



Biochar for Soil Health: Working with USDA-NRCS on Biochar

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FARM PRODUCTION AND CONSERVATION
FSA | NRCS | RMA | Business Center

Working with the USDA-NRCS on Biochar for Soil Health

Goals

- Understand when the NRCS would recommend biochar to farmers.
 - **Conservation Planning Process**
- Understand how the NRCS can provide financial assistance to farmers for utilizing biochar as a soil amendment.
 - **Farm Bill Conservation Programs**



Planning: Inventory and Evaluation

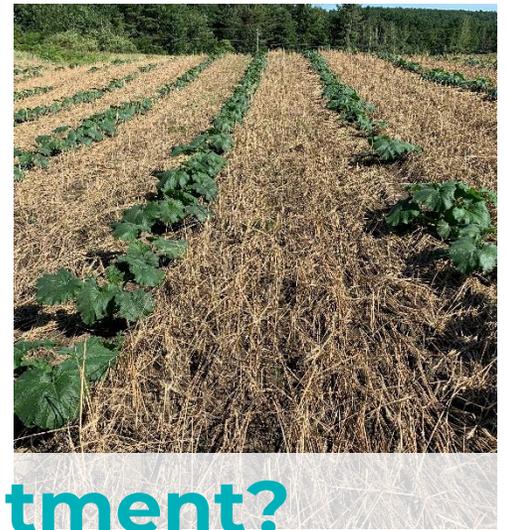
- Happens locally; on the farm.
- Lead by the farmer's goals and objectives.
- Identification of Resource Concerns
Resource Concern: Degradation of the **soil, water, air, plant, animal or energy** resource base to the extent that the sustainability or intended use of the resource is impaired.
- Evaluation through tools, testing, and/or observations.



National Planning Procedures Handbook, Amed. 9, December 2021

Biochar Treats Resource Concerns

- Aggregate Instability
 - Compaction
 - Concentration of salts or other chemicals
 - Organic matter depletion
 - Soil organism habitat loss or degradation
- SOIL**
- Inefficient irrigation water use **> WATER**
 - Plant productivity and health **> PLANTS**



When does a Resource Concern require treatment?

Evaluating Resource Concerns

- Client Input/Planner Observations
- In-field Soil Health Assessment Worksheet
- Traditional Soil Tests – Organic Matter
- Soil Health Testing – Comprehensive/Single
- Soil Erosion and Tillage Intensity Computer Models (RUSLE2)
- Interpretive GIS Layers – Web Soil Survey
- Method depends on the Resource Concern being evaluated



In-Field Soil Health Assessment

Cropland In-Field Soil Health Assessment Worksheet		Meets Assessment Criteria (Yes/No)
Soil Health Resource Concerns CPT: Compaction SOM: Soil Organic Matter Depletion AGG: Aggregate Instability HAB: Soil Organism Habitat Loss or Degradation	Indicator Timing and Use Anytime ☀️ After Rain or Irrigation ☁️ With Adequate Moisture 💧 Before a Tillage Event 🚜 Primarily No-Till Systems ⚙️ Before Growing Season 🌱 During Growing Season 🌿 Interview 🗣️	<input type="checkbox"/> Y <input type="checkbox"/> N
Location	Soil Cover ☀️ SOM, AGG, HAB • Surface cover from plants, residue or mulch; cover greater than 75% (estimated)	<input type="checkbox"/> Y <input type="checkbox"/> N
Field/CMU	Residue Breakdown ☀️ ⚙️ 🗑️ SOM, HAB • Natural decomposition of crop residues or organic mulch is as expected with crop and conditions	<input type="checkbox"/> Y <input type="checkbox"/> N
Tract #	Surface Crusts 🚜 🗑️ 🌿 AGG, HAB • Crusting on no more than 5% (estimated) of the field/CMU	<input type="checkbox"/> Y <input type="checkbox"/> N
Client/Customer	Ponding/Infiltration ☀️ ☁️ 🌿 🗑️ CPT, AGG • No ponding on non-hydric soils within 24 hours following typical rainfall or surrogation event • OR, no infiltration difference between assessment area and fencerow sample • OR, soil infiltrates 1-inch of water in 30 minutes or less	<input type="checkbox"/> Y <input type="checkbox"/> N
Plan	Penetration Resistance 💧 🚜 🗑️ 🌿 CPT • Penetrometer rating <150 psi within top 6-inch depth and <300 psi in the 6 to 18 inches • OR, slight or no resistance with wire flag inserted to 12 inches	<input type="checkbox"/> Y <input type="checkbox"/> N
	Water-Stable Aggregates ☀️ CPT, SOM, AGG, HAB • Strainer: soil structure remains intact with aggregates apparent; • OR, Soil Quality Test Kit (SQTK)/Jornada slake box meets stability class 5 to 8 • OR, Cylinder: At least 80% (estimated) remains intact after 5 minutes with little to no disturbance	<input type="checkbox"/> Y <input type="checkbox"/> N
	Soil Structure ☀️ CPT, SOM, AGG, HAB	<input type="checkbox"/> Y <input type="checkbox"/> N



