relative to 100 years
- Crediting adjusted based on expected levels of recalcitrance after 100 years or length of time sequestered if less than 100 years



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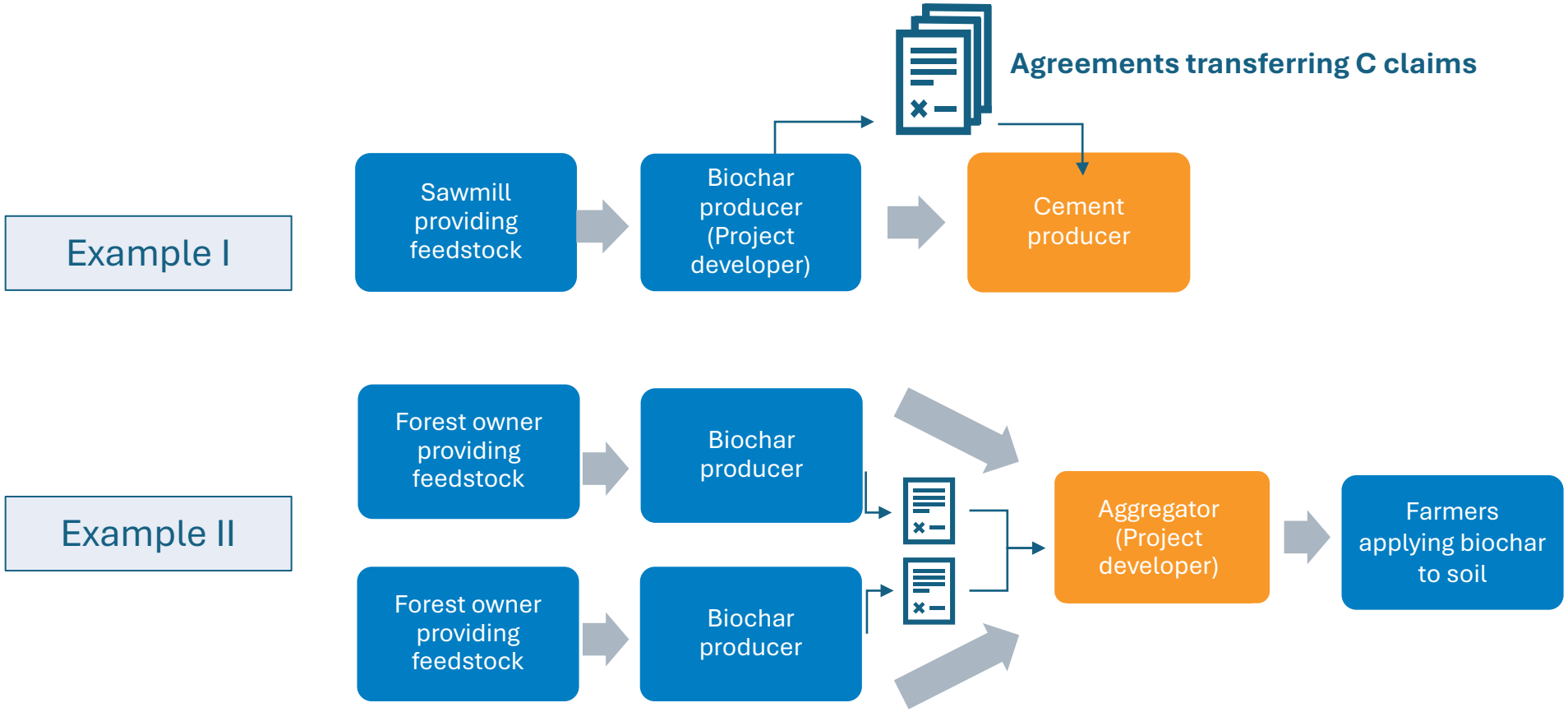
Project Developer (Section 2.3)

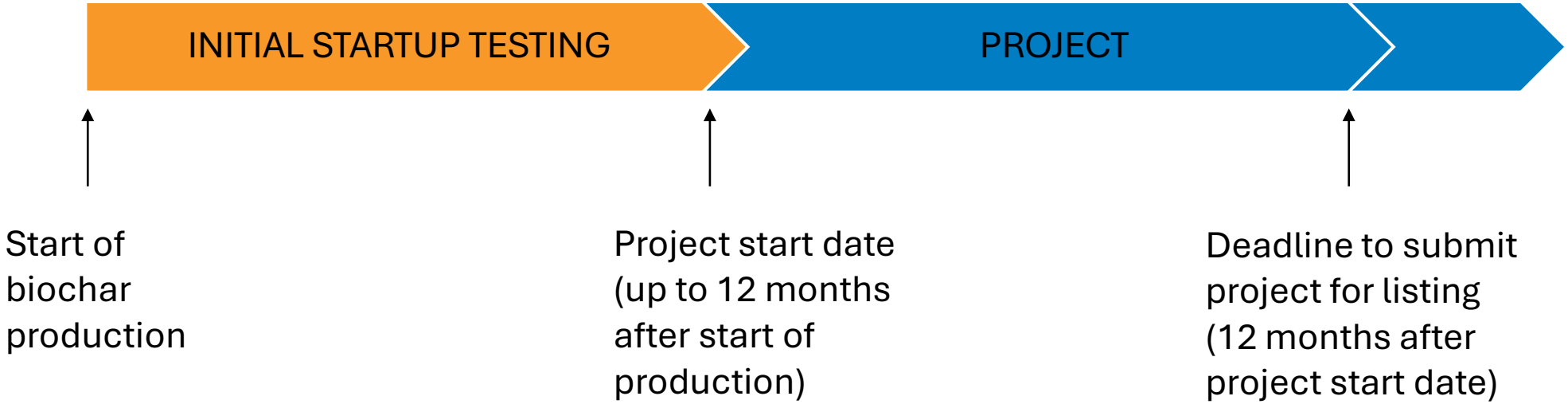
Project developer is assumed to be the biochar producer

