Internet GIS as a Historic Place-Making Tool for Mammoth Cave National Park

Ann E. Epperson

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INTERNET GIS AS A HISTORIC PLACE-MAKING TOOL
FOR MAMMOTH CAVE NATIONAL PARK

A Thesis
Presented to
The Faculty of the Department of Geography and Geology
Western Kentucky University
Bowling Green, Kentucky

In Partial Fulfillment
Of the Requirements for the Degree
Master of Science

By
Ann E. Epperson
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INTERNET GIS AS A HISTORIC PLACE-MAKING TOOL
FOR MAMMOTH CAVE NATIONAL PARK

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This project laid the groundwork for an Internet-delivered Public Participation Geographic Information System to facilitate exploration and discovery of the past communities of the Mammoth Cave Park area. The emergence of Internet Web 2.0 design along with distributed GIS services allows for anyone to interact with and add to the information found on central Internet sites. Historical geography often relies upon public participation from individuals outside the academic world to provide narrative descriptions, photographs and manuscripts of past places and events to augment information held by institutions and academia. A public-participation website for the Mammoth Cave Historic GIS (MCHGIS) created a central Internet location for dispersed and disparate data related to pre-park communities to be presented with a geographic context. The MCHGIS project allowed for visualization of the pre-park communities in unique ways and contributed new understandings of this pre-park area.
Introduction

Geographic Information Systems (GIS) make complex spatial and temporal information readily available for use and analysis to both professionals and the public. Categories of spatial information available are virtually limitless; any information with a spatial component can be captured in GIS. When one combines GIS with the accessibility of the World Wide Web, spatial information can be used by anyone with Internet access and basic computer skills. The ability of desktop GIS technology to improve the results of public participation (PPGIS) in a variety of projects has been widely researched over the past two decades. Internet GIS can improve PPGIS projects by simplifying the accessibility of GIS data and enabling the two-way collaboration necessary for data discovery. Internet-enabled, two-way PPGIS is just now being realized and researched.

One such potential application for Internet GIS is in the field of historical geography. Historical geography often relies upon the participation of individuals outside the academic world to provide narrative descriptions, photographs, manuscripts, and other documentary evidence of past places and events. Incorporating public participation into historical geography allows for collaborative information sharing and imparts a sense of community-building and ownership among participants. While public participation is an integral and accepted research tool in historical geography, GIS is only now being embraced by historical geographers as a mainstream research tool (Gregory 2007).

This project explores the ability of Internet PPGIS to facilitate exploration and discovery of the past communities of the Mammoth Cave National Park area. Warnell (1997) described the settlement of this area prior to the park’s creation and documented churches, schools, and cemeteries that served the area’s largely agrarian communities. Algeo (2010) notes that of the three eastern U.S. National Parks authorized in
1926: (Mammoth Cave, Great Smoky Mountains, and Shenandoah); Mammoth Cave was the most densely populated area of the three to be vacated and yet has received the least attention from researchers on its relocated population.

Former residents and their descendants have developed a strong sense of camaraderie and community over the years. This sense of fellowship manifests itself in such efforts as an annual Homecoming each 4th of July at Mammoth Cave National Park, occasional family reunions for specific families, and a persistent online community at MyFamily.com where members share genealogy information, photos, stories, and other topics of interest related to the former communities of Mammoth Cave National Park as well as current family news and events. These efforts to memorialize the memories and shared sacrifices of relocation have created a shared “public memory” of this place amongst its members, with much of the history passed down in the form of oral history and in documents scattered in private collections throughout Kentucky and other parts of the country.

Brunt (2009) created a historic GIS (HGIS) of the Mammoth Cave National Park area by integrating 1920 Edmonson County manuscript census data with the park’s GIS data on 1936 parcels, house locations, and roads. The Mammoth Cave HGIS research provided the first in-depth, household-level demographic analysis of the area prior to the park’s creation. One question that remained from that research project was: how can this information be shared with the public and expanded upon by the many people who knew this area as home? Public Participation GIS is the answer.

This project converts the Mammoth Cave HGIS into a public participation GIS via the Internet. A PPGIS enables sharing the historic data with the public and provides
the public with a means to contribute to this body of knowledge. Public Participation GIS seeks to give a voice to population typically marginalized by the established political structure. Traditionally Mammoth Cave National Park gives little treatment in their visitor interpretive center and website to the settlement history of the area prior to the park’s creation, focusing instead on the natural landscape upon which the park is founded.

An Internet-enabled Mammoth Cave HGIS could serve as a central repository for much of this dispersed and disparate information, including oral histories, photographs, and letters, putting that information in a spatial context that would enable connections between households, communities and the larger region. This project has four outcomes: the creation of an Internet mapping application for the Mammoth Cave HGIS, linking photos to properties within the HGIS, a method for allowing the public to contribute additional photos and other materials to the research effort, and a user survey to gauge the effectiveness of the application. This project explores how an Internet GIS extends the availability of historical data to the general public in a meaningful and educational way, and, in turn, examines how Internet GIS can provide a way for the public to participate in the documentation and facilitate the discovery of the past places of Mammoth Cave National Park.
**Literature Review**

Mammoth Cave became a National Park in July of 1941. By this time, all the former residents, some 2,000 inhabitants of the area, were gone. Evidence of previous habitation by people such as houses, barns and cultivated fields were removed as the National Park Service endeavored to return the land to its “natural” state. As a result, knowledge of pre-park settlement patterns and history is limited and resides in resources scattered throughout the United States, including various private papers and photo collections, the government census, land acquisition and condemnation records, and oral histories of former inhabitants of this area (Algeo, 2004).

Algeo (2010) argues there are four compelling reasons to recreate the settlement history of the Mammoth Cave region, and make that history publicly accessible. First, the United States national park model is often used internationally. Better understanding of the implementation of this model can lead to better treatment of displaced peoples as national parks continue to be created around the world. Second, to fully understand the contribution of Mammoth Cave as a national symbol, one must understand the process of the park’s creation. Third, studying the short and long term consequences of the invocation of eminent domain can contribute to a greater understanding of modern social justice issues. Lastly, an Internet-accessible GIS of the pre-park communities of the Mammoth Cave area will document and honor the forced sacrifices of home and community that the residents of the area endured.

Many journal articles document historical geographers’ reluctance to fully embrace GIS. Several impediments existed, between including cost and complexity of the technology, having to deal with approximations as opposed to definite boundaries (and
grappling with how to depict those approximations in GIS), historians’ cultural and academic preference for the narrative approach, and a lack of readily available, standardized, GIS-ready data sets. Historical geographers initially viewed GIS with skepticism, fearing it would replace qualitative social research techniques with a positivist approach (Gregory and Healey, 2007). Historical geographers saw GIS as a computer tool rather than an approach to scholarship (Gregory and Healey, 2007).

Another barrier has been the limited ability of GIS to adequately represent time, a fundamental concept for historical geographers, whose work deals with people and places that invariably change over time (Langran, 1992). As a part of the rise of quantitative analysis in geography during the 1960’s, geographic analysis focused on the location and distribution of spatial data, while the temporal component became just another attribute of a spatial feature. This epistemology prevented early development within GIS of temporal analysis tools (Ott and Swiaczny, 2001). However considerable effort has recently been going into creating spatiotemporal tools. GIS is a powerful tool for representing complex layers of spatial data, and improving in the incorporation of temporal data (Bodenhamer, 2008, 220).

Despite these challenges, the new research field of historical GIS is slowly emerging. Gregory and Healey (2007) note that, over the past decade, social science researchers have begun to embrace GIS for its ability to discover new relationships from a variety of seemingly unrelated data by studying their geographic context. Historians’ perspective of GIS is evolving from that of a computerized mapping system, the “map metaphor,” to a system capable of portraying objects not typically portrayed on paper maps (Goodchild, 2008), such as the movement of a person through time. In addition,
historical GIS can reveal previously hidden spatial patterns and data contained in maps and other geographic sources (Knowles, 2000).

As a result historical geographers over the past several years have begun to harness GIS technology to both expand current research efforts and to explore new research topics. The University of Minnesota maintains a Historic GIS Website entitled National Historical Geographic Information System (http://www.nhgis.org). This project provides publicly available aggregate U.S. census data and GIS-compatible boundary files for the United States between 1790 and 2000. This site both allows users to download data to a desktop GIS and provides a link to an online mapping application called Social Explorer (accessed at http://www.socialexplorer.com), that was developed at Queens College of the City University of New York. Social Explorer helps users visually analyze and understand the demography of the US through a suite of maps and data reports. This website provides demographic and socio-economic data maps of the United Stated between 1790 and 2007. The user selects the timeline and demographic information to display on the map. The user at home can create and view maps of the past without expertise on traditional historic research methods. Social Explorer enables dynamic creation of custom historic maps, allowing the user to explore a vast array of aggregated cultural attributes in a fraction of the time it would take to create a traditional atlas map. Social Explorer does not offer the ability to view census data at the individual household level.

George Towers (2010) created a historic GIS to analyze the past landscape of the southern Appalachian communities extant in Summer County, West Virginia, roughly 100 years ago. Towers utilized the available aggregated census data for that time period.
Individual household data for the rural communities of that period was not a component of this research project. Towers geo-referenced a historic USGS topographic map and noted the location of key structures on the map as “nodes.” These nodes became the foci of cost analysis equations along with modern topographic coverages in the GIS used to model the early agricultural neighborhoods of the region as described by ethnographers and cultural geographers. Towers concluded that this methodology can be extended to other historical research projects and thus “extend our understanding of the region’s historical geography and contemporary cultural landscape” (Towers, 2010, 77). Towers used spatial patterns of house locations to model approximate historic village boundaries, but he makes no use of household-level demographic data for those villages.

Brunt (2009) studied the pre-park communities of the Mammoth Cave area, using GIS as an analysis tool. Brunt collected key digital data layers from the Mammoth Cave Park archives, including 1930’s-era roads, 535 private property parcel boundaries from 1936, and the location of 665 houses in the park prior to their demolition. These layers form the basis of the Mammoth Cave HGIS project. His research involved developing a methodology to identify specific residents of these structures using the recently released 1920 manuscript census. This census is a household-level, hand-written census that by policy of the U.S. Government remained secured from the public for 72 years to protect the privacy of those recorded in the census. These data sets form the foundation of the Internet-enabled HGIS project.

Brunt acknowledges that this methodology is not without risk of error. If an owner possessed one parcel, and that parcel had one house, and the parcel owner was listed as owing his own house in the census, there is a high level of probability that the
house was occupied by the parcel owner, and in many cases the manuscript census verified this assumption. However there were many challenges with the 1920 manuscript census. Brunt encountered varying degrees of data quality including variable handwriting, condition of the reproduced documents and poor quality of the microfilm. Discrepancies were noted in the spelling of surnames in the manuscript census records. Routes used by the census taker were unknown and thus had to be hypothesized. Many of the matches between census households and house locations were confirmed by tapping into the “public memory” of the community, by interviewing local historians and former Mammoth Cave area residents and their descendants. In his research, Brunt identified likely residents for 142 of the structures and produced a quantitative demographic analysis of this region just prior to the park’s formation.

The demographic data available in the Social Explorer are common aggregate census attributes, but these data lack the comprehensive resident household details. Tower’s study of past communities employs a model to approximate rough boundaries of neighborhoods, but also does not provide any household-level demographic details as captured through more traditional and time consuming historic geography methods such as personal interviews and research of library archives and private holdings. The Mammoth Cave HGIS is unique in its approach to map an accurate representation of household-level census data.

Public memory is defined as “a body of beliefs and ideas about the past that help a public or society understand both its past, present, and by implication, its future (Bodnar, 1991). Public memory exists both as an official societal accounting of events and as a vernacular culture of memories from various social units. These public memories
represent an array of special interests, and at times these memories can contradict one another. Public memory can lack precision and is often affected by cultural interpretation of events at the time they occurred. Yet public memory provides a valuable lens through which to observe a place and time. GIS provides a unique research opportunity to overlay the public memory with a geographic context, and thus reconstruct past places. Oral history and family records of a place often reside in the public domain or the collective public memory. Public participation is thus an integral component to historical research of near-recent history.

Research has shown that public participation can be enabled and extended through use of GIS. One landmark study has been the ongoing research of Ghose (2001), who undertook a qualitative, intensive case study to determine if an underprivileged community group could harness GIS to more effectively communicate with their local government. While a centrally located GIS was able to arm the citizen group with much more dynamic and meaningful data, thus improving their ability to communicate, several problems were noted as well. The most significant barrier to using GIS was its cost and complexity. This challenge was overcome by forming key partnerships with universities and other agencies (Ghose, 2001). Several earlier PPGIS studies document the lack of public access to GIS data, software, and hardware which often marginalized the public’s participation in a given project (Peng, 2003).

Tulloch et al. (2002) developed a new, comprehensive model evaluating three key elements of PPGIS success in public land management: efficiency, effectiveness, and equity. GIS enables information management and data queries to be performed more quickly and with fewer materials or people than were used previously. Improved
performance improves the effectiveness of the agency in its core mission, in this case, public land management. Extending land records to the public via GIS increases the availability of the data beyond the walls of the agency, granting a wide audience easier access. GIS often involves a significant capital output; however, organizations can realize internal improvements in data management, in terms of both efficiency and effectiveness, which can partially offset the initial investment. Only a full characterization of benefits, both quantitative and qualitative, however, can deliver a true measure of return on investment. An equity/empowerment benefit, such as those studied in Ghose’s research, should be factored into measuring the success of the traditional PPGIS model.

