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An Automated Method to Generate A, B, and C Soil Horizon Thickness Maps for Iowa

Introduction

The Gridded Soil Survey Geographic database (gSSURGO) is an Environmental Systems Research Institute (ESRI) ArcGIS file geodatabase delivered on a statewide platform. The gSSURGO database contains the highest level of detail for soil geographic spatial and tabular data compiled by the National Cooperative Soil Survey (NCSS). The 10-m resolution raster product is a flexible and convenient spatial layer that can quickly be joined with a variety of soil properties and interpretations to produce order 2 soil maps (Soil Survey Staff, 2018).

During the first 100 years of the soil survey program in the United States, soil surveys were completed on a county by county basis to meet local demands for land management planning. Therefore, soils information was subject to varying influences of expert decision making made by each county. Prior to the digitization of soil maps and development of gSSURGO, soils information was seldom used for broad-scale analyses and interpretations. When researchers attempt to expand their swath of spatial soil analyses, the inherent subjective variation creates inconsistencies across county lines. The NCSS has implemented the Soil Data Join Recorrelation initiative in an attempt to 'harmonize' soils information, i.e. create "…continuous and joined coverage within the attribute database (Soil Science Division Staff, 2011) ."

Objectives

The purpose of this study was to utilize the ArcPy site package via the Python scripting language to perform Geographic Information Systems functions in ArcGIS on the gSSURGO database in an attempt to:

1. Create a script that automates the generation of A, B, and C master soil horizon thickness for the state of Iowa.
2. Elucidate potential inconsistencies and missing data within the Iowa gSSURGO database.

Methods and Materials

All processing on the fy2018 gSSURGO database was performed with Python version 2.7 and ArcGIS 10.6 for Desktop. All dominant component key fields from the component attribute table were joined to their respective soil map unit in the 10-m gSSURGO raster attribute table. Horizons for each dominant component from the chorizon attribute table were queried and selected based on master horizon designation. In the case of horizons with two master distinctions (e.g. AB), the first letter was used to assign master horizon designation. The sum of thicknesses for each respective master horizon was calculated and joined to the 10-m raster attribute table based on the component key field. Subsequent maps were generated with the ArcPy mapping module and exported to a PDF for viewing.

