

METHODS AND TOOLS

SPATIAL THINKING AND GEOGRAPHIC INQUIRY

You are geography, and geography is you. As you move through space in your everyday life you are observing and interacting with the elements that make up the study of geography. When you go to a place, you affect the place and the place affects you. You make decisions based on these spatial encounters. The mode of thinking you use, whether you know it or not, involves a method. Geographic inquiry is similar to the approaches, strategies, and tactics used in other disciplines and types of research—basic scientific method, for example. The focus here is on the patterns of people moving through space and time, the reasons underlying those patterns, and the causes and the effects in the web of life. Knowing where something is and how its location determines its characteristics and relationships with other phenomena is the foundation of geographic thinking. From this foundation you can shape a perspective of the world and all that's in it. You can, in fact, create as many different perspectives as there are people in the world.

Now, without further ado, here are the steps of geographic or spatial inquiry, the same ones used by scientists, government officials, business people, and concerned citizens from one end of the globe to the other:

- 1 Ask geographic questions.
- 2 Acquire geographic resources.
- 3 Explore geographic data.
- 4 Analyze geographic information.
- 5 Act upon geographic knowledge.

Let's clarify them.

Ask geographic questions

Think about a topic or place, and identify something interesting or significant about it. Spin that observation into the form of a question, such as *Why do these particular trees show signs of stress?* or *How do the types of businesses change as we move along this street?* or *What does it matter if that whole area is cleared of trees?* By turning the interesting observation into a question, you can focus the exploration. Good geographic questions range from the simple *Where are things?* to *How do things change between here and there?* to deeper questions, such as *Why does this thing change between here and there?* or *What is the result of this thing changing between here and there?* Thus, you might be tempted to ask *Where do songbirds nest?* or *Why is there drought in this region while that region is flooded?* or *What is the result of refugees moving from this land across the border to that place?* A good question sets up the exploration.

Acquire geographic resources

Once you have a question, you can think about the information needed to answer it. Here, it's helpful to consider at least three aspects of the issue: geography, time, and the subject of your project—sustainable development.

WHAT'S THE GEOGRAPHIC FOCUS OF YOUR RESEARCH?

In studying a country in relation to others, your inquiry might require country-level data, and you would need data for the country of interest as well as for neighboring countries. Defining the geographic focus helps you define the scale (global, regional, local) of your inquiry, and helps you define the extent (a city, a country, a continent, the globe) of your inquiry.

FOR WHAT PERIOD OF TIME DO YOU NEED THE DATA?

Answering questions about things happening today would mean, of course, using information that's as current as possible. On the other hand, your questions might become clearer and sharper if you included a historical perspective or imagined a future scenario.

FOR WHAT SUBJECT(S) AND SPECIFIC TOPIC(S) DO YOU NEED DATA?

It is very useful to take time to consider the topical aspects of the data you need. Population may be the general theme of your study, but international migration may be your actual focus. Learn to dissect your data needs. The sharper you can make your focus, the less likely you are to get lost in piles of unrelated and unnecessary data.

Often, you can find the necessary geographic data quite easily, in readily available packages or downloadable from the Internet. Sometimes you have to produce the data yourself, or convert data from one form into a more appropriate form. In the early days of GIS, almost all data had to be produced independently. These days, the rise of the Internet and exponential increases in computer speeds and capacities have made it much easier to acquire information. This explosion of data means you may find material in a wide range of formats, at multiple scales, with variable quality. After tracking down what is readily accessible and recording any source information about your data, you need to look at what is still missing and decide if you can answer your question. Even if you are missing some data you'd like to have, you may still be able to answer your initial question, or a variation of it, by exploring your resources carefully.

Explore geographic data

Turn the data into maps, tables, and charts. Maps are especially valuable, because they give you a powerful view of patterns, or how things change over space. Maps also allow you to integrate different kinds of data from different sources—pictures (aerial photos, satellite images) and features (roads, rivers, borders)—in layer after layer. Explore your data in a variety of combinations. Look at individual items and what is around them. Explore how spatial phenomena relate to things around them: mountains and streams, cities and coastlines or rivers, agriculture and deforestation. Be creative. Observe.

For any one set of data, there are many ways to twist and turn it. By integrating maps with tables, charts, and other representations, some patterns may begin to appear, patterns which might spur you to refine your original question or to seek out one more set of data. Such refinement at this stage is common and sensible. For example, when first exploring regional rainfall patterns, you might not have anticipated that you would need the locations of mountain ranges, but having this data might just make a difference.

