



Using GIS to Support Conservation and Land Management: Q & A with TNC-LF's Spatial Analyst Sarah Hagen

If you've clicked on LANDFIRE's interactive Web-Hosted Application Map (aka the [WHAM!](#)), you've touched base with GIS Analyst Sarah Hagen, its creator and manager. Perhaps you reached for spatial data resources to guide plans for restoring vibrant green infrastructure to crowded urban spaces, or needed information to support plans for forest protection in the Midwest. Maybe you took a trip to Africa or checked on the feasibility of launching RX fire programs in certain geographies. If so, you've touched on a few of Sarah's many collaborations with partners and colleagues across the globe. To her, GIS deals with the "where" in the equation. She notes, "We're really good at 'what' and 'how' and even 'why,' but without GIS, we'd struggle more with the question of where action on the ground can be the most effective." LF asked her to expound on three W's and an H: What, How, Why, and Where.



Sarah Hagen joined The Nature Conservancy (TNC) in 2006 while a graduate student at the University of Wisconsin. Since then, she has worked for two state chapters and several multi-state regional programs, and for the last decade has split her time between TNC's LANDFIRE program and the Conservancy's Illinois Field Office (ILFO) science team. She is a spatial ecologist at the latter, working with Director of Science Dr. Maria Lemke on a variety of local, state, and regional projects that require both ecological and mapping components. At LANDFIRE, Sarah provides the GIS foundation for the five-person team's work.

In addition to the WHAM!, which highlights projects using LANDFIRE data and tools across the U.S., Sarah's projects include leading the GIS and historic fire analysis in the Illinois Fire Needs Assessment; developing the [Chicago Greenprint](#), an online, interactive map that helps TNC and partners make informed decisions about urban conservation work; and leading the terrestrial mapping effort for [Protect Land and Water Strategy](#) development in TNC's Midwest Division, where she plans to incorporate LANDFIRE data and tools to help the Division determine protection priorities for the next fifty years. Her degrees are from the University of Wisconsin, and she is based in Minneapolis.

How did you find LANDFIRE or LANDFIRE find you?

LANDFIRE and I found one another by happy accident. In 2009, I was a GIS Analyst for TNC's Central U.S. region when TNC-LANDFIRE Program Lead Jim Smith contacted my supervisor, looking for a spatial analysis to help with a large-scale, national GIS analysis for a project funded by the Departments of the Interior and Agriculture. Having just wrapped up work with the Upper Mississippi River Program, I was able to step in to assist LANDFIRE for about 10% of my time. Following a corporate restructuring that year, LANDFIRE and ILFO agreed to share my time equally, which is still the arrangement.

What are some of the spatial data and other projects you've worked on, e.g. websites, GIS, Biophysical Settings Review, ILFO, and so on?

My first major LANDFIRE project was an analysis of Vegetation Condition across the U.S. This work used Vegetation Condition Class, Fire Regime Group, and Succession Class data, along with state boundaries, ecoregional boundaries, protected areas, and other geographies, and helped us create the [Vegetation Departure Calculator](#), where users can view departure percentages and Fire Regimes within select areas of interests.

Next, I provided the GIS analysis and mapping backbone for our 2011 report [Accounting for Ecosystem Alteration Doubles Estimates of Conservation Risk in the Conterminous United States](#) in PLoS One. To do that, I combined Vegetation Departure with GAP protection status and information on land conversion to create an index showing the risk of doing land protection or management within an ecoregion.

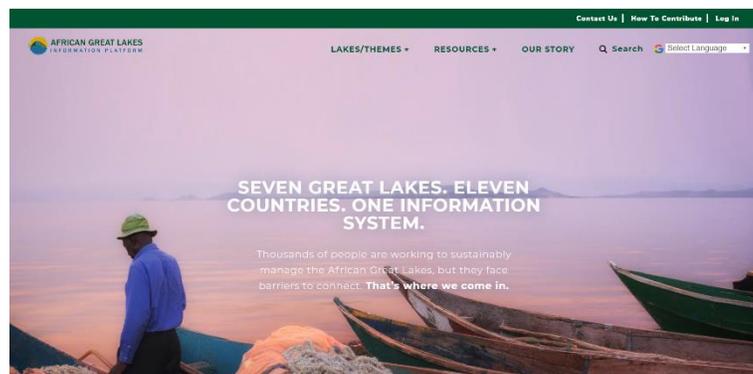
Recently I've focused on mapping and website development, creating and maintaining both the WHAM! and the BpS Review and [Document Delivery](#) websites.

On the non-LANDFIRE front, my ILFO work involves big-picture science projects. For instance, in addition to working on *Chicago Greenprint* and the Conservancy's Land and Water Strategy, I am the lead author on two preserve conservation and protection plans, and have created a [suite of time-series maps](#) looking at the spread of aquatic invasive species in the Great Lakes. Additionally, I mapped predicted temperature and growing season shifts in the U.S. based on predictive climate modeling. I am also the Illinois representative on the steering committee for TNC's [Conserving Natures' Stage](#) analysis in the Great Lakes and Tallgrass Prairie regions.