While traditional desktop GIS programs remained costly and cumbersome for the mainstream public, the Internet began to facilitate the transfer of GIS processes to the public. Kingston et al. (2007) explore the role of PPGIS in improving public participation in local environmental decision making. The goal of improved public participation was similar to that of Ghose et al. (2001), however this research involved delivering PPGIS via the Internet, and results indicate that the Internet makes a difference. Internet GIS made information more accessible to the public, and interactive GIS systems can fully encourage public participation in GIS projects (Kingston et al., 2007).

GIS has evolved from a mainframe-based system to a desktop/server system to distributed GIS services over the Internet (Peng, 2003). GIS mainframe architecture and GIS desktop architecture both require significant investments in hardware and software, including a server to house the data and client computers to run GIS operations. In the past these requirements limited GIS access to those who had the resources to invest in it. With the emergence of distributed GIS, the Internet is harnessed to deliver GIS services
to anyone who has Internet access. Rather than a desktop PC acting as the client, the web browser becomes the client. GIS services can now be consumed by anyone with access to a browser, be it on their home PC, a cell phone, a GPS device, or any other Internet-enabled device. Mass-market access to GIS is becoming commonplace. The casual user is becoming more spatially aware through technology such as Google Earth and in-vehicle navigation devices.

Concurrent to the development of distributed GIS services was the emergence of the “Web 2.0” concept. The early web schematic (Web 1.0) was a model of pushing data out to users, a one-way communication flow where requested Internet content was delivered to the user from a central site. The Web 2.0 model allows for two-way Internet content sharing. It enables collaboration between the central site and web users, allowing users to interact with and add to the information found on central Internet sites (Goodchild, 2007). Popular examples of Web 2.0 include Wikipedia and Google Earth, both of which distribute content to users and accept new and revised content from users via the web.

The Web 2.0 experience has created an Internet culture of two-way communication. This new culture is creating a dynamic shift in the PPGIS model from that of a geographic information delivery system to that of a collaborative, iterative information-sharing system. Interactive GIS web sites use maps and images to provide a more engaging spatial context to place-making. In the case of Google Earth, a user can view a map of a landmark, such as the Great Wall of China, and click on the map to view a photograph or a short video of the location, thus bring the map to “life.” Pietsche (2000) showed that computer visualization greatly enhanced the process of design for urban
environments. The web is effective at helping users visualize a place in an “interactive, associative, realistic, and accessible way” (Al-Kodmany, 2001, 805). Of course, allowing the public to add information to a dataset without some form of validation is a major risk for Web 2.0 web sites, and researchers must account for this in research design. The original Wikipedia design permitted open editing. Over time, multiple inaccuracies and intentional vandalism was allowed by a lack of controls on who could edit the web pages. Wikipedia changed its original “anyone can edit anything” policy by establishing a system of content editors and web page security (Hafner, 2006). Despite the risks of participatory web sites, extending the functionality of web-enabled spatial visualization to participatory exploration can yield results that traditional media could never offer.

Al-Kodmany’s (2001) research in urban design PPGIS suggests three future directions for research: (1) improving web interface design; (2) understanding users' experience and interpretations of web-based visualizations; and (3) evaluating the effectiveness of available web-based technologies to communicate residents' perceptions. A workshop documented by Craiglia et al. (2003) revealed three similar research foci for PPGIS: (1) how the PPGIS process contributes to users’ understanding of issues, and the role the technology plays in influencing users; (2) how users represent their local views using GIS; and (3) the human-technology learning process and methods of interaction in participatory projects.

Over the past decade, interactive Internet mapping services such as Mapquest and GoogleEarth, have come to be considered mainstream resources. They are available not only on the Internet but are also incorporated into our daily culture such as in current event maps displayed on the evening news or in popular mobile navigation devices such
as the Tom Tom or Garmin Nuvi. Simple mapping operations such as zooming, panning, or searching for an address or landmark have become routine in today’s society. Public Internet access has also greatly increased over the past decade through rural broadband initiatives such as those implemented by Connected Nation (www.connectednation.org), cellular and satellite access options, multiple free wi-fi locations, and for those who lack a computer or other Internet device, free computer access through most libraries. Thus opportunities to engage in PPGIS are becoming more numerous.

Recently East Carolina University partnered with the Pamlico-Tar River Foundation (PTRF) to coordinate a volunteer watershed monitoring project via GIS. Monthly water quality updates, first launched in 2005, can be viewed on an Internet Mapping Service (IMS) by the general public. The Citizen’s Watershed Monitoring Project reached its goal of widespread dissemination of the water quality data through the IMS (Luchette, 2008). This is an example of the PPGIS as a consumption model; extending data in a transparent way to citizens.

True PPGIS involves the public in a Web 2.0 framework, where participants consume geographic information, and add their own data to it. PPGIS is often used in interactions between local governments and their citizens in political decision-making processes such as neighborhood needs analysis and community planning (e.g. Elwood, 2008; Ghose, 2001; Goodchild, 2007). By engaging the public via PPGIS techniques, public officials can extend the participation opportunity to those who could not attend a meeting in-person and to those who may prefer to remain anonymous (Wong and Chua, 2001).
Engaging individuals in participatory research can be challenging. Shiffer (1995) and Al-Kodmany (2001) both observe that gaining a meaningful or statistically significant number of participants relies upon users being externally motivated to log on and seek out a participatory opportunity, and this still holds true for today’s applications. Affleck and Kvan (2008) conducted a case study in 2005-2006 involving the preservation of the cultural heritage of Hong Kong as interpreted by resident online social networks, rather than official institutions such as museums. Participants were encouraged to share photographs and memories of this place in an online, collaborative forum. By facilitating a virtual community’s participation in documenting and interpreting local history, both participants and observers can gain unique and meaningful insights into the cultural heritage of this community. The single greatest challenge in this research effort was the level of participation; although some good contributions were made, overall participation was low. The authors speculate this may be due to the non-captive nature of the Internet audience, as opposed to participants being actively led in a captive, community meeting setting. Creating a virtual community that encouraged engagement and fostered online group discussions proved difficult.

There are many examples of public participation GIS on the Internet and many examples of historic GIS projects in the literature. The Internet-enabled Mammoth Cave HGIS is unique in its approach to documenting the pre-park communities at a household level and inviting the affected public to contribute to this body of knowledge through a dedicated web mapping application. This project aims to leverage the convergence of society’s Web 2.0-enabled PPGIS culture with the emergening Historical GIS research field. By providing an interactive, Internet-based historical GIS of Mammoth Cave
places, previously dispersed and disparate data resources will be presented with a geographic context. Users will experience enhanced visualization of communities through an interactive map that displays artifacts, photos, and eventually, short audio and video clips. This project creates a participatory historical GIS web mapping application with the goal of deriving new understandings of the communities and individuals that comprised Mammoth Cave National Park.
Data Sources and Methodology

This project produces an interactive web-enabled historic GIS (HGIS) mapping application. The Internet HGIS contains property parcel outlines and house locations within the current extent of Mammoth Cave National Park as developed by the Brunt (2009) HGIS research project along with a seamless topographic background map for geographic reference. Historic photographs of the area’s houses, residents and other features link to GIS features representing houses and parcels and are available for users to view via a hyperlink. The website allows users to submit new photos or other information for inclusion in the project and offers an option to take a user survey on the website’s performance and usability. Mammoth Cave National Park currently restricts use of its GIS data for public release, so approval was necessary to use this data in a public-participation GIS. Following approval from the park, the website was shared with the public for their review and participation, both through live demonstration at Homecoming 2010 and via announcements on targeted social networking sites. This project enables active participation in the GIS, allowing the public to provide new information about where people lived in the pre-park communities of the Mammoth Cave area, provide photographs of their homes and families, and provide feedback on their online experience. This feedback allows project developers to better tailor the site to meet the public’s needs and expectations.

Original Historic GIS map document (Brunt 2009)

The HGIS map document that formed the basis for this project is in ESRI .mxd format (Analysis.mxd) created in ArcMap 9.3. Its layers were imported into a personal geodatabase and consisted of:
- Road Feature Class: ESRI vector format, line feature;
- 1936 Land Tract Feature Class: ESRI vector format, polygon feature;
- 1920 Structure Feature class: ESRI vector format, point feature
- 1980 USGS Topographic Map: Raster file of multiple scanned paper maps showing elevation, streams, major cave entrances, and other physical features along with modern roads and structures.

Examples of Analysis.mxd are shown in Figures 1A (House and parcel locations) and 1B (Topographic Map). A new map document was created for the PPGIS called CaveHGIS.mxd from the Analysis.mxd. The purpose of the Analysis.mxd was primarily quantitative analysis of demographics. The primary function of the CaveHGIS.mxd is to deliver interactive mapping services, thus several modifications were necessary to improve visual acuity of the map.

![Figure 1A: Original map document without topographic layer (Brunt, 2009)](image-url)
Figure 1B: Original map document with topographic layer (Brunt, 2009)

The feature classes of Analysis.mxd contained no meaningful metadata other than spatial projection details. Collection of metadata is crucial for a project of this nature. The map document and associated layers are all projected in Kentucky State Plane South FIPS 1602 Feet, North American Datum 1983. Metadata was created for each of the feature classes through data gathered both by reviewing Mr. Brunt’s thesis and personally interviewing Mr. Brunt in 2008 and 2009. According to an interview with Mr. Brunt the “Structures” feature class was first digitized from the old 1930’s era “brown line” topographic map during Mammoth Cave Archeological Inventory Project circa 1993. This specific information was added to the metadata for the Structures feature class. Standard metadata was created for each feature class, including Key Words, Abstract, and Purpose on the Description tab. It is expected that the metadata will continue to evolve as the project progresses. During the interview, Mr. Brunt also relayed
information regarding the Data Use Agreement required by the Park in order to use the
GIS data sets provided by the Park. This agreement forbids release of data originally
provided by the Park to the public without prior Park approval.

The symbology of each feature class was evaluated for clarity in the interactive
map. ESRI ArcMap allows for almost infinite variations in symbology. The predominant
background color of the map is the muted green tones of the topographic map. The color
selections for the feature classes needed appropriate contrast to the map background and
to each other. There are three basic color systems for specifying color on maps: HSV
(hue, saturation and value), CMYK (cyan, magenta, yellow, black), and RGB (red, green,
blue). RGB is the main color system used in computer graphics (Brewer, 2005). Since
this is a mapping project intended for consumption via the Internet by a wide range of
people, the color selection emphasis was placed on the RGB scheme.

The parcels feature class is a polygon shapefile that provides a framework for
locating properties. Its symbology uses solid 2.00 point line in black color to show
property boundaries and has no fill pattern to allow the background topographic map to
be visible behind the parcels. Roads are typically shown on a map in black, brown or
gray. In order to contrast with the black outline of the parcels and the gray hillshading of
the background topo map, the Roads feature class is displayed with a broken line, 2.00
point size, in the “Cherrywood Brown” color. There are only eight named roads in the
layer, so labels for this feature class are displayed when this map is at full extent,
allowing the site user to see road names. The label text is white with a light brown halo
mask and the labels are designed to follow the line of the road.

The Structures feature class has all 665 structures (houses) in one table, with
owner/occupant name added to 142 structures in the “Resident” field. In order to
differentiate those structures that have a value in the “Resident” field from those that do
not, a standalone Structures feature class was created, comprised of the 142 houses for
which occupants were identified by Brunt. The “Structures” feature class name was
changed to “1920 House Location,” and the new feature class to “1920 House, Occupant
Identified by Census,” and the two features were given contrasting colors to allow easy
visual differentiation. The 1920 House Location feature class is displayed as a square,
10.00 point size, in “Cretean Blue.” The 1920 House, Occupant Identified by Census
feature class is displayed as a square, 10.00 point size, in “Mars Red.” Map layers are
drawn in the order specified by the layer’s position in ArcMap’s Table of Contents, with

Figure 2: Map document with revised symbology

the layer at the bottom of the Table of Contents drawn first and the remaining layers
superimposed, in order, on top. Thus the red 1920 House, Occupant Identified by Census
is listed first so that it will be visible on top of the blue 1920 House Location layer. Next
are Roads and then Parcels in 1936, with the topographic map as the background.

Figure 3: CaveHGIS.mxd zoomed in beyond 1:24,000.

Labels were enabled for both the 1920 House, Occupant Identified by Census
layer and the Parcels in 1936 layer at a minimum scale range of 1:24,000 (Figure 3). This
prevented the map from appearing cluttered when at the full extent. As the user zooms in
closer than 1:24,000, these labels become visible. Labels for both layers were given a
contrasting halo mask to help the text stand out from the topographic background map.

Topographic Map

The background topographic map raster file used in Brunt (2009) was not ideal
for a web mapping application. ESRI offers free streaming map layers for ArcGIS users via ArcMap’s Resource Center. The images constantly stream as the zoom extent is refreshed by the user. One of these layers is a World Topographic Basemap with topographic data from the USGS Earth Resources Observation and Science (EROS) Center. This basemap offers smoother lines than a simple raster of a USGS topo map, and it offers hill-shaded relief, which aids user interpretation by providing more apparent visual depth of topography. When the user zooms into the scanned raster (Figure 4, right side), the features on the topographic map become large and pixilated, or grainy, in appearance, while the ESRI-supplied topographic map (Figure 4, left side) refreshes both features and hill-shaded relief at each scale. A high quality topographic map is an essential background for the web GIS application because many people associate their
memories of the area in reference to specific topographic features including streams, ridges, and sinkholes. The original raster file was thus replaced with the ESRI Resource Center Topographic Basemap because of its superior visual properties and ability to change resolution with changing map scale.