However, others may be the project developer if able to secure agreement with the biochar producer(s)

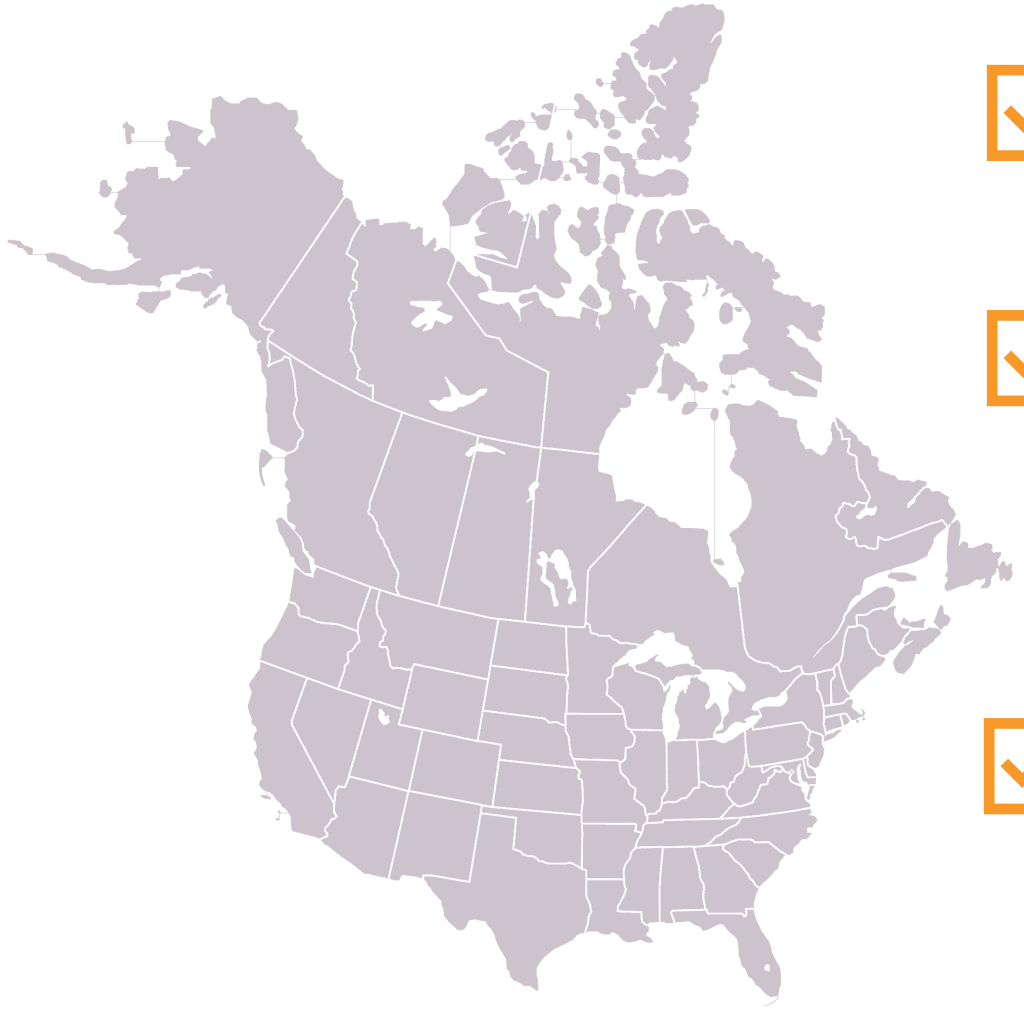


Project Start Date (Section 3.2)

- Date the project is submitted to the Reserve, or
- Date biochar production begins using the production technology employed under the project, with allowance for 12-month start-up period



Location, Compliance & Safeguards



Location: U.S. or Canada

- Reasonably high regulatory standards
- Reliable enforcement of regulations

Compliance:

- With relevant laws/regulations, providing assurances against environmental and social harms from project activities
- Includes potential testing for contaminants, e.g., heavy metals

Tested:

- For organic contaminants (e.g., PCBs, dioxins/furans, PAHs) unless certain production conditions met

