WHY MAP YOUR COMMUNITY?

by Bob Coulter

This booklet contains a series of tutorials with tips and techniques on how to use ArcGIS to map your local community. In these opening pages I hope to put the remainder of the booklet in context by addressing the more fundamental question of why it is a good idea to map your community. I will suggest that there are two fundamental, inter-related reasons. Quite simply, people should map their community to:

- place themselves on the map, helping to build a sense of place in the world, and
- place local issues on the map, enabling better investigation and analysis.

Over the past 15 years I've worked with students who have conducted investigations of local issues such as water quality in a neighborhood creek, the potential environmental consequences of a new baseball stadium, and patterns in racial and economic segregation. Each of these projects and many like it have provided opportunities for students to deepen their understanding of the world and how it works, starting with a local phenomenon that was important to them. It's much easier to develop enthusiasm for a topic you can see every day than it is for an abstraction in a textbook. The local creek filled with critters is a much better "draw" for students' interest than a picture of a creek somewhere else.

Aside from these broader educational reasons, there is also a more pragmatic reason to consider: Rich investigations such as these create the space in which your students can practice a range of skills that feature prominently on standardized tests, including math skills with number operations and data analysis as well as language skills used for interpreting evidence and drawing conclusions. Many aspects of the emerging "Common Core" standards in math and language, as well as the Science Frameworks advanced by the National Academies of Science can be addressed through GIS-enhanced projects.

Note also that while the projects described here sound sophisticated, they are accessible to younger students. With the right motivation—often provided by the local context—students bring a lot more sophistication to their work than they might for something that is seen as "just a school assignment." With the right guidance, comparatively young students are capable of sustained and meaningful analysis. Together, students' motivation nurtured by your guidance can create magical learning experiences.

To help you along the way, the tutorials offered here are intended to help you and your students focus on the issues being investigated without having to get buried in learning all of the tools ArcGIS offers. The tools highlighted here are the ones I've found most useful in more than a decade of supporting local projects, dating back to the days of ArcView 3. If you think others might be useful, drop me a note at bob@lrec.net. Your idea might make it in an updated version. Also, as ArcGIS evolves, this booklet will be updated to remain current. (This is already its third iteration, following on earlier versions for ArcGIS 8 and 9).

And now, on to the business at hand: Why map your community?

Goal #1: Putting Yourself on the Map

There seems to be something almost instinctual when kids see a map: they want to place themselves on it. Where do I live? What's near me? Where is my friend's house? Developmentally speaking, David Sobel (1998) has shown a developmental trajectory for young students, starting with representations of home and moving out into the neighborhood. It seems that we never lose our fascination with home, though, as a place to anchor ourselves. Looking more broadly, basing our learning in the local community serves a similar "homing" function, providing the springboard from which we can learn about the world. While there is no doubt that we live in an increasingly global world, a range of research assembled by the Place-based Education Evaluation Collaborative (PEEC) shows that students benefit from starting with what is immediately familiar. In particular, when students have opportunities to engage in locally-based studies when they can measure and monitor their impact have proven to be particularly valuable in promoting depth and motivation among young learners (Duffin, Murphy, and Johnson, 2008).

Given these educational benefits, a number of educators are becoming more interested in place-based approaches to education. As noted by PEEC (2010):

- Place based education immerses students in local heritage, culture, ecology, landscapes, opportunities and experiences as a foundation for the study of language arts, mathematics, social studies, science, and other subjects.
- Place based education encourages teachers and students to use the schoolyard, community, public lands, and other special places as resources, turning communities into classrooms.
- Project-focused and inherently tailored by local people to local realities, place-based education is equally relevant in small towns and big cities, equally effective for kindergarteners and high school students.

A good place to start with place-based projects is a map of the local area. The tools and techniques described here can help you get started in building curriculum resources that bring local mapping to your classroom.

Goal #2: Putting Issues on the Map

Aside from that first step of putting yourself on the map, there is a lot of benefit to be had in mapping local issues. A continuum I've found helpful is to think of kids studying water quality. All too many students simply read about water quality in their textbook, perhaps with the posed picture of a scientist looking at a water sample. One step further, students can conduct hands-on testing of water samples with simple tools like thermometers and pH paper. A third step would be to go outside and get the benefit of actual field experience: What is the water like in the creek that runs by the playground? Each step adds complexity and authenticity to the students' work.

As important as these steps are, I encourage you to take the next step, which is to add a spatial component to your investigations. How does the water quality here compare with the water down stream? What factors might explain the difference? One of my first geospatial projects with students (Coulter, 2000) involved fifth graders who wanted to map local water quality for a science fair project.

They tested at four different locations over the course of four months using a variety of chemical tests and electronic probes. In the end, they found that water quality suffered a "dip" in a highly industrialized area with several limestone operations (thus accounting for the pH increase) and an area with exposed soil banks and a denser road network (both of which accounted for their measured uptick in the level of solids in the water through erosion and runoff).

