CART Soil Map Toolbox (version 3.0).

This is the user guide for **CART Soil Map Toolbox (version 3.0**). This version is compatible with ArcMap 10.4 – 10.6.1. Earlier versions of ArcGIS Desktop will not be able to run the tool, so please have ITS do an upgrade to at least 10.5 if this is an issue.

The purpose of the CART Soil Map Toolbox is to provide developers and soil scientists with more detailed information about the way soils data is being used by the CART application. Hopefully this information in the form of soil maps and reports can be used to improve queries for Soil Data Access and to validate the methods being used to summarize soils data to the land unit level. This ArcMap tool is not part of the actual CART application.

September 09, 2019

Input Spatial Data Layers

Input Data

The CART Soil Map tool is currently pulling data from three web services:

- https://sdmdataaccess.sc.egov.usda.gov
- http://csip.engr.colostate.edu:8083/csip-soils/d/wepot/2.1
- https://intapi.eauth.usda.gov/nrcs/cp/NRCS_RS_ConservationResourcesWQM/m/wqm/rfactor/1.2

These URLs are designed for handling AOI data requests from custom applications and do not have a webpage designed for web browsers.

Even though the databases behind the services contain spatial data, these three services are designed to return only data, not map layers. Soil Data Access can return coordinate data for soil features, but it requires a script to convert those coordinates into polygon geometry needed for a map layer.

Users may substitute a local PLU shapefile for the CLU web feature service.

Installation of the CART Soil Map Tool

Installation is one-time-process that does not require Admin privileges. Upgrading to a newer version would involve removing the old folder and then downloading the replacement from the NRCS-GIS Sharepoint at:

NRCS-GIS SharePoint Tools-CART

Unzip the CART_SoilsMap_Tools zip file to a convenient location on a local hard drive. Make note of the location so that it can be found again later. The toolbox contents are self-contained within a folder named **CART_SoilMap_Tools**. This folder has all the files needed to run the tool and contents must remain intact because of interdependencies.

Installation of the CART Soil Map Tool

CART_SoilMap_Tools folder contains the following files and folders:

1. Cart_Test_SoilMaps.mxd
2. CART Soil Map Toolbox.tbx
3. ToolData folder containing layers for ArcMap
    a. Common Land Units Feature Service 2013 Data with Labels.lyr
    b. Test_AOIs shapefile
    c. World_Imagery.lyr
4. Documentation: UserGuide_CART_SoilMap_Toolbox.pdf
5. Other subfolders: Documentation, Scripts

Running the CART Soil Map Tool

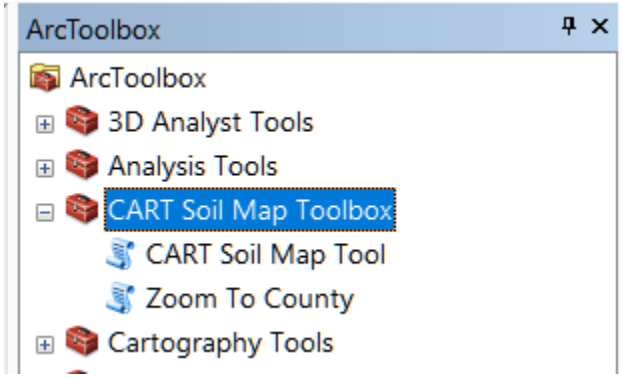
Five steps required to generate a series of CART soil maps

1. Open the Cart_Test_SoilMap.mxd. Please note. If you have problems opening the mxd, you can simply add the toolbox and even the layer files (Common Landunits and World Imagery .lyr) to your own ArcMap session. The background layers are all online, so it may take several seconds initially for the map to display.
2. Begin by selecting a couple of the Common Land Unit polygons to serve as an area-of-interest. Use the Select Feature tool in ArcMap. 
3. Please note, the Common Land Unit layer will not display below 1:50,000 scale and if more than eight polygons are selected, the tool will not run.

Running the CART Soil Map Tool

Five steps required to generate a series of CART soil maps (cont'd)

3. Open the CART Soil Map tool. If you are unable to expand the 'CART SoilMap Toolbox because the little 'plus' button on the left is missing, please contact support (see last slide).
4. Select a valid land units layer from the first choice list. The layer must have at least one polygon selected (blue highlight) in order to run the tool. If a ⊗ is displayed, hover the mouse cursor over it to see the error message.



Running the CART Soil Map Tool

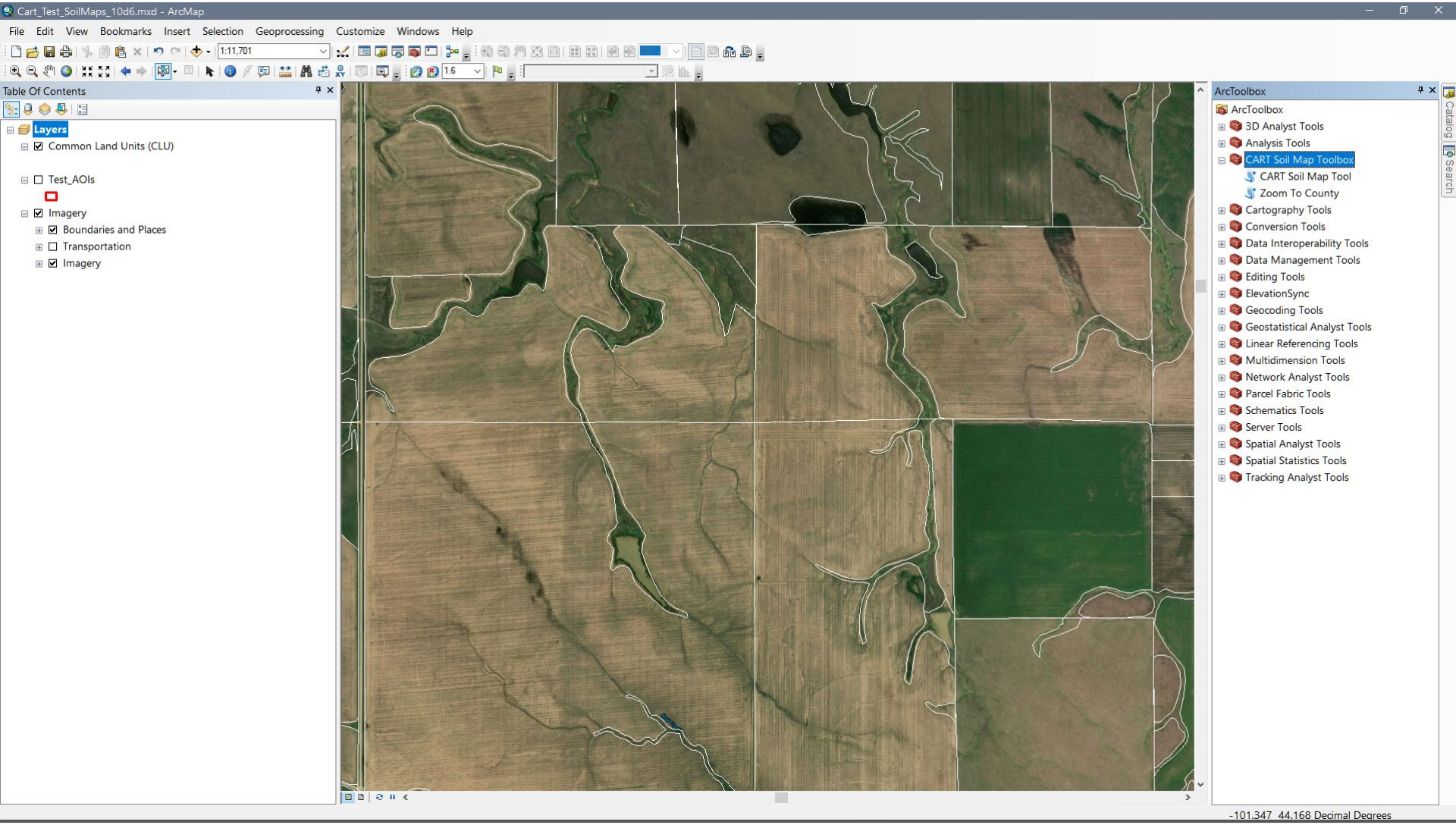
Five steps required to generate a series of CART soil maps (cont'd)

5. Set the output folder where the new geodatabase and other output data will be written. Output layers for the same land unit from previous runs may fail to overwrite until you quit out of ArcMap and start up again.