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Additionality

Ensuring only crediting for actions that go beyond what would have occurred in the absence of the project

Legal Requirement Test

- Project activities must not be legally required
  - e.g., if only biochar production is legally mandated, then project passes test since climate benefits are dependent on specific conditions also being met by acquisition and end use phases

Performance Standard Test

- Standard of performance that must be met by a project to be eligible
- Separate performance standard test for each phase of project
  - Biomass acquisition
  - Biochar production
  - Biochar application

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Additionality – Performance Standard Test

Biomass Acquisition Phase

- Feedstock must be on eligibility list
- Waste and by-product feedstocks
  - Assumed business as usual (BAU) fate of combustion or decomposition in near-term
  - Actual BAU fate of project feedstocks is consistent with BAU assumption
- Purpose-grown biomass
  - Grown on reclaimed mining sites or marginal lands
  - Harvesting does not result in loss of ecosystem C from lack of regrowth or from depletion of soil C
  - Initially limited to perennial grasses

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Additionality – Performance Standard Test

Biochar Production Phase

- Biochar production typically faces numerous barriers to long-term viability
- Recognition of some success stories in the industry
- Projects with historical production (>12 months) only credited for biochar produced above and beyond what had previously been produced

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Additionality – Performance Standard Test

Biochar Application Phase

- End use must be on the eligibility list
- Must meet standard of having high assurance of carbon in biochar remaining sequestered

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Project Stacking

Activities recognized by one protocol overlap with those recognized by another

Allowed if certain conditions can be met, including:

- Double-counting risks are eliminated
- Additionality is preserved

Requires approval and guidance from the Reserve

Examples for biochar:

Soil Enrichment Protocol

Reduced Emissions from Megafires Forecast Methodology

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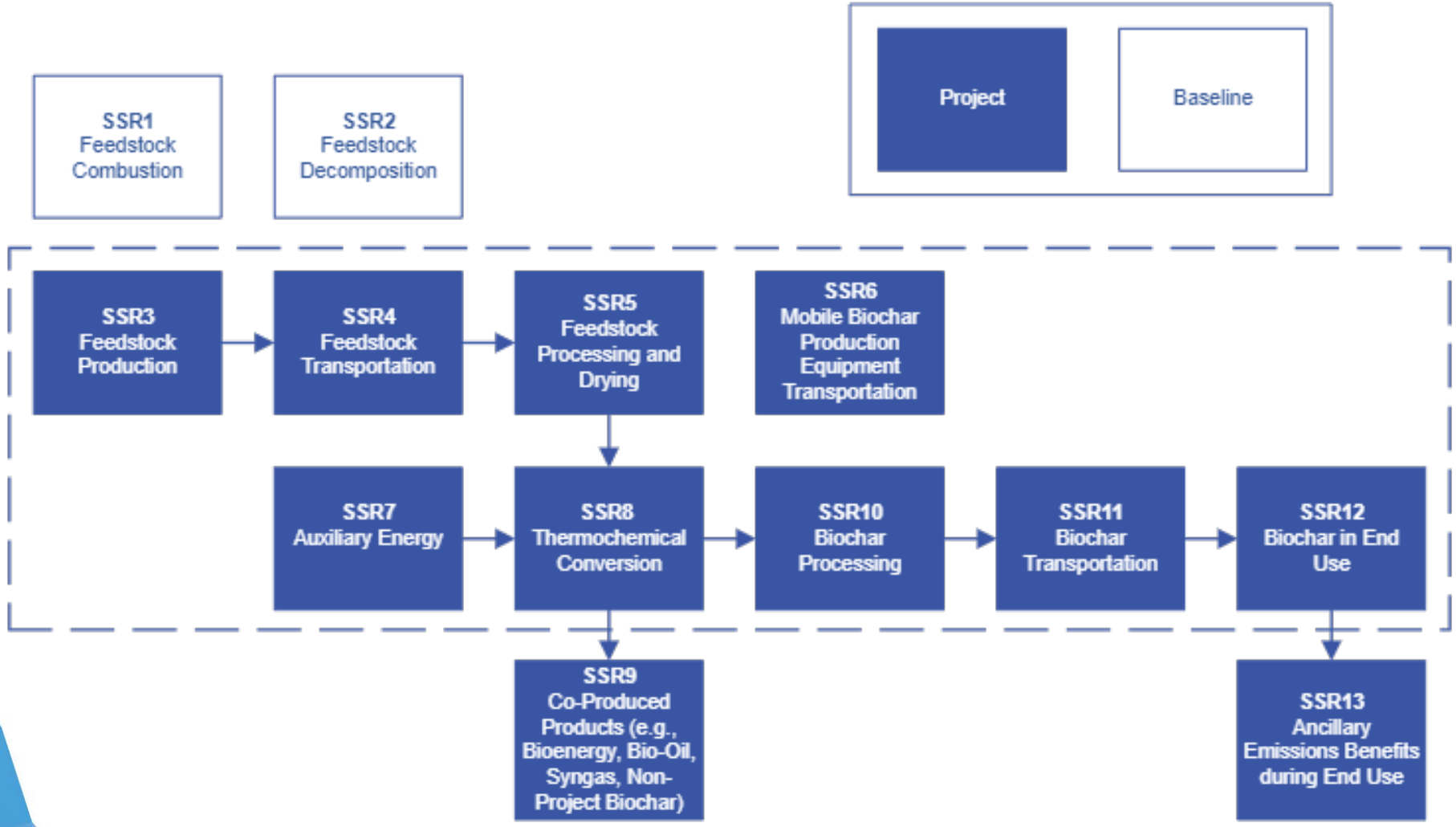
QUANTIFICATION