**Archival Photos**

The Civilian Conservation Corps (CCC) took photos of the area as they worked to demolish structures and build roads for the new park and these photos are part of the Mammoth Cave National Park archives. Photos included houses, farm outbuildings, barns, and various other subjects. Each photo has a five digit unique identifying number. The metadata for each photo includes a text description, and, in some cases, a property owner name and/or a parcel (tract) number. The photo metadata was compared to the census and parcel information in the HGIS database in attempt to match photos with specific properties.

As with the manuscript census interpretation in Brunt’s 2009 research, the photo metadata was at times challenging to interpret. Questions on spelling, property or house placement, and the owner name as listed in the photo metadata were some of the problems encountered. In each case where a decision to link a photograph to a GIS feature was made, research notes were appended to the photo metadata explaining why a photo was used and how it was assigned a parcel or house feature (Appendix A).

The original project plan was to link each photo with its corresponding structure feature. (The term “structure” is used in lieu of “house” as a few of the structures in this feature class represent a church or a school). This proved problematic as there were very few cases where a one-to-one relationship existed between a structure and a confirmed
photo match. In fact, only six photograph-structure matches were made. In most cases parcels had more than one structure on them making a specific assignment impossible without corroborating evidence. Thus all the photos in this project were matched to the parcels including the six that are also matched to a specific structure.

Differences in spelling were sometimes encountered between the parcel owner name in the database and the handwritten name. This could be due to a spelling error or to the photographer writing down phonetically what he thought he heard spoken in the field. One example of this is tract 281 as shown in Figure 5. The parcel database lists the owner as “Tom M. Denham.” The photo metadata lists the owner this tract as “T. M. Durham.” The photographer could have written Durham either because he thought that was what he heard, or because he was more familiar with that name spelling and assumed the speaker was mispronouncing the name. The match between the photo and the parcel is made based upon the tract number despite the slight variation in spelling between the

<table>
<thead>
<tr>
<th>ID</th>
<th>CATNUM</th>
<th>NAME</th>
<th>Acres</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>351</td>
<td>281</td>
<td>Denham TOM M.</td>
<td>63.203012</td>
<td>2</td>
</tr>
<tr>
<td>237</td>
<td>227</td>
<td>Barbee E Ellis</td>
<td>159.745609</td>
<td>6</td>
</tr>
<tr>
<td>310</td>
<td>149</td>
<td>Jones A O</td>
<td>389.950532</td>
<td>15</td>
</tr>
<tr>
<td>27</td>
<td>7</td>
<td>Ritter E T</td>
<td>50.429384</td>
<td>2</td>
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<tr>
<td>297</td>
<td>277</td>
<td>Holton W O</td>
<td>88.933585</td>
<td>3</td>
</tr>
<tr>
<td>96</td>
<td>502</td>
<td>Ritter Ralph</td>
<td>11.021925</td>
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<tr>
<td>154</td>
<td>173</td>
<td>Sanders Mitche</td>
<td>51.090283</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 5: Rectifying photo metadata with property parcel records
two records. In cases of spelling differences the property parcel spelling was used, as this database represents the record of property ownership likely compiled by individuals with greater knowledge of the area while the CCC photographer came from elsewhere.

In order to link a photo with features in a feature class, two fields were added to the feature class attribute tables. The “Location” field is a text field listing the file location (i.e. pathname) of the photo. The pathname is relative rather than absolute; this allows for the transfer of the map document to other server locations in the future if needed. The “Verification of photo source” text field lists the source of information for the photo’s location on the map, such as the CCC metadata or an individual contributor’s name and date. These fields were added to three feature classes: 1920 House, Occupant Identified by Census and Parcels in 1936.

Web Application Development

A pilot project was developed to gauge public interest and effectiveness of the public participation HGIS concept. The map document CaveHGIS.mxd was shared on a dedicated laptop in ESRI ArcMap 9.3 with participants at the 2009 Homecoming at Mammoth Cave National Park. This is an event held each Fourth of July, sometimes referred to locally as “Going to the Fourth,” where descendants of former residents of the park area and their families gather to share information and enjoy the camaraderie of fellowship in their shared histories. This event provided researchers with an opportunity to gather information on family histories in the form of photographs and narratives, and it provided the public with an opportunity to view the HGIS.

The software chosen to create the Internet mapping application was ArcGIS Server 9.3. ArcGIS Server works in tandem with ArcMap by importing .mxd documents
as map “services.” The user can then create one or more Internet mapping applications that use these services. Following the pilot project, the CaveHGIS.mxd was imported into ArcGIS Server as a map service. A new Internet mapping application called Mammoth HGIS was created in .Net WebADF (Application Developer Framework) supplied with ArcGIS Server. The application serves the CaveHGIS.mxd to users via the Internet. This application was designed to be user-friendly and intuitive. Standard web mapping tools commonly found in other web mapping applications were added, such as pan, zoom, identify, overview map, and search. The website allows users to search for a family surname by entering part or all of the surname of interest. The search results provide the user with a list of each matching record, and each parcel in the search return is highlighted on the map. Selected information about each parcel is also returned, including acreage, and the head of household’s age and occupation if known from a match with a census record. When the user selects a parcel that is linked to a photo, the hyperlink tool displays the photo(s) associated with that parcel in a new browser window.

Public Participation

Two avenues for public participation on the website are the ability of users to submit information directly to the researcher for incorporation into the website, and the ability to take an anonymous survey on the usability of the website. Both functions are housed in the application link “Email Us or Take a Survey.” This link launches a MCHGIS research project website. The website includes both cursory and more detailed descriptions of the MCHGIS project for the casual user. A risk of allowing users to directly insert data into the participatory website is the introduction of error or intentional malfeasance, a well-known problem with Web 2.0 sites such as Wikipedia, so we opted
not to allow posting of user-supplied data until it could be vetted by a project researcher. A link on the project website called “Email information or pictures to WKU staff” automatically launches the user’s e-mail client with an e-mail address of the researcher in the “to” column. This allows the researcher to receive and vet user submissions for accuracy, suitability and inclusion in the MCHGIS. Another link called “Take a Survey on the Mammoth Cave HGIS Website” enabled users to provide anonymous feedback on the website. The user survey was created in the University’s Qualtrics online software, was approved for use by the University Human Subject Review Board on May 27, 2010 (Appendix C), and subsequently published for public use on the Qualtrics website. The purpose of the survey was to gauge users’ perception of both the functionality and the overall purpose of the website. The survey provided measurable metrics on website performance such as how easy or difficult the mapping application was to use and how beneficial the help text was, and also allowed the user to enter free form comments and suggestions regarding the web mapping application.
Results and Analysis

Pilot Project, Homecoming 2009

A small number of photos were hyperlinked to matched parcels in the CaveHGIS map document to serve as a test case, and the project was loaded onto a laptop equipped with an ArcMap license. This laptop allowed the researchers to create a pilot project for the annual Homecoming event to test users’ interaction with the online map document and photos. A 36-inch by 48-inch map was produced in an ArcMap Layout and printed on a large-format printer to serve as an additional visual display at Homecoming. On Saturday, July 4, 2009, the pilot project was introduced to participants at Homecoming. The poster-sized map display garnered people’s attention, and as they examined the map, I asked what family name they were interested in. That name was then searched in the map document database on the laptop, and if located it was highlighted on the map. I would then click on a parcel linked to a photo, causing the photo to display in a new pop up window in the map view. Homecoming participants were genuinely excited to see the maps and photos and to find their relatives in the databases. Dr. Algeo and I explained to participants that the goal of the pilot project was to test the concept of interactive mapping for the pre-park communities of the Mammoth Cave area, with the long-range goal of making this available on the Internet for everyone to access. We also used a scanner to collect additional photographs for future addition to the project.

Bob Ward, Chief of Science and Resources Management for Mammoth Cave National Park, expressed a great deal of support and enthusiasm for the pilot project. Mr. Ward brought the superintendent Mr. Patrick Reed over to our table and asked that we provide a brief demonstration. The project was demonstrated and the future vision of a
Public Participation HGIS project was discussed. Mr. Reed was impressed with the project and offered his opinion that it could one day be an interactive tool in the visitor center. Indeed this was a stated goal in the thesis proposal for this project.

The pilot project was also discussed in an article in the July 5, 2009 edition of *The Daily News* in Bowling Green, Ky. The article invited readers to submit additional historical information, and this publicity resulted in a few additional photographs and stories e-mailed to Dr. Algeo over the following week. The July 4, 2009 pilot project resulted in discussions with upwards of 50 people at Homecoming and several new photographs to add to the collection.

At the time of the pilot project, only a few photos were assigned to parcels in the map document, as most of the effort to date had been on refining the application interface. Following the pilot project, the remaining photographs were reviewed and, where possible, matched to parcels. A note of why each photo was added was included in the map photo metadata. A key item of feedback received was that it would be helpful to identify on the main map which parcels have associated photos. A second feature class was created from Parcels in 1936 and renamed Parcels with Photos. For these parcels, the outline color was changed to Solar Yellow at a 2 point width. This symbology facilitated users’ ability to quickly identify which parcels had linked photos.

**Web Application Development**

The pilot project provided the proof-of-concept necessary to develop the web application. The software used to develop the web application was ArcGIS Server 9.3. This software integrates a map document and it symbology directly from ArcMap into the application, preserving the “look and feel” of the original map document.
The first step was to create the mapping services from .mxd files that the web application will use. There are two services used by this application. The CaveHGIS service was created from CaveHGIS.mxd. This service is used as the main web mapping application. An overview map was added in the upper right corner of the web application, providing users with a reference view the area displayed in the main map. The overview map only needed to display the extent of the park boundary, so a copy was made of CaveHGIS.mxd and renamed HGISext.mxd. This HGISext.mxd map document contained only the topographic map and the park outline; all other feature classes were deleted. This provided an appropriate map document for the HGISext service.

**Layers**

Each feature class of the service is called a layer in ArcGIS Server. Each feature class has many attribute fields, and displaying every field is not necessary in the application. Subsets of each feature classes’ attributes were selected to display to the user on the records tab of each layer. The house layers display key census attributes: resident name, age, occupation, district, and own/rent status. The parcel layers display tract number and acreage in addition to the census data of the resident, if known. The hyperlink tool was added via custom HTML code to display in the parcel layer’s attribute fields (Appendix A). This hyperlink tool provides the user with an option to click on the link to the photo(s) associated with the parcel.

**Tasks**

The web application needed a search tool that allowed for family name searches. The search task was designed to accept part or all of a name to facilitate ease of use. The search task returns any matching values in the attribute field “Name” in the Parcels layer
and ‘Resident’ in the 1920 House, Occupant Identified layer (Figure 6). The family names recorded as “resident” corresponds to the head-of-household name as noted in the 1920 manuscript census. The search return results are listed separately by layer in the Search Results window. The default results limit is 50 records, and this should suffice. The most common name in the data tables is Davis with 40 entries in the parcel table.

![Image of ArcGIS Server Manager](Image)

**Figure 6:** Creation of the Search Family names tool

**Map Elements**

Standard user controls were added to the application, including items such as north arrow, scale bar, pan, identify and map overview. These elements are found in other commonly used Internet mapping applications such as MapQuest or Google Maps. Also, custom copyright text was added to the application.
External Links

Standard ESRI-provided links were replaced with links to customized help text, the Mammoth Cave National Park Cultural History website, and the project website where users can take a survey, contact the researchers, or learn more about the HGIS research project. Also the link for Help was renamed How To Use This Site in order to be more descriptive for first time users.

Customizations and Technical Challenges

As is often the case with new applications, testing revealed several elements that required modification or correction. One of the first functions tested was the Full Extent button. This button returns the user from a zoomed-in state back to the full extent of the map. The application automatically uses the largest extent of the layers present in the

![Figure 7: Setting the full extent of the map](image)
map to set the default full extent. Because this map included the world-wide streaming topographic map layer, the map zoomed out to the extent of the entire world, rather than the extent of the park. To address this issue the initial extent setting on the layers tab was changed to the extent of the CaveHGIS.mxd (Figure 7). This prevents the user from zooming out beyond the extent of the Mammoth Cave area.

The standard help text for the application is found on the Internet server at wwwroot\Mammoth_HGIS\Help\Default.htm. Using Microsoft Notepad the file’s HTML text was edited to include site-specific directions for the Mammoth Cave HGIS application, including how to use the hyperlinking feature to view the historic photographs (Figure 8).

Figure 8: HTML help text written in Default.htm

The first time the website loaded, the list of layers in the Map Contents window
was displayed, however the layer symbology for each layer did not display. The user was forced to manually expand each layer to view symbology. Changing the default application setting to display the symbology at startup was not possible within the ArcGIS Server wizards. In order to enable each layer’s symbology to display when the website is loaded required customizing the code for the Table of Contents function in the Default.aspx file (Appendix A). This file, located at D:\wwwroot\mammothHGIS\default.aspx is created for the application automatically by ArcGIS Server and controls the initial layout of the website.

After the web application had been created, we envisioned potential future possibilities for the project. We thus decided to add a field to the data table called “website.” This field created a place to record a website location for a particular family name or property, and was inserted as part of a plan to expand the functionality of the project in the future.