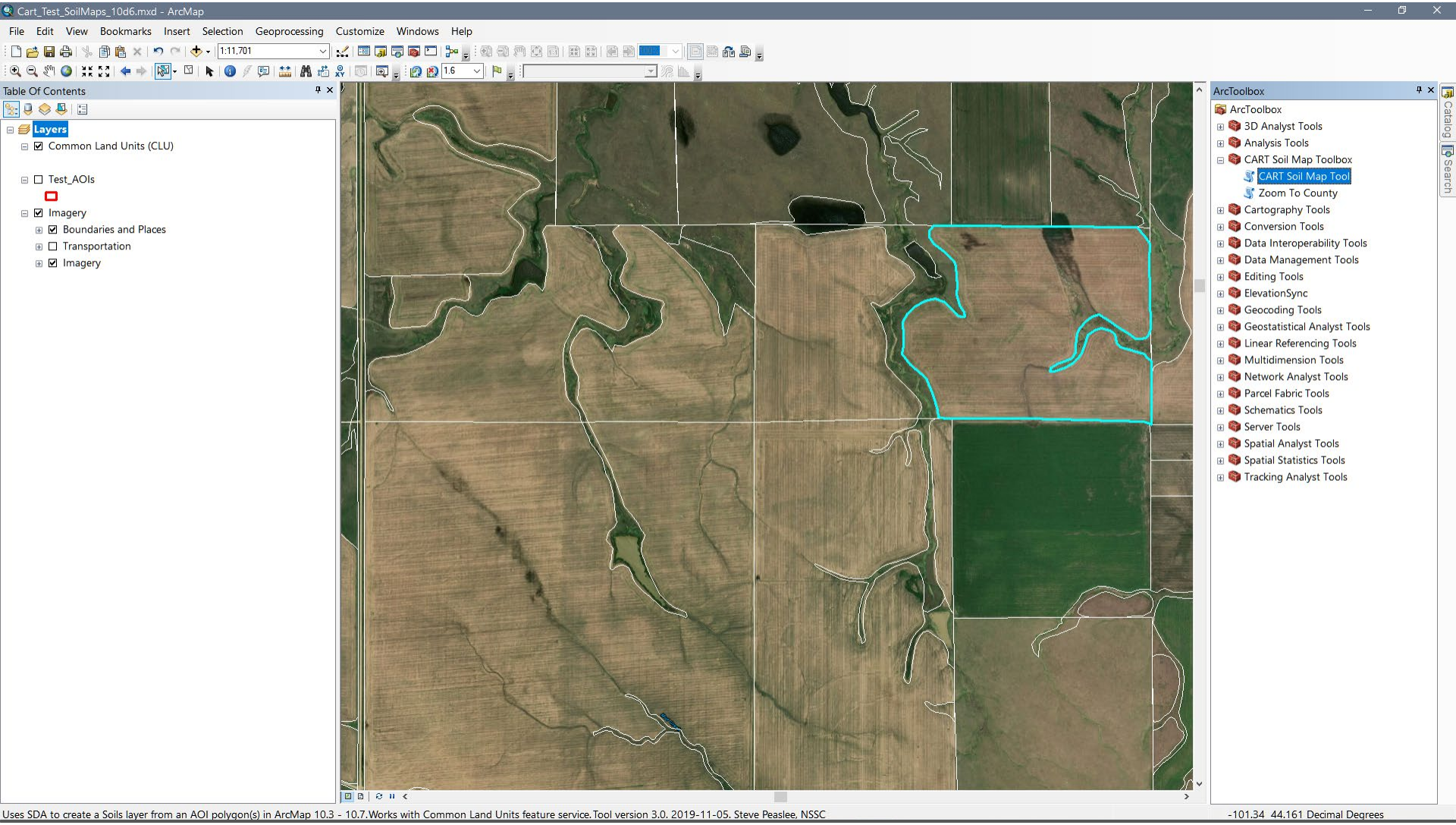
The following several slides illustrate the process and the tool output.

Contact information for assistance is on the final slide.

ArcMap project with imagery and 2013 CLU. The CART Soil Map Toolbox is highlighted.

