# Out of the Classroom and Into History:
# Mobile Historical GIS and Community-Engaged Teaching

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THE INVESTIGATION OF TIME is at the heart of historians' pursuits. Many also recognize the importance of space, since the chronology of action and ideas necessarily occurs in the physical world we all share. The conscious integration of time and space has found growing favor among scholars recently as the "spatial turn" has influenced research across historically minded disciplines.[1] Spatial history approaches have been demonstrated to engage students with the natural and built environments that influenced historical events and decision making.[2] For this reason, many historians are learning to use geographic information systems (GIS) and other geospatial technologies in their teaching.[3] In this article, we argue that historical GIS (HGIS), especially when taken out of the lab and into the landscape, is also well suited to achieve another important pedagogical goal: community-engaged teaching. Many universities and teachers incorporate community engagement and service-learning into their curricula to connect content with real-

world applications and to help create civic-minded graduates.[4]  This article provides three case studies in which an interdisciplinary team of faculty and graduate students used mobile HGIS technologies to engage students with local communities and heritage organizations. We argue that HGIS-based projects integrate space and time in ways that make history immediately relevant and accessible, and, in so doing, promote the cultural value of history in the daily lives of students and their communities.

## Spatial Thinking with HGIS
## Promotes Community-Engaged Active Learning

Our projects combine successful methods from history, geography, and cultural landscape studies to promote interdisciplinary scholarship, create active learning environments for students of multiple ages, and facilitate community engagement.  Geographers have long understood the importance of spatial thinking—that is, to have the ability to use the properties of space to communicate, reason, and solve problems.[5]  For researchers to think spatially, they need to utilize a set of concepts fundamental to geographic understanding, such as the concepts of spatial interaction, proximity, distance, location, and place.  With such concepts, deeper understandings of complex spatial processes, such as segregation, mobility, and neighborhoods, can be explored.  Primarily, spatial thinking allows researchers to use space to model the world, both today and historically, in valuable and meaningful ways.[6]

In recent years, scholars have been using HGIS to combine spatial thinking with historical research.  These approaches, similar to those long embraced by historical geographers, do not abandon the traditional tenets of history and the humanities—the text, the archive, and the narrative.  Rather, they create value-added scholarship that considers space and time together using documentary as well as geographical, material, and spatial forms of primary evidence.[7]  Some have termed this integration "Deep Mapping."[8]  They formulate new kinds of historical research questions and refine the geospatial methods and tools we use to answer them.  In the projects presented in this article, we integrate history and spatial thinking by working collaboratively across academic disciplines, combining expertise in geospatial methods

and historical research to develop better questions and create richer responses.  In so doing, we answer the call of many scholars who celebrate the ability of interdisciplinary scholarship to drive up the quality and rigor of historical questions.[9]

Likewise, GIS can elevate student engagement with history. Scholars from several disciplines argue that using GIS in the classroom strengthens multiple learning styles and cognitive skills, and cultivates spatial thinking.[10]  Others have begun to see the potentials of integrating historical maps and data within a digital representation of history, especially within a geographic information system.[11]  Historian Steven Mintz has argued that we have reached "Stage 4.0" of digital history studies, in which students can use technology to delve into the built environment using advanced visualization and "devise their own conceptual models for understanding our collective past."[12] But, as always, the challenge is to make sure that the digital classroom tools are just that—tools that move students toward the end goal of critical engagement with historical problems, rather than becoming ends in and of themselves.[13]  To prioritize this critical engagement, our projects require students to generate their own historical questions from direct interaction with primary evidence, both from documents and the built environment.  The digital HGIS platform integrates documentary and spatial evidence to quickly interrelate these types of primary documents and encourage the next step: critical thinking.

One way to promote critical engagement in space-time integration is by using digital spatial storytelling techniques.[14]  These kinds of online spatial narratives have become a dynamic and accessible way to communicate about spatial relationships and processes in history.[15]  Spatial storytelling embraces the approaches for which digital history scholars have been arguing—namely, new technologies that draw on techniques from across the digital humanities that can lead scholars and students toward important questions about the patterns we see in historical big data and/or spatial relationships.  Students in two of our case studies employed the Esri Story Maps platform to activate spatial thinking in a digital format using historical evidence.  Esri, Inc. has made a commitment to promoting spatial thinking among students by making ArcGIS software free to any K-12 school in the United States.[16]  In addition, the company's GeoInquiries program offers classroom activities,

created by educators and integrated with national standards, that use ArcGIS Online maps and data to promote spatial thinking within U.S. history and world history curricula, among others.[17]

