Science Societies

From asphalt to ecosystem: Spatial data creates a story

By Alison Jennings

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Graduate students from the University of Wisconsin–Madison (UW–Madison) visiting Society headquarters. From l to r: Arik Waldinger, Annelies Quinton, Ava Beyers, Matteo Franke, Connor Kasper, Chenchen Deng. Not photographed: Brittany Juneau and Michal

Laszkiewicz. Photo courtesy of Susan Chapman.

In a previous issue of *CSA News*, we described a new initiative to evaluate the ASA, CSSA, and SSSA headquarters using soil and environmental health parameters. Here, we have a brief update about how the project has progressed since the initial soil health assessment, with an interactive, narrative-rich StoryMap.

Have you ever wondered how a hydrologist might monitor water availability? How an ecologist might track the presence of an endangered species? How a city planner might decide where to build a park, and how they'd determine the public transportation route to get there?

Modern-day problem solving is built off the questions "who," "what," "when," "why," and, now more than ever, "where." *Where* is the water flowing? *Where* do the endangered animals live? *Where* should the public park go—*where* are the most families in need of extra green space?

All of these questions can be answered with data points that are tied to locations. *Spatial data* are data attributed to precise locations within a landscape. Can you put a datapoint on a map? Can you relate it to another datapoint through distance, proximity, or other boundaries? If yes, then it's spatial data.

These kinds of data can be gathered with the help of several kinds of modern-day technologies, such as Global Navigation Satellite Systems—satellite systems like GPS—and Geographic Information Systems (GIS), which collect, map, and analyze spatial data in order to uncover hidden patterns from the environment.

One of the most well-known uses of GIS is its ability to map and visualize data. Its graphical output helps researchers communicate large amounts of complex information. Maps made through GIS are "kind of like Google Maps completely on steroids," says Michal Laszkiewicz, graduate student in the Environmental Observation and Informatics (EOI) program at the University of Wisconsin–Madison (UW-Madison). "[GIS is] completely customizable, so you can make measurements, you can add things, you can take away things. You have complete control," he says.

Last year, Laszkiewicz and other EOI graduate students helped a UW-Madison undergraduate Soil and Environmental Science (SES) capstone class attach soil health data—such as soil pH, soil nutrients, and soil moisture—to specific areas of the property where the ASA, CSSA, and SSSA headquarters is located, in order to analyze spatial patterns of the site and potential suitability for green infrastructure.

The suburban office space in Madison, WI is actively undergoing a student-led project to turn the conventional landscape into a functioning ecosystem—and that all starts with the property's soil.

The undergraduate students collected soil samples, took those samples to the lab, and assessed the soil's physical and chemical properties. Meanwhile, the EOI graduate students analyzed this data to see how soil metrics changed across the office's landscape, says Dr. Edward Boswell, environmental scientist and teaching faculty at UW–Madison.

Boswell, who teaches classes in GIS and Geodesign, mentored the EOI students throughout their portion of the project. Since most graduate students in the EOI program already have a background in some kind of spatial data analytics, Boswell tries to structure his classes with practical experience and community-based learning instead of lectures. Working with the SES capstone class was the perfect opportunity to hone his students' skills.

Undergraduate students from the university's Department of Soil and Environmental Science (SES) assessed the site's soil properties before graduate students in the Environmental Observation and Informatics (EOI) program mapped the data. Photo courtesy of Lexie Hedrick.

Before the work really began, the graduate students sat down with the SES students to see what needs the capstone class had and how GIS could support their analysis. “The things that we often talk about in lecture—about deciding which type of data you want to collect, how you want to collect the data, what data are necessary to answer your questions—those are sort of easy to discuss in the classroom, but they come to life when you sit in a room like we did,” says Boswell. One tool that helped the SES students was created by Brittany Juneau, who led efforts to create a smart form for easy data analysis and mapping using ArcGIS Survey123. The survey allowed the field workers to record sampling locations where a piece of data or photograph were taken.

Once lab and fieldwork were done, many of the findings were curated in an ArcGIS StoryMap, an illustrated, narrative way to display information. “A StoryMap is really beneficial because it can take these complex maps and the data that’s been collected and puts them into a much more user-friendly and readable way of understanding it,” explains Annelies Quinton, EOI student. “It tells a story of what's happening.”

These kinds of narratives really shine when communicating scientific information in an engaging or digestible way, says Boswell, who adds that the maps can be as technical or as broad as you’d like, depending on your audience. Students chose to make the *Asphalt to Ecosystem* StoryMap into a broader narrative to communicate the scientific details of the project to the general community, with simple explanations of the science, lots of videos and photos, and a rich narrative surrounding the data visualizations.

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The EOI students drafted the initial StoryMap, which later translated into the current version, designed and updated by Dr. Janet Silbernagel of Silvernail Geodesign. Concurrently, landscape architecture student Jayita Burman, under the guidance of Dr. Silbernagel, designed potential landscape plans based on the findings of the two student groups. Both the fall analysis and spring design processes have been documented in the most recent version of the StoryMap, which explains the project background, current results, and future directions.

Acknowledgments

The Soils and Environmental Science (SES) capstone class is taught every year by Dr. Nick Balster, professor of Soil Science at the University of Wisconsin–Madison. The 2025 students were: Owen Weisse, Luke Sprecker, Megan Zlimen, Haley Bondoc, Lexie Hedrick, Cammy Whitcomb, Boya Shi, Caitlyn Garb, and Yier Fan.

Environmental Observation and Informatics (EOI) master's students Ava Beyers, Chenchen Ding, Matteo Franke, Brittany Juneau, Connor Kasper, Michal Laszkiewicz, Annelies Quinton, and Arik Waldinger were mentored by Dr. Edward Boswell, teaching faculty at the University of Wisconsin–Madison.

Dr. Janet Silbernagel, owner of Silvernail Studio for Geodesign, created the current version of the Asphalt to Ecosystem StoryMap and guided senior intern Jayita Burman in designing a sustainable landscape for the Societies.

The ACSESS Sustainability Committee, led by Rebecca Funck, Susan Chapman (formerly, now retired), and Keith Lovejoy, coordinated this ongoing project.

View StoryMap

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