Soil Health Testing



United States Department of Agriculture

CEMA 216
February 2022

CONSERVATION EVALUATION AND MONITORING ACTIVITY Soil Health Testing

DEFINITION

Quantitative testing for physical, biological, or chemical characteristics of soil and constraints of soil using approved laboratory methods.

CRITERIA

General Requirements

A Conservation Evaluation and Monitoring Activity (CEMA) is the assessment, monitoring, or recordkeeping activities required to plan, implement, or determine the effectiveness of conservation practices as described herein.

The CEMA includes the performance of work and documentation of the tasks, results, interpretations, and other activities described herein.

This CEMA includes details to collect and analyze soil based on soil health resource concerns and planning objective. Soil samples will be submitted to laboratories for analysis using standardized methods.

Plans and specifications for soil testing shall be consistent with this standard and the referenced technical notes.

Technical Requirements Applicable to All Soil Tests

Individuals collecting soil should demonstrate the knowledge, level of skill, and experience



United States Department of Agriculture

Natural Resources Conservation Service

Published May 2019, Updated November 2019

Soil Health Technical Note No. 450-03

Recommended Soil Health Indicators and Associated Laboratory Procedures



Interpretive GIS Layer

Dynamic Soil Properties Response to Biochar



The screenshot displays the 'Dynamic Soil Properties Response to Biochar' layer selected in the 'Suitabilities and Limitations for Use' section. The map shows various soil types and their response to biochar application, with a color-coded legend. A pop-up window provides a detailed description of the layer.

Map — Dynamic Soil Properties Response to Biochar

<https://websoilsurvey.nrcs.usda.gov/>

Description — Dynamic Soil Properties Response to Biochar

Dynamic Soil Properties Response to Biochar Application

Biochar is the solid byproduct of the decomposition of organic materials in oxygen-limited environments at high temperatures, a process known as pyrolysis. The extremely carbon-rich material has an average half-life of 1,400 years, due to its recalcitrant benzene-ring structure, allowing it to sequester carbon in soils over long periods of time, with the potential to provide substantial increases to soil organic matter when applied to soils. Although it has not been extensively tested,

Planning: Decision Support

- Problem solving through Conservation Practices
 - Structural or vegetative measures, or management techniques, used to meet specific needs in planning and implementing conservation.
 - Based on standards and practice specifications.
- Soil Carbon Amendment (808/336)
 - The addition of biochar, compost, and biochar/compost mixes to soils.