The use of HGIS with students can also create immersive learning environments in the local community. We draw on traditions of cultural landscape studies, which tightly dovetail with techniques of spatial thinking, HGIS, and spatial storytelling. Scholars in all the authors' disciplines regard the physical manifestations of human relationships in space as primary evidence of change over time, and employ fieldwork methods to access that evidence.[18] This kind of landscape evidence is often overlooked by academics and the general public alike because it can seem mundane, familiar, and innocuous. As geographer Don Mitchell has written, "Landscape is at once patently obvious and terrifically mystified."[19] They may seem innocuous, but the very buildings, street grids, pathways, and infrastructure features that surround us every day both manifest past human discourse and continue to shape our relationships in the present day.[20] Educators have recognized the value of "place-based education," which uses local landscapes to connect students both physically and psychically with nearby resources, both natural and cultural.[21] Incorporating place-based teaching approaches with HGIS is particularly fruitful because of the benefits of visualizing space and time together in one's familiar surroundings, such as college campuses or childhood neighborhoods.[22] Research projects that combine geospatial technologies with historical studies easily fulfill contemporary pedagogical goals of creating an immersive learning environment, making them natural candidates for teaching.

The clear pedagogical advantages of creating digital history projects that immerse students in the built environment align powerfully with the goals of service-learning and community-engaged teaching. Service-learning and community engagement more broadly, which promote the role of the university as a public good, have a long history in American higher education. Scholars trace the roots to the Morrill Land-Grant Act of 1862, and see a reinvigoration a century later with the anti-Ivory Tower sentiments of the 1960s. Over the last few decades, community engagement has gained traction in research and pedagogy. Starting in 2010, research universities could apply for a voluntary Carnegie Classification in community engagement administered by the New England Resource

Center for Higher Education, which credentials projects that promote the "mutually beneficial exchange of knowledge and resources in a context of partnership and reciprocity" between universities and local, regional, national, and global communities.[23] Most academic fields have promoted or developed community engagement practices under various terminologies. Public history and public archaeology, which trace roots to the mid twentieth century, have grown in favor, as have community-based participatory research (CBPR) models in sociology and health research, as well as public-participatory GIS (PPGIS).[24] All of these seek to build projects *with* rather than *for* public communities. Scholars in multiple fields demonstrate that bringing members of the public to the table at the beginning of the planning process generates buy-in from all parties and creates more useful and satisfying research outcomes.

Likewise, in university curricula, community-engaged teaching projects have long had several interrelated goals, as defined recently by service-learning expert Joy Beatty.[25] The projects presented in this article align well with two of Beatty's identified goals. First, the professional model of service-learning prepares students for real-world applications of content by creating learning environments out of the classroom. In other words, students learn desired content in real-world settings. Second, the public engagement model promotes civic-mindedness and helps to create engaged citizens. For these models, the learning goal itself is community engagement. By using collaborative HGIS to promote historical spatial thinking as well as community engagement, our projects suggest ways to achieve both of these goals. They energize students, researchers, and communities with real-world problem-solving and civic-mindedness, and, in so doing, they strengthen ties between universities and local communities.[26]

Our projects join a small number of published examples that have used teaching case studies to suggest the multi-disciplinary research value of publicly engaged HGIS projects. A pioneering effort by Robert Summerby-Murray in 2001 demonstrated the advantages of using HGIS to offer problem-solving projects that engage with local municipal policy-making in heritage management.[27] We follow his lead with today's open-access and mobile technologies. More recently, other scholars introduced history students to community-engaged cultural landscape fieldwork, such as architectural historian

Amber Wiley's project to document and map sites of jazz innovation with the New Orleans digital humanities platform MediaNOLA, or Steven D. Branting's student-led project, published in this journal, to map and revivify Lewiston, Idaho's nineteenth-century cemetery.[28] Jennifer Gebelein has found success using GIS with high school students, on which we build with the GIS Resources and Applications for Career Education (GRACE) Project interns.[29] We also build on the work of Ruth Mostern and Elana Gainor, who taught students to use Google Earth to create digital atlases of the Silk Road, and used the project as a laboratory for developing profession-wide standards for evaluating digital humanities projects.[30]

In this paper, we present three case studies that each demonstrate the power and utility of using HGIS and mobile GIS technologies to empower students to do historical geographical community-based service learning. The first study illustrates how Esri Story Maps can be used to introduce students to integrating archival sources in a digital spatial environment and to foster historical spatial thinking. The second study illustrates the use of mobile historical GIS tools to engage students in a service-learning project to build a web-based GIS applications to aid heritage planners in managing properties in a resource-poor heritage district. The final case study combines the two previous approaches to create a place-based summer curriculum in which local high school students learn about the application of GIS as a STEM approach to discovering historical places, people, and phenomena, while creating meaningful digital exhibits for a national historical park.