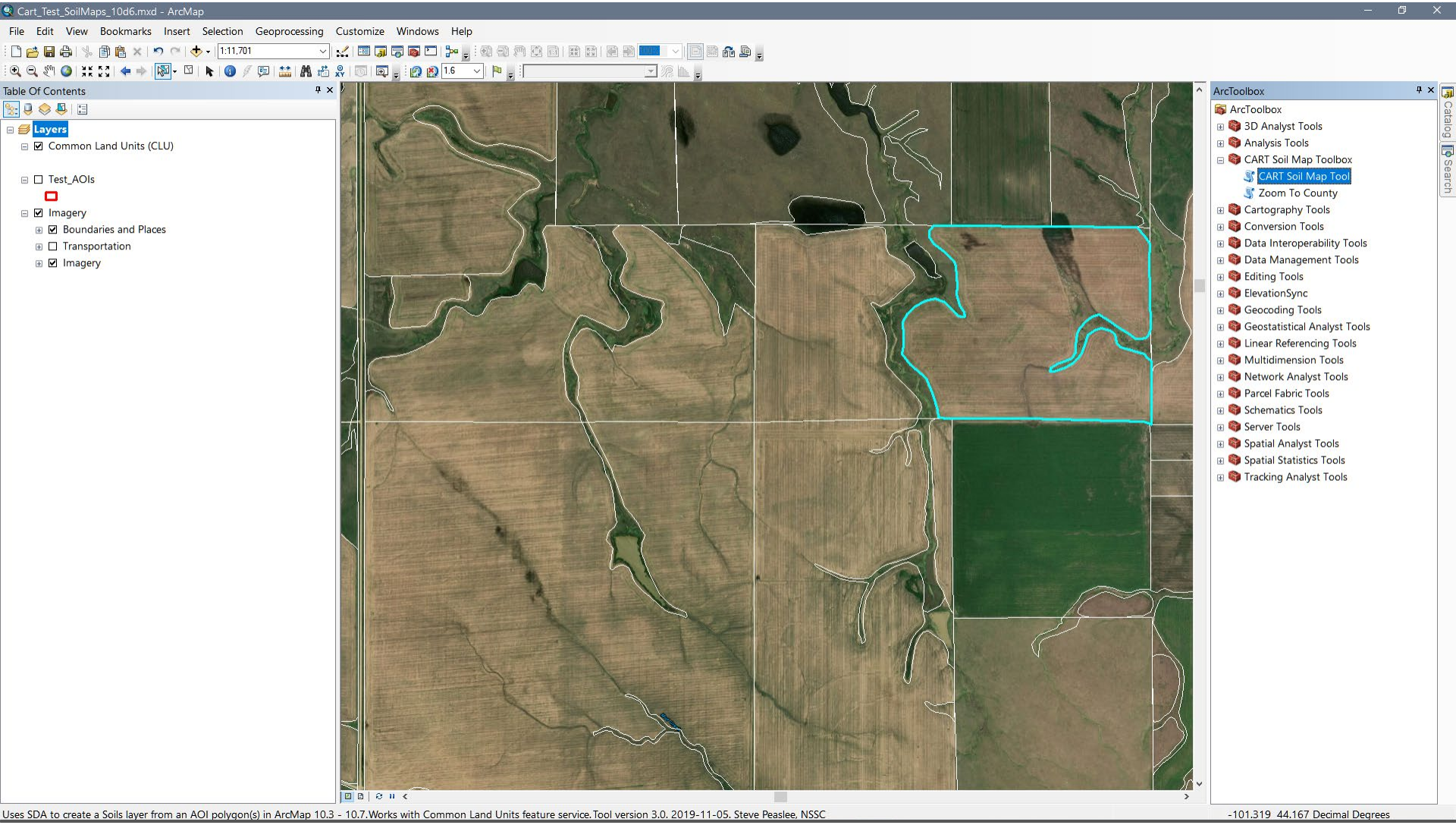


Select one or more land units to process (Select Features Tool). Maximum is eight.



The shift-click method works best when selecting multiple CLU polygons.

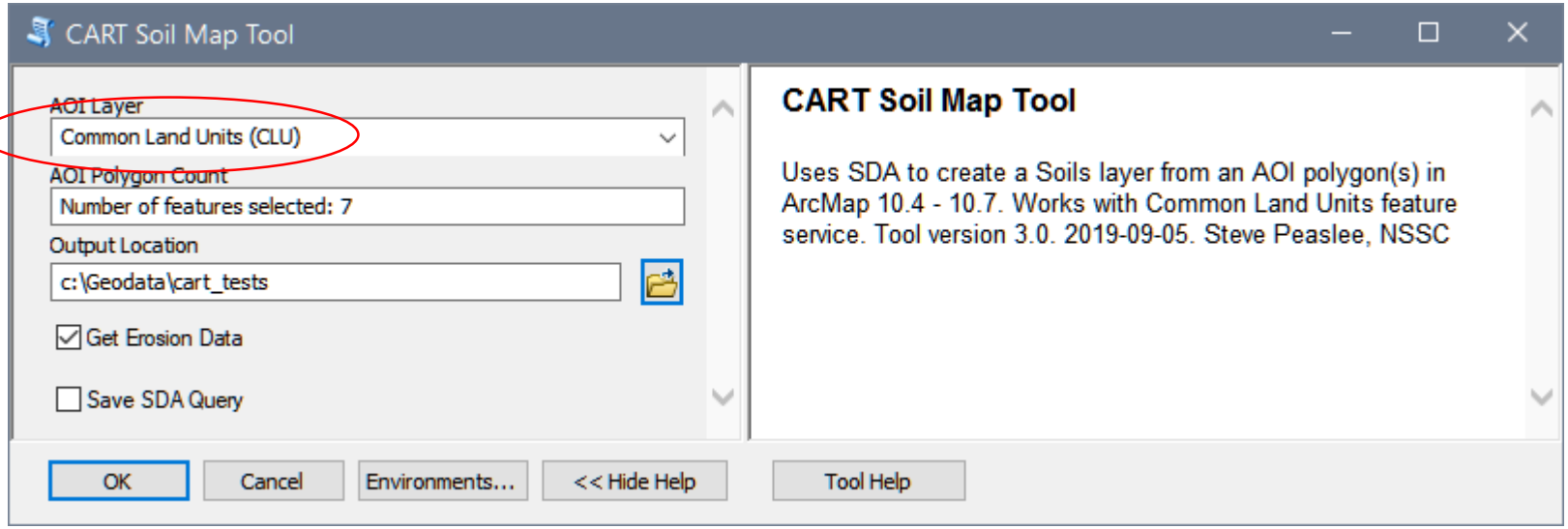
Double-click the ‘CART Soil Map Tool’ to execute.