GHG Assessment Boundary



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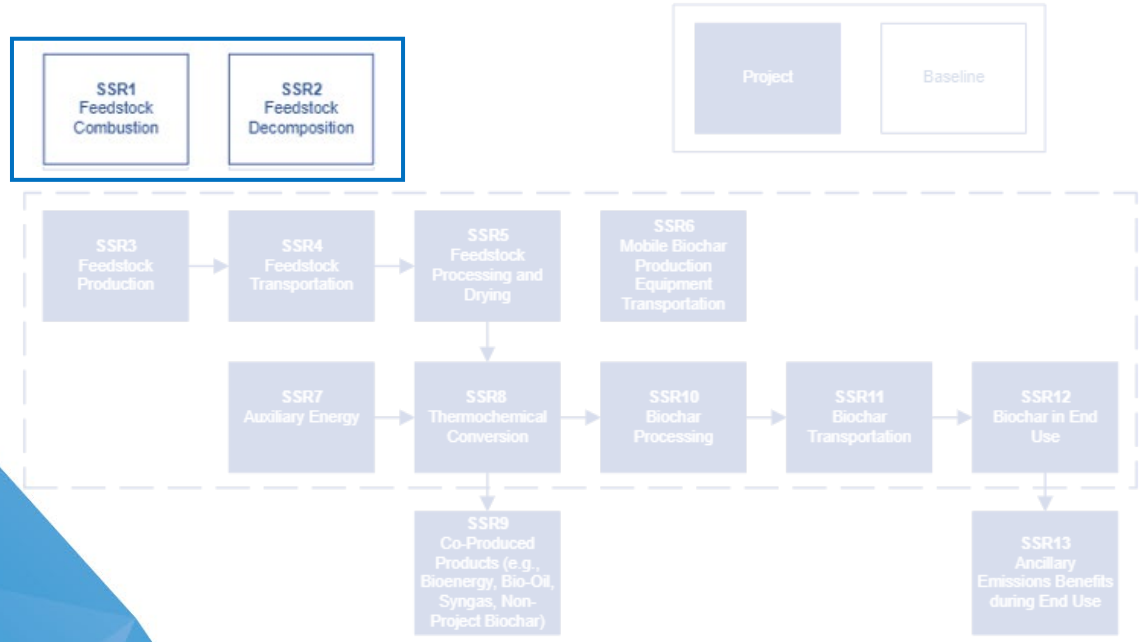
Quantification - Baseline



Assumes no emissions and no stored carbon for quantification purposes

Relies on feedstocks eligibility limits:

- Business as usual fate of short-term combustion or decomposition, or
- Not previously existing (i.e., purpose-grown biomass)

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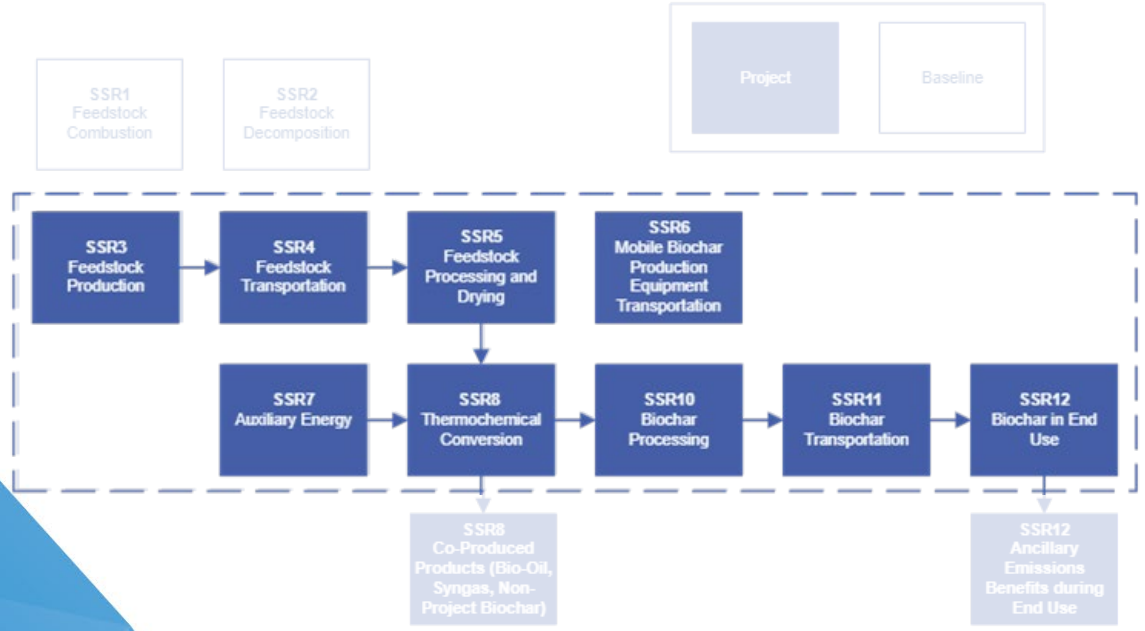
Quantification - Project