## Communicating Historical Spatial Thinking Using Story Maps

In Fall 2015, we augmented a university history course by using geospatial technologies to engage students with primary historical documents related to the changing landscape around campus. This upper-level undergraduate course, called "Building America: History of Planning, Development, and Engineering in the U.S," was team-taught by Sarah Fayen Scarlett and Don Lafreniere. The course engaged twenty-six students with the overlapping histories of mining and related industries (which dominated our region), housing development, and university expansion in an approximately

square-mile area around our campus. Students used the Esri Story Maps online spatial storytelling service and a local ArcGIS Server hosting HGIS data to create a set of digital exhibits combining maps, demographic data, historic photos, and first-hand period accounts uncovered in their own research.

Before introducing any geospatial technologies, however, we encouraged students to interact with the landscape itself and find related primary historical documents. During the second class meeting, we split into two groups and took students to predetermined spots on campus. Together, these small groups of about thirteen students and one professor each engaged in collective first-hand observation of landscape evidence. Urged to set aside their natural tendency to jump to conclusions, the students described what they saw around them without interpretation: trees lining walkways, parking lots next to buildings, and a state highway dividing the campus. We asked them, "Why do those features look the way they do?" They began to get at questions of time; changing values and architectural styles; different desires between the students, administrators, and neighborhood residents over the years; and the shift from pedestrian to automobile transportation on campus. After developing lines of inquiry, the students engaged with historical maps, on paper in the field, to begin to learn how historical maps can be used to develop historical geographical questions and discover spatial relationships in the past that influence our landscapes today. This exercise became an assignment. We asked them to pick three of the landscape features that sparked questions for them, and develop critical historical questions in a short written essay.

Later, groups of three to five students pooled the features about which they had developed research questions, and began seeking historical documents to find answers. Each group was assigned a specific date range of a few decades and taught how to use the University Archives and county courthouse to locate primary resources. They chose historic maps of the campus and the surrounding area, learned to georectify them over modern aerial imagery using the open-source tools at MapWarper.net, and uploaded their georeferenced historical maps as basemaps for use in the Esri Story Maps platform. Each student pursued independent research in the University Archives and local municipal records to add historical documents like photos, property data, and university records. Each group synthesized their
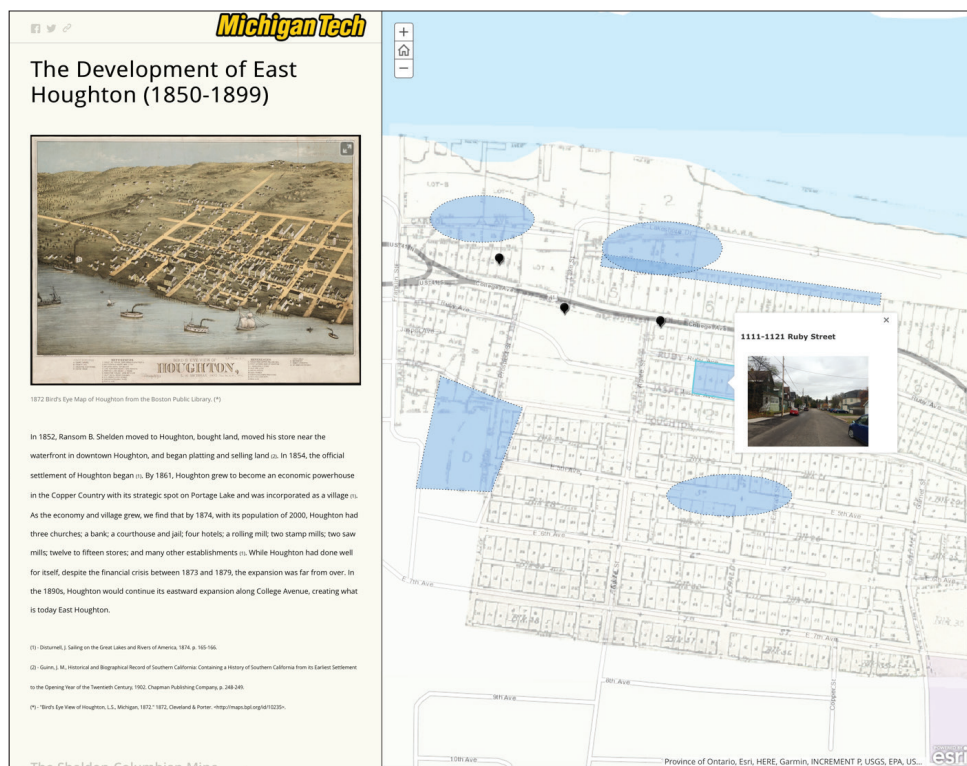
**Figure 1**: Students developed Story Maps that combined the use of historical documents with cultural landscapes fieldwork, which required them to explore unfamiliar historical content, cultivate the ability to read the landscape around us, and communicate historical stories for a public audience. Available at <http://www.keweenawhistory.com/project-news/archives/08-2016>.

