Carbon Status of the Soils of Iowa State University

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Introduction

Iowa State University and its affiliated organizations own and manage 76 farms across the state with a collective area of 6,392 hectares. The farms represent 20 soil associations, from the deep loess of Western Iowa to the eolian sands along the Mississippi River.
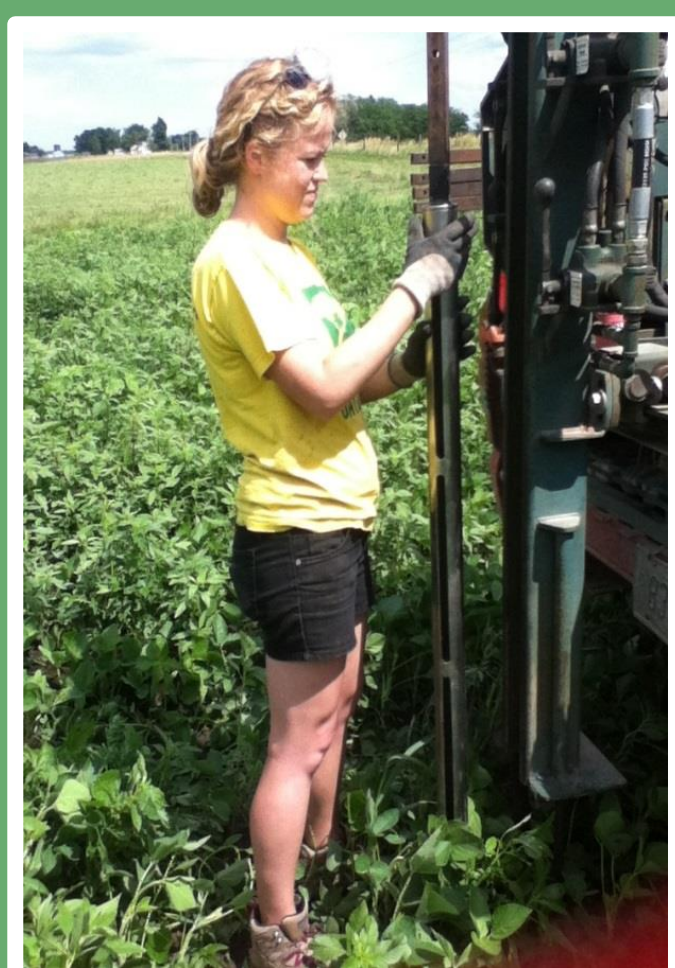
Objective

To quantify the soil organic carbon (SOC) stocks of Iowa State University's farms.

Our research is part of ISU's Green Team's Sustainability Initiative. The College of Agriculture and Life Sciences has commissioned this study in order to calculate and manage their SOC stocks.

Methods

- This first phase of our project is an analysis of existing data
- 76 farms were digitized using aerial photographs and ArcGIS 10.1
- Shapefiles were delineated in the USDA-NRCS Web Soil Survey
- Average SOC kg m^{-2} stocks to 0.18 and 1.0 meter were determined