Emissions accounted for:

- Feedstock production emissions (for purpose-grown biomass only)
- Feedstock transportation emissions
- Feedstock processing emissions*
- Auxiliary emissions from biochar production*
- Thermochemical conversion emissions (CH4)*
- Biochar processing emissions*
- Biochar transportation emissions

**Proportional adjustment factor applied for co-production settings*

Removals accounted for:

- Carbon sequestered in biochar (relative to 100-year permanence timeframe)

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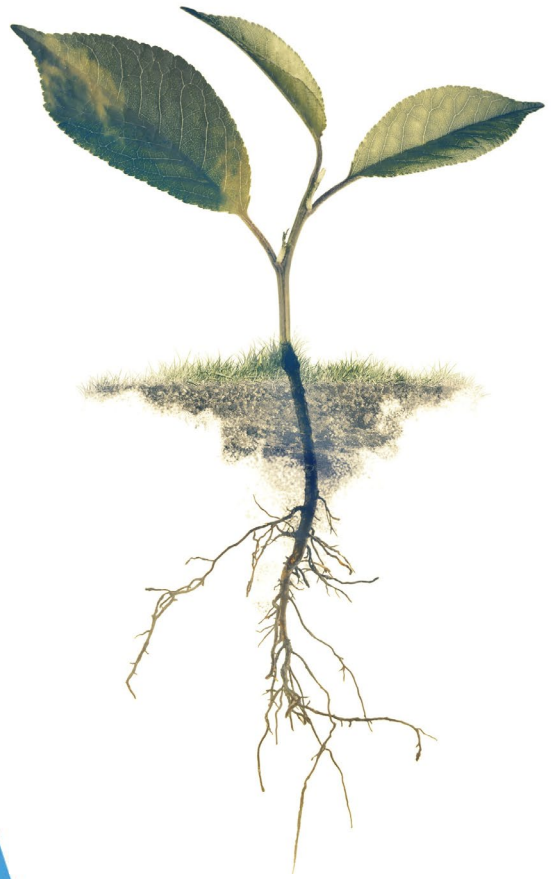
Quantification - Permanence



Permanence factor applied to biochar C estimates to reflect durability of C relative to 100-year timeframe

- Varies by end use
- For certain uses, permanence factor is based on lifespan and risk of C being released into atmosphere at end of life
- For soil applications and similar end uses (or for which ultimate fate is residence in soils), permanence factor is based on application of equation from Woolf et al. 2021
  - Requires average soil temperature of end use location
  - Standardized soil temperature data from Lembrechts et al. 2022

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Secondary Effects

Increases in GHG emissions outside of the project's assessment boundary as a result of the project activity. Also referred to as "leakage"

Secondary Effect Source	How Addressed
Displacement of crops to produce purpose-grown biomass	Feedstock eligibility limits
Diversion of feedstock away from bioenergy facility	
Capture of biochar produced during bioenergy feedstock combustion (i.e., reinjection ash) rather than reinjection into furnace to be combusted	Calculation of leakage if energy output of project facility decreases

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Biochar CRT Calculation Tool

Summary tab

Biochar CRT Calculation Tool

For use with the U.S. and Canada Biochar Protocol v1.0

	Data entered by project developer
	Data calculated automatically
	Standard/fixed data

General Information

Reserve Project ID (CAR####)	
Project Name	
Project Owner	
Project/Crediting Period Start Date	
Crediting Period End Date	
Current Reporting Period Start Date	
Current Reporting Period End Date	

Equation 5.1 - Net Quantified Removals		**Variable**	**Notes**
Baseline Emissions (tCO2e)	-	*BE*	No baseline emissions assumed
Project Emissions (tCO2e)	-	*PE*	From result of Eq. 5.2
Baseline Sequestered Carbon (tCO2e)	-	*BC*	No baseline sequestered carbon assumed
Total Project C Removals (tCO2e)	-	*PC*	From result of Eq. 5.11
Secondary Effects (tCO2e)		*SE*	From result of Eq. 5.12
Total Quantified Removals (tCO2e)		*QR*	Total amount of CRTs to be issued for the reporting period