research into an agreed-upon theme, and worked together to create a historical argument by situating traditional historical evidence in a digital spatial storytelling environment (**Figure 1**).

In this Story Map project, we saw benefits for students and faculty alike. For students within a history class, the ability to visualize landscape change and construct historical narratives using layered maps, historic photos, and documents made history come alive for non-history majors. Several student reviews noted the value of putting the history of their immediate built environment into the historical context of national trends, including suburbanization and the post-World War II growth of research universities. On the other hand,

a few evaluations indicated that some students struggled to see the larger value in telling micro-histories, or wished they could have better connected human lives with the narratives of landscape change over time. But even for the students who may have felt disappointed with the final products, most praised the fieldwork aspect, which not only engaged them with new historical content, but also strengthened skills in reading a landscape and interpreting the histories that can be told by closely observing and recording the changing environment around us.

The robust resources that made these student outcomes possible resulted from combining our collective expertise. One faculty member's experience in HGIS and spatial analytics, and another's knowledge of local history and cultural landscape theory, together offered richer experiences in a single semester than either professor could have created alone. Ten years ago, pioneering geographer and HGIS specialist Anne Kelly Knowles identified some of the conceptual barriers for historians learning to use GIS, including the basic recognition of much historical data as having a spatial element.[31] Around the same time, Amy Murrell Taylor, a historian and early adopter of HGIS, articulated a common concern about the learning curve to gaining expertise in HGIS software and best practices.[32] Today, more and more scholars and teachers are thinking spatially about history, and the resources for learning HGIS techniques are improving quickly. Our experience suggests that team teaching and collaborative research, when possible, can benefit faculty and students alike to kick-start digital spatial history curricula.

## Using Mobile Devices to Collect
## Historical Geospatial Data for Municipalities

In Spring 2016, we built on our experiences using HGIS to teach historical spatial thinking and combined it with service-learning. In a mixed undergraduate and graduate course called "GIS for Social Sciences," faculty and Ph.D. student teachers worked together to create projects to meet an immediate need in the nearby village of Calumet, Michigan. Calumet grew up around the successful Calumet and Hecla Mining Company starting in the 1850s. The town enjoyed a population of about 32,000 in the 1910s at the height of its copper mining, but has seen its numbers fall precipitously since the company closed permanently in 1968.[33] Today, Calumet Village has about

**Figure 2**: Using ArcGIS's Collector App for iOS, students recorded street addresses and façade elements, ranked relative condition, determined current occupancy, and documented the number of stories for each structure for the Village of Calumet (Photo by author).

1,200 residents and the surrounding township has 6,400. Parts of the town and former industrial core make up a National Register Historic District and have been interpreted by the Keweenaw National Historical Park since its founding in 1992. The village's built heritage has been under constant threat due to population loss and the resulting reduction in tax revenue and commercial investment. Many buildings have succumbed to demolition-by-neglect. The village government, which includes a full-time staff of only one administrator, was actively seeking state funding and tax relief, but required an accurate inventory of the relative condition and occupancy status of the buildings in the Historic District. The class project engaged students with this real-world need, requiring them to supplement and ground-truth the existing outdated GIS dataset from the county planning commission and create a usable GIS for the village to manage their built heritage.