Tell us about your work on the Africa mapping/website and the new commitment to the Nature Conservancy's Protecting Lands and Water Strategy. How does LANDFIRE link to it?

The Conservancy encourages staff to take time for professional development and personal growth. To that end, TNC provides Coda Fellowships (named after the family who funds it), where TNC staff who need short-term project assistance are matched with an employee with the right skills. I received a [fellowship](#) to lead the effort to develop a [data-sharing and information platform for the African Great Lakes](#).

A website had been set up for the [North American Great Lakes](#), and the Africa program needed a person who could interface with the web developers, the marketing staff and content managers, and the on-the-ground staff and partners in Africa who would provide information and use the platform. My role was to coordinate communication among all the groups as well as to locate, write, and create content for the new site, framed around the specific issues most impacting resources and people in the African Great Lakes region. This platform provides useful information to those working or looking to work in the African Great Lakes area and allows people to showcase their work while also collaborating with others who might be attempting similar projects.



The Land and Water Strategy tasks each Division to re-think conservation plans for a climate change and resilience focus. In the Midwest Division (Wisconsin, Illinois, Indiana, Michigan, and Ohio), I will lead the effort to create the maps of priority areas that reflect the full diversity of ecosystem types. We hope to identify both “protection landscapes” -- areas with high climate resilience or that are important climate corridors –and “restoration landscapes” where an investment of time, money, and effort might restore their functionality. This is where I believe LANDFIRE data will play a key role.

How does your varied work cross-pollinate?



The biggest links between ILFO and LANDFIRE projects are in the [Illinois Fire Needs Assessment \(ILFNA\)](#), and in the Midwest Division Protect Land and Water Plan.

The ILFNA used LANDFIRE Mean Fire Return Interval as a baseline for how much fire was historically on the landscape. Removing the areas from analysis that weren't listed as naturally vegetated systems, e.g. agriculture, per LANDFIRE's Existing Vegetation Type (EVT), provided a realistic “apples-to-apples” comparison of fire acres in the state. From there we determined how many acres should have an annual fire return, and set a baseline target of fire acres/year. We then cross-walked EVT systems to the Illinois Natural Areas Inventory vegetation systems and asked various agency land managers for their realistic estimate for an updated fire return interval. Those numbers

gave us an even more accurate acres/year target to aim for. In turn, we used the updated fire return interval numbers received from the land managers to inform our models and documents in the recent [Biophysical Settings review and update](#).

The *Protect Land and Water* work is a bit more speculative. The intention is to use the LANDFIRE Vegetation Departure data to help identify landscapes that may be too degraded to hold fire and probably not worth the time, effort, and money for restoration, as well as those that are in good vegetation condition and may easily be brought back into functional systems. The planning team has high hopes that LANDFIRE data will give us some of the answers we're looking for.

Your work has profound impact on the ground – why is GIS vital to fulfilling the vision of LANDFIRE and The Nature Conservancy?

I love this question. The short answer is that GIS gives us the “where.” As ecologists, we know what needs to be done, we know how to do it, and we know why it needs to happen. But without GIS, I think we'd struggle a lot more with the question of “where are these actions going to be most effective?” GIS is a tool to answer questions.

The longer answer is this: When I applied for my graduate degree in GIS I had to interview before I was accepted into the program. Of the many questions posed, I remember one: I was asked why I wanted to further my study of GIS and what I hoped to do when I completed my degree. I answered that I wanted to use GIS in combination with my knowledge of wildlife ecology, landscape ecology, and environmental conservation to identify places on the landscape that conservation and land management could have the most benefit. Those words almost perfectly describe the work I have done for thirteen years, and I wouldn't change a minute of it.

Contact:

shagen@tnc.org

Office: 612/331-0733

The Nature Conservancy Minnesota Field Office

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The Illinois science team, especially Dr. Jeff Walk, Illinois Director of Conservation, and Dr. Maria Lemke, Illinois Director of Science, who support this somewhat odd remote-employee, split-time position. Jeff is a strong LANDFIRE believer who helps me find ways to connect ILFO work with LANDFIRE whenever possible, even if it was just me coming to him with a longshot “what if we try this” idea.

Bill Kleiman and the [Illinois Prescribed Fire Council](#) do amazing work on prescribed fire in Illinois; their leadership, guidance, and work in completing the Illinois Fire Needs Assessment was invaluable.

Hannah Spaul, Director of Land Management with the TNC Wisconsin Chapter is a champion of prescribed fire in the Midwest and a LANDFIRE supporter, as are John Wagner, Rob Pflieger, and Steve Richter.

Resources

[Illinois Prescribed Fire Council](#)

[LANDFIRE Web-Hosted Applications Map \(WHAM\)!](#)

[African Great Lakes Information Platform](#)

[Resilient and Connected Landscapes Analysis](#)

[Chicago and Cook County Greenprint Analysis](#)