Acknowledgements

Iowa State University Farms

Major Land Resource Areas of Iowa

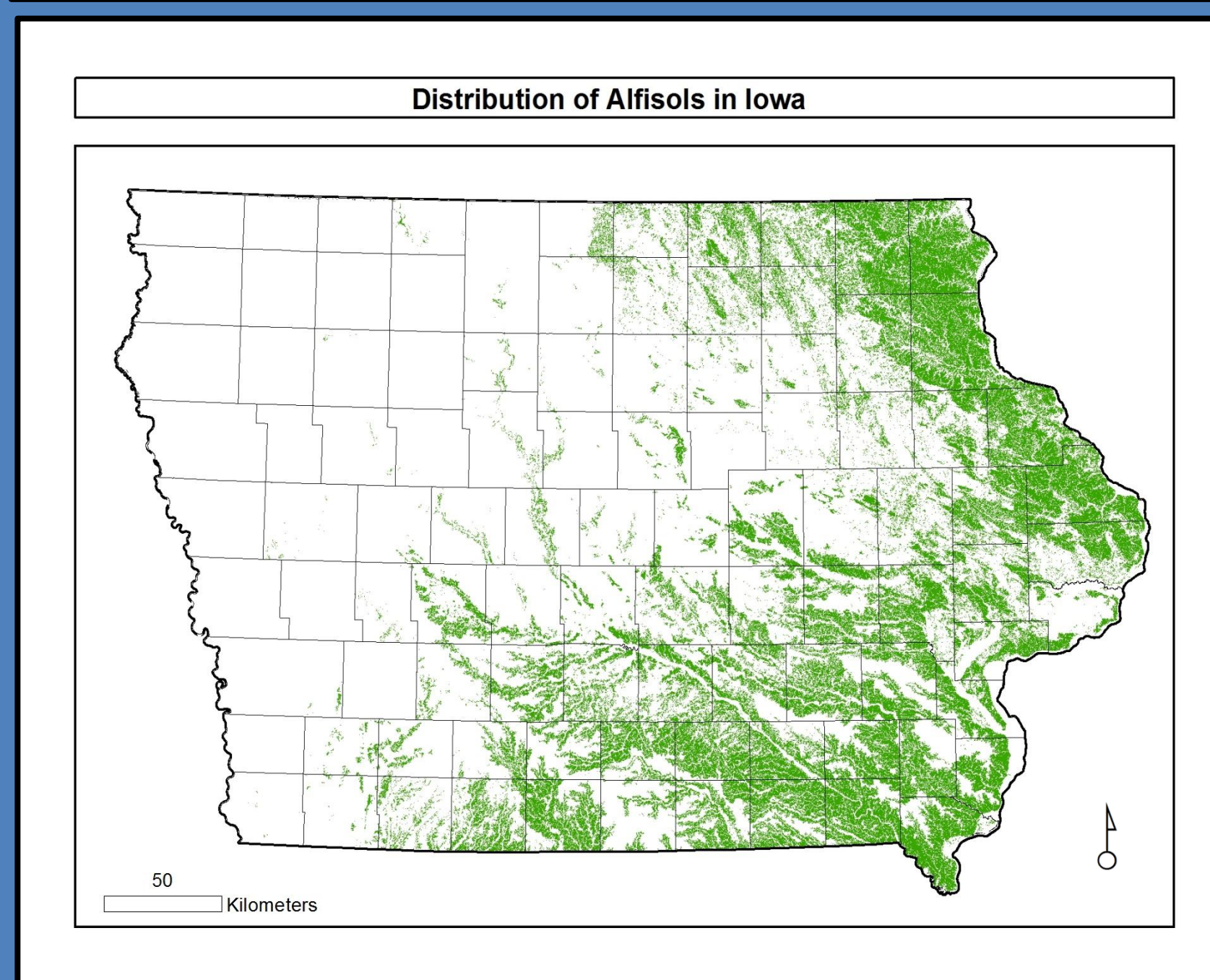