    In Spring 2016, ten students at both the undergraduate and graduate level took to the streets of Calumet with smartphones and

tablets to create a GIS for the built heritage of the Village. Using ArcGIS's Collector App for Android and iOS, students mapped building footprints, captured contemporary photographs, recorded street addresses and façade elements, created a condition ranking, determined occupancy, and documented the number of stories for each structure (**Figure 2**). The data was synced live within an enterprise geodatabase.

This contemporary fieldwork approach not only allowed us to record field data efficiently, but it also encouraged students, faculty, and stakeholders to share ideas and start conversations in real time as the research proceeded. Direct digital entry greatly sped up the traditional survey methods of clipboards, pencils, and bulky cameras. Qualitative GIS data, in the form of geotagged photographs, plus the collaborative, team-oriented data collection procedure kept the content from being impersonal digital data. For the students, the information they were collecting connected to the authenticity of bricks-and-mortar life, and also acquired the complexity of historical layering. Conversations in the field highlighted the material and spatial details that led students to important questions. For instance, one group discovered a building spanning two town lots. To answer their mounting questions, they inspected the structure on the spot, finding clues in the color of the brick and discrepancies in the woodwork that led them to realize that the building had started as a duplex. This sparked discussions about changing population density, the old custom of living above one's store, and the subsequent middle-class movement to separate work from home at the end of the nineteenth and early twentieth centuries. Other real-time discoveries occurred when groups reviewed their work synced to the ArcGIS Server. The team immediately could identify buildings that had been missed or whose data had obvious problems, and students could go back into the field to pick up missing information. The students presented a draft of the data collected in the form of a searchable WebGIS interface to the Village at a Historic District Commission meeting to solicit a list of needs and wants from the user community. Students incorporated the community's feedback and all data was provided back to the Village as a user-friendly WebGIS, which is actively being used to manage Village-owned buildings and as a promotional tool to encourage redevelopment and heritage preservation activities.

Teaching historical spatial thinking in the field with a community partner using mobile devices reached two of Beatty's service-learning types. Students gained experience setting up a GIS, performing data collection and assessment, and learning ways that change over time in our built environment can be important to contemporary life. Just as important, students stepped out of the university and into a local community to help solve a particular problem. In a special issue of *Diversity and Democracy*, several authors argued that service-learning in this civic engagement model builds bridges between socio-economic groups and fosters parity and understanding within our democracy.[34]

## Incorporating History with STEM for Meaningful Heritage Engagement with High School Students

In Summer 2016, a partnership between the authors and the Keweenaw National Historical Park facilitated a project that created meaningful engagement between local high school students and the history of their communities and landscapes. The GIS Resources and Applications for Career Education (GRACE) Project is funded by a grant from the National Science Foundation's Innovative Technology Experiences for Students and Teachers (NSF-ITEST) program. The objective of the GRACE Project is to train high school teachers from across the state of Michigan in how to use geospatial technologies in their curriculum. The Project also pays students in economically disadvantaged communities to learn GIS as a career development strategy by applying GIS skills and tools to solve real-world problems by partnering with community organizations. We worked with Michael Roland, a GRACE-trained teacher at Calumet-Laurium-Keweenaw (CLK) High School to identify talented students from his classes and neighboring Houghton High School with an interest in STEM technologies. Eleven students were introduced to GIS by GRACE Project advisor/consultant and long-time GIS educator Randall Raymond, and they spent about six days completing Esri's training modules in ArcGIS with the help of the authors and a team of undergraduate students at our university.

These projects became opportunities for the students to learn GIS and contribute to real-world research that supports heritage, preservation, and the interpretation needs of the National Park Service. Eight high school students worked with undergraduate and graduate

students, as well as faculty, on our ongoing research project to build a historical spatial data infrastructure (HSDI) for our three-county region. Our HSDI is a scaled-up HGIS built to be flexible and expandable to accommodate multiple big data sets, as well as public engagement and volunteered information from users. For this HSDI, the GRACE interns learned to digitize building footprints and record attributes about the built environment such as civic addresses, number of stories in a building, and the presence of basements or porches, based on Sanborn Company fire insurance maps, starting in 1949 and working backward through time toward 1888. By digitizing individual building footprints, the interns prepared them to be connected to other big data within the HSDI, such as city directories and historical school records. Through this activity, they gained skills in map reading and analysis, and began to recognize the dynamic changes built into their immediate environment. They learned to identify when structures changed, why industrial activity was located near specific resources, how industry dealt with waste, how it consumed water and timber resources, and why residents settled in specific patterns that continue to shape their neighborhoods today.

