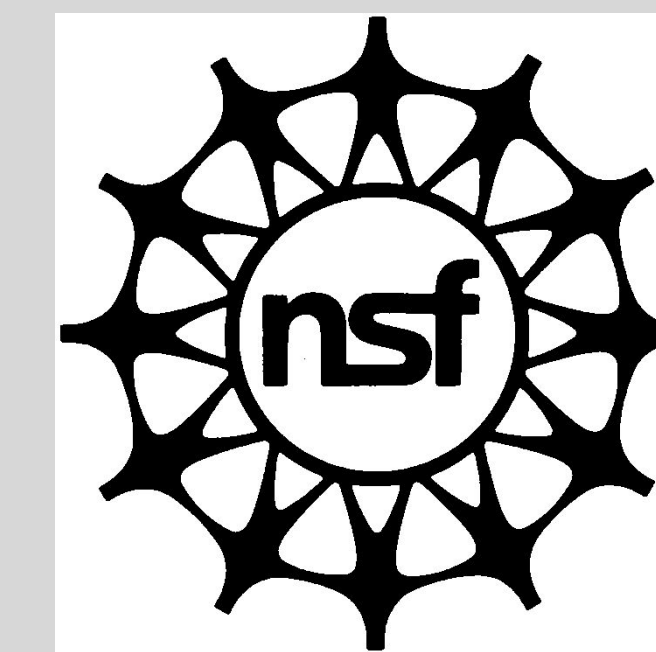# A Case Study of Hickory Woods using ArcGIS Online

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Geographic Information Systems (GIS)

What is GIS?

GIS is a catchall term referring to Geographic Information Systems and Science. "Geographic" captures the spatial component (e.g. maps), "Information" refers to the data behind the maps (linked attribute tables), and the "System" is the software and databases which allow for data management and spatial analyses. All together, it allows us to collect, store, visualize, manage, and analyze all types of spatial data, thereby providing a better understanding of spatial relationships, patterns and trends. GIS stores location-based data as a collection of layers which are integrated and analyzed together.
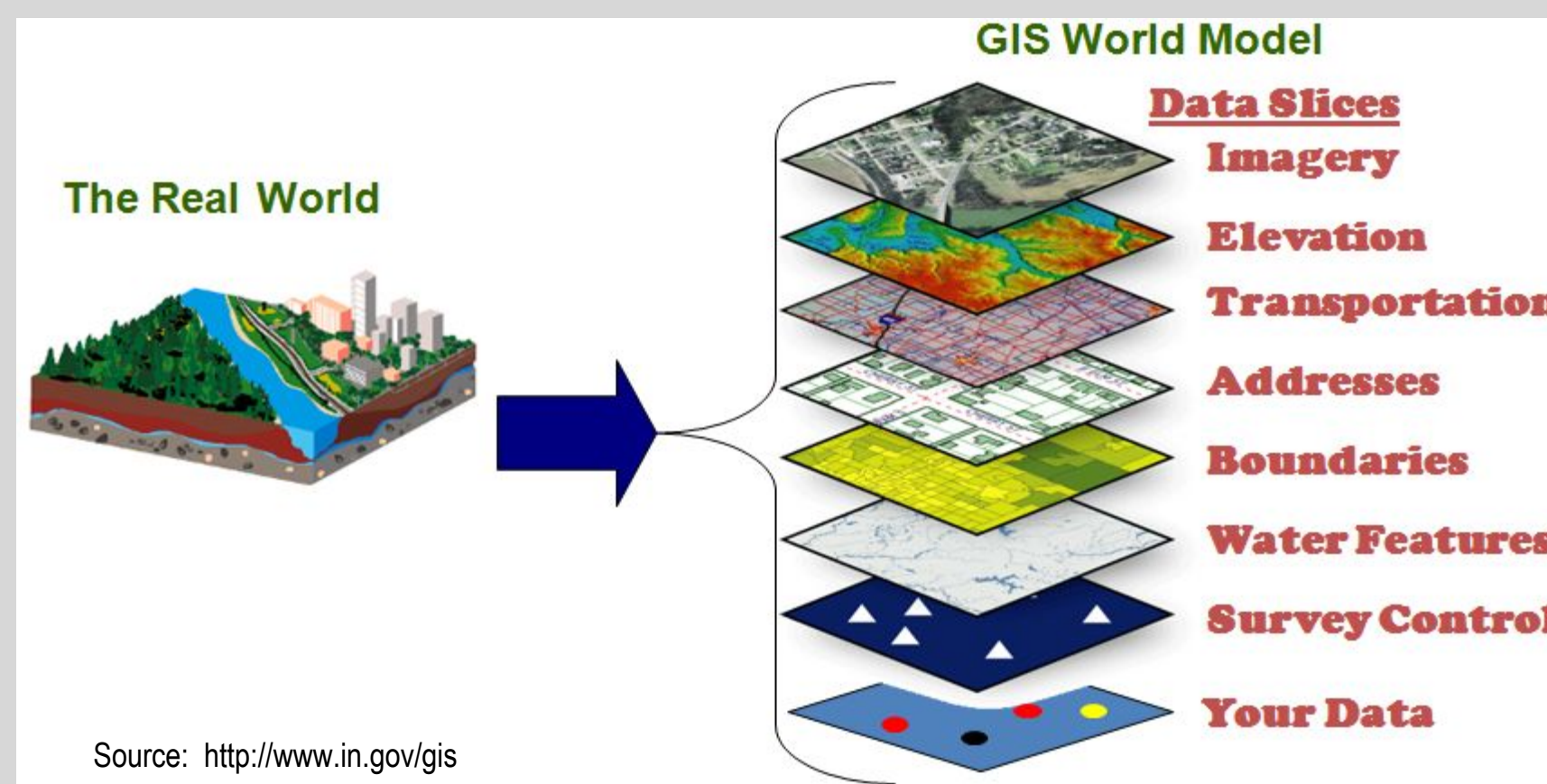
Why GIS?