**Distribution of Mollisols in Iowa**
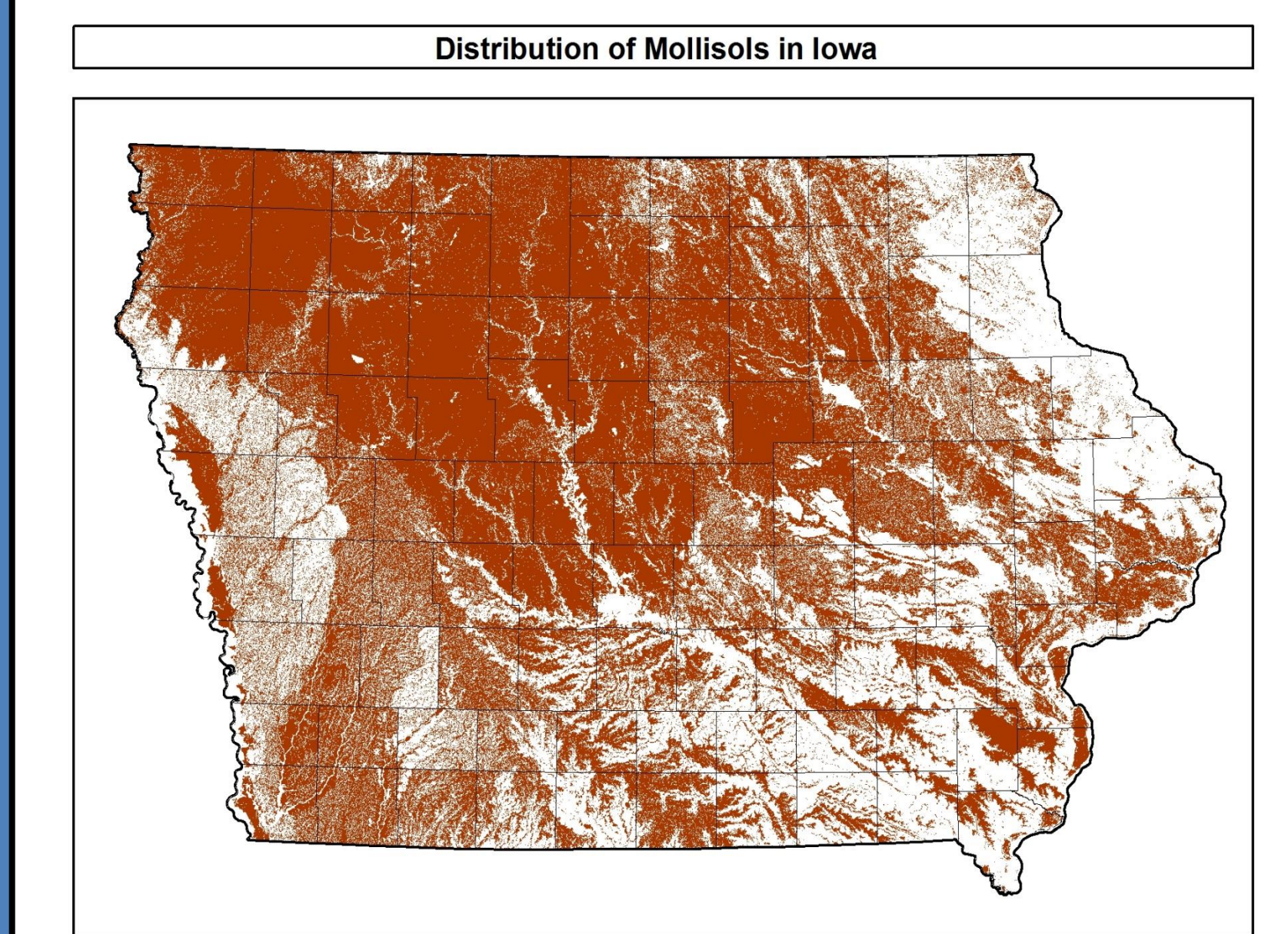