The other three GRACE interns worked at the Keweenaw National Historical Park, with Chief of Interpretation and Education Kathleen Harter and Historian Jo Holt creating digital map-based versions of National Park interpretive material. Using the Story Maps software, the interns transformed the traditional printed Visitors Guide for the Keweenaw NHP into an interactive online map, which allows visitors to see more illustrations and historical photographs of regional Heritage Sites from their mobile devices or on a computer while planning their park visit.[35] Similarly, they made a Story Map from a three-fold brochure aimed at youth visitors. They also mapped the Park's successful #MissingInTheCopperCountry social media project, which superimposes historic photos onto snapshots of today's landscape to illustrate and interpret structures that have been demolished.

To make sure that the GRACE interns made the connection between the maps they were creating and the actual landscapes around them, the instructional team arranged weekly expeditions with researchers and community groups. All of these students understood that they were growing up in a former mining district, and they had visited the most visible interpreted sites, like the Quincy Mine Hoist and the National Park Visitor's Center. But since Michigan schools stopped

**Figure 3**:  GRACE interns and instructional staff use tablets and smartphones with the ArcGIS Explorer App to compare historical maps with current landscape features, including this 1896 Bosch Brewing Co. building in Lake Linden (Photo by author).

teaching local history in the mid-2000s, many of the remnants of mineral extraction and processing that fill our landscape remained mysterious ruins to these students.

For one of the first expeditions, we loaded historical maps and aerial photos of the former copper milling town of Lake Linden into ArcGIS Explorer and equipped the interns with tablets and smartphones. Using 4G streaming data, the group walked through town, watching our location marker move with us on the digitized historical maps. This allowed us to compare the houses, storefronts, and empty lots in the landscape today with what stood there 50, 100, and 125 years ago (**Figure 3**).  Our region's dramatic landscape change became especially blatant to students when we walked through a grassy lakeside park with familiar playgrounds and boat launches, only to realize that we were walking over former stamp mills, leaching facilities, and flotation plants.  A few local residents came out of their houses to ask what we were doing.  Students shared their tablets to let community members see the changes around their own homes (**Figure 4**).

**Figure 4**: A university student uses a tablet with ArcGIS Explorer for iOS to show a local resident her house and neighborhood on early twentieth-century fire insurance plans (Photo by author).

Another expedition asked students to contribute their own interactions with the towns around them to an ongoing municipal improvement initiative. The Village of Calumet, the local health department, and the Keweenaw National Historical Park received a Complete Streets grant to improve walkability and bikeability in
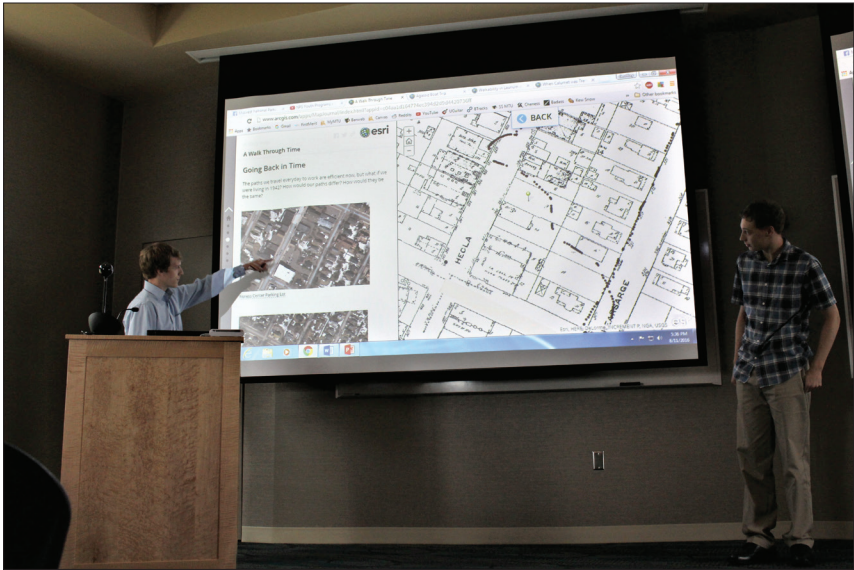
**Figure 5**: Two GRACE interns present their Story Map, which compares the built environment of the 1940s with today's landscape along the routes they frequently walk to and from school (Photo by author).