GIS is near ubiquitous across diverse fields. For example, it improves logistical efficiency in transportation networks, disaster decision-making, analyzing land use change over time, site-suitability analysis, environmental modeling, and much more. The variety of applications lends itself well to vertical and horizontal integration in K-12 education – subject interdisciplinarity at any desired level of complexity. Everything exists in space and thus has a location. Smartphones have built-in GPS capability, offering an economical way to collect geospatial data.

GIS Summer Camp at UB

BPS teachers and students participated together in the 2017 GIS Summer Camp. The goal of the Camp was to provide teachers and students with guided instruction and hands-on practice with GIS concepts, software, mobile applications, and analysis.
The lessons included:

- Using smartphones and Collector App to map sites at Cradle Beach Camp
- Using drones to collect GIS data and aerial photographs
- Navigating Google Earth to visualize geographic phenomena
- Creating 3-D buildings using Sketch Up
- Designing Story Maps using Google Earth & ArcGIS Online
- Using real project data to perform geospatial analysis (mapping "hot spots") of contamination

Rationale

Incorporating the use of GIS into a high school classroom can be a powerful tool for teaching and learning. GIS lends itself well to building and reinforcing content knowledge and skills. It promotes higher order thinking such as understanding spatial relationships and data analysis. Additionally, creating Story Maps requires students to conduct research as well as read and write in their content area, skills that are aligned to the Common Core Learning Standards. The interdisciplinary nature of GIS also assists teachers and students in meeting the requirements of the Next Generation Science Standards, thus helping students become more prepared for college and careers.
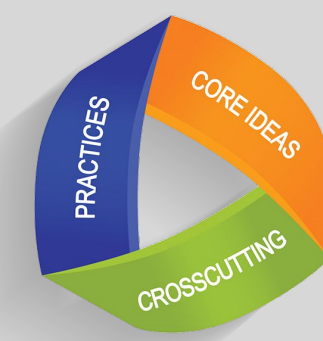
Hickory Woods Case Study

Hickory Woods is a residential neighborhood of approximately one square mile located less than a mile from South Park High School. The history of this area as well as its proximity to the school makes it both a relevant and engaging case study for students. This year round project will require students to conduct research and write informative text as well incorporate the use of GIS software such as Collector, Story Map and ArcGIS online.

HISTORICAL INFORMATION

- Adjacent to the former Republic (LTV) steel mill and Donner Hanna Coke facilities, operated since the 1920s.
- Construction of new homes began in the late 1980s.
- Evidence of dangerous soil contamination from the Superfund site was found in 1999 during construction of homes.
- In 2000 the EPA took soil samples and found elevated levels of arsenic, lead and PAHs in some areas.
- A fund was set up to compensate homeowners for lost property value, each receiving $12,500.
- Boone Park was underwent remediation in 2010

OBJECTIVE 1:
Students will be able to describe in writing after conducting research the history of land use in the Hickory Woods neighborhood from the early 1900s-Present.

Hickory Woods Story Map

There are several applications available online for students to use to create and present their Story Maps. The one that has the most application in my classroom and for this project is the Story Map Tour. It allows students to present a place based narrative or show a timeline of events. Students can add geo-located pictures, images as well as video. Points can be added manually or imported from the ESRI Collector App.