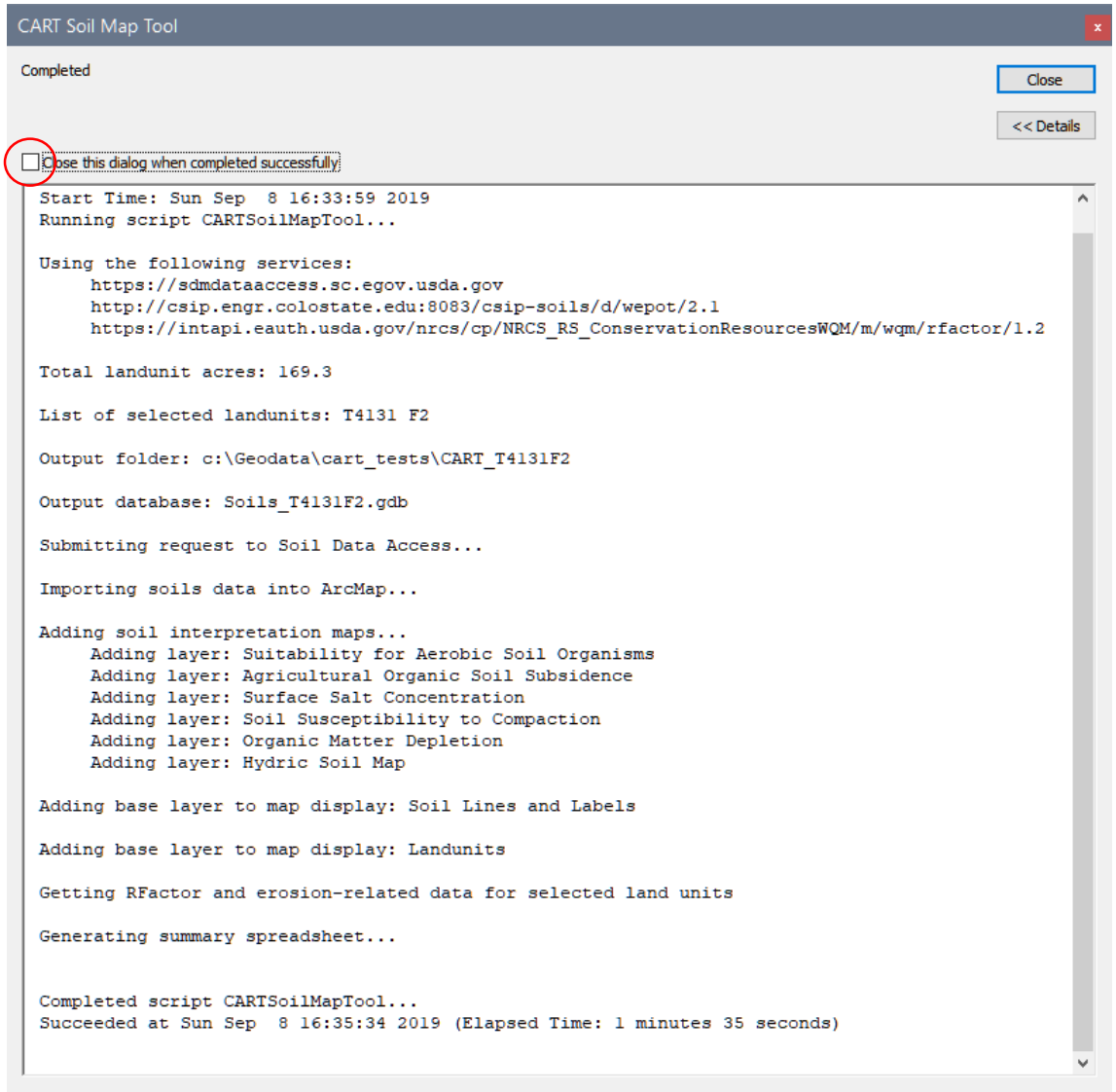
The CART Soil Map Tool menu…

If the ‘Common Landunit’ layer is present in the ArcMap table of contents (TOC), it will automatically appear as the first choice for the AOI layer. The user can switch to another layer in ArcMap by clicking the down arrow on the right side of ‘AOI Layer’. Valid choices are any polygon map layer containing ‘PLU_*’ or ‘CLU_*’ attribute fields.

User may set the ‘Output Location’ to any folder. A local folder is recommended for storing the output data. Tool help for each menu choice is available on the right side.

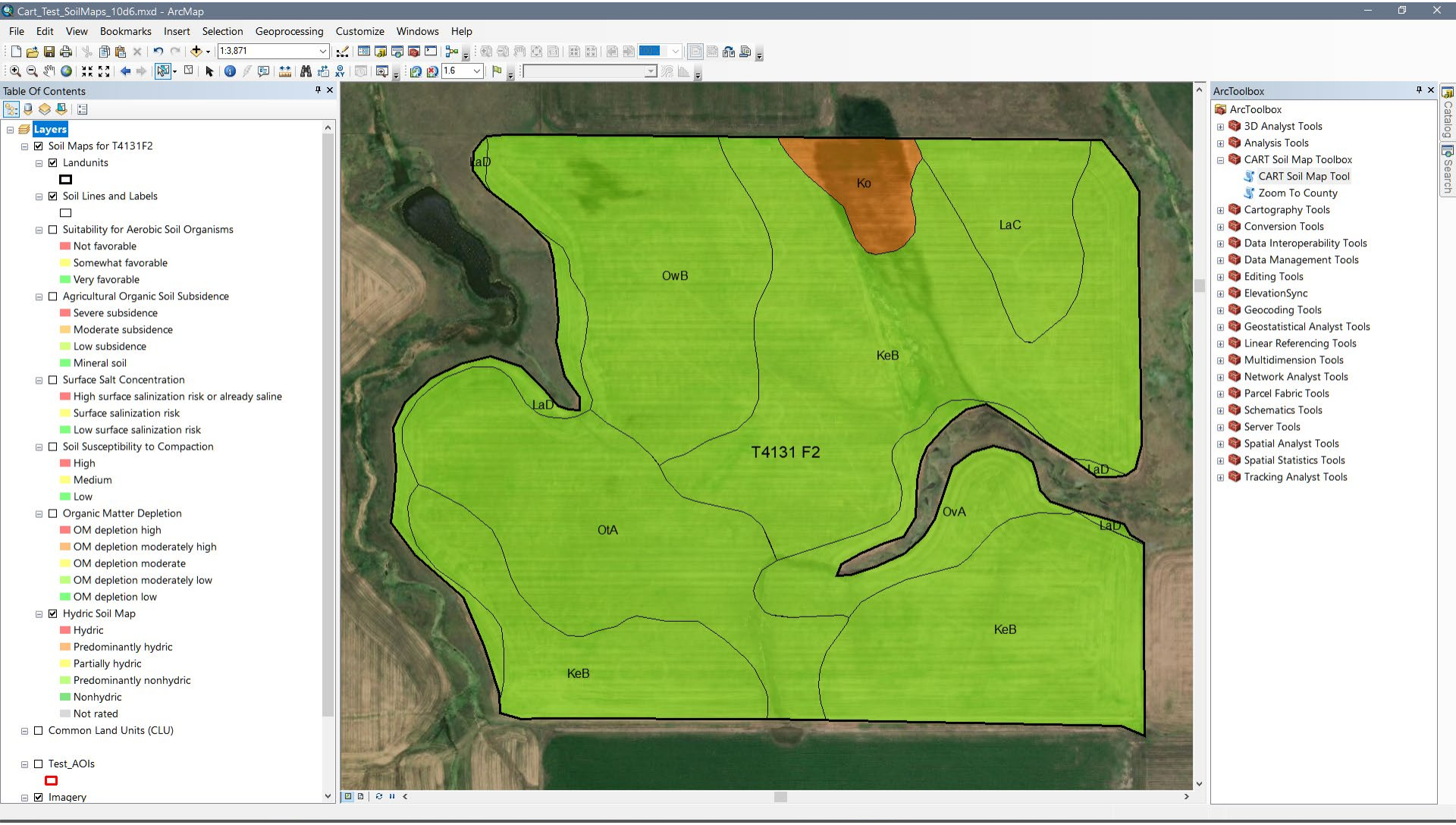


The tool console window displays status messages and processing time.



Uncheck the 'Close this dialog…' box in order to see any warnings or error messages.

Upon completion, the tool will display the hydric soil map and a spreadsheet will also pop up.

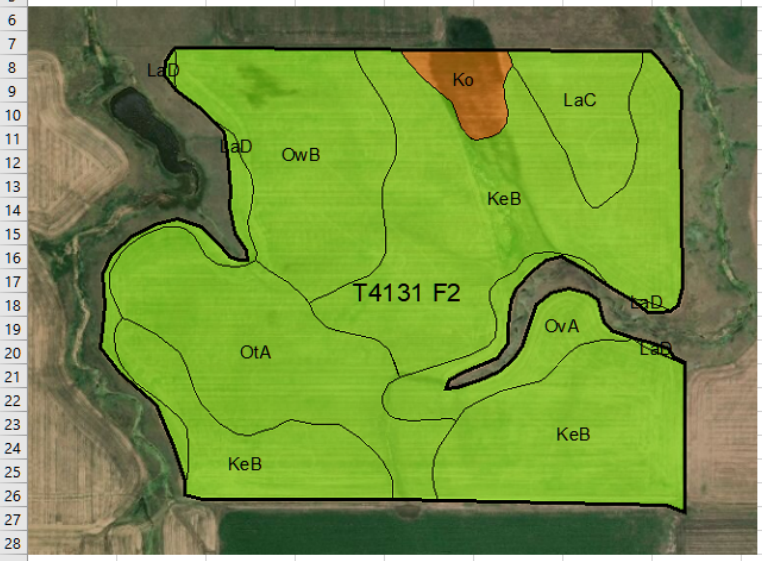


A series of soil map layers are generated. Only the hydric map is displayed initially.

The spreadsheet has several worksheet tabs. The first sheet contains the soils map.