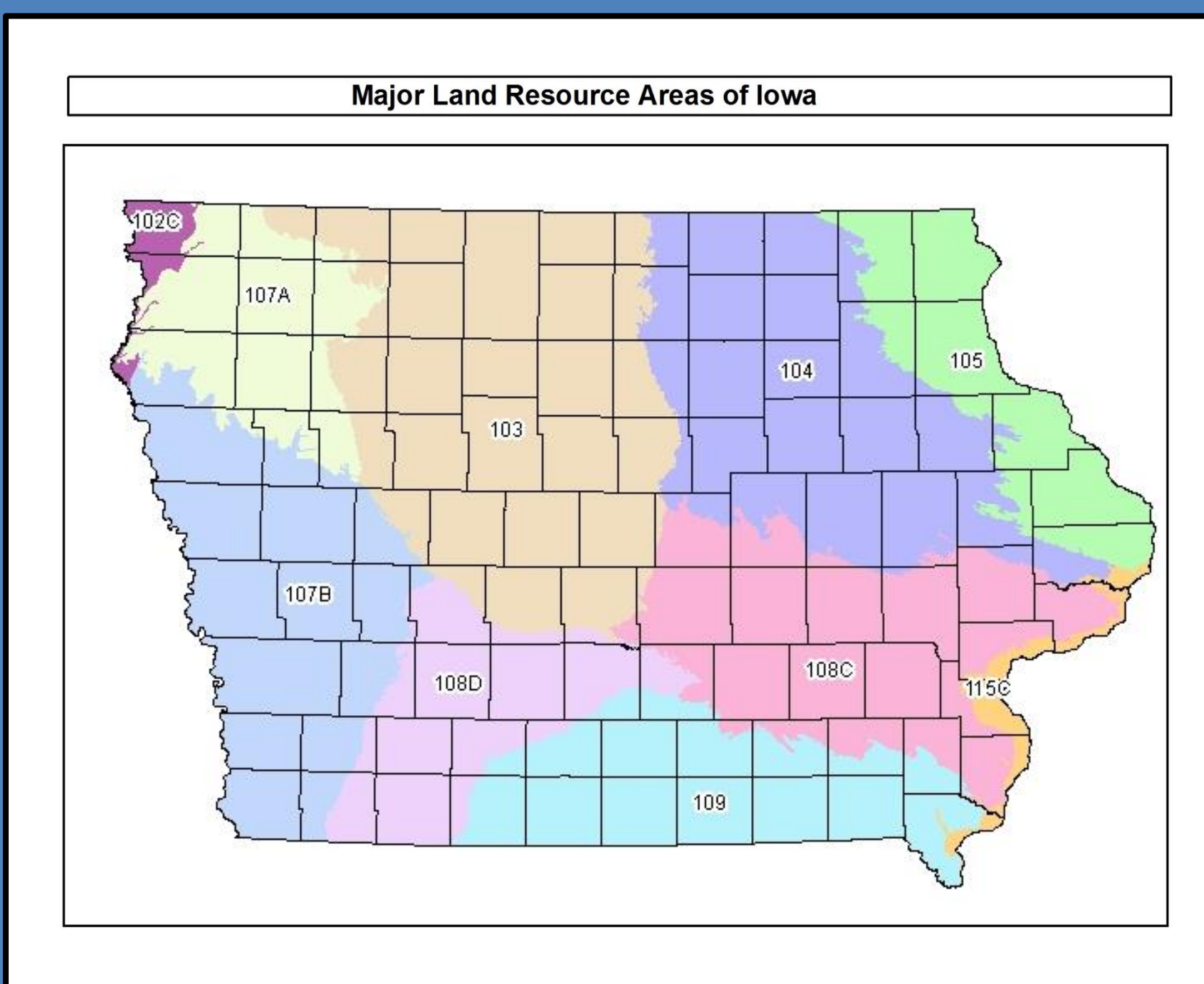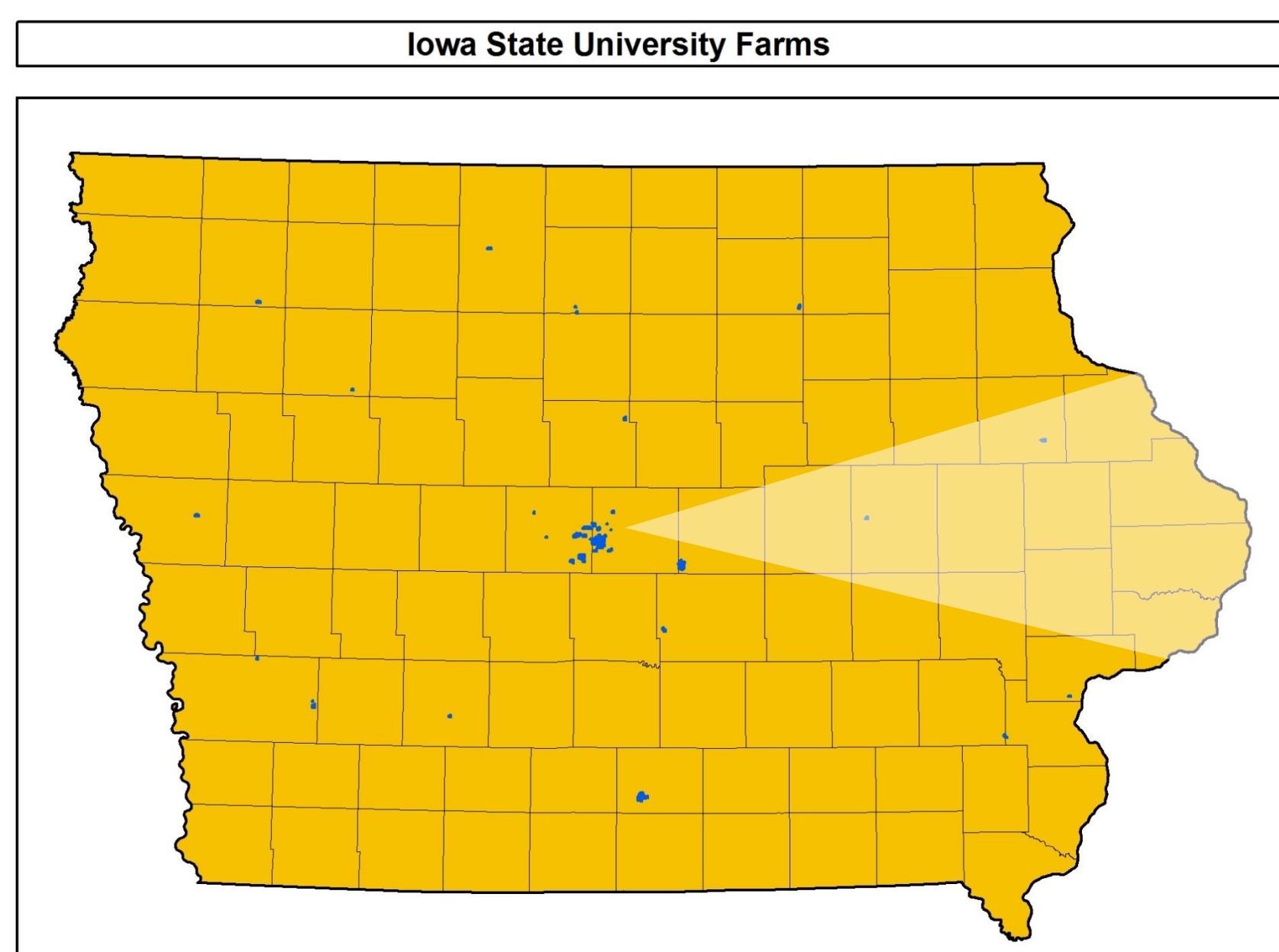**Distribution of Alfisols in Iowa**