Although this field was added to the .mxd file, the field did not appear to exist in the ArcGIS Server application. After numerous attempts to repair the problem, the software company ESRI was consulted on the issue. ESRI explained that, by default, the application caches layer information to improve time response to queries. However this setting also prevents any new updates to tables from entering the web application. ESRI developed a work-around to address this issue. The Application Settings tab has a checkbox called "Cache layer information in application state.” When caching is turned on, updates to the services do not appear in the application. By temporarily un-checking this box and refreshing services, the table updates appear. However, when this tab was opened in our application there was no such checkbox visible. Further investigation
revealed that this “work around” exists only in the 9.3.1 version. Version 9.3, the version the project was currently developed in, had no work-around. ESRI recommended upgrading the ArcGIS Server version to 9.3.1.

Upon consultation with the University GIS lab manager, it was decided to upgrade the software to version 9.3.1. Unexpected things can happen when software is upgraded so prior to upgrading several key files containing code and customizations were copied to another folder. Once the license was upgraded, the web application could no longer access any services; the layers were now invisible. The link between the application and the services was lost in the upgrade, and no easy fixes were identified in online research. Rather than spend more time troubleshooting this latest problem, the website was rebuilt from scratch using the backup files. Once the site was rebuilt in 9.3.1, the caching checkbox was present in the application, and operated properly. The site was defaulted to cache layers, but when data updates are performed, this check box will have to be temporarily turned off in order to import the updates into the application.

**User Survey Creation**

In order to gauge the web mapping application’s friendliness and success in achieving project goals, a user survey was developed. An effective survey considers both the wording of the questions and their sequencing to obtain meaningful research data (Breitbart, 2003). The survey was created in the University’s standard survey software, an online resource called Qualtrics (www.qualtrics.com). Some questions are structured so that a certain answer such as a yes or a no will trigger an additional clarifying question. A copy of the survey as it appears in Qualtrics is found in Appendix B. This survey was approved for use by the WKU Human Subjects Review Board (HSRB) on
The user survey gathers key information about users and site performance. The user survey asks respondents to indicate if they are a former resident or descendant of the park area or if they are a staff member of MCNP or WKU. Several questions are asked about the performance of the website, such as its ease of use, help text readability, and if any problems were encountered. In order to gauge the user’s experience, the survey asks about previous experience with other online mapping applications. Finally the survey asks users for input on future features and functionality they would like to see in the mapping application. The final Qualtrics survey function automatically records the recipient’s browser information to assist in troubleshooting, should the user report a problem. No personal information is gathered. Elements collected are: Browser Type, Browser Version, Operating System, Screen Resolution, Flash Version, Java Support, and User Agent.

**Companion Project Website**

In order to disseminate the survey, solicit public contributions such as photographs, letters, etc. to the HGIS, and to provide general information on the research project, a companion project website was created at: [http://mammothgis.yolasite.com/](http://mammothgis.yolasite.com/) (Figure 9). Users can link to the project website from the web mapping application by clicking one of two links at the top right of the window: “About the Project” or “Email us or Take A Survey.” This is a two-page website. The About the Project page provides a detailed description of the overall research project, with links to project related publications.

The Home page contains the link to take the web mapping application survey as
described earlier. As required by the HSRB approval letter, this page explains that the survey is both voluntary and anonymous. Also found here is a link to the researcher’s email address for submission of contributions for the Mammoth Cave HGIS. It is anticipated that over time, many period photographs and other items will be offered for inclusion in the application. The application is not designed to directly accept the users’ content in the classic Web 2.0 model. Erroneous submissions to uncontrolled Web 2.0
sites such as Wikipedia are well documented in mainstream media. Thus researchers need a method for vetting entries into the HGIS application, and email is the most effective means of receiving and vetting offered content.

**The Not-So-Public Roll Out**

The final phase of this project was the public release of the website to a target group of users: the former residents and their descendants, Mammoth Cave Park employees, select WKU staff, and other GIS professionals. The goal was to engage this group with the website and gather their feedback via the online survey. Homecoming 2010 (July 4, 2010) was targeted as the public release date. Because of the aforementioned Data Use Agreement with the Park forbidding public release of the park-provided GIS data layers without consent, we needed the Park’s formal permission to release the website to the public. It was anticipated that this would be a mere formality, since Park personnel had been aware of the project and expressed a great deal of support over the course of the HGIS project. Further, the GIS data used in the project was digitized from publicly available sources and is not proprietary park information. We were wrong in this assumption.

The web mapping application project was completed in mid-May 2010, and Mr. Bob Ward, MCNP Chief, Science and Resources Management was contacted on May 17, 2010 to request a date to demonstrate the application to park staff and to discuss the data use agreement. Several subsequent attempts were made to arrange the meeting and finally on June 14, 2010 we received confirmation that a meeting was set for June 24, 2010 at the Park Headquarters.

The presentation/meeting was attended by several park management personnel
(Appendix D). The stated goal was to release this site to the public at Homecoming 2010, and gather their feedback. Although there appeared to be support for the project, some questions regarding archeological resource protection were raised. No specific information was shared on the current status of unauthorized collection or vandalism incidents within the park, despite inquires as to what specifically needed protection.

Mr. Ward stated he would look into the issue and get back with us. On July 2, 2010, I received an email from Mr. Ward indicating that NPS archeologists had concerns regarding the house locations on the website. While Mr. Ward did grant permission to present the website on a laptop at Homecoming, the park was not ready at this time to release the website URL to the public. The park wanted to find a way to make the map less precise and thus less amenable for the public to use in navigating to and plundering or damaging potential archeological home sites.

The park-provided layers in their current state have a degree of error built in which may be due to the methodology used by the digitizers. According to Brunt (2009) these features were digitized from the 1936 USGS topographic map. This map is sometimes referred to as the “brown-line topo map,” in reference to the brown shades used in the map. This map is rendered in North American Datum (NAD) 1927. The current topographic datum for modern data, including the topographic map underlying this website is NAD 1983 and this created a locational shift in the park’s GIS data when overlain on the modern topographic map in the website. The degree of error, up to several hundred feet in places, does not affect our research in terms of identifying relative house locations, although it does sometimes place a house on the incorrect parcel, creating some uncertainty in resident identification. Unfortunately making the map even less precise, as
the park desires, would hinder the very purpose of the overall research project to identify the residents of this area. As stated previously the high resolution topographic maps aid descendants in locating features familiar to them relative to their ancestors’ homes. Also, the park personnel were not swayed by the assertion that the house locations were derived from already-publicly available map data in the form of the old “brown line” topographic map, or that our target release audience was highly unlikely to attempt misuse of this information. In fact, among the target audience, many of the former residents and their descendants have already visited their old homesteads, guided by either other relatives or by Mr. Norman Warnell, a local historian of the MCNP area (Brunt, 2009). Although the park decided not to publicly release the website at this time, they did agree to allow a demonstration of the website at Homecoming 2010, with a promise that the website would be coming sometime in the future.

On Sunday July 4, 2010, the Homecoming presentation was conducted at MCNP. The large poster used at the previous year’s Homecoming event was displayed, and many people again enjoyed locating family names on the poster (Figure 10).

*Figure 10: Homecoming 2010, poster viewing*
The laptop was set up adjacent to the poster to demonstrate the new application on the Internet. Many of this year’s participants remembered the project from 2009 and were anxious to see the new web mapping application (Figure 11).

![Image](image1.png)

**Figure 11:** Homecoming 2010, HGIS Application demonstration

Homecoming participants were disappointed to learn that the website was not yet approved for public release. A genealogy expert on the MCNP families wanted to send the URL to someone in California whose family once lived here, in order to view a couple of the photos on the website and confirm some family information for her studies. This is a great example of the extensibility of a web-based GIS; all one needs is the Internet and they can participate in the research, regardless of their geographic location. I promised her we would continue working with the park service and try to have an acceptable public website by the end of the summer.

All the participants were excited to see the interactive map and the photos linked to the parcels. In each case, participants became engaged in the map as the properties came into view, and houses or barns appeared in the pop-up photos. The visual interface triggered memories and stories in the participants that will make for rich human geography studies of MCNP in the future. One older gentleman related to Tom M.
Denham was so excited to see the house on tract 281 that he asked if I could print and mail him a copy so he could frame it (he didn’t own a computer). While explaining the map and the research to an elderly (over 90) lady, she touched my elbow and said “God Bless you for doing this!” Her reaction revealed that she did not just think this was an academically interesting project, she felt personally touched by it and comforted in knowing that her past was being preserved for the future. Many participants expressed this emotion to varying degrees.

Sharing this information with the public also assisted the researcher in verifying the accuracy of the information. Recall that red squares were the houses that Mr. Brunt identified via census and family interviews, and blue squares were unknown structures. In one example, Dan and Alice Lee, descendants of Dan Lee (senior), offered very detailed information following Homecoming 2009 on a red square once described as “Hunt’s Sink” (tract 385) on the original HGIS map:

“The red square would be the house. The blue square would be the souvenir stand. There were two (tourist) cottages (The Homelike Inn), and ice house, and gas pumps across the road. There was also a barn behind the residence. Next door to the ice house was a small house where employees of the Lee’s lived. I’ll attach photos of the cottages and souvenir stand. We also have one of the barn and one of the ice house and small residence. …Dan says Hunt’s Sink was down behind the house, not in front as on the map. It was probably named for Jim Hunt; his dad’s uncle who owned the property for many years. I’m also including a picture of Alvie Skagg’s house and Sonie Denison’s store. Sonie’s house was just behind and to the left of the store. Sonie’s property was across the road behind the cottages, about a city block, Dan says.”

The Dan Lee tract, 385, has two structures digitized on the right side of the road, one red (labeled Hunt’s Sink) and one blue. Visible on the topo map is the distinct “Hunt’s Sink” feature located behind the houses (Figure 12). The photos provided by the Lee’s match their description of the house and souvenir stand and were added to the map.
The features described in the email as being on the opposite side of the road are not digitized features in the HGIS, yet the photo evidence confirms their existence. This information provides the researcher with evidence of the early tourist hospitality market

Figure 12: Corrected labels on the Dan Lee Tract

around the cave, and detailed location information that can be used to attempt locating the actual sites in the field and add them to the map as new squares. Alva Skagg’s tract is 431, and has one blue square on it. This evidence suggests that Alva resided in this structure. Tract 332, the property located across the road from the Lee property, has two blue squares close together that could be the store and house as described in the Lee e-mail. The census records should be consulted by a future researcher to corroborate these findings before the house residents table in the HGIS is modified. However the email provided details strong enough to have the photos included into the HGIS website. This single email is excellent proof of the rich and detailed historical facts and memories that a
web-based HGIS can help discover from the public memory and capture into research.

While viewing the map many participants told stories of making a trip in the woods to find old homesteads. Several people have made the trip at least once in their lives, usually when they were younger, to visit the land. One gentleman, likely in his 60’s from his appearance, told his story of making the “mecca” to the family homestead while viewing the HGIS map. When he was 14, he and his uncle made the trek through the woods and found his grandmother’s old homesite. All that was left was a concrete foundation overgrown with vegetation. Next to the house in some weeds, he found an old blue granite coffee pot and his uncle confirmed from memory that was his grandmother’s coffee pot. He said he excitedly took the coffee pot home and still has it today, preserved as a link to his past. One of the group listening to his story was a park ranger who smiled and said:

“Uh oh, don’t tell me you did that!”

To which the man replied; “Did what?”

“Say that you took an artifact out of the park!” the ranger replied as he smiled.

The man retorted rather matter of fact; “I didn’t take a park artifact. I took my grandmother’s coffee pot.”

The ranger’s friendly tone and good natured body language suggested he was not serious, given that this occurred many years ago. However this exchange captures perfectly the debate we engaged in with the park service over the public release of this website, and captures the sentiments still lingering today over the removal of these people from their land by the government. The gentleman of this incident recovered an item from a relative’s home site within the park. To him, it belonged to his family, it represented cherished memories, and he took it home. To the park service, this action is
pilfering a cultural resource within the park. This story illustrates the question we are grappling with in this research partnership with MCNP, and one discussed in numerous Archeology, Public History, and Cultural Geography journal articles; that is: who owns the past?

Public Release of the Web Mapping Application

While a long term solution to this issue will have to be worked out in the future, in the interest of immediately launching and testing the website, the house layers were removed from the public version of the website. Users can view parcels, photos, and owner names of those parcels; however the ability to see individual house locations and visualize the neighborhoods and communities of the area has been diminished. Eliminating the “Houses” layer from the public website is problematic for a number of reasons, not the least of which is the loss of ability to search the list of 142 census-matched names. Many of these confirmed residents were renters rather than landowners, and the only record of their existence in the HGIS is found within this layer. This raises a serious research issue of equitability; as now only the privileged landowner is part of the publicly searchable website.