Soils_T4131F2.xlsx - Excel

Hydric Soil Interp Map	
Landunits	T4131 F2
Acres	169.35

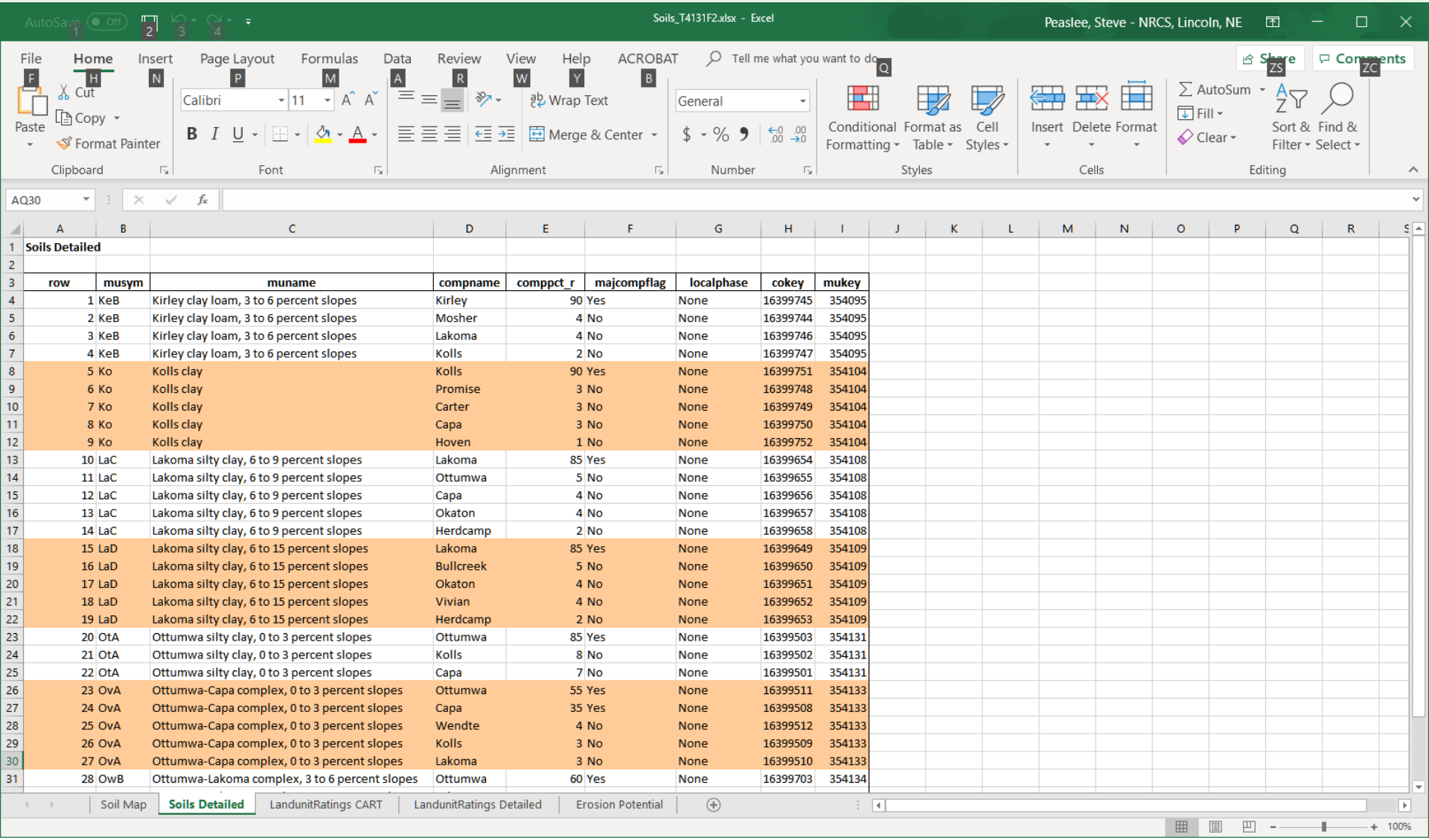


row	landunit	mukey	musym	muname	mapunit_acres	areasymbol
1	T4131 F2	354095	KeB	Kirley clay loam, 3 to 6 percent slopes	84.31	SD055
2	T4131 F2	354131	OtA	Ottumwa silty clay, 0 to 3 percent slopes	28.73	SD055
3	T4131 F2	354134	OwB	Ottumwa-Lakoma complex, 3 to 6 percent slopes	27.31	SD055
4	T4131 F2	354133	OvA	Ottumwa-Capa complex, 0 to 3 percent slopes	9.78	SD055
5	T4131 F2	354108	LaC	Lakoma silty clay, 6 to 9 percent slopes	9.63	SD055
6	T4131 F2	354109	LaD	Lakoma silty clay, 6 to 15 percent slopes	5.03	SD055
7	T4131 F2	354104	Ko	Kolls clay	4.57	SD055

Soil Map | Soils Detailed | LandunitRatings CART | LandunitRatings Detailed | Erosion Potential

Soils are grouped and highlighted by land unit.

The ‘Soils Detailed’ sheet contains a table of soil mapunit-component information.