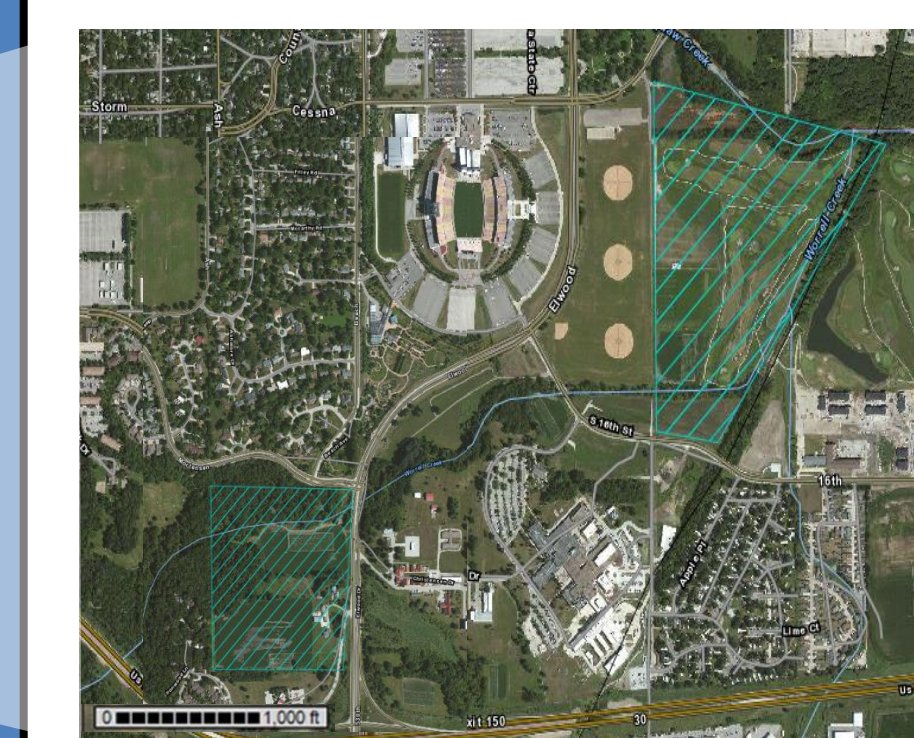**Figure 1.** Location of Beach Bottom Farm and Packer Farm using Web Soil Survey