The revised website (http://161.6.109.206/MammothHGIS/) and survey were subsequently accepted by the park and officially launched on August 1, 2010. The announcement was targeted to the former residents and their descendants via their social networking website, as well as emails to Mammoth Cave Park and Western Kentucky University personnel and other interested parties. The announcement included a request to review the website and take the user survey.
User Survey Results

Over a six-week period following the public release of the website, 42 user surveys were started, and 35 were fully completed (Appendix E). Qualtrics records each instance of an initiated survey as “started,” even if no actual questions were answered by the user. A survey is initiated by clicking the link to complete the survey. A total of 40 respondents identified with one of the three categories of user: 16 identified as former residents or their descendants, 2 were employees of either MCNP or WKU, and 22 were neither of those categories. The relatively low turnout (18) from the former resident, descendant, and current staff categories was disappointing, but not entirely unexpected. Just as Affleck and Kvan (2008) found, target user participation was low despite the interest and enthusiasm expressed at in-person meetings with the target audience. In the case of the Mammoth HGIS the target users are a mostly older generation whose familiarity and comfort level with computers and the Internet varies widely. For example, recall that Mr. Tom Denham’s relative was excited to see this website and asked for a paper copy of the Denham parcel map and house photo because he and his wife did not own a home computer. He expressed an interest in not only returning to the 2011 Homecoming to see the project’s progress, but also informed relatives in nearby Louisville that they should attend the next Homecoming to look at the website on demonstration. During the Homecoming demonstrations, participants were interested in viewing the information, but most people preferred the researcher to “drive” the website as they provided verbal input and viewed the results. Only two or three participants felt comfortable enough to work with the website independently, and these were the same people who manage the online social networking site for former residents and their
descendants. The extremely low turnout from MCNP staff is disappointing as much interest in the project was expressed at the June 30, 2010 staff meeting. A possible contributing factor is that the current Chief of Science and Resources Management is retiring this year, and much effort is going into that transition.

Twenty-three percent of respondents learned about the website at Homecoming, and 58% indicated that someone directly provided a link to the site. Six respondents learned of the Mammoth HGIS on another website, and half of those listed MyFamily.com as the source. These results suggest that the most effective means of generating user survey feedback came from direct requests.

Eighty-nine percent of respondents have used some form of Internet mapping such as Google Earth or Mapquest, indicating most have some experience at online mapping. Of those, 68% found the site easy to use, 13% felt neutral, and 18% indicated it was difficult to use. Half of the respondents used the help text in the HGIS, and of those respondents roughly half (9) felt the help text was easy to understand, 25%(4) had no opinion, and 25% (4) thought it was difficult to understand.

Ten respondents indicated they had some type of difficulty using the site, but only 3 chose to describe their problem. One person at first had trouble understanding how to access photos, another could not get the site to load, and the last one indicated the site seemed to be complicated and overwhelming. One individual contacted me directly regarding the inability to load the website and it was determined that pop-up blockers had to be turned off for the site to load properly on their computer.

Eighty-nine percent of respondents are interested in using a website such as this for learning about the history of Mammoth Cave area families, and several kinds of
information were suggested including more photographs (86%), audio clips of interviews (71%), and digital images of written documents (74%). One respondent suggested other census records besides 1920 be accommodated perhaps as a drop down box so future census data could be added to the website. This would allow the user to view changes through time. Captions on the photos were also requested. Another respondent indicated they would like to see an aerial or satellite photo option in addition to the topographic map. Overall the free form comments were very positive and indicate interest in seeing this project develop and progress. Twelve respondents recorded their e-mail address to receive future updates to the site. This e-mail list can become an email group for researchers to solicit future feedback and ideas on the project.

User feedback, both from the surveys and directly from colleagues, indicated that perhaps the web mapping application was not the best “front page” for the project. Everyone was provided the HGIS website (http://161.6.109.206/mammothHGISE/) as the first place to visit regarding the HGIS project. Rather, they suggested users should enter the project through the companion website first (http://mammothgis.yolasite.com/), where they can read an overview of the project’s purpose and goals, see photos from Homecoming events, read project research papers, and get a general sense of the project prior to examining the HGIS website itself. Visiting the project information website first provides a context to the web mapping application, thus aiding in users’ understanding of the HGIS content and use.

Perhaps the most important feedback was provided by a professional GIS colleague who stated that ESRI is planning to “uncouple” future releases of the .Net WebADF from ArcGIS Server following the ArcGIS Server version 10. In the future it
may be necessary to migrate the website to one of ESRI’s REST-based API’s such as JavaScript, Adobe Flex or Microsoft Silverlight. According to ESRI, REST (short for Representational State Transfer) provides a simple, open Web interface to services hosted by ArcGIS Server. It will likely be another 2-3 years before ESRI uncouples the WebADF from ArcGIS Server, but it is a change that future HGIS project managers should plan for.
Conclusions

There are many instances in U.S. history where communities dissipated, and their memory and identities are lost forever. The Mammoth Cave area is a notable exception, with former residents and their descendants working hard to preserve their past. The MCHGIS project enabled a dynamic visualization of their past and a geographic digital repository for their public memory. Sharing the MCHGIS with the public resulted in user-submitted photos and information that led to new understandings about where some residents lived.

The Mammoth Cave HGIS began with 665 structures, 142 census-confirmed occupant names, and 535 property parcels. Using the photo metadata along with private submissions, 50 parcels were associated with one or more photos, with a total of 100 photos linked into the new HGIS website. In addition four tracts were matched with a photo by tract number, even though there were no digitized structures present in those polygons. This confirms previously unknown information that structures were present on these tracts, although we do not yet know where on the parcels those structures were sited. Those are tracts 281 (Denham), 542 (Little Jordan School), 388 (Little Hope Church) and 541 (Chestnut Grove School). At least two of these tracts, 281 and 388, may have a location error between the digitized house location and the parcel boundary. Rectifying these location differences in the future may shed light on the true locations of structures on parcels, but that effort was outside the scope of this project.

This project created a web interface that allows users to connect to the MCHGIS remotely using only an Internet connection and a web browser. The Homecoming demonstration and the user surveys revealed differences in user interaction with the HGIS
website. Users’ interaction was largely predicated on their comfort level with computers and the Internet. The target user-group, comprised of former residents and their descendants, were very interested in interacting with the website at the Homecoming forum, however, many participants were more comfortable allowing someone else to operate the HGIS online maps for them. Many of the target participants are of a generation who are less likely to be comfortable operating a new web application; a few confessed that they did not even own computers. Conversely, the Mammoth Cave genealogy group has a strong presence online via the MyFamily.com website, and users of that site can make valuable contributions to the MCHGIS. Repeated demonstrations of the MCHGIS at future Homecoming events are crucial to encouraging website use amongst the target group. Other categories of users provided valuable feedback to improve future website design and promote a better user experience. The companion website on Yola.com is the preferred entry point for those unfamiliar with the project and provides the context necessary to fully understand the HGIS application.

This project demonstrated that using GIS can extend knowledge of the historic Mammoth Cave settlement in ways not seen before. New visualizations of familiar territory were realized by both researchers and former residents and their descendants, and new information was discovered as a result. This project fulfills Bodenhamer’s vision of a Historical GIS;

“In sum, Historical GIS offers an alternate view of history through the dynamic representation of time and place within culture. This visual and experimental view fuses qualitative and quantitative data within real and conceptual space. It stands alongside—but does not replace-traditional interpretive narratives, inviting participation by the naïve and knowledgeable alike” (Bodenhamer, 2008, 231).
Future Research

The MCHGIS website functionality can be extended in the future with the addition of other media such as audio files, documents, and links to individual family websites. Future research is needed to address the location errors in the HGIS map that may be due to digitizing or datum errors. The current availability of the 1930 manuscript census affords an opportunity for researchers to extend Brunt’s research and perform a comparative analysis of the temporal differences over the decade preceding the formation of the park. A resolution with MCNP that allows former residents and their descendants to view former home sites must be reached. Many voices have been silenced with the exclusion of renters from the online database. Understanding relative resident locations is the key to identifying additional residents through future research.
Appendix

A. Technical Documentation and Photo Metadata

B. Qualtrics Survey Design

C. HSRB approval

D. MCNP meeting sign in sheet

E. Qualtrics User Survey Report 09/18/10
Appendix A

Technical documentation on the ArcGIS Server 9.3.1 application

This document is intended for future support of the web application. The user should have a basic working knowledge of ArcMap and ArcGIS Server. The web site is supplied with data directly from the ArcMap .mxd and associated personal geodatabase. The CaveHGIS.mxd resides in two places:

- the local Kevin-3 pc in the GIS lab at C:\CaveHGIS\n- the ArcGIS Server in the server room at Data (D):\CaveHGIS\n
The reason for keeping the project .mxd in two places serves two purposes. First, it is always good to have more than one location in case of hardware failure or file corruption. Second, for unknown reasons it is not possible to update the .mxd that is stored on the ArcGIS Server. I tried troubleshooting this problem, including stopping all services and pausing the web application, to no avail. The easy work around is to update the .mxd on the local Kevin-3 machine, then upload the updated files to the Server. Currently the website virtual directory is Northrend:80/Mammoth_HGIS and the actual IP address of the website is 161.6.109.206/Mammoth_HGIS.

Map Caching
Map caching improves the performance of the website, but also prevents updates to the services that use the databases from being displayed in the application. In order to see additions made to the database in the website, you must go in the Application Settings tab and uncheck "Cache layer information in application state," and then refresh services. You can always re-check to cache layer information once updates are complete to improve performance.

Updating Photos or Tabular Data
Updating the project files on the server is accomplished via remote connection between the Kevin-3 machine and the Server. See the WKU GIS Lab manager for access and password instructions. Once remotely connected to the server, both the C drive on the Kevin-3 machine and the D drive on the server are visible in the File Explorer. This facilitates easy and quick file transfers.

The physical location of the web application is:
Data (D):\wwwroot\Mammoth_HGIS\n
Just as there are two copies of the .mxd, it is a good idea to keep a backup copy of the web application. I therefore keep a copy of the wwwroot\Mammoth_HGIS folder and all its contents on the Kevin-3 machine at C:\CaveHGIS\wwwroot\.

Instructions for updating data
The physical location of the photos displayed in the map is
Data (D):\wwwroot\Mammoth_HGIS\Photo\mapphoto:
The backup copy of photos is located at:
C:\CaveHGIS\Photo\mapphoto
To update data in the .mxd, access the .mxd on the Kevin-3 machine. The data tables for the parcel and house location feature classes include a field listing the physical location of the photos. This is where the web application located the photos for the hyperlinking feature of the application. Every record has a location noted in this field. For features without an associated photo, the file links to a message (nophoto.jpg) stating no photos yet exit for that record.

When a new .jpg is ready to add to the project, name the .jpg by the parcel (CATNUM field in the feature class) it belongs to, and save in the mapphoto folder. Then change the field entry from the nophoto.jpg to the new photo name.

There is a field for future use where the location of an individual website can be stored. This can be used to hyperlink a feature to an outside website, such as a family genealogy site for that particular surname. It is currently not used for this phase of the project.

Once the data is updated in the data tables, and any new photos have been placed in the mapphoto folder, move the necessary files from the Kevin-3 machine to the Server. In order for the changes to display in the web application, you must restart the service(s) associated with the application. It is a good idea to refresh the web application also.

Web Application customization
ArcGIS Server displays all custom features of the .mxd, such as view scale limits and graphics. However there are also several customizations added to the web application.

Full Extent
Under the default settings for zoom to full extent, the map will zoom out to the extent of the largest layer. Because this map uses the topo map service from ESRI, the default map zooms out to the extent of the world, which is not very helpful. In Layers Tab at the bottom is Map Display. I set the initial extent to the extent of the CaveHGIS.mxd, making sure this is zoomed to the correct extent. This will prevent the user from zooming out beyond the extent of the Mammoth Cave area.

Hyperlinking
The hyperlinking feature of the website involved adding some custom HTML code. In the Layer Properties of the parcels, go the records field. Click on the records tab. Select custom formatting radio button. Select the HTML radio button. Scroll down to the HTML code for the Photo field (called LOCATION). Copy and replace with this after the "TR"

```
<TD style="BACKGROUND-COLOR: lightgrey">Photo</TD>Overview Map
<TD cellpadding="3px"><A href="{LOCATION}" target=_blank>View picture</A></TD></TR>
```

This creates a hyperlink for the tabular field listing the file location of the photo. The photo folder was placed in the virtual directory wwwroot/Mammoth_HGIS. Any new photos added will need to be updated here. Be sure when adding photos to the Kevin-3 mapphoto folder, that you remember to upload them to the Server in the wwwroot folder, just as you upload the updated .mxd and databases to the Data (D):\HGIS folder.
Troubleshooting—Occasionally when editing the application layers, this HTML text becomes corrupted. It may have odd characters added like:

```
href="http://northrend/ArcGIS/Manager/Modules/Applications/Wizard/%7BLOCATION%7D" target=_blank>View picture </A></TD></TR>
<TR></TR></TBODY></TABLE>
```

This causes the hyperlinking in the application not to work. Keep a copy of the correct HTML text so if this happens, you can paste in the correct text again and save the project.

**Search Family Names Tool**

In the Tasks section, I chose a Search function to search names. Two fields are searched, the Name field of the Parcels table and the Resident field of the Occupant Identified table. Entering part or all of the name will return all matching results from these two fields, sorted by layer type. The default for search return is 50 records. This can be changed in the future if needed.

**Web Links**

Custom web links are entered in the Page Properties tab. The standard helptext is located at Data (D):\wwwroot\Mammoth_HGIS\Help\Default.htm. I edited the HTML code of the Default.htm in order to display customized help to the user.

**Overview Map**

Overview maps are set in Map Elements|Overview Map. The default overview map is the project .mxd. This results in a cluttered overview map displaying houses, parcel outlines and roads in a tiny square at the top right of the map. I created a separate service to display the extent of the map in the overview box without all the symbology, just an outline of the park.