Equation 5.2 - Project Emissions			
Emissions from feedstock production (tCO2e)	-	*PE_FProd*	From result of Eq. 5.4
Emissions from feedstock transportation (tCO2e)	-	*PE_FT*	From result of Eq. 5.5
Emissions from feedstock processing (tCO2e)	-	*PE_FProc*	From result of Eq. 5.6
Emissions from transportation of mobile biochar production equipment (tCO2e)	-	*PE_MT*	From result of Eq. 5.7
Auxiliary emissions (tCO2e)		*PE_AE*	From result of Eq. 5.8
Emissions from thermochemical conversion (tCO2e)		*PE_PY*	From result of Eq. 5.9
Emissions from biochar processing (tCO2e)	-	*PE_BP*	From result of Eq. 5.10
Emissions from biochar transportation (tCO2e)	-	*PE_BT*	From result of Eq. 5.11
Total project emissions (tCO2e)	-	*PE*	Value automatically transferred to Eq. 5.1

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MONITORING, REPORTING AND VERIFICATION

Monitoring, Reporting & Verification

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Monitoring and Reporting

- Data collection
- Chain of custody tracking
- Biochar sampling and testing
- Reporting documents and tools
- Reporting periods

Verification

- Verifier qualifications
- Review process
- Verification cycle

Data Collection

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Data category	Basis for data
Feedstock production (purpose-grown)	Mass of feedstocks
Feedstock transportation	Volume of fuel consumed OR mass of feedstock and distance transported
Feedstock processing	Volume of fuel and/or amount of electricity consumed OR type of processing used
Auxiliary energy use	Volume of fuel and/or amount of electricity consumed
Biochar processing	Volume of fuel and/or amount of electricity consumed OR type of processing used
Biochar transportation	Volume of fuel consumed OR mass of biochar and distance transported
Biochar produced and applied to eligible end use	• Mass, by end use type • Organic C content % • Dry matter % } Sampling & testing

Chain of Custody Tracking

- Critical component of monitoring, reporting, and verification (MRV) for biochar projects
- Transfers of biomass from feedstock source to biochar producer to end user, including intermediary entities

Biomass Acquisition

Biochar Production

Biochar Application

Temporary custody between other phases (e.g. transporters, storage facilities)

Biochar Sampling and Testing

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Purpose	
Determine eligibility of biochar • $H:C_{org}$ <0.7 • Contaminant levels within limits from legal standards and environmental safeguards	Establish values used for quantification • $H:C_{org}$ • Organic C % • Dry matter %

Two types of sampling/testing	
Biochar quality (i.e., chemical composition)	Dry matter

Biochar Quality Sampling

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Projects establish a pool of daily samples to demonstrate eligibility of biochar and to determine values for credit quantification.

Sample pool requirements		
Comprise a minimum of 10 samples	Individual samples may only be in sample pool for no more than 12 months	At least one new sample must be added to the sample pool every 2 months

Sampling methodology	
Project developer determines approach to be used	Protocol specifies minimum standards

Biochar Quality Laboratory Testing

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Accreditation

ISO

A2LA

TNRC RECOGNIZED TNI ACCREDITATION BODY

State-/province-approved certification program

Analysis

- Organic C content
- $H:C_{org}$
- Relevant organic pollutants per environmental safeguards
- Other contaminants, dependent on end use and applicable laws, regulations, and other environmental safeguards

Methods consistent with either IBI or WBC testing methods or other approved methods identified on protocol webpage

Dry Matter Sampling and Testing

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Purpose is to determine how much moisture is in project biochar

Moisture content in biochar is highly variable	Mass of biochar is critical to credit quantification	Don't want to credit for water weight of biochar

↓

Sampling and testing for every amount of biochar weighed for project reporting

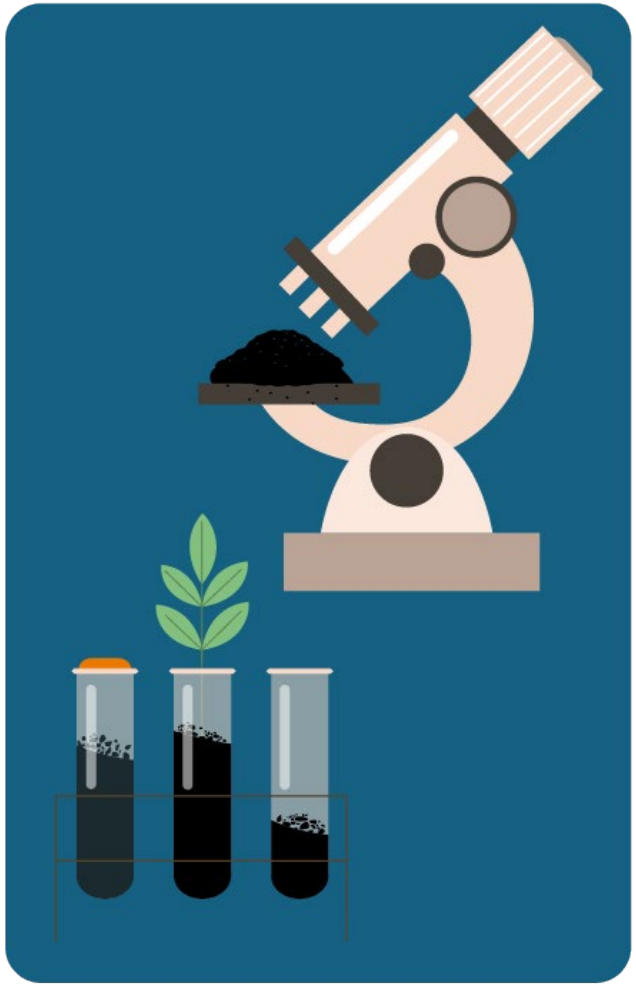
↓

Sampling methodology

Project developer determines approach to be used	Protocol specifies minimum standards

