

One of the most important accomplishments of the Kentucky Geological Survey (KGS) in its 163-year history was completing a project to geologically map the entire state at a detailed scale of 1:24,000 (1 inch on the map equals 2,000 feet on the ground). The project, carried out in cooperation with the U.S. Geological Survey, resulted in 707 geologic quadrangle maps (GQ's) being published from 1960 to 1978; each map covers a 7.5-minute by 7.5-minute area. The maps are provided to the public at low cost, and have been the best-selling geologic publication in Kentucky ever since the first one rolled off the press in the early 1960's. More than 81,000 maps have been sold since then, and approximately 5,000 are still sold each year, attesting to their continuing popularity.

This popularity is an indirect measure of how much the maps are valued, but there had been no formal estimation of their value until Subhash Bhagwat and Viju Ipe made an economic evaluation in 2000. Bhagwat and Ipe, both mineral economists with the Illinois State Geological Survey, wanted to know the value of Kentucky's GQ's because the Illinois Survey has just begun a program to map the entire state of Illinois at the same scale that Kentucky did. The Kentucky maps were an ideal study case because they've been in circulation for more than 25 years, long enough for a meaningful evaluation.

KGS scientists cooperated with Bhagwat and Ipe to design a questionnaire that asked these basic questions:

- ❖ How are the maps used?
- ❖ What are the maps worth to the user?
- ❖ What are the maps worth to the state?

KGS mailed the questionnaires to the 2,200 geologists registered with the Kentucky Board of Registration for Professional Geologists; 20 percent of the questionnaires were returned. KGS staff tabulated the responses, and Bhagwat and Ipe analyzed the responses.

How are the maps used?

The responses indicated a wide variety of uses for the maps (see chart, below), some of which could not have been anticipated at the time the mapping program began.

How people use Kentucky geologic quadrangle maps (modified from Bhagwat and Ipe, 2000)*:

Category	Map use	Percent of respondents
Exploration & development	Coal	30
	Oil & gas	32
	Industrial minerals	32
	Ground water	73
Environmental consulting	Pollution prevention	53
	Industrial applications	41
	Site clean-up	68
Hazard prevention & protection	Landslides	33
	Earthquakes	14
	Karst problems	54
	Subsidence	40
Engineering	Buildings & foundations	37
	Roads & highways	35
	Railroads	16
	Pipelines	30
	Utilities	26
	Dams, dikes, & locks	27
City planning	Zoning decisions	17.5
	Landscape planning	11
	Building codes	7.5
Regional planning	Waste disposal	45
	Transportation	16
	Industrial permits	38
Property valuation	Property tax assessment	11
	Land acquisition	35

*Sum of percentages exceeds 100 because each user reported more than one map use.

Some of the most common uses were:

- ❖ Exploring for and developing ground-water resources
- ❖ Cleaning up environmentally damaged sites
- ❖ Avoiding karst hazards
- ❖ Designing foundation engineering
- ❖ Making zoning and city planning decisions
- ❖ Locating waste-disposal facilities
- ❖ Evaluating property

What are the maps worth to the user?

This question was answered in several different ways. The users said they saved an average of \$43,527 because the maps were already available and therefore they didn't have to do the mapping themselves. Gathering only *the minimum* amount of information necessary for them to do a credible job would have cost an average of \$27,776.

Geologic mapping was so vitally important to their work that they estimated a map was worth 17 percent of their total project cost. The users held GQ's in such high esteem that they would be willing to pay \$342 *per map!*

What are the maps worth to the state?

The mapping program was funded by both Federal and State tax dollars. Have the taxpayers gotten their money's worth? If we multiply \$27,776 (cost to gather minimum information necessary to do a credible job) by 81,000 (total number of GQ's sold), we get a minimal value of \$2.25 billion for the maps; if we multiply the 81,000 maps sold by \$43,527 (the amount already having a GQ available saved the users), we get a maximum value of \$3.53 billion for the maps. If we subtract the cost of the mapping program (\$90 million, in 1999 dollars) from the minimum value of \$2.25 billion, we see a net gain of \$2.16

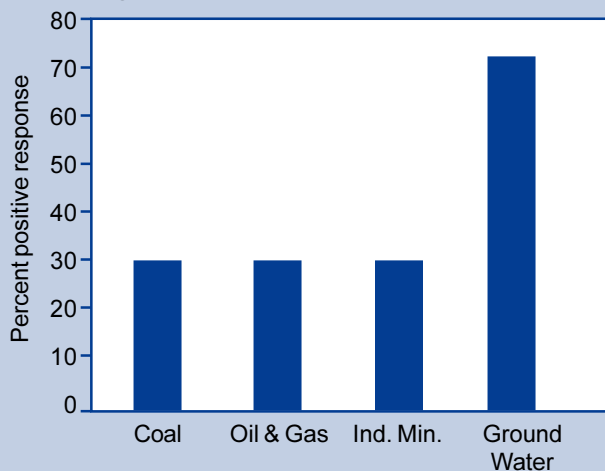
billion. This is a remarkable return on the taxpayers' investment!

The public has been extremely well served by the mapping program, as demonstrated by this cost-benefit analysis. Even if you've never bought a geologic quadrangle map, you still benefit from the maps. That's because economists consider GQ's "public goods," much the same as roads, dams, and reservoirs are—in fact, GQ's make it possible to build better roads, dams, and reservoirs, and build them more economically. And the public will continue to reap the benefits of the maps, because the information they contain will continue to be used for many more decades.

References cited

- Bhagwat, S., [2000], Recent study validates ambitious geologic mapping program: Illinois State Geological Survey, 4 p.
- Bhagwat, S.B., and Ipe, V.C., 2000, What are geologic maps worth: Geotimes, December 2000, p. 36–37. ❖

Map use for exploration and development (modified from Bhagwat, 2000)



Map use in regional planning (modified from Bhagwat, 2000)