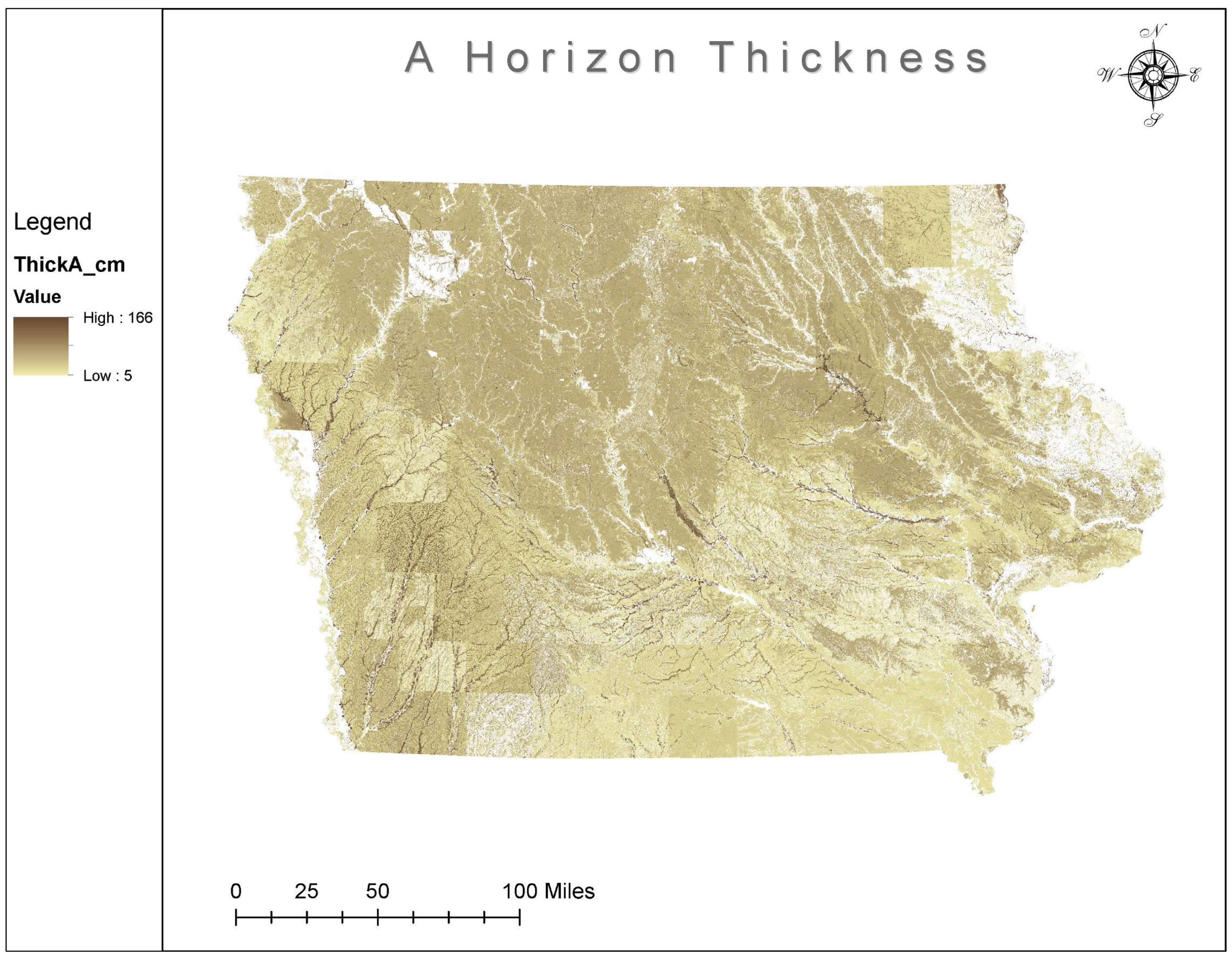

Figure 1. Thickness of the master A horizon based on map unit dominant component for Iowa.