Using a GIS, this kind of visual exploration is simple to do. One layer of information stacks on top of another. By changing the map symbols, altering the sequence of layers, or zooming in to specific parts of the map, patterns and relationships become easy to see.

Analyze geographic information

After creatively exploring the relationships between this and that, or here and there, focus on the information and maps that most seem to answer your questions. Using carefully constructed queries, you can highlight key comparisons or expose patterns that had lain hidden during initial explorations. Focus on relationships between layers of information; make

inferences about the distribution of things; calculate the degree to which the presence of something affects the presence or character of something else. Key on the deeper questions—*Why is it there?* and *So what?* See if some predictions can be made. For instance, if you discover that most traffic accidents in your community occur at intersections along major streets running due east–west, what would you expect to find in other communities, and why?

The power of the computer becomes especially helpful in this analysis step. Since GIS data is made up of map representations and tables of characteristics, a GIS can handily solve queries and identify things. “Computer, please find for me all cities of one million or more people where rainfall is less than ten inches per year.” Quick to find answers, the GIS still is dependent on *you* to shape the questions.

You can also use the power of manual map overlays using transparent sheets to portray various themes or thematic data layers over a common base map. The use of multiple map overlays helped geographers long before the advent of computers.

At this point in your inquiry, your aim should be to draw conclusions from what you have seen in the maps, map overlays, charts and queries, and to answer your question. You might find you do not have the information you need to answer the question—that’s OK. The important thing is that you now understand the issue better than before, and you have drawn some conclusions from your research, turning pieces of data into geographic knowledge.

Act upon geographic knowledge

You have used GIS to weave data together from multiple sources, transforming it in the process into knowledge on which you can act. Bring your new understanding to bear on your community. Tell other people what you've learned and why it's important. Sustainable development depends on the involvement, consensus, and carefully planned actions of your entire community.

Good citizens and decision makers for the planet need to act according to an integrated understanding of the relationships between diverse forces. It is not enough simply to understand why things are where they are, and not even enough just to comprehend the impact of what's already happened or is likely to happen. Knowledge needs to be comprehensive and it needs to be shared—the big picture, the microscopic details, and everything in between. There can't be any missing links, overlooked facts, or excluded parties in

the solution to a problem in which everything is connected in a web of cause and effect.

This may mean doing a presentation to your school about the health of nearby trees because shade can ease the strain on power supplies, or to your town council about reducing pesticides in the local produce because fresh fruit and vegetables translate directly into lowered health care costs. It may mean encouraging local businesses to provide resources for a community far away, or helping the state change its energy policies because of impact beyond its borders. Understanding the widespread linkages and helping others see how their lives are affected means “thinking globally, acting locally.” You've probably seen the bumper sticker. Now that you've got a better idea of what that slogan really means, you'll be in an ideal place to answer the question, *Now what?*

TOOLS

Geographical research doesn't have to be based on data you hand-picked in the field. Your research may lead you to use what's called “secondary” or “tertiary sources of information”—already existing maps, reports, and photographs. You will also use a number of tools to develop your project. The following checklist will help you start to plan your sustainable development project.

You may use any combination of these tools and more, as long as your focus remains on defining and communicating issues related to the spatial relationships of sustainable development in your world. The success of an investigation or project relies more on the clear definition of the issues and a good set of questions than on the tools used. Spatial analysis and thinking are the critical elements of geographic science.

CHECKLIST OF EQUIPMENT AND DATA

Equipment

- Camera
- Charts
- Compasses
- Computers
- Global Positioning System (GPS)
- Survey equipment
- Graphs
- Measuring tapes
- Transparent sheets
- Notebook to record your project and references

Images

- Aerial photographs
- Satellite imagery for large areas

Maps

- Boundaries delineated
- County/city road map
- Topographic maps

Software

- GIS
- Spreadsheets
- Word processing
- Database management

Data

EXISTING BIOLOGICAL DATA

- Published inventories
- Field notes and memory
- Government, local and national level published reports

EXISTING PHYSICAL DATA

- Geology maps
- Maps showing hazards, floodplains, etc.
- Topographic maps
- Aerial photographs
- Satellite imagery for large scale
- Photographs

Data analysis

- Comparison of recent to past
- Field notes/inventory
- Placement of information into data banks (files)

Display format

- Maps, using either digital or manual methods showing the changes
- Reports, describing your theme, approach, results, and summary
- Photographs