

RICH MAP



POOR MAP

The fact that poverty and public health are related is widely understood, but the relationship is often difficult to quantify. Recognizing this, researchers, activists, and policy makers are beginning to combine “poverty maps” that locate the poor with maps that identify environmental conditions, creating a tool that helps guide policy decisions and remediation actions.

The use of such spatial analysis tools to understand the connections between health and where people live can be tracked to nineteenth-century Europe. John Snow’s 1854 cholera map of London was credited with stopping an epidemic by identifying and inactivating its source: a pump that drew water from a well contaminated with sewage. And Charles Booth advanced the technique with his 1889 street map of London in which every street was colored to indicate the social and economic class of its inhabitants.

Enhanced computer power and the advent of geographic information system (GIS) mapping software now enables a kind of multidimensional mapmaking that the early poverty mappers would have envied. Today’s digital maps present layers of data that are linked to geographic location—for example, a region’s highway infrastructure, forest cover, building locations, the presence of airborne toxicants, and infant mortality—and allow these data to be displayed, manipulated, and analyzed in any manner of ways for a particular time period.

Brave New Cartography

Poverty mapping using GIS capabilities is being sponsored by governments and

nongovernmental organizations on every continent. In a bid to promote the use of poverty maps by United Nations (UN) member states and organizations as well as nongovernmental organizations—particularly in the areas of food security and environmental management—the government of Norway has funded the Poverty Mapping initiative, which is run by the

regional poverty maps to be used as policy tools.

The most useful maps show poverty at a district or community level, rather than on a national scale. These higher-resolution maps can reveal poor regions and communities that may disappear among wealthier areas at lower resolution. Higher-resolution maps can more closely

tie population to specific spatial features such as roads, health clinics, and factories.

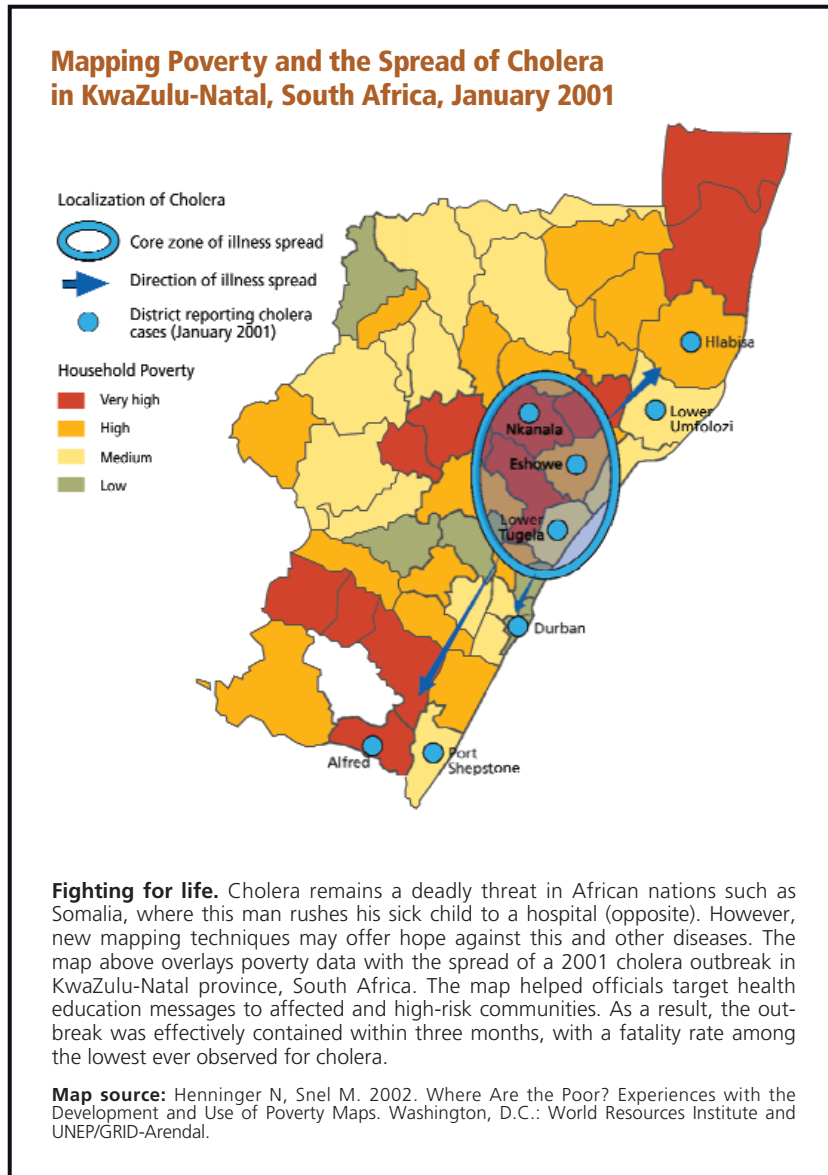
“These maps have the potential to greatly influence public decisions or to make the decisions more transparent,” says Norbert Henninger, deputy director of the Information Program at the World Resources Institute. “When maps get in the public domain, you can raise public awareness—it becomes crystal clear when you see on a map that resources [such as health care services, income, and water supplies] aren’t going into poor neighborhoods. If poverty mapping is done correctly, the great long-term value will be the enhanced use of existing data and a better-integrated data infrastructure.”

Seeing Leads to Doing

Henninger was one of the writers of the World Resources Institute and UNEP/GRID-Arendal report *Where Are the Poor? Experiences with the Development and Use of Poverty Maps*, which cites case studies

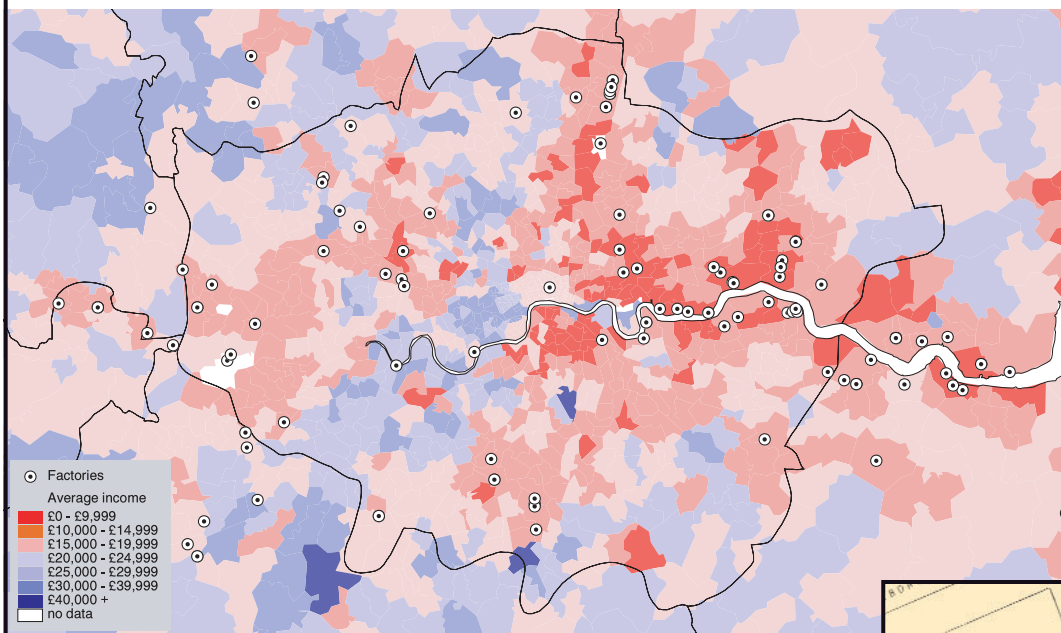
in 14 countries in Africa, Asia, and Latin America. The studies show the diversity of actions that can result from compiling a poverty map.

In the Brazilian state of Minas Gerais, for example, poverty maps help guide the distribution of tax revenue earmarked for local infrastructure so that instead of



UN Food and Agriculture Organization, the Arendal (Norway) office of the UN Environment Programme (UNEP)/Global Resource Information Database (GRID), and the Consultative Group on International Agricultural Research. Similarly, the World Bank has sponsored the creation of numerous national and

Industrial Sites and Average Income in the London Area



Then and now. Poverty mapping has come a long way since John Snow plotted cholera cases on his London map (right). Today's digital maps, such as the one above showing the location of polluting factories in relation to resident income, allow nearly infinite exploration of multiple layers of data.



problems and poverty, suggesting the need for a closely integrated approach that would aim at alleviating both poverty and environmental stressors.

For Good Measure

Developed countries also can benefit from using maps as tools to link poverty and environmental health. The environmental justice movement has focused attention in the United States and Europe on adverse health effects associated with pollution-intensive industries and hazardous waste sites, which are often disproportionately located in low-income and minority communities.

granting money based only on the size of a city, the state will redistribute more than \$1 billion to poorer cities that can demonstrate they are prepared to invest in health, education, sanitation, and environmental conservation. And in Guatemala, overlaying a poverty map of the country with a road map shows the close correlation between lack of roads and poverty. As a result, the World Bank is helping to develop and fund a road building plan so that poor people can share in basic services that depend upon access to roads, such as reaching centrally located health care facilities.

Henninger says there is an untapped potential for environmental health applications of poverty mapping, as demonstrated by its use in helping to contain a 2001 cholera outbreak in KwaZulu-Natal province, South Africa. Three agencies cooperated to provide data on the spread of the disease, access to safe water and sanitation, and poverty. Once the governmental agency Statistics South Africa mapped all the data, the picture showed that cholera was spreading along the river floodplain, moving through and toward poor areas. A targeted health education campaign in which people were taught to

use clean water sources and boil their drinking water contained the outbreak within three months, with a fatality rate of 2.2 deaths per thousand people, one of lowest ever recorded for a cholera outbreak.