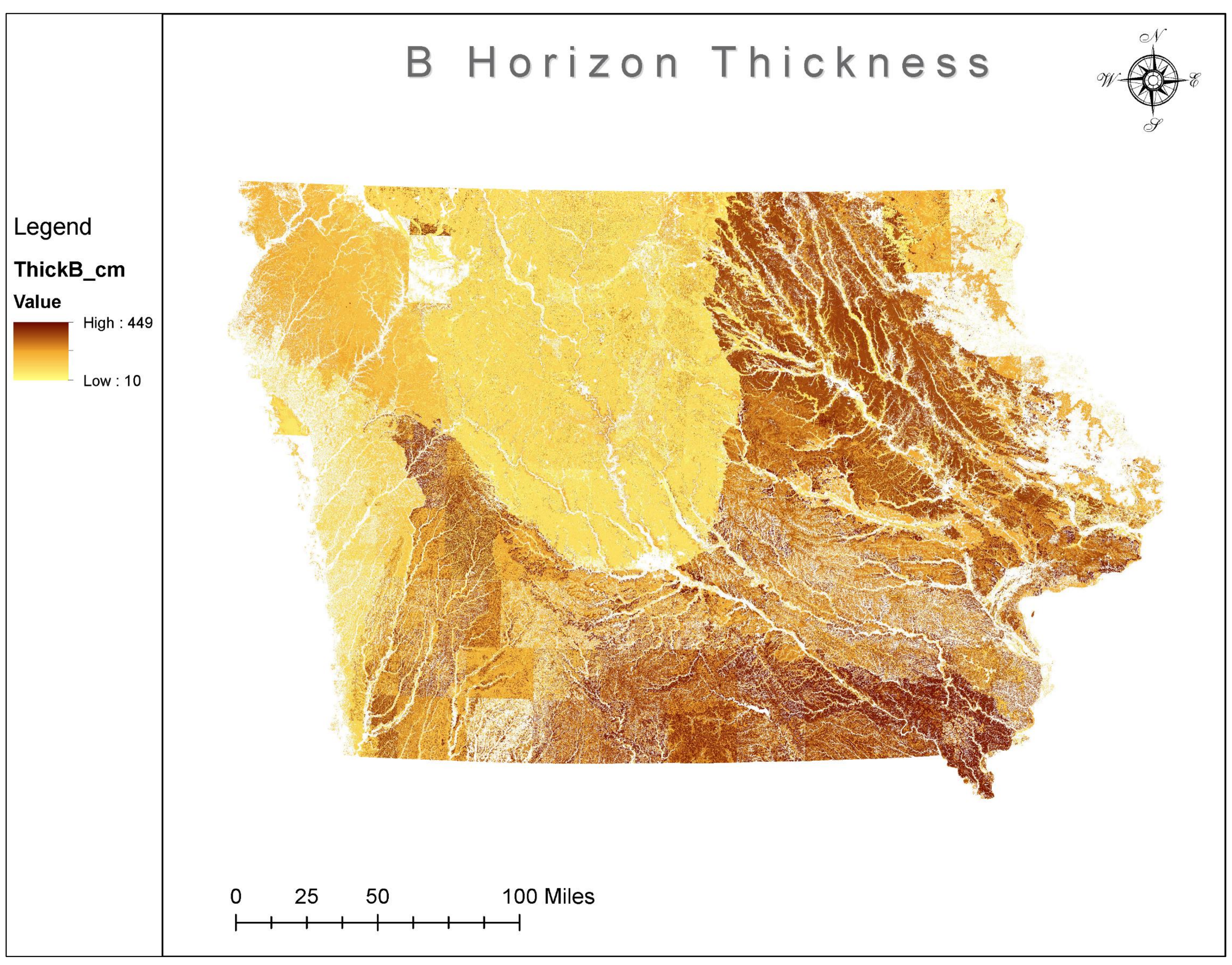

Figure 2. Thickness of the master B horizon based on map unit dominant component for Iowa.