Figure 2. Location of Beach Bottom Farm and Packer Farm using ArcGIS
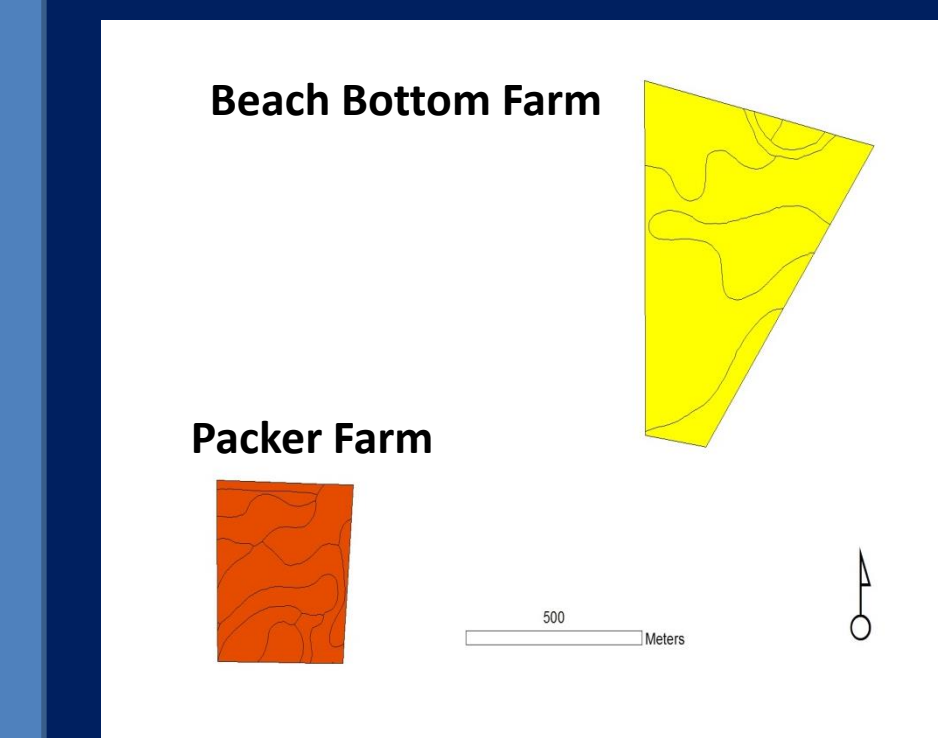
Table 1. Highest SOC Stocks by Series

