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A Carbon Assessment of Iowa State University Farms Soils

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Introduction

The objective of this study was to quantify the soil organic carbon (SOC) stocks of Iowa State University's (ISU) farmland. Soil organic carbon is a worthwhile property to measure because its quantification may allow ISU to more fully realize its environmental impact and to target conservation measures to land parcels with the lowest carbon content. The carbon content of ISU's land also could be useful economically if a carbon credit system was implemented.

Materials and Methods

ISU and affiliated organizations manage 82 land parcels in Iowa. The bulk of the farms are located near the university campus in Story and Boone Counties, however, there are 17 outlying farms in 16 counties scattered across the state. The farms are positioned to represent the major soil types of Iowa and are used for a myriad of activities that include crop and livestock production, extension demonstrations, and research projects.

The USDA-NRCS Web Soil Survey (WSS), an online mapping tool that allows the user to access various soil properties for a specific location, was used to measure SOC to 7-in. and 40-in. depths. Soil organic carbon content was derived from the Organic Matter percentage option in WSS, which represents the percent on a weight/weight-basis of soil organic matter for soil material that is less than two millimeters. The SOC content for each soil map unit (SMU) was determined by

multiplying Organic Matter percent, Bulk Density ($\frac{1}{3}$ bar), depth, 0.5 SOC/1.0 Organic Matter, and correcting for units. These SOC values then were multiplied by the percent area of each SMU within the farm and summed to achieve a weighted average for the entire farm.

Results and Discussion

0–7 in. depth. There is tremendous variability in the carbon values for Iowa State University's farms. The average farm SOC content is 1.2 lb ft⁻² for the surface 7 in. Web Soil Survey ranks Beach Bottom Farm as having the highest SOC content with 1.5 lb ft⁻² (Table 1). The Beach Bottom Farm is located in Story County and is currently being managed as a golf course, as well as a grassed parking lot. The Beach Bottom Farm is nearly flat and has alluvial (deposited by running water) soils with a fine or fine-loamy family particle size classification. The major soils have Cumulic properties, in this case a thickened Mollic epipedon resulting in high organic matter content.

The lowest SOC content for a 0–7 in. depth is found at the Western Research Farm, Haas Memorial Farm, and Muscatine Island Research Farm with 0.6 lb ft⁻² (Table 1). The Western Research Farm is located in Monona County in the Loess Hills and is primarily a reduced tillage cropping system of corn (*Zea mays*), soybeans (*Glycine max*), and alfalfa (*Medicago sativa*). The Western Research Farm has a rolling landscape with well-drained soils of which 40 percent are moderately to severely eroded. The Haas Memorial Farm is located in Pottawattamie County and has a cropping rotation of conventional tillage corn and no-till soybean. The majority of the farm landscape is rolling with well-drained, loess-formed soils that are moderately to severely eroded. The Muscatine

Island Research Farm is located in Muscatine County and is primarily used for horticulture crops, has sandy soils, and low slopes that are excessively well-drained.

0–40 in. depth. The average farm SOC content for a 0–40 in. depth is 4.0 lb ft⁻². The farm with the highest SOC content for a 0–40 in. is the Beach Bottom Farm with 7.0 lb ft⁻² (Table 1). The lowest SOC content is found at the Western Research Farm with 1.6 lb ft⁻².

In regards to cumulative totals for a 0–40 in. depth, ISU's soils contain 2,453,775,382 lb of SOC. In order to put these numbers in

perspective, for fiscal year 2014 Iowa State University estimates its campus carbon dioxide equivalent emissions to be 505,248 tons (J.D. Witt, ISU Power Plant, personal communication, August 22, 2014). When comparing WSS's Total Carbon value and campus emissions, the carbon stocks of ISU are equivalent to over 12 years of campus emissions.

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Table 1. Farm Soil Organic Carbon (SOC) (lb ft⁻²) for 0–7 in. depth and 0–40 in. depth for 20 Iowa farms.

Farm ¹	County	SOC lb ft ⁻²	
		7 in.	40 in.
Allee	Buena Vista	1.4	4.9
Armstrong	Pottawattamie	0.7	2.2
ABE/Agronomy	Boone	1.3	4.5
Beach Bottom	Story	1.5	7.0
Brayton	Delaware	0.7	2.1
Haas	Pottawattamie	0.6	2.3
Horticulture	Story	1.1	3.5
Lagerstrom/Diemer	Kossuth	1.3	5.0
Marsden/Paulsen	Boone	1.3	4.5
McNay	Lucas	0.8	2.4
Muscatine Island	Muscatine	0.6	2.0
Neely-Kinyon	Adair	0.9	3.1
Northeast	Floyd	1.3	4.0
Northern	Hancock	1.4	4.3
Northwest	O'Brien	1.2	5.5
Rhodes	Marshall	0.7	2.1
Seeck	Benton	1.0	4.1
Southeast	Washington	1.2	3.6
Uthe	Boone	1.2	4.0
Western	Monona	0.6	1.6

¹Farm names have been shortened and are listed alphabetically.