Soils_T4131F2.xlsx - Excel

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AQ30

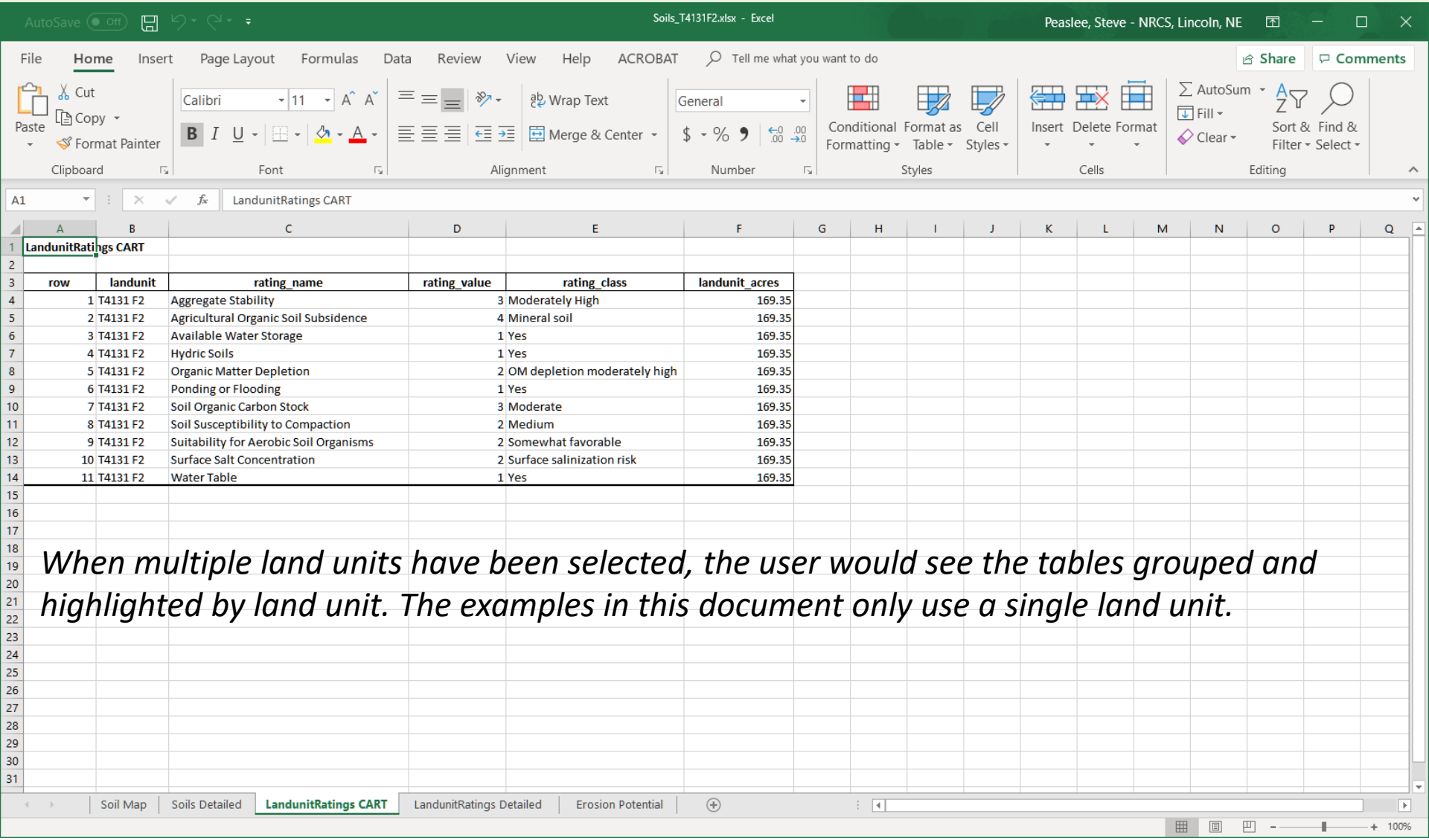
Soils Detailed

row	musym	muname	compname	comppct_r	majcompflag	localphase	cokey	mukey
1	KeB	Kirley clay loam, 3 to 6 percent slopes	Kirley	90	Yes	None	16399745	354095
2	KeB	Kirley clay loam, 3 to 6 percent slopes	Mosher	4	No	None	16399744	354095
3	KeB	Kirley clay loam, 3 to 6 percent slopes	Lakoma	4	No	None	16399746	354095
4	KeB	Kirley clay loam, 3 to 6 percent slopes	Kolls	2	No	None	16399747	354095
5	Ko	Kolls clay	Kolls	90	Yes	None	16399751	354104
6	Ko	Kolls clay	Promise	3	No	None	16399748	354104
7	Ko	Kolls clay	Carter	3	No	None	16399749	354104
8	Ko	Kolls clay	Capa	3	No	None	16399750	354104
9	Ko	Kolls clay	Hoven	1	No	None	16399752	354104
10	LaC	Lakoma silty clay, 6 to 9 percent slopes	Lakoma	85	Yes	None	16399654	354108
11	LaC	Lakoma silty clay, 6 to 9 percent slopes	Ottumwa	5	No	None	16399655	354108
12	LaC	Lakoma silty clay, 6 to 9 percent slopes	Capa	4	No	None	16399656	354108
13	LaC	Lakoma silty clay, 6 to 9 percent slopes	Okaton	4	No	None	16399657	354108
14	LaC	Lakoma silty clay, 6 to 9 percent slopes	Herdcamp	2	No	None	16399658	354108
15	LaD	Lakoma silty clay, 6 to 15 percent slopes	Lakoma	85	Yes	None	16399649	354109
16	LaD	Lakoma silty clay, 6 to 15 percent slopes	Bullcreek	5	No	None	16399650	354109
17	LaD	Lakoma silty clay, 6 to 15 percent slopes	Okaton	4	No	None	16399651	354109
18	LaD	Lakoma silty clay, 6 to 15 percent slopes	Vivian	4	No	None	16399652	354109
19	LaD	Lakoma silty clay, 6 to 15 percent slopes	Herdcamp	2	No	None	16399653	354109
20	OtA	Ottumwa silty clay, 0 to 3 percent slopes	Ottumwa	85	Yes	None	16399503	354131
21	OtA	Ottumwa silty clay, 0 to 3 percent slopes	Kolls	8	No	None	16399502	354131
22	OtA	Ottumwa silty clay, 0 to 3 percent slopes	Capa	7	No	None	16399501	354131
23	OvA	Ottumwa-Capa complex, 0 to 3 percent slopes	Ottumwa	55	Yes	None	16399511	354133
24	OvA	Ottumwa-Capa complex, 0 to 3 percent slopes	Capa	35	Yes	None	16399508	354133
25	OvA	Ottumwa-Capa complex, 0 to 3 percent slopes	Wendte	4	No	None	16399512	354133
26	OvA	Ottumwa-Capa complex, 0 to 3 percent slopes	Kolls	3	No	None	16399509	354133
27	OvA	Ottumwa-Capa complex, 0 to 3 percent slopes	Lakoma	3	No	None	16399510	354133
28	OwB	Ottumwa-Lakoma complex, 3 to 6 percent slopes	Ottumwa	60	Yes	None	16399703	354134

Soil Map | Soils Detailed | LandunitRatings CART | LandunitRatings Detailed | Erosion Potential

Soils are grouped and highlighted by soil map unit and sorted by component percent.

The ‘LandunitRatings CART’ sheet will contain summary ratings for each landunit.

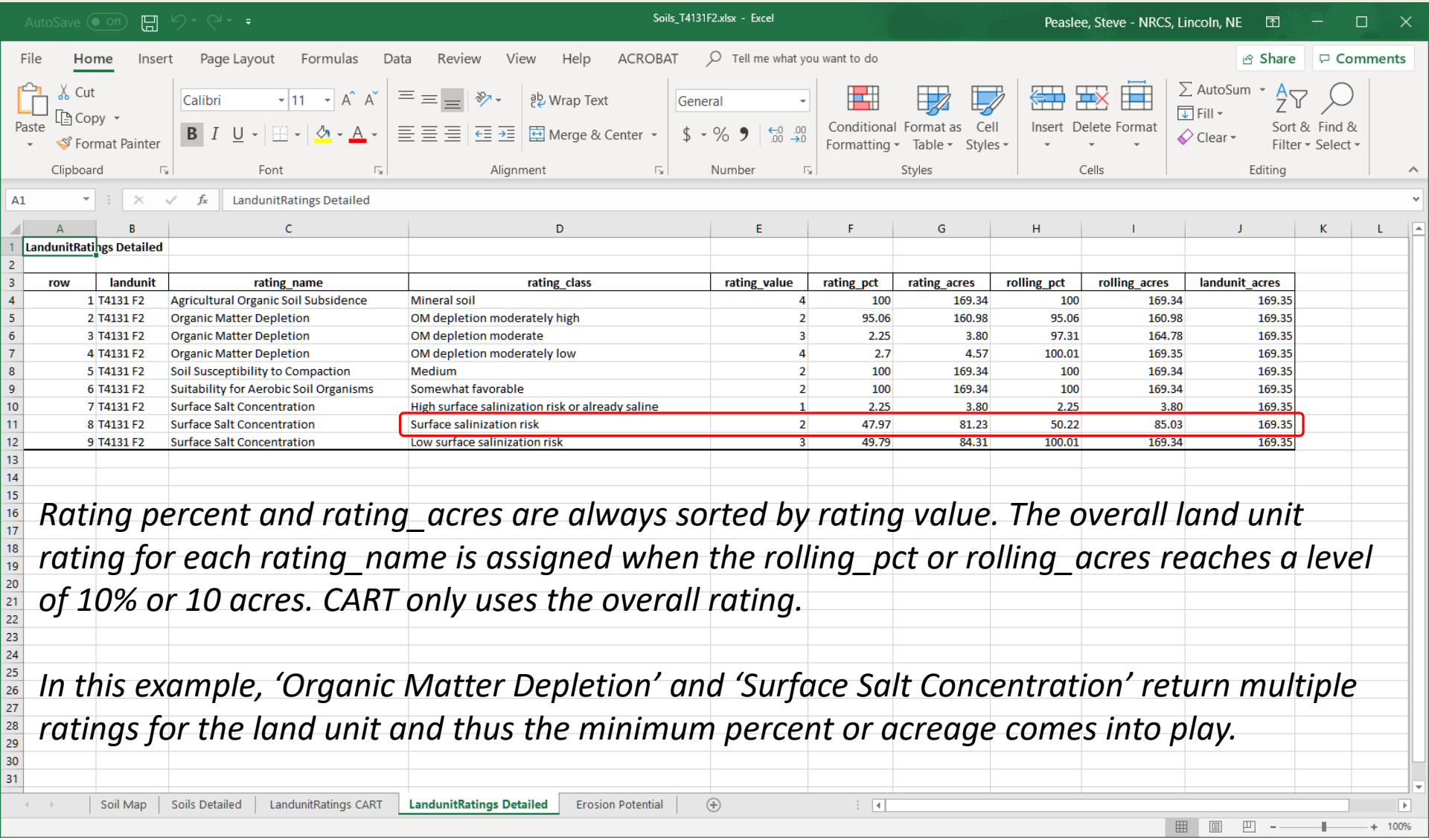


LandunitRatings CART

row	landunit	rating_name	rating_value	rating_class	landunit_acres
1	T4131 F2	Aggregate Stability	3	Moderately High	169.35
2	T4131 F2	Agricultural Organic Soil Subsidence	4	Mineral soil	169.35
3	T4131 F2	Available Water Storage	1	Yes	169.35
4	T4131 F2	Hydric Soils	1	Yes	169.35
5	T4131 F2	Organic Matter Depletion	2	OM depletion moderately high	169.35
6	T4131 F2	Ponding or Flooding	1	Yes	169.35
7	T4131 F2	Soil Organic Carbon Stock	3	Moderate	169.35
8	T4131 F2	Soil Susceptibility to Compaction	2	Medium	169.35
9	T4131 F2	Suitability for Aerobic Soil Organisms	2	Somewhat favorable	169.35
10	T4131 F2	Surface Salt Concentration	2	Surface salinization risk	169.35
11	T4131 F2	Water Table	1	Yes	169.35

When multiple land units have been selected, the user would see the tables grouped and highlighted by land unit. The examples in this document only use a single land unit.

The ‘LandunitRatings Detailed’ sheet will contain more detailed rating information.



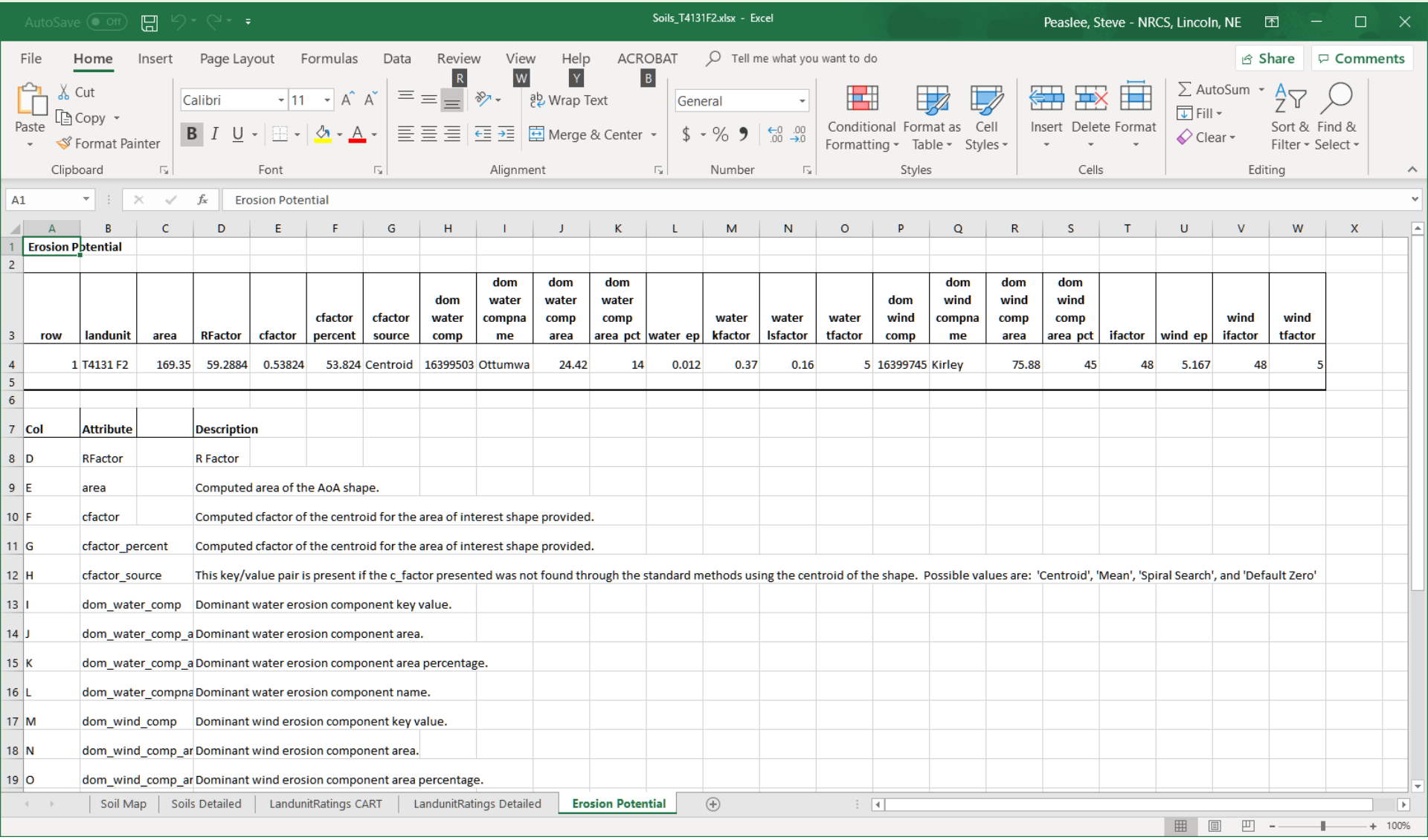
Soils_T4131F2.xlsx - Excel

row	landunit	rating_name	rating_class	rating_value	rating_pct	rating_acres	rolling_pct	rolling_acres	landunit_acres
1	T4131 F2	Agricultural Organic Soil Subsidence	Mineral soil	4	100	169.34	100	169.34	169.35
2	T4131 F2	Organic Matter Depletion	OM depletion moderately high	2	95.06	160.98	95.06	160.98	169.35
3	T4131 F2	Organic Matter Depletion	OM depletion moderate	3	2.25	3.80	97.31	164.78	169.35
4	T4131 F2	Organic Matter Depletion	OM depletion moderately low	4	2.7	4.57	100.01	169.35	169.35
5	T4131 F2	Soil Susceptibility to Compaction	Medium	2	100	169.34	100	169.34	169.35
6	T4131 F2	Suitability for Aerobic Soil Organisms	Somewhat favorable	2	100	169.34	100	169.34	169.35
7	T4131 F2	Surface Salt Concentration	High surface salinization risk or already saline	1	2.25	3.80	2.25	3.80	169.35
8	T4131 F2	Surface Salt Concentration	Surface salinization risk	2	47.97	81.23	50.22	85.03	169.35
9	T4131 F2	Surface Salt Concentration	Low surface salinization risk	3	49.79	84.31	100.01	169.34	169.35

Rating percent and rating_acres are always sorted by rating value. The overall land unit rating for each rating_name is assigned when the rolling_pct or rolling_acres reaches a level of 10% or 10 acres. CART only uses the overall rating.