↓

Testing must follow an approved method identified in the protocol



Project Documentation

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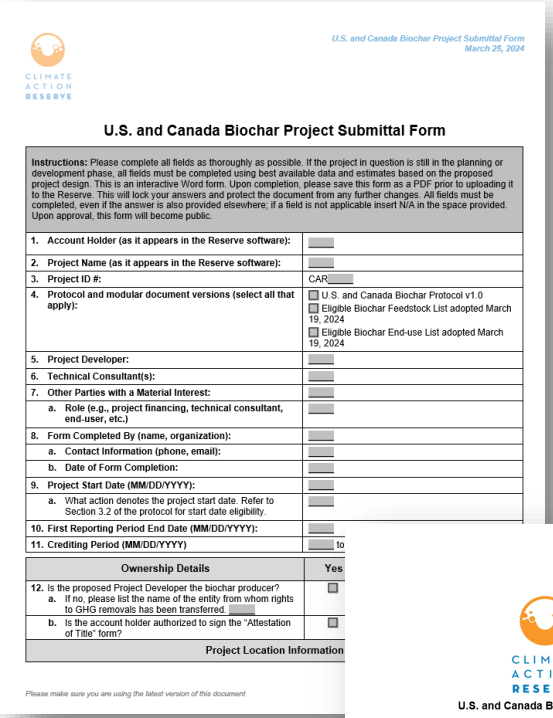
To submit a biochar project for listing:

- Project Submittal form
- KML and shapefile of biochar production location

For CRT issuance:

- Project Data Report
- Monitoring Plan
- Chain of Custody documentation
- Biochar CRT Calculation Tool
- Signed Attestation of Title
- Signed Attestation of Regulatory Compliance
- Signed Attestation of Voluntary Implementation
- Verification Report
- Verification Statement



U.S. and Canada Biochar Project Submittal Form
March 25, 2024

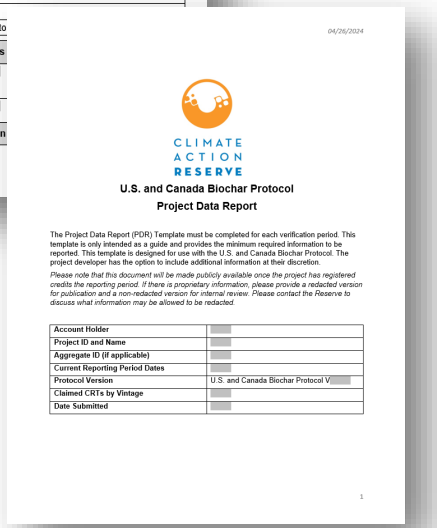
U.S. and Canada Biochar Project Submittal Form

Instructions: Please complete all fields as thoroughly as possible. If the project in question is still in the planning or development phase, all fields must be completed using best available data and estimates based on the proposed project design. This is an interactive Word form. Upon completion, please save this form as a PDF prior to uploading it to the Reserve. This will lock your answers and protect the document from any further changes. All fields must be completed, even if the answer is also provided elsewhere; if a field is not applicable insert N/A in the space provided. Upon approval, this form will become public.

1. Account Holder (as it appears in the Reserve software):	
2. Project Name (as it appears in the Reserve software):	
3. Project ID #:	CAR
4. Protocol and modular document versions (select all that apply):	☐ U.S. and Canada Biochar Protocol v1.0 ☐ Eligible Biochar Feedstock List adopted March 19, 2024 ☐ Eligible Biochar End-use List adopted March 19, 2024
5. Project Developer:	
6. Technical Consultant(s):	
7. Other Parties with a Material Interest:	
a. Role (e.g., project financing, technical consultant, end-user, etc.)	
8. Form Completed By (name, organization):	
a. Contact Information (phone, email):	
b. Date of Form Completion:	
9. Project Start Date (MM/DD/YYYY):	
a. What action denotes the project start date. Refer to Section 3.2 of the protocol for start date eligibility.	
10. First Reporting Period End Date (MM/DD/YYYY):	
11. Crediting Period (MM/DD/YYYY)	to

Ownership Details	Yes
12. Is the proposed Project Developer the biochar producer? a. If no, please list the name of the entity from whom rights to GHG removals has been transferred.	☐
b. Is the account holder authorized to sign the "Attestation of Title" form?	☐
Project Location Information	

Please make sure you are using the latest version of this document



04/26/2024

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U.S. and Canada Biochar Protocol
Project Data Report

The Project Data Report (PDR) Template must be completed for each verification period. This template is only intended as a guide and provides the minimum required information to be reported. This template is designed for use with the U.S. and Canada Biochar Protocol. The project developer has the option to include additional information at their discretion.