**Table of Contents**

The map legend to the user is the Table of Contents (TOC) for the map. The list of layers in the maps displays to the left of the map in the website, but by default the layers are not expanded. The user has to click on the plus sign next to each layer to reveal the symbology. I used the ESRI forum to ask how to automatically expand TOC. I received an answer to “change expanddepth value from 1 to 2”. I searched various application files for the value “expanddepth” and found it in Default.aspx. I opened this file in notepad, located the line using expanddepth for the TOC, and changed the value from =1 to =2. Now the website opens with the TOC layers expanded.

**Supporting Websites**

I created a website on Yola.com to support website surveys, future project development and future user submissions to the website. I pasted the Yola site link into a custom weblink in the HGIS application. I created a survey on the WKU Qualtrics website, and pasted that survey link to the website.

The WKU GIS Lab manager and the thesis sponsor have password access to these resources.
Photo Metadata - Photos in project map

Notes in italics from Epperson project 2009-2010

Tract 431, Alva Skaggs home (Alice Lee email 7/6/09)

Tract 117, (Jim Cave email 7-14-09) Emory Lee and Lilly Pearl Cave’s sons (all deceased). House location confirmed. Walter Cave (photo) is Jim’s father.

27303a – tenant house
CAPTION: DEMOLITION:-- DWELLING TO BE RAZED ON TRACT NO. 227.
ELLIS
MARBEE GRANTOR.
PROGRESS PHOTOGRAPHS, DEMOLITION
C1934
Placed photo with house ID by Brunt as Marbee Rental, although this is listed as “Warnell Guess”, and not verified by the manuscript. This house is on the property line of the parcel boundary, another house lies in the center of the parcel. It is possible this was the Barbee house?

27303b – tenant house: DWELLING ON TRACT NO. 149
C1934
Several houses on this tract, not sure which one this photo belongs to

27308 – house & outbuildings
VERSO: DWELLING TO BE RAZED ON TRACT # 281. T. M. DURHAM.
CAPTION:- BOX SIDING
HOUSE- THIS HOUSE IN GOOD CONDITION COMPARED TO OTHERS IN AREA. ECW FILES
Dwellings, Demolition
C1934
No house object on this parcel, but we now know there was a house here.

27313 – single pen house
VERSO: DEMOLITION:-- DWELLING ON TRACT # 45.
DWELLINGS, DEMOLITION
C1934
One house to one photo-positive match

27941 – log I-house (very interesting)
CAPTION: MISCELLANEOUS: L-2 HOUSE OF GARVIN SUIT- TRACT NO. 361.
MADE MAY 5, 1936.
Two, possibly 3 house objects on this parcel, not sure which house this photo belongs to
27477 – house, interesting vernacular
VERSOS: DWELLING ON PROPERTY SOLD KY NP COMM. BY PARSLEY BROTHERS TRAIL NO. 11.
DWELLINGS, DEMOLITION
TRAIL NO. 11
C1934
3 structures on parcel, not sure which one this photo belongs to. Notes says “trail” instead of “tract”

27945 – house w/ outbuilding & kids in yard
CAPTION: MISCELLANEOUS: L-7 HOUSE ON THE B.S. STURGEON TRACT NO. 515.
MADE MAY 5, 1936.
DWELLINGS
Two to four structures on this parcel, not sure which one this photo belongs to

27947 – farmstead
CAPTION: MISCELLANEOUS: L-9 HOUSE ON THE MARGARET PARKER TRACT NO. 515.
MADE MAY 4, 1936.
DWELLINGS, OUTBUILDINGS
Note from Epperson-recorded as 515 in photographers notes however parcel records show she owned 415, this is likely a typo, as we have a confirmed parcel match on tract 515 for Sturgeon.
One house to one photo-positive match

28080 – barn
CAPTION: MISCELLANEOUS:-- OLD BARN ON THE H. P. HOUCHINS TRACT NO. 373.
NOV. 9, 1936.
BARNS
One structure on parcel, not sure if structure is house or barn in GIS layer. Only have a photo of a barn.

28082 – barn
CAPTION: MISCELLANEOUS:-- BARN ON THE W. T. DENNISON TRACT NO. 332.
NOV. 9, 1936.
BARNS
Multiple structures on parcel not sure which photo goes with which structure.

28083 – store
CAPTION: MISCELLANEOUS:-- STOREHOUSE ON THE W. T. DENNISON TRACT NO. 332.
NOV. 9, 1936.
BUSINESS ENTERPRISES
See also email Dan and Alice Lee 7-6-09 picture identified as Sonnie Dennison’s store. Sonie’s house behind and to left of store if facing from the road. Added to parcel and to house layer

28079 – Meredith’s Place Onyx City – road side rock shop
CAPTION: MISCELLANEOUS: MIKE MEREDITHS PLACE ON THE W.P. COX TRACT.

NOVEMBER 6, 1936.
BUSINESS ENTERPRISES, KEEPSAKES
Perry Cox listed as owning several nearby tracts. Only oneGIS structure shown on one tract: 310. The photo shows a structure in the distance, could this be a match for a roadside location? Attached to parcel.

28110 – house w/ lumber pile (destroyed outbuilding?)
CAPTION: MISCELLANEOUS: HOUSE ON THE C.I. HANSEN TRACT.

NOVEMBER 24, 1936.
DWELLINGS
Tract 365 note large bird, maybe turkey, on the log. Added to parcel and house layers

28113 – nice house?
CAPTION: MISCELLANEOUS: HOUSE OF EARL HANSEN. NOVEMBER 24, 1936.
DWELLINGS
Added to tract 364 and house layer

28115a & b – barn?
CAPTION: MISCELLANEOUS: GARAGE AND BARN ON LEE WOOD TRACT.

NOVEMBER 1, 1936.
BARNs, GARAGES
Tract 442, currently has two structures located on GIS parcel, not sure if GIS structure is house or barn. Saving to parcel layer.

28117 – large barn?
CAPTION: MISCELLANEOUS: BARN ON THE GANTER TRACT, NOVEMBER 12, 1936.
NOTE DETERIORATED ROOF.

BARNs
Added to tract 359, more than one structure on GIS parcel. This is a significant sized barn.

28122a&b – saddlebag w/ addition
CAPTION: MISCELLANEOUS:- HOUSE ON THE PERRY COX TRACT NO. 311. NOV. 24, 1936.

DWELLINGS
One structure on GIS layer, added to both parcel and house. There are 2 pix of the house I combined both in one jpeg.

Tract 385, added souvenir stand photo from Lee email 7-9-09 to identified structure. The adjacent structure is the Lee house.

28136a&b – weird tractor?
MISCELLANEOUS:- OLD OIL RIG AND OLD BOILER ON THE DOYLE PROPERTY IN DOYLE VALLEY
NEAR DOYLE’S BIG POND. DEC. 4, 1936.
EQUIPMENT, OIL WELLS
DOYLE’S BIG POND
Pond located on tract 335 as per topo map. Note topo map spelling is DOYEL.

28192 – house on road?
CAPTION: MISCELLANEOUS:- HOUSE ON THE NEWT FRANCE TRACT.
MARCH 8, 1937.

DWELLINGS
Of the structures shown on Newt France tracts, the Newt resident house is the only one on the road. Therefore I think this is a positive match. I linked to parcel 355 and to the structure.

28194 – barn?
CAPTION: MISCELLANEOUS:- BARN ON GEORGE BECKNER TRACT.
MARCH 8, 1937.

BARN
Linked to parcel 286, but not linked to structure which is probably a house.

28202 – barn?
CAPTION: BARN ON NEWT FRANCE, TRACT MARCH 8, 1937.

Could be the structure off the road on tract 355-linked to parcel

28207 – saddlebag house?
CAPTION: MISCELLANEOUS:- HOUSE ON ELIJAH DAVIS PLACE. MARCH 19, 1937.

Other structure photos listed later as Elijah Davis property also identify the tract as 322. 322 tract has one house that was identified as the residence of ED by the Brunt project. This house (28207) is likely one of the rentals on tract 321, added to 321.
28233 – transverse crib barn w/ odd structure; ask Norman?
CAPTION: MISCELLANEOUS:- DIT WEBB'S BARN. MARCH 31, 1937.  
Two structures on Dit Webb tract 520. Not sure which is house and which is barn. Added to parcel layer 520.

28234 – church?
CAPTION: MISCELLANEOUS:- LITTLE JORDAN SCHOOL HOUSE.  
Added to tract 542. No structure in layer but now we have a picture of the school that was there.

28238 – classic saddlebag house?
CAPTION: MISCELLANEOUS:- AMOS COOK'S HOUSE. MARCH 31, 1937. TRACT 446.  
Added to tract and house layers

28239 – large stock barn foregrounding leaning fence; use this! ?
CAPTION: MISCELLANEOUS:- BARN ON AMOS COOK PLACE. TRACT NO 446.

28242 – saddlebag house w/ laundry in foreground?
CAPTION: MISCELLANEOUS:- J.A. DAVIS HOUSE APRIL 1, 1937. TRACT NO 469.  
AT CADE. DWELLINGS, WELL  
Added to house and parcel layers-confirms resident on tract?

28243 – house being torn down?
CAPTION: MISCELLANEOUS:- HOUSE ON ELDRED PARSLEY PLACE, APRIL 1, 1937.  

DEMOLITION
Emailed dr. k

From: "Katie Algeo" <katie.algeo@wku.edu>  
Subject: Re: parsley puzzle  
Date: Fri, 09 Apr 2010 17:56:30 -0500  
To: “Ann E Epperson (Student)” <ann.epperson@wku.edu>

Hi Ann,

There's only one Eldred. Of the two sources, Warnell & someone from one of the homecomings, I trust Warnell more. Let's remove the other one.
Katie

On Fri, 09 Apr 2010 17:16:41 -0500
"Ann E Epperson (Student)" <ann.epperson@wku.edu> wrote:
> Another puzzle - Eldred Parsley is listed in Matt's project as a
> confirmed resident on 2 Eldred Parsley tracts. Could they be the same
> person, or different people? The census data table shows on one tract
> his age, and Warnell as the source. the other tract shows "public"
> and "verify resident", but has no age entered.
>
> Ann Epperson, P.G.
> Therefore this photo is attached to parcel and structure located on tract 523.

28240a & b – looks like 2 shots of same house (dogtrot w/ passageway partly
enclosed) at different times; second shot seems to be used to store hay)
CAPTION: MISCELLANEOUS:- EUGENE MEREDITH'S HOUSE MARCH 31, 1937.
(MEREDITH MARKED THROUGH AND E.G. PARSLEY WRITTEN IN)
DWELLINGS

28241a&b – two outbuildings?
CAPTION: EUGENE MEREDITH'S BARN MARCH 31, 1937. (E.G. PARSLEY
TRACT 492
IS WRITTEN IN IN INK)
OUTBUILDINGS, FARMING, EQUIPMENT

From: "Katie Algeo" <katie.algeo@wku.edu>
Subject: Re: location puzzle
Date: Fri, 09 Apr 2010 18:00:35 -0500
To: "Ann E Epperson (Student)" <ann.epperson@wku.edu>

Hi Anne,

a&b of the same number are always two shots of the same structure.

It looks like someone made a correct to Parsley. Because Parsley is
also 492, I think we should go with it. Another possibility is that the
tract was sold shortly before the park bought it.

Katie

On Fri, 09 Apr 2010 16:56:18 -0500
"Ann E Epperson (Student)" <ann.epperson@wku.edu> wrote:
> Here is an interesting puzzle-
> 
> 28240a & b – looks like 2 shots of same house (dogtrot w/ passageway
> partly enclosed) at different times; second shot seems to be used to
> store hay)
> CAPTION: MISCELLANEOUS:- EUGENE MEREDITH'S HOUSE MARCH 31, 1937.
> (MEREDITH MARKED THROUGH AND E.G. PARSLEY WRITTEN IN)
> DWELLINGS
> 28241a&b – two outbuildings?
> CAPTION: EUGENE MEREDITH'S BARN MARCH 31, 1937. (E.G. PARSLEY TRACT 492
> IS WRITTEN IN INK)
> OUTBUILDINGS, FARMING, EQUIPMENT
> 
> So, attached is a view of the map. Tract 492 is Meredith parcel. EG
> Parsley is across river. Hard to tell from photo, the house appears to
> be in the middle of a hillside. What do you think, Meredith or
> Parsley?
> Should I base the placement on the recorded tract number?

Dr. Katie Algeo
Associate Professor of Geography
Western Kentucky University

*Therefore Photos attached to 492 parcel.*

28261 – house practically obscured by weedy fence?
CAPTION: MISCELLANEOUS:-- (HOUSES-PROPERTY) HOUSE ON MARTIN BROTHERS
TRACT NO. 399. MAY 11, 1937.
DWELLINGS
*One house on tract, confirmed resident.*

28263a – transverse or drive-in crib barn w/ wagon & smaller crib?
CAPTION: MISCELLANEOUS:-- (HOUSES-PROPERTY) BARN ON THE MARTIN BROTHERS
TRACT NO. 399. MAY 11, 1937.
BARNS, CARTS AND WAGONS

28266 – double crib barn?
CAPTION: MISCELLANEOUS:-- (HOUSE-PROPERTY) BARN ON THE J.A. DAVIS TRACT NO. 467. MAY 11, 1937.
BARNS

28267 – 2 story saddlebag house?
CAPTION: MISCELLANEOUS:-- (HOUSE-PROPERTY) HOUSE ON THE J.A. DAVIS TRACT NO. 467. MAY 11, 1937.
DWELLINGS
*two structures shown on map.*

28268 – double pen house; mostly obscured?
CAPTION: MISCELLANEOUS:-- (HOUSE-PROPERTY) HOUSE ON THE W.J. RITTER PROPERTY.
TRACT NO. 503. MAY 11, 1937.
DWELLINGS
28269 – 2 barns?
CAPTION: MISCELLANEOUS:-- (HOUSE-PROPERTY) BARN ON TRACT NO. 503, W.J. RITTER.
MAY 11, 1937.
BARNs, OUTBUILDINGS

28270 – barn?
BARNs

two structures shown on map.