In this example, ‘Organic Matter Depletion’ and ‘Surface Salt Concentration’ return multiple ratings for the land unit and thus the minimum percent or acreage comes into play.

The ‘Erosion Potential’ sheet contains data from the WEPOT and Rfactor services.



Soils_T4131F2.xlsx - Excel

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File Home Insert Page Layout Formulas Data Review View Help ACROBAT Tell me what you want to do Share Comments

Paste Cut Copy Format Painter Clipboard

Calibri 11 Font

Wrap Text Merge & Center Alignment

General Number

Conditional Formatting Format as Table Cell Styles Styles

Insert Delete Format Cells

AutoSum Fill Clear Sort & Filter Find & Select Editing

A1 Erosion Potential

Erosion Potential

row	landunit	area	RFactor	cfactor	cfactor percent	cfactor source	dom water comp	dom water compname	dom water comp area	dom water comp area pct	water ep	water kfactor	water lsfactor	water tfactor	dom wind comp	dom wind compname	dom wind comp area	dom wind comp area pct	ifactor	wind ep	wind ifactor	wind tfactor
1	T4131 F2	169.35	59.2884	0.53824	53.824	Centroid	16399503	Ottumwa	24.42	14	0.012	0.37	0.16	5	16399745	Kirley	75.88	45	48	5.167	48	5

Col	Attribute		Description
D	RFactor		R Factor
E	area		Computed area of the AoA shape.
F	cfactor		Computed cfactor of the centroid for the area of interest shape provided.
G	cfactor_percent		Computed cfactor of the centroid for the area of interest shape provided.
H	cfactor_source		This key/value pair is present if the c_factor presented was not found through the standard methods using the centroid of the shape. Possible values are: 'Centroid', 'Mean', 'Spiral Search', and 'Default Zero'
I	dom_water_comp		Dominant water erosion component key value.
J	dom_water_comp_a		Dominant water erosion component area.
K	dom_water_comp_a		Dominant water erosion component area percentage.
L	dom_water_compna		Dominant water erosion component name.
M	dom_wind_comp		Dominant wind erosion component key value.
N	dom_wind_comp_ar		Dominant wind erosion component area.
O	dom_wind_comp_ar		Dominant wind erosion component area percentage.

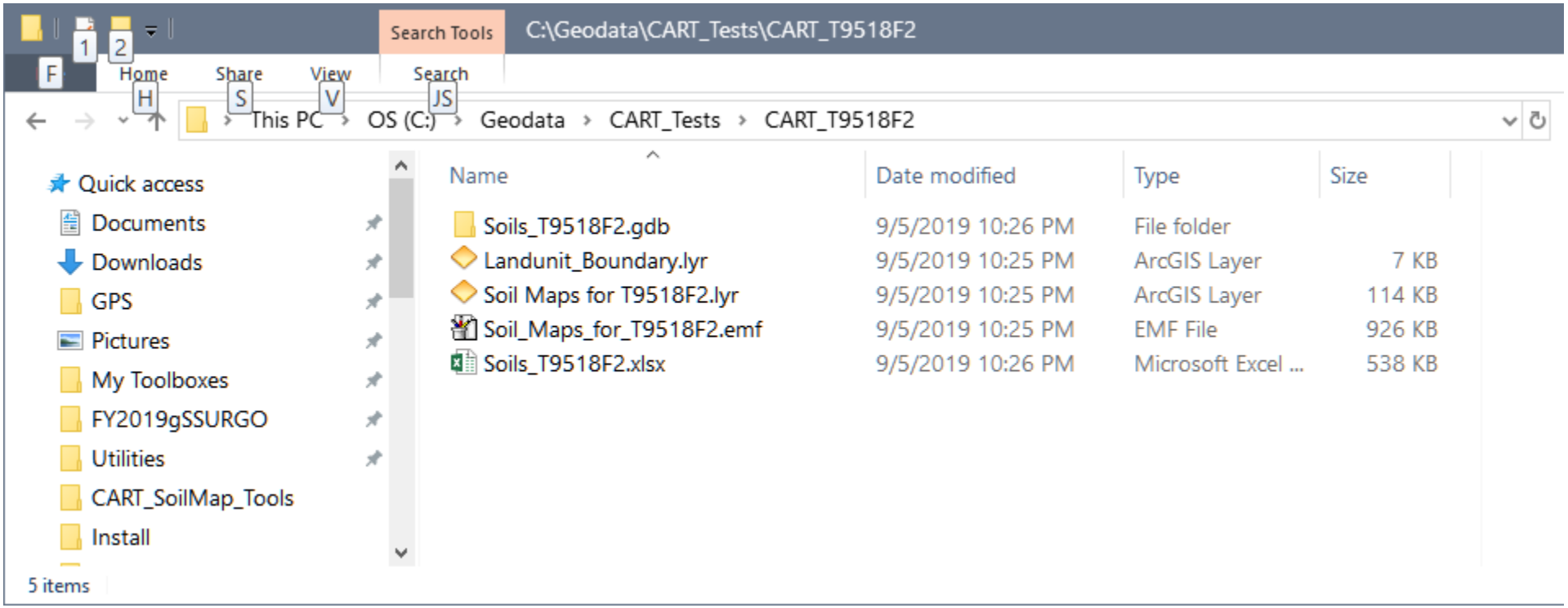
Soil Map | Soils Detailed | LandunitRatings CART | LandunitRatings Detailed | Erosion Potential

100%

The ‘Erosion Potential’ sheet contains data from the WEPOT and Rfactor services.

Below is a screenshot of Windows File Explorer with an example of the types of data created by the tool. The folder and most data files have the land unit identifier incorporated into the name.

The Soils geodatabase and .lyr files can be added to other ArcMap documents and even zipped up for distribution. All data paths are relative so keep the contents intact if the folder is moved.



Help!

In case of problems with installation/tool execution or if there are general questions, please contact: Steve Peaslee, National Soil Survey Center. steve.peaslee@usda.gov

The CART SoilMap ArcToolbox is compatible with ArcMap 10.4 through 10.6. It has not been tested with 10.7, but I wouldn't expect any issues.

To obtain support, tool errors should be captured by highlighting all tool messages from the very first line in the tool window to the very last line. Copy-paste the text (using Ctrl-C) into an e-mail to support. If the tool window is small you may have to expand it or scroll to the top to make sure none of the text is missed. See slide 12 for an example of what the tool messages normally look like. Sending message text rather than a screenshot is preferred because it is easier to read and the text should contain all input parameters plus the error message.

Periodic tool updates and documentation will be posted at: NRCS-GIS SharePoint Tools-CART