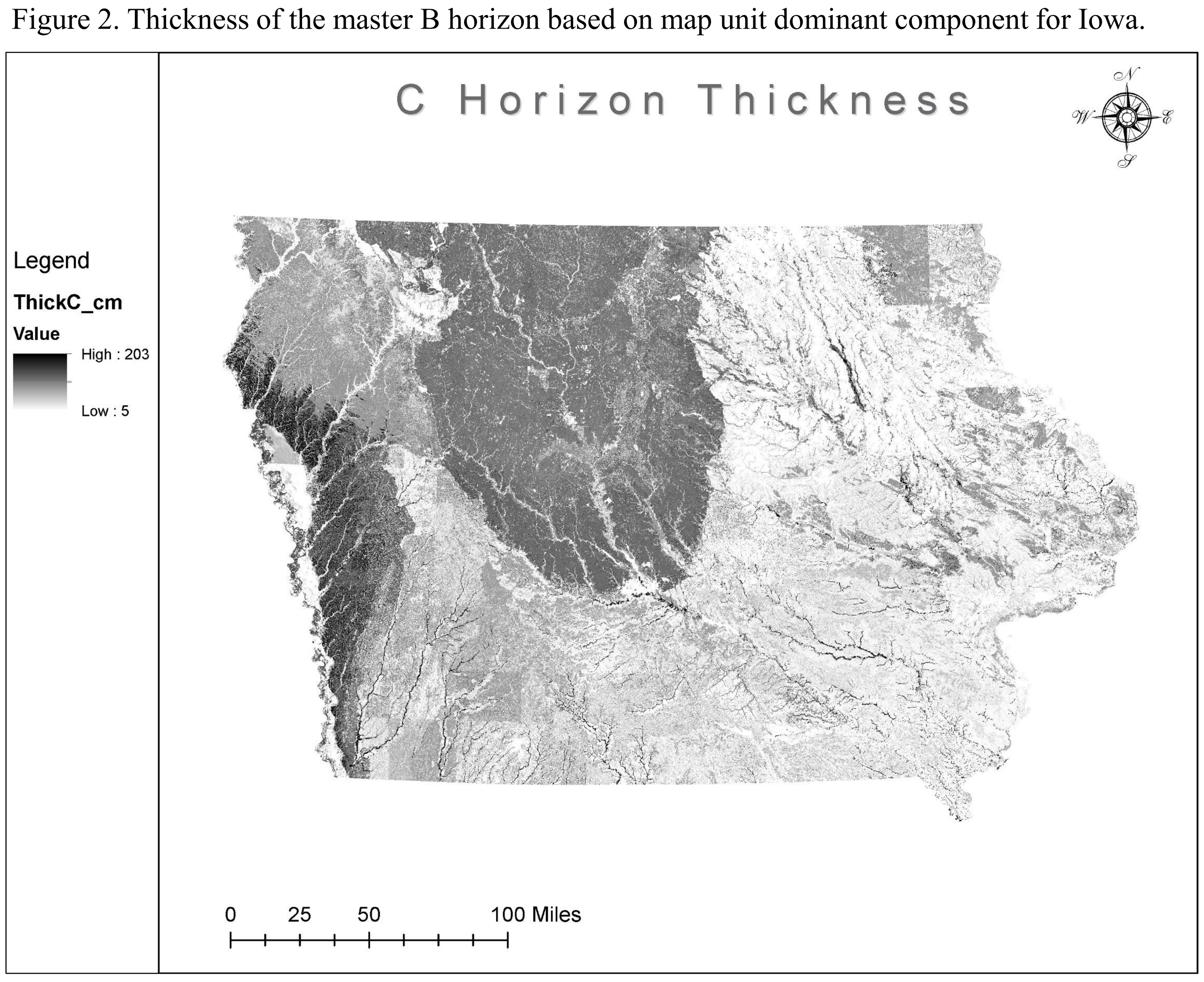

Figure 3. Thickness of the master C horizon based on map unit dominant component for Iowa.

Results and Discussion

It is apparent that there are some discrepancies in genetic horizon designation and thickness by county soil surveys. Government boundaries are clearly outlined by the symbology (Figs. 1-3). Furthermore, there are several areas missing dominant component horizon thicknesses which resulted in blank (white) areas (Figs. 1-3). Missing data are particularly noticeable in Clay county in the NW part of the state. This is problematic as the symbology for figure 4 becomes misleading and incorrectly displays a C horizon thickness of 5 cm. *A priori* knowledge of soil formation in the till landscapes of NW Iowa indicate this area should have a much deeper C horizon. It should be noted, that soils without master horizons in this study may not be displayed. Nonetheless, all maps provide an excellent display of major soil regions of the state as interpreted by the horizon thickness, an implicit indicator of differential pedogenesis. Lastly, scripting without a graphical user interface has its downfalls, as cartographically pleasing aesthetics are much more difficult to produce.

Conclusions

This study employed automated scripting in Python language via the ArcPy site package for ArcGIS on the 2018 gSSURGO for Iowa to generate maps that display the thickness of A, B, and C master soil horizons. Although the SDJR has made efforts to ensure continuous coverage for soil spatial and tabular data for the state, inconsistencies at county boundaries still remain. Furthermore, there are missing horizon thickness data in the gSSURGO database chorizon attribute table that should be addressed.

References

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