A few years later one of these students returned to GIS as he completed a required environmental analysis project for his 8th grade Earth science class. At the time, there was a great deal of local interest in the possibility of the St Louis Cardinals building a new baseball stadium. Using GIS, Nathan investigated a number of relevant environmental issues, including whether the new stadium would encroach on a flood plain and whether the soil type and underlying geology would be suitable. He also used historic land use data to identify a possible concern, as the new stadium site had previously been used as a gas station. As it turned out, the stadium was built, and a few years later an issue appeared briefly in the local papers as to whether there was a soil pollution problem at the new stadium. Nathan beat them to the story!

Aside from supporting these individual projects, teachers can leverage high interest events to support rich inquiry. Living in the midwest, tornados are an all too common occurrence. Three times I've had occasions to support tornado-based GIS projects. This can be done at a relative micro-scale plotting paths of individual tornado strikes such as the one that hit Lambert St. Louis Airport in April 2011, or on a larger scale as students look for broad patterns. On New Year's Eve 2010 we had a highly unusual winter tornado strike, which kicked off an investigation by middle school students of how tornados in Missouri vary seasonally. Each of these projects used a high interest event to make otherwise dry Earth science content come to life. Teachers, armed with geospatial tools, turned the news into an investigation.

Lest you think GIS is all about science, you can use GIS to investigate a number of social issues as well. Back in 2008 I had the privilege of working with Molly, a 6th grader at a local elementary school. She wanted to investigate change in her suburban St Louis community in the fifty years since her grandfather moved there. Using ArcGIS and historic Census data from NHGIS (nhgis.org), Molly mapped racial change since 1960 and crafted a series of maps that captured her community's current socio-economic divide. She then proudly presented it to an audience of thousands of geospatial professionals at the ESRI annual conference.

Where can your students go with GIS?

Goal #3: Deepening Academic Skills With GIS

If you have read this far, you are probably willing to grant that using GIS has the potential to be a powerful learning tool. Still, you may be asking yourself if you can do this and still meet your curriculum requirements. To respond, I encourage you to consider the learning embedded in the examples cited above. A range of Earth and social science concepts came to the fore, and mathematics skills were developed as students collected and analyzed relevant data. Along with this, students practiced language skills as they communicated with local experts, conducted online research, discussed their findings, and generated conclusions.

Fortunately, geospatial projects align well with the new *Frameworks for Science Education* promulgated by the National Academies of Science as well as the Common Core standards in mathematics and language arts. You don't need to choose between rich local learning projects and meeting curriculum standards. With creative design, you can have both. The following chart shows a few examples of how you can address emerging science and mathematics standards with GIS. Your students will also develop a range of language skills as the investigate issues, conduct background research, and communicate their findings.

Common Core Standards for Mathematical Practice

- Make sense of problems and persevere in solving them.
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

National Academies of Science Frameworks—Scientific Practices

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

In my experience the key to a successful project is to build students' enthusiasm and motivation to investigate real-world issues that have a local connection, and to provide the guidance needed to help them succeed. As the teacher, you are the architect or designer of their learning experiences. I hope that these tutorials help you to navigate through the menus and buttons so you can focus on the learning. To help you get started, the table below gives an overview of each tutorial

Section	Focus	What's it Good For?
1.1	Getting Started	The basics of starting ArcGIS and mapping data.
1.2	Adjusting your view	Zooming in and out to refine your view of the data.
1.3	Editing the legend	Mastering the legend gives you control over how your data is presented. Learn editing tips here.
2.1	Joining data tables	Often, you'll find a data table (such as per capita income for each county in a state) and want to map it. Start here to learn how to plot that data on your map.
2.2	Managing .e00 files	While .e00 (or coverage) files are an older "legacy" format, much local data still uses it. This section will help you to manage the data efficiently.
2.3	Importing imagery	How to bring aerial photography into your projects.
3.1	Defining map projections	Geographers use different projections to suit their purposes. For the most part ArcGIS can work with these different projections. When it can't, look here.
3.2	Clipping data layers	How to have just a portion of a larger data layer—perhaps your city's roads from a county road layer.
3.3	Merging data layers	The opposite of the previous task. In this one, combine two layers to make a larger one. Imagine you need the creek layers from a couple of adjacent counties to map a watershed.
4.4	Plotting single addresses on a map	Tips for plotting a single location like your school on a map.
4.2	Plotting multiple addresses on a map	Ways to plot a set of addresses (like store locations) easily.
4.3	Plotting GPS coordinates on a map	Ways to plot data for which you have collected latitude and longitude data, such as creek monitoring locations.
4.4	Combining imagery and coordinates	How to have your locations plotted on an aerial photograph of your study site

References

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