Please note that this document will be made publicly available once the project has registered credits the reporting period. If there is proprietary information, please provide a redacted version for publication and a non-redacted version for internal review. Please contact the Reserve to discuss what information may be allowed to be redacted.

Account Holder	
Project ID and Name	
Aggregate ID (if applicable)	
Current Reporting Period Dates	
Protocol Version	U.S. and Canada Biochar Protocol V
Claimed CRTs by Vintage	
Date Submitted	

1

Reporting Period

Basis for providing documentation to the Reserve for monitoring and verification purposes

Crediting Period

10 years

Reporting Periods

Minimum of 10 per crediting period (one/year)

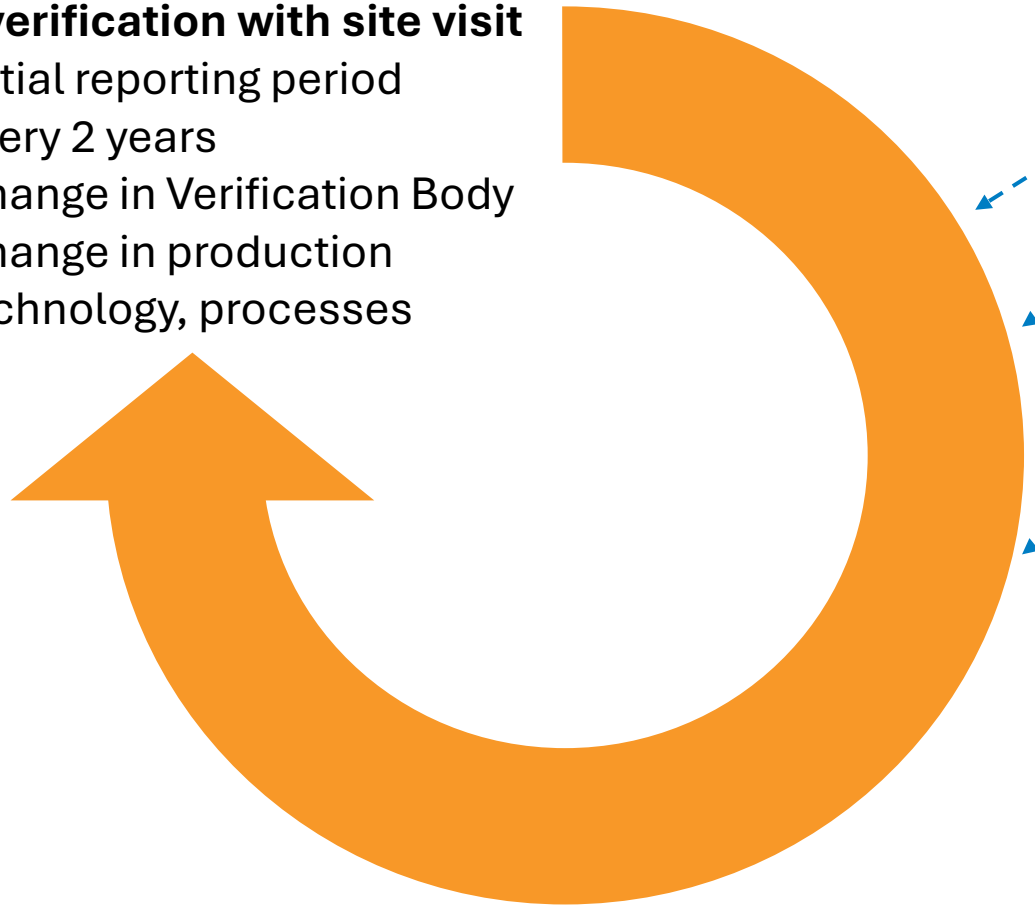
But can opt to have shorter reporting periods

Updated Project Data Report must be provided to Reserve no later than 12 months after each reporting period

Verification Cycle

Full verification with site visit

- Initial reporting period
- Every 2 years
- Change in Verification Body
- Change in production technology, processes



Optional desktop verification(s) between site visits

- Verifications must be completed within 12 months of end of reporting period(s) being verified
- Virtual site visit may be allowed, with approval, in place of an in-person site visit
  - In-person at least every 4 years

Verification

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Project developer:

- Selects verifier

Verifier must be:

- ISO-accredited
- Approved by the Reserve
- Trained under the protocol

Verification activities (all verifications):

- Review data and documentation supporting eligibility and credit quantification
- Produce Verification Report and Verification Statement

Additional activities for site visit verification:

- Confirm alignment between reported eligibility and observed conditions
- Assess data and record keeping at the facility/operation level
- Assess on-site evidence to confirm baseline and emissions calculation assumptions
- Review sampling procedures and sample archives

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Q&A / COMMENTS

KEY CONTACTS

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