



## Northern Minnesota Closed Cycle Biochar Pilot 2023-2026

Funded by USDA Forest Service

**Goal:** Demonstrate the Soil health impact of biochar applied to crop and pasture fields on sandy, clay, and loam soils.

**Project Scope:** Through field scale applications of biochar only and biochar mixed with on farm manure supplies, this project will explore all aspects of planning, and implementing the U. S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) 336 Soil Carbon Amendment practice.

The project found farmer partners in Carlton County, MN that had hay, pasture, and crop fields on sandy, clay, or loamy soils.

### **Sites:**

Site 1. S&K Ranch is a 310 acres farm raising row crops, hay and utilizing pasture to support a 40 cow/calf pair beef herd. Soil type on project fields is Ahmeek-Normanna-Canosia complex – loamy soils.

Site 2. Rob and Laura Sandstrom farm 26 acres as sheep pasture along with chickens in the farmstead. Soil type in project pasture area is Omega loamy sand.

Site 3. This 310 acre property consists of hay fields and woodlands owned by Minnesota Power. The hay land is cropped by contract with local farmers. The project field has not seen any soil amendments for over 10 yrs including not ever being reseeded in at least that time period. Soil type is Cloquet fine sandy loam.

Site 4. Heikes Farms operates 917 acres on their home farm and another 600 acres of cropland in the surrounding area of Holyoke, MN and Foxboro, WI. This 1500 acres supports a 130 cow calf pair beef herd along with 40 feeders. In addition, Heikes Farms supplies straw products to various erosion control companies and hay products to a wide variety of livestock operation in the region. Soil types on the home farm are Ontonagon and Bergland Clay, while on the WI project field 7 miles away the soil type is Manitowish sandy loam.

**Field Assessments:** Using the NRCS In Field Soil Health Assessment Tool all project fields were assessed for Resource Concerns related to soil health. Soil samples were collected from each field and submitted to 2 separate independent labs for their soil health suite analysis plus water holding capacity, soil respiration, organic matter, and aggregate stability. This sets the existing soil conditions.

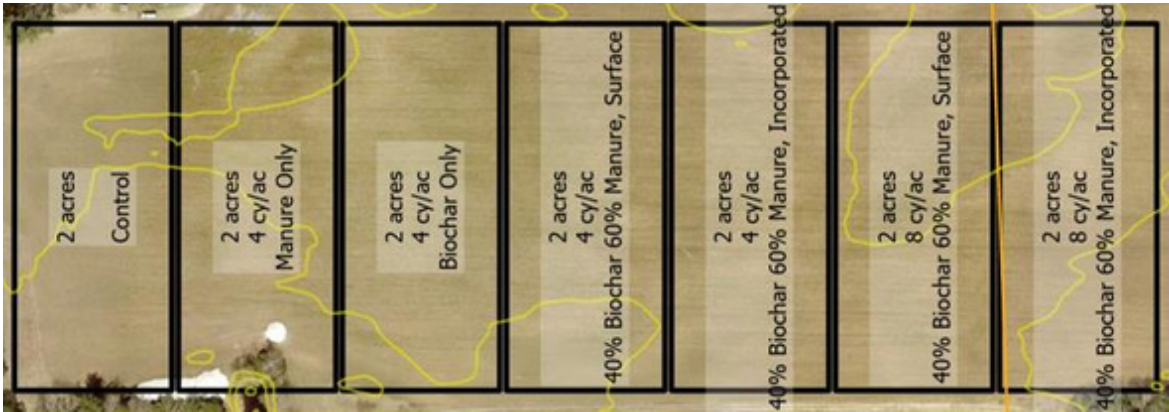
**Biochar:** Biochar was purchased from Terra Char. The original batch IBI was done in 2015 so a new IBI was run to document current biochar parameters. The biochar was ordered wetted to allow easier handling on the farm and reduce product loss from handling an outside storage. Delivery was made in early October by 3 separate semi pulled dump trailers from Missouri. Moisture stated on the IBI was 62%. The particle size was small with 31% < 0.5mm, 26% 0.5 - 1mm, and 21% 1 - 2mm. Dump sites were located at 3 of the 4 participating farms. Sites 2 and 3 shared one load.

**Biochar-Manure Mixing:** Site 1 mixed the biochar with beef manure by tractor and bucket. Piles for each plot were made separately and each pile was mixed once in the 16 day inoculation period. Site 2 mixed the biochar with Sheep manure with a skid steer bucket. The pile sat for 5 months over winter and was mixed before being spread in the spring. Site 3 only used biochar. Site 4 mixed the biochar with beef manure by loading a large manure spreader with tractor and loader and then running the spreader to mix and offload into a pile. The pile sat for 31 days from mid-December through mid-January.

All project sites used a 40% biochar – 60% Manure mix ratio consistent with one of the MN NRCS cost share scenarios. All three mixes were sampled and submitted for a standard manure analysis plus soil respiration, organic matter.

**Application:** Biochar/manure mixes were applied to plots using manure spreaders supplied by the farmers.

**Demonstration Plot Design:** The project sought input from University of MN regional Extension Educators on plot design. All crop plots in the demonstration contained these same trials. Site 1 also implemented a biochar only demonstration on 2 acres of bale grazing pasture. Site 3 had no access to manure, so biochar only was applied at 4, 8 and 12 cu. yds./ac. rates.



Plots were adjusted to the acreage available at the farm.

Farm	Plot	Volumes in cu. yds.		Acres	# of trials
		Biochar	Manure		
Risacher	Hay	13.6	18.4	8.3	7
	Bale Graze	8.0	0.0	2	2
	Farm Total	21.6	18.4		
Sandstrom	Pasture	6.8	9.2	3.5	7
	Farm Total	6.8	9.2		
Hikes	Hay	27.2	36.8	14	7
	Pasture	13.6	18.4	7	7
	Rye	27.2	36.8	14	7
	Farm Total	68.0	92.0		
MP	Hay	48.0		8	5



Biochar Mixing at Site 1

### Follow up testing:

Soil samples from each of the projects 42 trials will be collected annually for 3 years (2024, 2025, 2026) and submitted to the lab for the exact same analysis as were done in the pre application stage. Forage volumes will be collected from each of the 42 trials for the same 3 years to document any changes in forage production.

**Field Days:** Field days will be coordinated on all 4 sites in the late summer after the first crop hay has been harvested. Field days were held in 2024 and more are being planned.

### Project Partners

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To view the StoryMap Collection of this Project with descriptions and experiences from each site visit the website below or scan the QR Code:  
<https://arcgis/1aHnvvb>