Beach Bottom Farm				
Soil Series	% of Farm	Taxonomic Name	% Slope	% OM
Coland	54.8	Fine-loamy, mixed, superactive, mesic Cumulic Endoaquolls	0 - 2	5.0
Spillville	24.3	Fine-loamy, mixed, superactive, mesic Cumulic Hapludolls	0 - 2	4.5
Zook	16.2	Fine, smectitic, mesic Cumulic Vertic Endoaquolls	0 - 2	5.0

Table 2. Lowest SOC Stocks by Series

Packer Farm				
Soil Series	% of Farm	Taxonomic Name	% Slope	% OM
Storden	28.7	Fine-loamy, mixed, superactive, mesic Typic Eutrudept	26 - 35	1.4
Clarion	20.8	Fine-loamy, mixed, superactive, mesic Typic Hapludolls	3 - 12	1.7
Terril	14.9	Fine-loamy, mixed, superactive, mesic Cumulic Hapludolls	0 - 2	4.5

Table 3. SOC Stocks from Highest to Lowest for Selected Farms

Farm	Area (ha)	County	MLRA	SOC kg m^{-2} * depth 1.0 m	SOC kg m^{-2} * depth 0.18 m
Beach	33.5	Story	103	34.3	6.8
Accola	32.2	Story	103	30.6	7.5
Seeck	80.9	Benton	104	28.7	6.1
Northern	69.8	Hancock	103	28.4	6.9
Allee	64.7	Buena Vista	108	27.7	7.1
Burkey	61.9	Boone	103	23.2	6.4
Northwest	110.1	O'Brien	107A	22.1	6.1
Lagerstrom-Diemer	98.1	Kossuth	103	21.9	5.7
Northeast	260.0	Floyd	104	20.3	6.1
Hort Farm	30.6	Story	103	17.7	5.5
Southeast	110.9	Washington	108C	15.9	5.2
Neely-Kinyon	64.7	Adair	108D	14.8	4.5
Muscatine	42.9	Muscatine	115C	14.7	4.4
Baird	92.1	Jasper	108C	12.0	3.9
Haas	64.7	Pottawatamie	107B	11.6	3.4
McNay	796.4	Lucas	109	11.4	3.9
Brayton	130.3	Delaware	104	9.5	3.0
Armstrong	161.9	Pottawatamie	107B	9.3	3.2
Western	113.3	Monona	107B	8.3	2.9
Packer	15.5	Story	103	3.5	5.1

* SOC values are averages. Farm names are shortened.

Discussion

- The range for SOC stocks to a 1.0 m depth is 3.5 to 34.3 kg m^{-2}
- The range for SOC stocks to 0.18 m depth is 2.9 to 7.5 kg m^{-2}
- The average SOC stocks to a 1.0 m depth is 20.6 kg m^{-2}
- The average SOC stocks to 0.18 m depth is 5.7 kg m^{-2}
- The surface 0.18 m contains, on average, about 30% of SOC to a 1.0 m depth
- The highest stocks to a 1.0 m depth is found at Beach Bottom Farm (Table 1), and the lowest is found at Packer Farm (Table 2). These two farms are located less than 700 m apart.
- The highest stocks to 0.18 m depth is found at Accola Farm, the lowest is found at Western Research Farm (Table 3)

Summary and Future Work

Phase one of our project demonstrates the variability of SOC stocks across the state on a micro and macro-scale.

While MLRAs, and the distribution of Mollisols and Alfisols illustrate trends, they cannot capture micro-variability or the effect of management.

Future work will include the analysis of soil inorganic carbon (SIC) and total carbon (TC). SOC, SIC and TC will be calculated for corresponding pedons from the NCSS and field data. 'Carbon Reports' which address past and future management will be generated for each farm using the USDA's COMET-Farm tool.

References

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