National Planning Procedures Handbook, Amed. 9, December 2021

Soil Carbon Amendment (808/336)

- Addresses an identified Resource Concern
- Requires soil and material testing.
- Biochar must meet criteria in the standard.
- Likely planned with a suite of soil health practices:
 - Cover Crops (340)
 - Reduced Tillage/No-till (329/345)
 - Crop Rotation (328)
 - Mulching (484)
 - Nutrient Management (590)



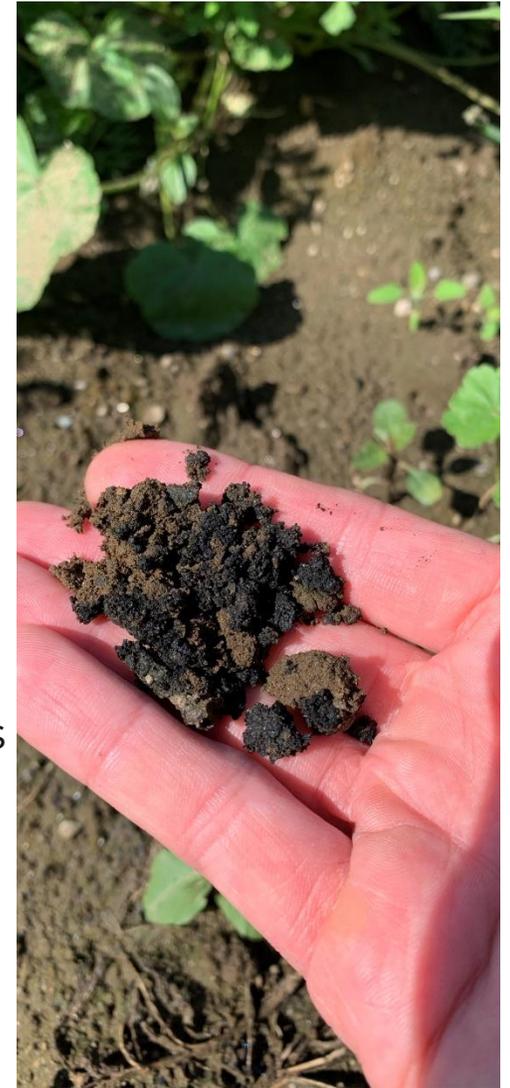
Soil Carbon Amendment (808/336)

808 – Interim standard adopted by ~22 states

336 – Final standard; review of federal register comments underway.

States currently using ICPS 808:

- Arkansas
- California
- Caribbean Area
- Colorado
- Delaware
- Idaho
- Illinois
- Indiana
- Massachusetts
- Maryland
- Maine
- Montana
- Michigan
- Nebraska
- New Hampshire
- New Jersey
- New York
- Oregon
- Hawaii/Pacific Islands
- Texas
- Utah
- Vermont



Field Office Technical Guide

- Repository for state specific technical information.
- Practice details found in:

Section 4 >> Practice Standards and Supporting Documents

<https://efotg.sc.egov.usda.gov/>

The screenshot shows the 'Field Office Technical Guide | NH' website. The header features a blue bar with the USDA logo and the text 'Field Office Technical Guide | NH'. Below the header is a large image of a lake at sunset with the text 'New Hampshire' and a 'Change state' button. The main content area is divided into a 'Document Tree' on the left and a search results section on the right. The 'Document Tree' includes sections for 'General Resource References', 'Natural and Cultural Resources Information', 'Resource Concerns and Planning Criteria', 'Practice Standards and Supporting Documents' (which is expanded to show 'Index' and 'Conservation Practice Standards & Support Documents'), 'Access Control (472)', and 'Access Road (560)'. The search results section is titled 'Soil Carbon Amendment (808)' and includes an 'Export Grid' button and a 'Highlights Only' filter. The results table has columns for 'Document Title', 'Type', 'Pub Date', 'End Date', 'Subject', 'Keywords', and 'Abstract'. Two results are shown: '808 NH ICPS Soil Carbon Amendment 2020' (published 2020-09-16) and '808 NH IR Soil Carbon Amendment 2022' (published 2022-01-26).