OBJECTIVE 2:

Students will be able to use GIS software including Collector and Story Map to visualize the timeline of events of the Hickory Woods neighborhood.
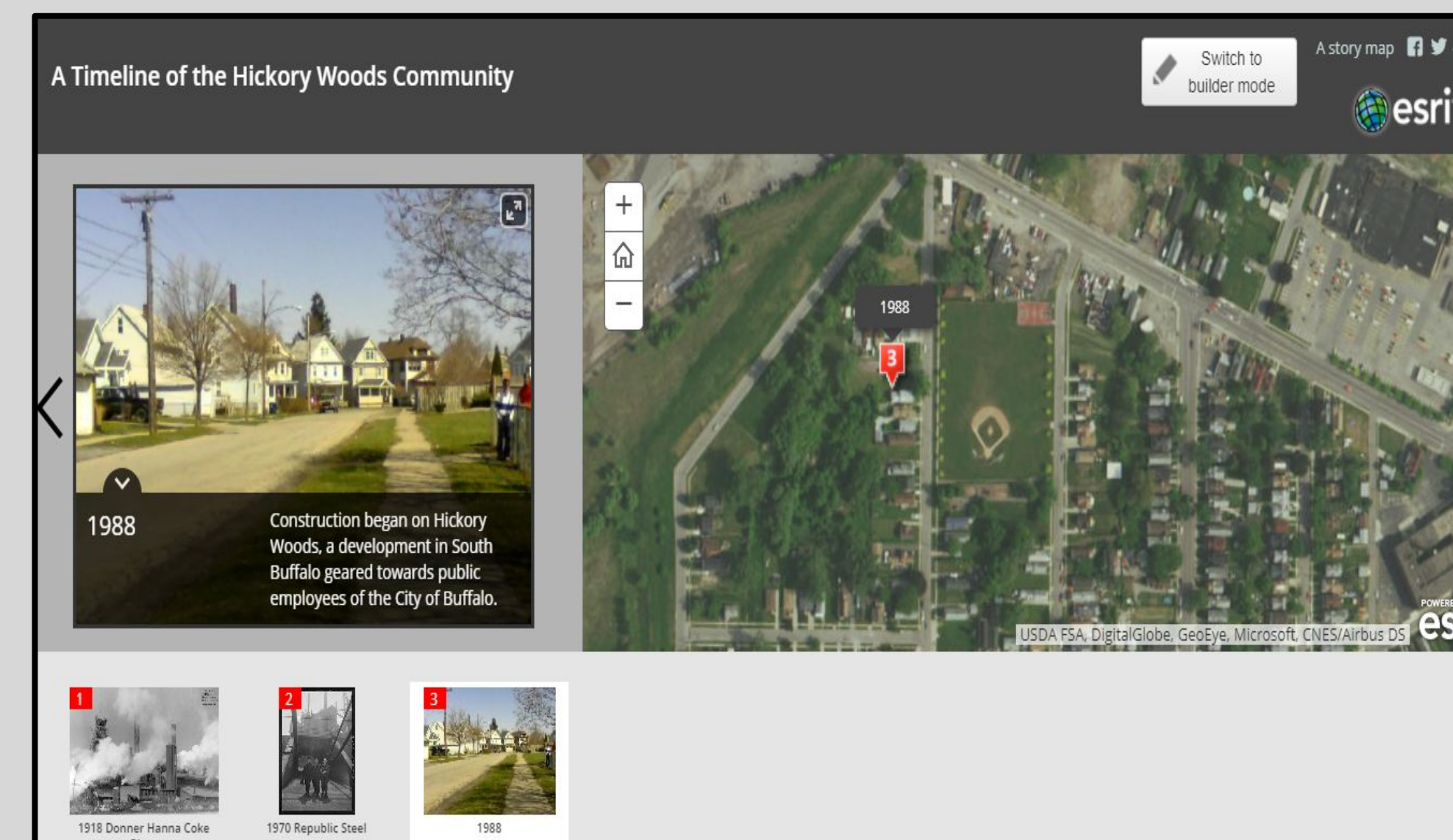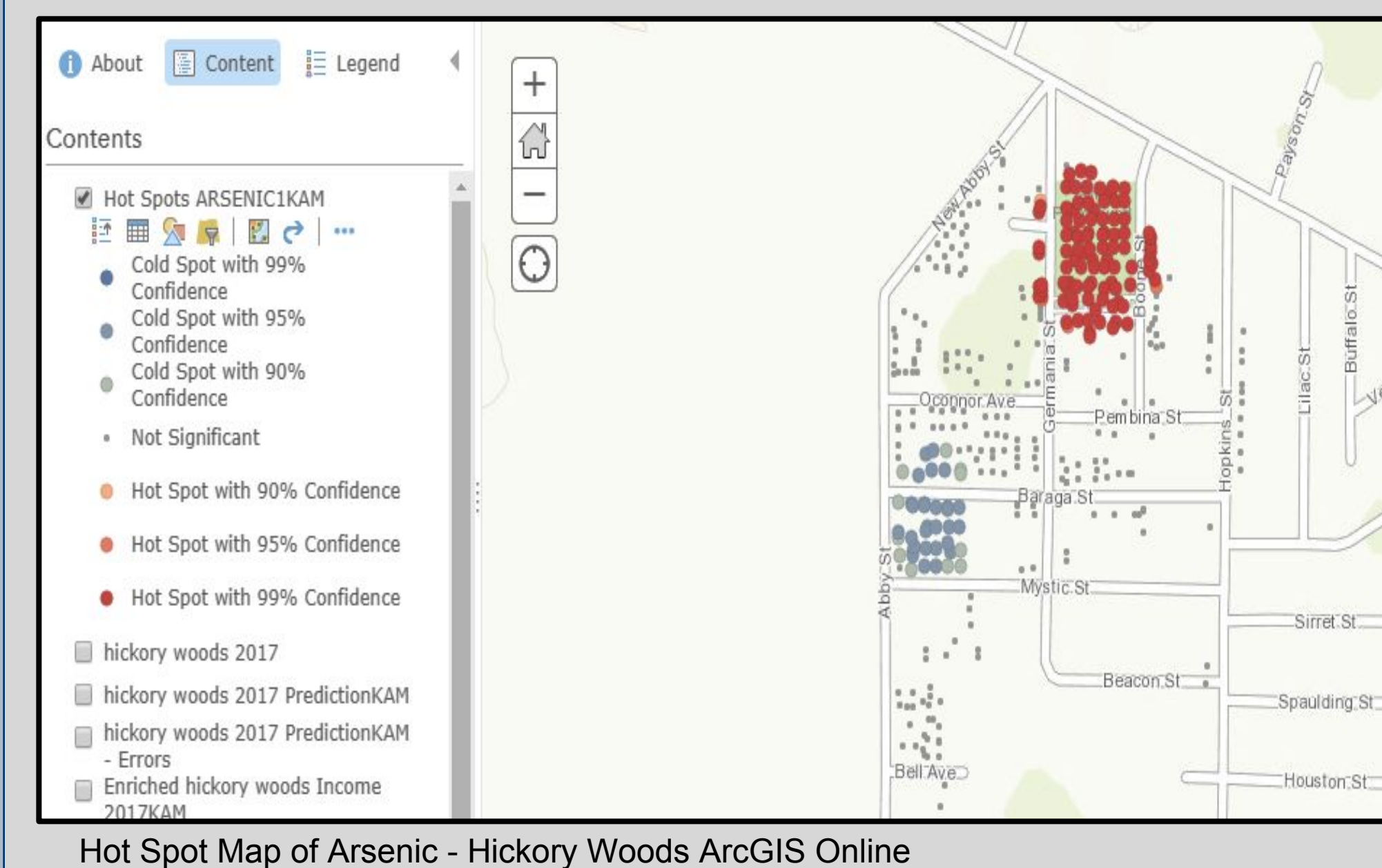

