

Notes from Geospatial/GIS Meetup May 13, 2025

Zoom

Attendees: Janet Reyes, facilitator

Via Zoom: Adeyemi Ifeoluwa, Andrew Haglund, Bhawana Acharya, Brendon Wheeler, Elia Scudiero, Luciane Musa, Luis Barrios, Mike Cohen, Nan Li, Tiffany Larrabee

Announcements

This meeting was recorded; video is available [here](#). The passcode to view is z4^S@zk=

The [Esri Imagery & Remote Sensing Educators Summit](#) virtual event is being held May 14-15, with a variety of sessions occurring over a three-hour span each day.

[UCANR](#) will be providing the 9th annual [DroneCamp](#) on June 23-27. Virtual participants will have live access to all the lecture presentations; in-person participants will additionally have flight workshops.

In San Diego in July, the [Esri Education Summit](#) will take place from the 12th-15th; the [User Conference](#) will be held from the 14th-18th. UCR has one complimentary pass remaining. Free virtual attendance is an option for many User Conference sessions.

Thanks to the State of California Department of Technology, UCR affiliates now have access to 2024 [Hexagon](#) imagery in ArcGIS Online and ArcGIS Pro. The imagery covers the state of California with 15 cm resolution. The WMTS service provides natural color imagery; the WMS service provides both color and color infrared. According to the DoT, "The data may be used for machine learning, archival work, and publications, among other uses" including public-facing apps. To access Hexagon,

- ArcGIS Online: go to Content > My organization and search for "Hexagon."
- ArcGIS Pro: in the Catalog pane go to Portal > My organization and search for "Hexagon." Drag and drop one or both of the services into the Map pane.

Presentation

Nan Li, Assistant Project Scientist in Environmental Sciences, gave a presentation titled **From Prairie to Crop: Spatiotemporal Dynamics of Surface Soil Organic Carbon Stocks Over 160 Years in Illinois.**

Soil organic carbon (SOC) is important for its role in storing and releasing nutrients essential for plant growth. Other benefits of SOC are increased soil porosity (which leads to more water and air available for plant roots) and the capturing of atmospheric carbon (sequestration). Poor management and farming practices over the years have led to decreasing levels of SOC, which in turn leads to declines in productivity and in healthy plant growth. Mapping the SOC stock accurately is crucial for evaluating carbon sequestration potentials. Looking at the change in SOC stock over time helps in understanding the impacts of different types of land use and improves the accuracy of future predictions.

The objectives of this study were to estimate the SOC stocks in Illinois, reconstruct 1845 SOC, and quantify spatial changes in SOC stocks from 1845 to 2012.

According to the [Public Land Survey System](#), in the 1800s a large percentage of Illinois' land cover was prairie, with a concentration of forested areas in the south. By 2012, much of the land in Illinois had been transformed to agriculture, with significant growth in urban development as well. Less than 1% of the original prairie and 18% of the forest cover remains.

This study used data from the [National Cooperative Soil Survey](#) (NCSS) as well as information from peer-reviewed publications on SOC in undisturbed prairie and forests. [Pedons](#) were harmonized to a depth of 30 cm. Environmental covariates were soil, elevation, and land use, which would be used as predictors. For the model, relevant information from each of the covariates was brought together to create a so-called covariate stack. NCSS data was aggregated and then combined with sample sites and the covariate stack to create a matrix.

The research team used the [random forests](#) model machine learning algorithm to learn the relationship between the SOC and the environmental variables. Once tuned and tested, the model was used to predict SOC across the state of Illinois.

The validation results showed that the model performed well in predicting current SOC stock. Next, the researchers used space-for-time substitution to model the SOC stock for 1845. By observing the current relationship between SOC and plant variations and projecting the distribution of plants back in time, they could map the projected SOC distribution in 1845.

The researchers compared the 250-meter pixel values of the SOC stock maps for 1845 and 2012 to calculate net change. Areas that were formerly prairie exhibited the largest decline in SOC. In the hilly parts of southern Illinois where disturbance has been minimal and conservation practices have been enacted, a net increase in SOC stock was calculated. This provides hope that with appropriate land management, levels of soil organic carbon could be replenished in heavily impacted areas. The maps can help land managers and policymakers prioritize areas for intervention.

Limitations of the study included low sample density in some regions, the coarse resolution of historic land use/land cover data, and the need for better datasets for erosion and drainage. Future work might include integrating remote sensing information such as LiDAR and SAR and attempting to predict subsoil SOC dynamics.

Discussion

Luis asked if the researchers used the van Bemmelen factor* in their calculations. Nan replied that they didn't; the study was broad and needed to rely on previous studies that already provided information on SOC stocks.

Janet asked whether the researchers had looked at the length of time an area had been in its new land use/land cover; if so, did that correlate to the amount of the SOC loss? Nan replied that this presentation was a summary of the study; in publications, the team has discussed that they'd also calculated SOC for the 1940s and 1980s. Most of the SOC loss occurred between 1845 and the 1940s.

Janet also asked whether farmers currently have economic motivation to improve the SOC stock on their lands. Nan said that farmers have adopted some practices, such as reduced tillage or protecting the land in winter from erosion, that also help preserve SOC stock. Mostly it is government agencies who are aware of the bigger picture that are motivated to make changes.

Finally, Janet asked whether this type of study has been conducted in other locations. There have been some global studies at very coarse resolution. SOC loss has also been studied in Wisconsin, where climate data was also factored in. But because the climate in Illinois hasn't changed significantly since 1845, such data wasn't incorporated in this study.

* a conversion factor to estimate soil organic matter from SOC

Contact

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