Document Title	Type	Pub Date	End Date	Subject	Keywords	Abstract
808 NH ICPS Soil Carbon Amendment 2020		2020-09-16	--	--	soil health, carbon, biochar	--
808 NH IR Soil Carbon Amendment 2022		2022-01-26	--	--	--	--

Conservation Programs

- Primary NRCS Conservation Programs for the application of biochar:
 - Environmental Quality Incentives Program (EQIP)
 - Agricultural Management Assistance (AMA)
 - Conservation Stewardship Program (CSP)
- Provide technical and financial assistance to implement planned Conservation Practices.
- Typically, program contracts are with individual farms, farmers, or private landowners.

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/>



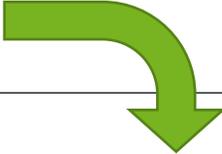
Payment Schedules

- **Flat-rate payments** made to participants based on the amount planned and implemented.
 - e.g. cubic yards of biochar applied to the soil
- Based on real-world costs for materials and labor.
- National payment rates; adjusted regionally.
 - Payment rates updated/set once per fiscal year.
 - Revised cost data are always welcome.

<https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/financial/?cid=nrcseprd1853230>



Payment Schedules



New Hampshire
Practice Scenarios - Fiscal Year 2022



 United States Department of Agriculture
Natural Resources Conservation Service

Practice: 808 - Soil Carbon Amendment

Scenario #30 - 100% Biochar

Scenario Description:

This scenario is used to import and apply biochar of known origin, production methods, and nutrient content is applied to land at a minimum rate of 4 cubic yards/acre to reduce nutrient leaching and improve organic matter, aggregate stability, habitat for soil organisms, and plant productivity and health. Prior to application biochar analysis is provided and the biochar is charged or saturated using compost tea, nutrients or other methods to occupy exchange sites.

Before Situation:

An in-field assessment or other appropriate planning criteria/tools indicate that soil organism habitat loss or degradation, aggregate instability or low organic matter levels are present and the addition of a carbon amendment is needed to contribute to the soil food web, improve aggregate stability and organic matter. Soil fertility/nutrients are tested prior to application. A soil health laboratory test may also be taken using Soil Testing (216) to document benchmark conditions.

After Situation:

Soil and biochar was tested. Biochar was judiciously applied at rate of at least 1 ton/acre or 4 cu yd/acre. Soil carbon levels are improved by the addition of stable carbon. Nitrate leaching is reduced and water holding capacity is improved. A soil health laboratory test may also be taken using Soil Testing (216) to evaluate the effectiveness of the practice.

Payment Schedules

Scenario Cost/Unit:		\$1,070.79				
Cost Details:						
Component Name	ID	Description	Unit	Cost	QTY	Total
Equipment Installation						
Tillage, Light	945	Includes light disking (tandem) or field cultivator. Includes equipment, power unit and labor costs.	Acres	\$11.35	20	\$227.00
Manure, compost, application	955	Loading, hauling and spreading manure/compost by ground equipment. Includes equipment, power unit and labor costs.	Hours	\$134.00	2	\$268.00
Materials						
Biochar	2743	Solid material obtained from thermochemical conversion of biomass in an oxygen-limited environment (pyrolysis). Biochar is typically produced from woody biomass, but other carbon sources may be used. Materials only.	Cubic Yards	\$244.01	80	\$19,520.80
Mobilization						
Aggregate, Shipping, Cubic Yard-mile	2360	Mobilization of aggregate material beyond 20 miles of local delivery from quarry to construction site. Cubic Yard-mile (Cubic Yard * miles of haul).	Cubic Yard Mile	\$0.35	4000	\$1,400.00

Application and Evaluation

- Participants complete Conservation Practices based on implementation requirements.
- Local NRCS staff verify implementation.
- Payment amount is based on:
Payment schedule rate x amount implemented
- Additional biochar treatments may be necessary based on a post-treatment evaluation of resource concerns.