the National Park. Students used passive GPS units to record their travel behavior during data collection and 4G-enabled iPads to record elements of the post-industrial landscape that promoted or hindered their safe route to school, such as unprotected street crossings or missing or broken sidewalks. Students recreated their routes from school to home and also recorded spaces in which they felt unsafe. Qualitative GIS data including personal perception narratives and photographs complemented the survey data. All data was synced live to an ArcGIS Server. Students returned to the laboratory and learned how to synchronize GPS data with field-collected GIS data. They analyzed their routes, applying basic spatial analytical techniques such as interpolation and hot spot mapping using kernel densities. Routes were aggregated and all information was put into a WebGIS for the Park Service staff to use.

As a culmination of the interns' experience, they created Story Maps to encapsulate their summer activities and to disseminate their research. They presented their Story Maps in front of a packed house on our university campus to the local heritage community,

researchers, their families, and teachers (**Figure 5**). Now available publicly online, these Story Maps demonstrate the students' collective deployment of spatial thinking to engage with the history of their own communities in ways that are relevant to their lives today.[36] One pair of students compared what they see on their walk to school today with what kids like them would have seen in 1942. Others used Sanborn Fire Insurance maps from 1888 through 1949 to find the most startling changes between the built environments of the past compared with today's landscape. GIS technologies became tools for considering how the past influenced their lives today.

Working with GRACE has produced measurable outcomes for several of these students. For some students, it was a transformative experience. One student exclaimed:

> I can get a job in this, they told us we were already using technology above entry-level jobs. I feel I know a lot about how to do it, what it means for understanding history, and I can figure out what to do by myself.

Two of the students presented their Story Maps at the Michigan Community Association of Mapping Professionals conference. As high schoolers at this professional gathering, they gained invaluable professional experience and received considerable attention from companies looking for GIS-trained employees. Further presentations at the school library attracted a large audience of excited community members, some of whom asked the interns about how they now see history in our community after completing this internship. Several said that they lacked an interest in local history before GRACE, but now are seeing more and more how the past has influenced the streets and buildings they live in. Another student commented:

> Looking at my town like this, I mean I pass that block every day… now I see it differently—you know why that house is abandoned, and then look at all the trash and why there's no traffic there, but one block away it's different. It gives you a new way to look at your surroundings and how to make them better.

Using spatial thinking, they all have made new connections between their current lives and the past that will translate into greater awareness of history as they move into adulthood. Moreover, two students have recently enrolled in college programs that use geospatial technologies with an application toward history and social sciences.

Overall, the GRACE Project brought together a dynamic combination of pedagogical approaches that connected the everyday experiences of high schoolers with their region's industrial history and today's heritage tourism. At the heart of the GRACE Project is Beatty's professional content model of service-learning, which was abundantly served by these students' exposure to GIS technologies, an area of job training that is in increasingly high demand.[37] Interestingly, the GRACE Project does double duty enacting the civic engagement model of service-learning by involving students who are themselves community members. Our close collaboration between university faculty and students with high school teacher and students broke down the traditional divisions of authority between university and community in multiple ways. Students are simultaneously "the public." Young people become the experts when the experiences of teenagers are a central research topic. Local voices speak through the National Park Service, often regarded suspiciously by locals as an arm of the federal government. A state technological university, often considered as training ground exclusively for engineers who leave the region after graduation, supports local education in both technology, geography, and history. If community engagement curricula aim to create civic-minded citizens while also improving town-grown relationships, this project models collaboration with K-12 schools in HGIS to elevate the value of history in community life.

## Conclusion

Based on our experiences with the three case studies presented here, we continue to develop ways to further evaluate and improve community-engaged HGIS teaching projects. As we stated above, and as digital history scholars have been arguing, teaching digital history maintains at its core the techniques of interpreting primary historical evidence. Our projects suggest ways to do this using primary evidence that is specifically spatial in nature. The assessment of our projects, which involved student evaluations and faculty assessment of student papers and Story Maps, suggests that students gained traditional historical research skills as well as the ability to interpret the cultural landscapes around them in terms of change over time. As we continue to integrate spatial storytelling tools with teaching and fieldwork, we will refine evaluation

instruments for Story Maps and other digital history outcomes following the lead of Mostern and Gainor, who pioneered ways to combine assessment of spatial thinking skills with historical interpretation specifically for digital historical atlases.[38]

Likewise, our community-engaged partnerships can be evaluated in part by surveying students about their level of interest and action in further civic engagement, and also by feedback from our community partners. The Village of Calumet uses the WebGIS built by our class extensively to manage their historical resources and to promote the vacant or underutilized properties to investors for redevelopment. The local economic development authority also utilized the web app to provide critical baseline data for a major grant proposal to the State of Michigan for funds to stabilize and remediate several key heritage properties.