ArcGIS Online Analysis

There are a number of analysis tools available on ArcGIS online that can be used by students to understand the data presented by the different layers on maps. A Hot Spot analysis tool will determine if there is any statistically significant clustering in the spatial pattern of data. For example, this tool is useful to show areas of high contamination as well as areas that have very low levels of contamination.

Objective 3

Students will be able to use the ArcGIS program to analyze patterns in data.

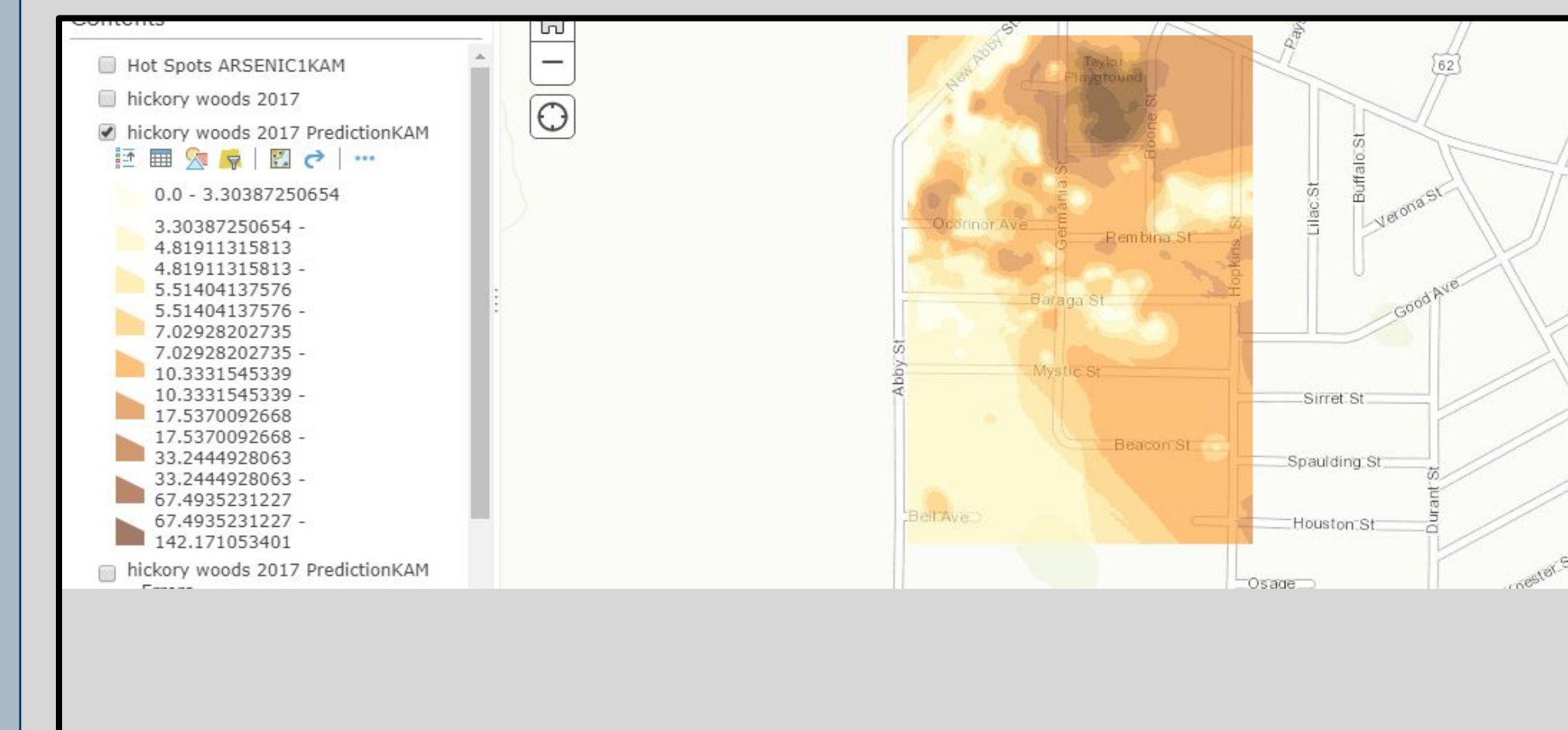Hot Spot Map of Arsenic - Hickory Woods ArcGIS Online

ArcGIS Analysis

Another analysis tool available on ArcGIS online is Interpolation. The Interpolate Points tool allows the user to predict values at new locations based on measurements from a collection of points. The tool takes point data with values at each point and returns areas classified by predicted values. This can be used to predict contamination in areas that have not been sampled and be helpful in determining future land use potential or possible remediation needs.

OBJECTIVE 4:
Students will be able to make predictions regarding possible sites of contamination by using the Interpolate Points tool on ArcGIS Online.

Interpolation Point Map of Arsenic - Hickory Woods ArcGIS Online

Curriculum Alignment

The Hickory Woods Case Study will be embedded in the Ecology and Human Impact Units in the Living Environment Curriculum.

Key Idea 7: Human decisions and activities have had a profound impact on the physical and living environment.

"Since the students of today will be the elected officials and informed public of tomorrow, the teacher should encourage a diversity of activities that will allow students to explore, explain, and apply conceptual understandings and skills necessary to be environmentally literate."

References

1. Tammy Milillo; Gaurav Sinha; Joseph Gardella, Jr., "Use of geostatistics for remediation planning to transcend urban political boundaries", *Environmental Pollution* (Oxford, United Kingdom) (2012), 170, 52-62.

2. Tammy M. Milillo, Sarah Glann, Debra Street, Kelly Duncan, Joseph A. Gardella, Jr. "Incorporating Qualitative and Quantitative Data into Public Participation, GIS for Environmental Remediation" *AIMS Environmental Science*, 2017, 4(2): 323-347. doi: 10.3934/environsci.2017.2.323

3. NYS p-12 Science Standards