28271 – 2 outbuildings?
CAPTION: MISCELLANEOUS:-- (HOUSE-PROPERTY) BARN ON THE LINDA SANDERS PROPERTY.
MAY 8, 1937.
BARNs

Likely belongs to Lindy Sanders (there is no linda listed) as listed on parcel 506

28273 – barn w/ fallen roof?
CAPTION: MISCELLANEOUS:-- (HOUSE-PROPERTY) BARN ON THE IDA DAVIS PROPERTY.
MAY 8, 1937.
BARNs

Tract 468

28274 – barn?
CAPTION: MISCELLANEOUS:-- (HOUSE-PROPERTY) BARN ON THE MARTIN BROTHERS TRACT NO. 397. MAY 13, 1937.
BARNs

28275a&b – house?
CAPTION: MISCELLANEOUS:-- (HOUSE-PROPERTY) HOUSE ON THE MARTIN BROTHERS VALLEY TRACT NO. 397. MAY 13, 1937.
Dwellings

28277a & b – 2 different barns?
BARNs

28312 – kids in door of single pen log house; great example?
CAPTION: HOUSES AND PROPERTY: HOUSE IN IDA DAVIS PROPERTY, JUNE 14, 1937.
Tract 468 is Ida Davis’ property

28313a&b – house w/ missing roof?


DWELLINGS
Tract 490 listed as Merideth, Jack in 1936.

28316 – house w/ pyramidal roof?

CAPTION: HOUSES AND PROPERTY: CHESTNUT GROVE SCHOOL HOUSE TRACT NO. 541, JUNE 8, 1937. SCHOOLS CHESTNUT GROVE SCHOOLHOUSE
No structure on map, but we know a schoolhouse was there by the photo.

28321 – double pen house w/ pyramidal roof & porch swing?


DWELLINGS

28322 – barn?

CAPTION: HOUSES AND PROPERTY: BARN ON DAN MEREDITH PLACE. JUNE 1937.

28323 – barn?

CAPTION: HOUSES & PROPERTY: CRIB ON DAN MEREDITH PLACE. JUNE 1937.

BARN BUILDINGS
Added all 3 to tract 491

28513 – saddlebag w/ el extension

CAPTION: MISCELLANEOUS:- FRONT OF HOUSE ON ROAD. FLOYD FRANCE PLACE. NOV. 1937.

DWELLINGS

28514 – back of house w/ orchard?

CAPTION: MISCELLANEOUS:- REAR OF HOUSE ON ROAD. FLOYD FRANCE PLACE. NOV. 37.

DWELLINGS
Add both to tract 353 multiple structure on tract, not sure which structure on map this belongs to.
28515 – back of box house w/ face in window?
CAPTION: MISCELLANEOUS:- REAR VIEW OF M.C. PARKER HOUSE. NOV. 37.
DWELLINGS
Could be a match for M.O. Parker, possible misspelling in photo notes? Added to tract 193

28516 – double pen box house?
CAPTION: MISCELLANEOUS:- FRONT VIEW OF HOUSE. LIZZIE DENNISON PLACE.
NOV. '37. DWELLINGS
Tract 475

28520 – double pen house w/ 2 roof materials?
CAPTION: MISCELLANEOUS:- FRONT VIEW OF HOUSE. FLOYD FRANCE PLACE. NOV. '37. DWELLINGS
Added to 353, multiple houses photographed on this tract.

28540 – upright & wing
CAPTION: MISCELLANEOUS:- REAR OF HOUSE; A.E. HANSON. NOV. '37.

DWELLINGS, OUTBUILDINGS

28541 – barn (grafitti on side?)
BARN
AE Hanson is tract 364, added to earlier photo of front of house. Also note house in the background behind barn.

28621 – single pen cabin w/ shed
CAPTION: MISCELLANEOUS:- (HOUSES & PROPERTY) A SMALL HOUSE ON THE HACKETT PROPERTY NEAR FROZEN NIAGARA ENT. TO MAMMOTH CAVE. FEB. 1938.
DWELLINGS
Tract 546

28622 – frame house
CAPTION: MISCELLANEOUS: (HOUSES & PROPERTY) REAR OF SMALL HOUSE ON THE PERRY COX TRACT NO. 310.
DWELLINGS
Added to earlier 310 photo of roadside stands.
28663 – double pen house
CAPTION: MISCELLANEOUS:- (HOUSE AND PROPERTY).  FRONT VIEW OF
HOUSE ON TRACT NO. 372, FRED HOUCHIN.  MARCH 21, 1938.

28664 – (same house from back? Shows L extension)
CAPTION: MISCELLANEOUS:- (HOUSES AND PROPERTY):- REAR VIEW OF
HOUSE SHOWN IN
PICTURE AT LEFT. TRACT NO. 372, FRED HOUCHIN.  MARCH 21, 1938.

Only one structure shown on map, also added to that. Possible resident confirm?

28670 – small barn
CAPTION: MISCELLANEOUS:- (HOUSES AND PROPERTY) REAR VIEW OF
OLD LOG STRUCTURE
ON PERRY COX’S TRACT NO. 312. IT IS SAID THAT THIS BUILDING WAS
USED AS A HOUSE IN THE + DWELLINGS

No structures in database, possible house on this tract?

28694 – single pen house w/ shed (note plants in pots on porch)
CAPTION: MISCELLANEOUS:- (HOUSES-PROPERTY) FRONT VIEW OF
HOUSE ON THE RALPH
RITTER PROPERTY.  TRACT NO._ APRIL 11, 1938.

28695 – same house from back?
CAPTION: MISCELLANEOUS:- (HOUSES-PROPERTY) FRONT VIEW OF
HOUSE ON THE RALPH
RITTER PROPERTY.  TRACT NO._ APRIL 11, 1938.

Tract 502 is Ralph ritter

28696a – barn; boy holding dog
28696b – same barn from back
MISCELLANEOUS:- (HOUSES-PROPERTY) FRONT (AND REAR) VIEW OF
BARN ON THE RALPH
RITTER PROPERTY.  TRACT NO. _ APRIL 11, 1938.

BARNs, OUTFbuildings

28697a – saddlebag house
28697b – saddlebag house from back?
MISCELLANEOUS:- (HOUSES-PROPERTY) FRONT (& REAR) VIEW OF
HOUSE ON RALPH RITTER
PROPERTY.  APRIL 5, 1938.
Multiple structures photographed, only one listed on map. Attached photos to parcel 502 only.

28702a – single pen log house
28702b – single pen log house; model T? in front
MISCELLANEOUS:-(HOUSES-PROPERTY) TWO VIEWS OF LOG HOUSE ON THE IDA
DAVIS PROPERTY. APRIL 4, 1938.
DEWLLINGS
Tract 468 is listed as Ida davis, only one structure listed in shapefile. Did she have more than one structure on property, or more than one property when photos were taken? Added to parcel.

28722a – double pen house
28722b – double pen house from side
CAPTION:- MISCELLANEOUS:-(HOUSES & PROPERTY) REAR VIEW OF HOUSE ON THE VIRGINIA
MANSFIELD PROPERTY. TRACT NO. APRIL 26, 1938.
DEWLLINGS
Added to tract 395, owner listed as Jennie Mansfield. Also added to houses based upon confirmed resident.

28793a – barn
28793b – barn
MISCELLANEOUS:-(HOUSE-PROPERTY) VIEWS OF BARN ON JEFFERSON DAVIS
PROPERTY. TRACT NO. 470. JUNE 1938.
BARN

28794 – small barn
CAPTION: MISCELLANEOUS:-(HOUSES AND PROPERTY) CORN CRIB ON JEFFERSON
DAVIS PROPERTY. TRACT NO. 470. JUNE 1938.
BARN

28797a – house
28797b – house
MISCELLANEOUS:-(HOUSES-PROPERTY) TWO VIEWS OF HOUSE ON JEFFERSON DAVIS
PROPERTY. TRACT NO. 470. JUNE 1938.
DEWLLINGS

28798 – shed
CAPTION: MISCELLANEOUS:-(HOUSES-PROPERTY) CHICKEN HOUSE ON JEFFERSON DAVIS
PROPERTY. TRACT NO. 470. JUNE 1938.
OUTBUILDINGS
28799 – house & shed
CAPTION: MISCELLANEOUS:– (HOUSES-PROPERTY) SMOKE HOUSE ON JEFFERSON DAVIS PROPERTY. TRACT NO. 470. JUNE 1938.

BARNs, OUTBUILDINGS

28800a – saddlebag log house
28800b – saddlebag log house; shows situation, overlooking river & w. shed in back

MISCELLANEOUS:– (HOUSES-PROPERTY) BACK AND END VIEW OF HOUSE ON E.G. PARSLEY PROPERTY. TRACT NO. 492. JUNE 1938.

DWELLINGS
28803a – barn w/ wagon in foreground
28803b – chicken house (?) with chicken in foreground
CAPTION: MISCELLANEOUS:– (HOUSES-PROPERTY) BACK VIEW OF RENA DAVIS PROPERTY. REFER TO PICTURE NO. 1655 FRONT VIEW. TRACT NO. 467. JUNE 1938.

DWELLINGS

28804 – large I house
CAPTION: MISCELLANEOUS:– (HOUSES-PROPERTY) FRONT VIEW OF HOUSE ON NOAH WEBB PROPERTY. TRACT NO. 527. JUNE 1938.

DWELLINGS

28805 – house w/ family on porch
CAPTION: MISCELLANEOUS:– (HOUSES-PROPERTY) BACK VIEW OF HOUSE ON NOAH WEBB PROPERTY. TRACT NO. 527 JUNE 1938.

DWELLINGS

28806 – structure; grinding stone in front
CAPTION: MISCELLANEOUS:– (HOUSES-PROPERTY) SIDE VIEW OF BUILDING USED AS BLACKSMITH SHOP. NOAH WEBB PROPERTY. TRACT NO. 527.

DWELLINGS
One structure on map, was Noah also the occupant?

28807a – barn
28807b – barn
28807c – barn; hay in loft
CAPTION: MISCELLANEOUS:– (HOUSES-PROPERTY) FRONT VIEW OF BARN ON NOAH WEBB PROPERTY. TRACT NO. 527. JUNE 1938
BARNs

28815a – barn
28815b – barn
MISCELLANEOUS:-(HOUSES-PROPERTY) BACK, FRONT AND SIDE VIEWS OF ELIJAH DAVIS BARN.  TRACT NO. 322.  JUNE 18, 1938.
BARNs

28816 – crude log house
CAPTION: MISCELLANEOUS:-(HOUSES-PROPERTY) SMALL LOG BUILDING ON ELIJAH DAVIS PROPERTY.  TRACT NO. 322.  JUNE 18, 1938.
DWELLINGS, OUTBUILDINGS
28847a – Little Hope Church
28847b – Little Hope Church
CAPTION: SCENIC:- LITTLE HOPE CHURCH NEAR FROZEN NIAGARA ENTRANCE TO MAMMOTH CAVE.  JUNE, 1938.
CHURCHES
LITTLE HOPE CHURCH
Tract 338

28930a – house
28930b – outbuildings
28930c – outbuildings
CAPTION: MISCELLANEOUS:-(HOUSES AND PROPERTY) VIEW OF HOUSE ON ELIJAH DAVIS PROPERTY.  TRACT NO. 322.  JULY 12, 1938.
DWELLINGS, OUTBUILDINGS
Added house to 322
Appendix B

Qualtrics Survey Design

HGIS Website - Live Copy

Q1 Help us understand who you are (check all that apply)
☐ Former resident of Mammoth Cave National Park (MCNP) area or a descendant thereof (1)
☐ Employee of Mammoth Cave National Park or Western Kentucky University (2)
☐ Neither of the above (3)

Q2 How did you learn about the Mammoth Cave HGIS website?
☐ • Learned about it at the MCNP Annual Homecoming (1)
☐ • Someone provided me the link to the site (2)
☐ • Saw it featured on another web site (3)
☐ • Other (4)

Answer If How did you learn about the Mammoth Cave HGIS website? • Saw it featured on another web site Is Selected

Q4 If you saw the HGIS website featured on another website, which one was it?

Answer If How did you learn about the Mammoth Cave HGIS website? • Other Is Selected

Q5 Please explain how you learned about the website:

Q6 Have you ever used an Internet mapping site before, such as Google Earth or MapQuest?
☐ Yes (1)
☐ No (2)

Q7 How easy or difficult was the Mammoth Cave HGIS website to use?
☐ Easy (1)
☐ Neutral (2)
☐ Difficult (3)
Q8 Did you click on the website link “How to Use This Site”?
☐ Yes (1)
☐ No (2)

Answer If Did you click on the website link “How to Use This Site”? Yes Is Selected

Q9 How easy or difficult to understand was the help text?
☐ Easy (1)
☐ Neutral (2)
☐ Difficult (3)

Q10 Did you experience any difficulty accessing or using the HGIS mapping website?
☐ Yes (1)
☐ No (2)

Answer If Did you experience any difficulty accessing or using the ... Yes Is Selected

Q11 Please describe the difficulty you experienced

Q12 Would you be interested in using a website such as this for learning about the history of former residents of the park area or for doing genealogical research?
☐ Very (1)
☐ Somewhat (2)
☐ Not at all (3)

Q13 What other kinds of information would you like to see added to this web site? (check all that apply)
☐ Photographs of individuals and families (1)
☐ Audio clips of interviews with former park residents (2)
☐ Digital images of wills, letters and other documents of historic significance (3)
☐ Other (4)

Answer If What other kinds of information would you like to see add... Other Is Selected

Q14 List what other kinds of information you would like to see:

Q15 Please add any other comments you have on the web site:
Q16 Optional-enter your e-mail address here, and receive announcements related to the HGIS website and research project!