Twenty years ago, the pioneering urban historian Dolores Hayden demonstrated that "public space can help to nurture [a] more profound, subtle, and inclusive sense of what it means to be an American."[39] Around the same time, Paul Theobald's *Teaching the Commons* argued that students who learn in and with their local landscapes go on to create healthier and more democratic communities.[40] Contemporary geospatial technologies are offering us new ways to heed the still-inspiring ideas of these cultural critics. As our team's community-engaged spatial history projects move forward, we will expand our use of public participatory HGIS and citizen science techniques to involve our neighbors in building an online historical atlas that will serve community needs. In the process, we will seek to foster intergenerational conversations between students at the K-12 and university levels and the residents of and visitors to our post-industrial rural landscape. The more students we can energize with the common everyday places that they share with a larger society—even if only during the four years of a typical high school or college career—the more hopes we have for ensuring history's role in our future.

Notes

1.      See, for instance, Charles W. J. Withers, "Place and the 'Spatial Turn' in Geography and in History," *Journal of the History of Ideas* 70, no. 4 (October 2009): 637-658; Deryck W. Holdsworth, "Historical Geography: New Ways of Imaging and Seeing the Past," *Progress in Human Geography* 27, no. 4 (August 2003): 486-493.

2.      Detlev Mares and Wolfgang Moschek, "Place in Time: GIS and the Spatial Imagination in Teaching History," in *History and GIS: Epistemologies, Considerations and Reflections*, ed. Alexander von Lünen and Charles Travis (Dordrecht, Netherlands: Springer Netherlands, 2013), 59-72; Robert M. Schwartz, "Teaching Environmental History: Environmental Thinking and Practice in Europe, 1500 to the Present," *The History Teacher* 39, no. 3 (May 2006): 325-354; Donald Janelle, "Spatial Perspectives on Analysis for Curriculum Enhancement in the Social Sciences," paper presented at the Annual Meeting of the Association of American Geographers, Las Vegas, Nevada, March 22-27, 2009.

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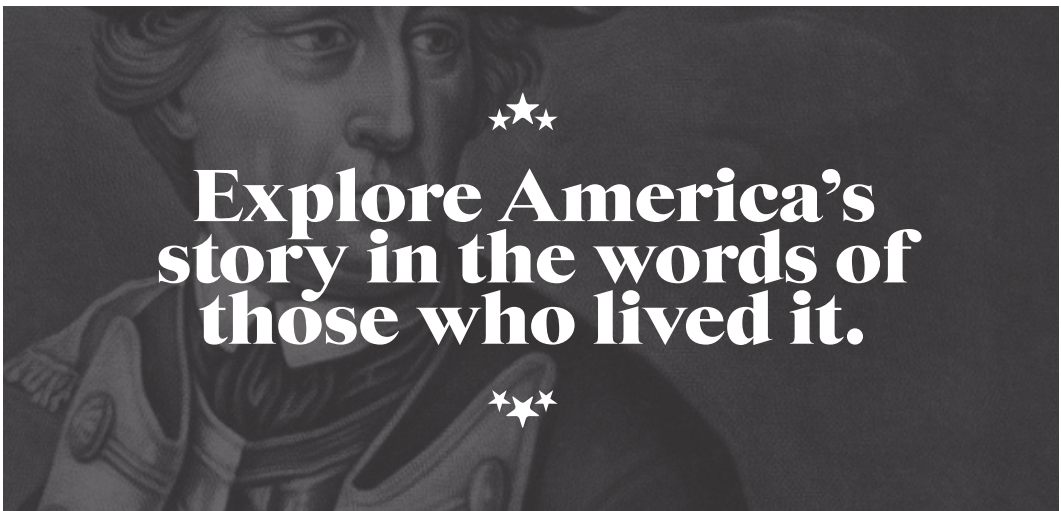
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