The World Bank is investigating the conjunction of poverty and the environment in Southeast Asia, trying to determine whether a direct link can be identified. Bank researchers are studying the correlations between poverty and deforestation, fragile soils, indoor air pollution, unsafe water, lack of sanitation, and outdoor air pollution. Preliminary results show that the links are different for each country.

In Cambodia, for example, poverty correlated most strongly to household environmental quality in the form of indoor air pollution, contaminated water, and lack of access to sanitation; no direct geographic relationship could be determined between poverty and deforestation or outdoor air pollution. This indicated that Cambodians would benefit most from programs that addressed poverty and household environmental quality. In neighboring Laos, however, there was correlation between all environmental

Mapping out the environmental characteristics of a place and the population can create quite a compelling picture, says Robert Bullard, director of the Environmental Justice Resource Center at Clark Atlanta University. He says that poverty mapping is still in its infancy, but it still is helping to advance the concept of environmental justice into international discussions on development, trade, and human rights. Bullard is concerned, however, that after the terrorist attacks of 11 September 2001, security concerns have made it harder to get important information on infrastructure such as pipelines, polluting factories, and power plants [for more on this topic, see "Does Secrecy Equal Security? Limiting Access to Environmental Information," *EHP* 112:A104–A107 (2003)].

In 2003, the United Kingdom Environment Agency published *Environmental*

Left to right: Friends of the Earth; UCLA School of Public Health; <http://www.ph.ucla.edu/epi/snow.html>

Quality and Social Deprivation, a research report showing that the poorest communities bear the greatest burden of poor air quality. For example, the most deprived wards, or communities, are exposed to 41% higher concentrations of nitrogen dioxide (a deep-lung irritant that damages the cells lining the lungs) than people living in wards of average deprivation. In addition, pollution sources are seven times more likely to be located in the poorest communities. According to Simon Bullock, environmental justice research officer at the advocacy group Friends of the Earth, this research was inspired by a map his organization created in 1998 linking the location of polluting factories in England and Wales to average income by postal code.

“This new report is promising because there has been a real lack of relevant academic research in the United Kingdom,” says Bullock. He notes that the fact that poor people live in poor conditions is considered common knowledge in the United Kingdom—“Since the prevailing winds come from the west, the rich have always lived on the west side of cities and the poor on the east,” he says. So the topic has, until now, attracted little interest in the press or research.

The Bigger Picture

In the broader struggle to improve the quality of life worldwide, poverty maps are being developed by researchers at the Center for International Earth Science Information Network (part of Columbia

University’s Earth Institute) to help achieve the Millennium Development Goals adopted by the UN member states in September 2000: eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria, and other diseases; ensure environmental sustainability; and create a global partnership for development.

But these goals were set in a vacuum, says Marc Levy, associate director for science applications at the center, who is working on this mapping project. “Now we must identify where and in what conditions people live: Is it dry, wet, urban, rural? What are the soil conditions? This information is valuable for understanding the poverty drivers and what interventions might help. We’re taking a global perspective, rather than one country at a time.”

A significant challenge in this effort will be finding measures that are comparable across different countries. The wide range of indicators of well-being in use impedes comparison between countries and thus allocation of priorities. Income, for example, is very difficult to compare because purchasing power varies between regions, and exchange rates fluctuate. So it’s better to focus on more universal indicators of poverty such as food consumption, says Levy.

Taking a broader view on trends in poverty mapping is Anna Ballance, program officer for capacity building at

UNEP/GRID-Arendal, who is coordinating the communications and outreach component of the Poverty Mapping initiative. She says the priority for poverty mappers is to expand their methodologies to be able to combine socioeconomic variables with environmental indicators: “This will let us look for causal relationships or synergies that could be used to improve planning and development.”

Ballance adds, “From personal experience, I believe there is some interest from the development community in using poverty mapping techniques and information, and I have witnessed growing commitment from the poverty mapping community to work together in a more cohesive way to achieve common goals, such as gathering information to monitor the Millennium Development Goals. I think the greatest advantage of poverty mapping is as a communication tool, and obviously we are trying to promote that.”

The Nexus of Poverty and Environment

If poverty and environmental degradation can be linked, then a joint remediation strategy may be appropriate rather than independent strategies for each. For a joint remediation strategy to be successful, though, it must address the problems of poor households and the sources of environmental concern in a cost-effective manner. It’s a hard balance to achieve, and it stretches limited government resources because it requires detailed data about both households and the environment.

Still, there is more mapping that can and will be done. Uwe Deichmann, a senior environmental specialist at the World Bank, says the bank’s Southeast Asian work “was really the first filter, with the data only available at medium resolution.” In the next phase, he says, researchers will conduct household surveys on specific problems such as indoor pollution and pesticide use.

The data infrastructure for mapping is getting better, says Deichmann, but the needs are still vast. “To get a better idea of causality and the dynamics of poverty–environment interactions, we need high-resolution data over time, at least two separate time points preferably ten years apart,” he says. He adds that all the donors to the World Bank are pushing for the development of high-resolution poverty maps, and that more and more poor nations, even if skeptical at first, are coming to see the value of these tools.

W. Conard Holton

Suggested Reading

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