Q17 Browser Meta Info
   Browser (1)
   Version (2)
   Operating System (3)
   Screen Resolution (4)
   Flash Version (5)
   Java Support (6)
   User Agent (7)
Appendix C

HSRB Approval

The project titled "Interactive GIS as a Historical Place-Making Tool for Mammoth Cave National Park" has been reviewed by the WKU HSRB and it has been determined that risks to subjects are minimal and reasonable, and that (1) research procedures and data collection would not cause the subjects to participate in any experiment that would violate the rights and welfare of the subjects, (2) research procedures and data collection would not cause the subjects to participate in any experiment that would violate any Federal, State, or local laws or regulations, (3) selection of subjects is equitable, and (4) the purpose of the research and the research setting is available to subjects and to students and that participation is clearly voluntary.

This project is therefore approved at the exempt from Full Board Review level.

Please note that the institution is not responsible for any actions regarding this protocol before approval. If you expand the project at a later date to use data from this consent, please resubmit. Copies of your request for human subjects review, your application, and this approval, are maintained in the Office of Sponsored Programs at the above address. Please keep any changes to this approved protocol in this office. A Continuing Review protocol will be sent to you in the future to determine the status of the project. Also, please use the standard approvals form to assure participants of compliance with The Office of Human Research Protection regulations.

Sincerely,

[signature]
Paul J. Beanley, M.S.T.M.
Compliance Coordinator
Office of Sponsored Programs
Western Kentucky University

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Office of Sponsored Programs
Western Kentucky University
Appendix D

MCNP Meeting Sign-in Sheet

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Representing</th>
<th>Phone</th>
<th>E-Mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ann Epperson</td>
<td>Grad Student</td>
<td>WKU</td>
<td>605-783-7183</td>
<td><a href="mailto:am.epperson@wku.edu">am.epperson@wku.edu</a></td>
</tr>
<tr>
<td>Katie Allen</td>
<td>Associate Prof.</td>
<td>WKU</td>
<td>(270) 545-5422</td>
<td><a href="mailto:kate.allen@wku.edu">kate.allen@wku.edu</a></td>
</tr>
<tr>
<td>Rick Tomaly</td>
<td>Arch. Proj. Main St.</td>
<td>WKU</td>
<td>270-219-2145</td>
<td><a href="mailto:rick.tomaly@wku.edu">rick.tomaly@wku.edu</a></td>
</tr>
<tr>
<td>Ken Kern</td>
<td>Management Assistant</td>
<td>MACA</td>
<td>270-842-3353</td>
<td><a href="mailto:ken.kern@wku.edu">ken.kern@wku.edu</a></td>
</tr>
<tr>
<td>Bruce Powell</td>
<td>Dept. Sup.</td>
<td>MACA</td>
<td>270-738-2186</td>
<td><a href="mailto:bruce.powell@wku.edu">bruce.powell@wku.edu</a></td>
</tr>
<tr>
<td>Mike Adams</td>
<td>Chief of Interpretation</td>
<td>MACA</td>
<td>270-738-3451</td>
<td><a href="mailto:mike.adams@wku.edu">mike.adams@wku.edu</a></td>
</tr>
<tr>
<td>Pat Kelly</td>
<td>Superintendent</td>
<td>MACA</td>
<td>270-738-2154</td>
<td><a href="mailto:pat.kelly@wku.edu">pat.kelly@wku.edu</a></td>
</tr>
<tr>
<td>Bob Ward</td>
<td>Chief Human Res.</td>
<td>MACA</td>
<td>270-738-2129</td>
<td><a href="mailto:bob.ward@wku.edu">bob.ward@wku.edu</a></td>
</tr>
<tr>
<td>Vicki Carson</td>
<td>PI</td>
<td>MACA</td>
<td>270-738-2192</td>
<td><a href="mailto:vicki.carson@wku.edu">vicki.carson@wku.edu</a></td>
</tr>
</tbody>
</table>
1. Help us understand who you are (check all that apply)

<table>
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<tr>
<th>#</th>
<th>Answer</th>
<th>Response</th>
<th>%</th>
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<tbody>
<tr>
<td>1</td>
<td>Former resident of Mammoth Cave National Park (MCNP) area or a descendant thereof</td>
<td>16</td>
<td>40%</td>
</tr>
<tr>
<td>2</td>
<td>Employee of Mammoth Cave National Park or Western Kentucky University</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>3</td>
<td>Neither of the above</td>
<td>22</td>
<td>55%</td>
</tr>
</tbody>
</table>

Statistic | Value
---|---
Min Value | 1
Max Value | 3
Total Responses | 40

2. How did you learn about the Mammoth Cave HGIS website?

<table>
<thead>
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<th>#</th>
<th>Answer</th>
<th>Response</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>• Learned about it at the MCNP Annual Homecoming</td>
<td>9</td>
<td>23%</td>
</tr>
<tr>
<td>2</td>
<td>• Someone provided me the link to the site</td>
<td>23</td>
<td>58%</td>
</tr>
<tr>
<td>3</td>
<td>• Saw it featured on another web site</td>
<td>6</td>
<td>15%</td>
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<tr>
<td>4</td>
<td>• Other</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>40</td>
<td>100%</td>
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</table>

Statistic | Value
---|---
Min Value | 1
Max Value | 4
Mean | 2.03
Variance | 0.59
Standard Deviation | 0.77
Total Responses | 40
3. If you saw the HGIS website featured on another website, which one was it?

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<th>Text Response</th>
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<tbody>
<tr>
<td>MyFamily.com</td>
</tr>
<tr>
<td>Mammoth Cave my family</td>
</tr>
<tr>
<td>Ancestry...Mammoth Cave Site</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Responses</td>
<td>3</td>
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</tbody>
</table>

4. Please explain how you learned about the website:

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<thead>
<tr>
<th>Text Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>I created it and am testing qualtrics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Total Responses</td>
<td>1</td>
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</table>

5. Have you ever used an Internet mapping site before, such as Google Earth or MapQuest?

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
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<td>Yes</td>
<td>34</td>
<td>89%</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>4</td>
<td>11%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>38</td>
<td>100%</td>
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</table>

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min Value</td>
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</tr>
<tr>
<td>Max Value</td>
<td>2</td>
</tr>
<tr>
<td>Mean</td>
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<tr>
<td>Variance</td>
<td>0.10</td>
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<tr>
<td>Standard Deviation</td>
<td>0.31</td>
</tr>
<tr>
<td>Total Responses</td>
<td>38</td>
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</tbody>
</table>
6. How easy or difficult was the Mammoth Cave HGIS website to use?

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Easy</td>
<td>26</td>
<td>68%</td>
</tr>
<tr>
<td>2</td>
<td>Neutral</td>
<td>5</td>
<td>13%</td>
</tr>
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7. Did you click on the website link “How to Use This Site”?

<table>
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<tbody>
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<td>Yes</td>
<td>18</td>
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<td>2</td>
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<tr>
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<tr>
<td>Mean</td>
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</tr>
<tr>
<td>Variance</td>
<td>0.26</td>
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<td>Standard Deviation</td>
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8. How easy or difficult to understand was the help text?

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<td>Neutral</td>
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9. Did you experience any difficulty accessing or using the HGIS mapping website?

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10. Please describe the difficulty you experienced

Initially did not understand the directions to allow access to photos.

Site would not come up

I found the information provided to be overwhelming and more complex than I was able to deal with. I'm sure that with someone beside me who knows this sort of program, the site will be very informative and interesting. But it is not designed for duffers like me. The problem is not that there is insufficient operating information on the site. The problem is that there is too much, so an inexperienced viewer like me is simply can't handle it.
11. Would you be interested in using a website such as this for learning about the history of former residents of the park area or for doing genealogical research?

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>Response</th>
<th>%</th>
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</thead>
<tbody>
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<td>23</td>
<td>68%</td>
</tr>
<tr>
<td>2</td>
<td>Somewhat</td>
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<tr>
<td></td>
<td>Total</td>
<td>34</td>
<td>100%</td>
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</table>

12. What other kinds of information would you like to see added to this web site? (check all that apply)

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</thead>
<tbody>
<tr>
<td>1</td>
<td>Photographs of individuals and families</td>
<td>30</td>
<td>86%</td>
</tr>
<tr>
<td>2</td>
<td>Audio clips of interviews with former park residents</td>
<td>25</td>
<td>71%</td>
</tr>
<tr>
<td>3</td>
<td>Digital images of wills, letters and other documents of historic significance</td>
<td>26</td>
<td>74%</td>
</tr>
<tr>
<td>4</td>
<td>Other</td>
<td>5</td>
<td>14%</td>
</tr>
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</table>
13. List what other kinds of information you would like to see:

Text Response

For the ages - it would be nice if there were something within the pull down box that indicates that is the age in 1920 (from the 1920 census) just in case you end up with census data from other years - and also for those who do not click the read this first information. Would actually be nice to have a link to that census data page eventually so you can see what the entire family makeup was during that period. Captions on the photographs would also be nice and where the photo was obtained (family member, library, etc. - and of course approx. year taken if known).

14. Please add any other comments you have on the web site:

Text Response

Both sets of grandparents lived on what is now the park. Both of my parents were grew up there.

I will look back again, but I don't recall seeing satellite / aerial map view. That would be nice too so that you can see what the land looks like now in the areas where people used to live. But, I can understand the Park's need to try to preserve the archaeological features, and that may provide people with the information to find those features.

This web site provides families an opportunity to reconnect to their homeplace, share their memories and preserve their place in history. As a GIS, it provides a wonderful example of how technology can preserve history in ways never before possible. With the easy to understand help text and wild card searches this site is user friendly and I think, will be well received. This is a great service to the public!

A great work in progress. Thanks for the site. It's very helpful to those of us who had families who lived there.

I would love to get photos and info about my family's that was former residents on the park.

Well done. The only thing I would add would be to cache the data if possible. I'm on a fast connection, but it could be slow for some, especially when using the WebADF for the interface. Also, keep in mind that if this application is to exist for a number of years, ESRI is deprecating the WebADF after the ArcGIS 10 cycle, so you will have to migrate it to one of their REST-based APIs (Javascript, Flex, Silverlight). That is still a couple of years off at least, but something to keep in mind. Otherwise, nicely done.
As a GIS professional, I found this web site, very well designed, useful, and user friendly. This is not my field, and I have no personal interest in Mammoth Cave National Park, so I looked at the site because I was asked to do so. It may well be that my reaction is atypical. But as I was asked for it, I have given it. Sorry if it is not helpful.

<table>
<thead>
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<tbody>
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15. Optional-enter your e-mail address here, and receive announcements related to the HGIS website and research project!

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<tr>
<td><a href="mailto:strangesk@insightbb.com">strangesk@insightbb.com</a></td>
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<td><a href="mailto:brandon.cowles892@wku.edu">brandon.cowles892@wku.edu</a></td>
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16. Browser Meta Info

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<td>Firefox</td>
<td>3.6.8</td>
<td>Windows NT 5.1</td>
<td>1280x1024</td>
<td>10.0.45</td>
<td>Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.2.8) Gecko/20100722 Firefox/3.6.8 (.NET CLR 3.5.30729)</td>
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| Browser | Version | OS | Resolution | Version | CLR
|---------|---------|----|------------|---------|------|
| MSIE    | 8.0     | Windows NT 5.1 | 1024x768 | 10.0.42.34 | CLR 3.5.30729) Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 5.1; Trident/4.0; .NET CLR 1.1.4322)
| MSIE    | 8.0     | Windows NT 5.1 | 1024x768 | 10.1.53.64 | CLR 3.5.30729) Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 5.1; Trident/4.0; GTB0.0; .NET CLR 1.1.4322; .NET CLR 2.0.50727; .NET CLR 3.0.4506.2152; .NET CLR 3.5.30729)
| MSIE    | 7.0     | Windows NT 5.1 | 1680x1050 | 10.1.82.76 | CLR 3.5.30729) Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 5.1; FBSMTWB; GTB6.5; .NET CLR 1.1.4322; .NET CLR 2.0.50727; .NET CLR 3.0.04506.30; .NET CLR 3.0.04506.648; .NET CLR 3.0.4506.2152; .NET CLR 3.5.30729; MSN Optimized;US)
| Firefox | 3.6.8   | Windows NT 5.1 | 1152x864 | 10.1.53 | Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.2.8) Gecko/20100722 Firefox/3.6.8 (.NET CLR 3.5.30729)
| MSIE    | 7.0     | Windows NT 5.1 | 800x600 | 10.1.82.76 | Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 5.1; FunWebProducts; GTB5; .NET CLR 1.1.4322; .NET CLR 2.0.50727; WinNT-PAR 16.07.2009; .NET CLR 3.0.4506.2152; .NET CLR 3.5.30729)
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<td>Total Responses</td>
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Bibliography


Ghose, Rhina. 2001. Use of Information Technology for Community Empowerment:


