Groundwater: Is

by Linda K. Lee
and Elizabeth G. Nielsen

For many years no one suspected that groundwater was contaminated by fertilizers and pesticides used by farmers. But no longer.

Tests of individual wells show that groundwater in some areas of the country is contaminated. Public concern has mounted as the results of more and more tests are revealed.

The extent to which groundwater in the United States is contaminated is not known. There has not been any formal survey of wells. But the episodic information has created concern that contamination is widespread and that drinking water could be contaminated with fertilizers and pesticides. The lack of dependable survey data challenged us to estimate the location of groundwater potentially contaminated with farm chemicals and the number of people who drink the contaminated water.

We generated these estimates by examining the geographic distribution of the use of selected farm chemicals—nitrogen fertilizers, and pesticides. These data were then related to hydrogeologic characteristics that are associated with groundwater contamination, wells, and population data in order to identify regions in which wells are most likely to be contaminated with farm chemicals and the number of people who drink the water from these wells.

Agriculture Is Involved

It is critical to learn more about groundwater contamination caused by human activities. There are documented and suspected risks to human health from exposure to contaminated groundwater. Because of the slow movement of groundwater in many areas, as well as the slow degradation of many chemicals, contamination can persist for years, even centuries. Cleanup costs can be prohibitive. Moreover, the interaction between surface water and ground water can mean that, in some areas, groundwater contamination in aquifers may ultimately lead to pollution of streams, lakes and estuaries.

Groundwater contamination has many sources—farming, mining, fuel tank leakages. However, agriculture's relative contribution may be significant. Estimates of the magnitude of groundwater contamination from agricultural fertilizers and pesticides are important prerequisites to estimating the risks to human health and property caused by farm chemical contamination.

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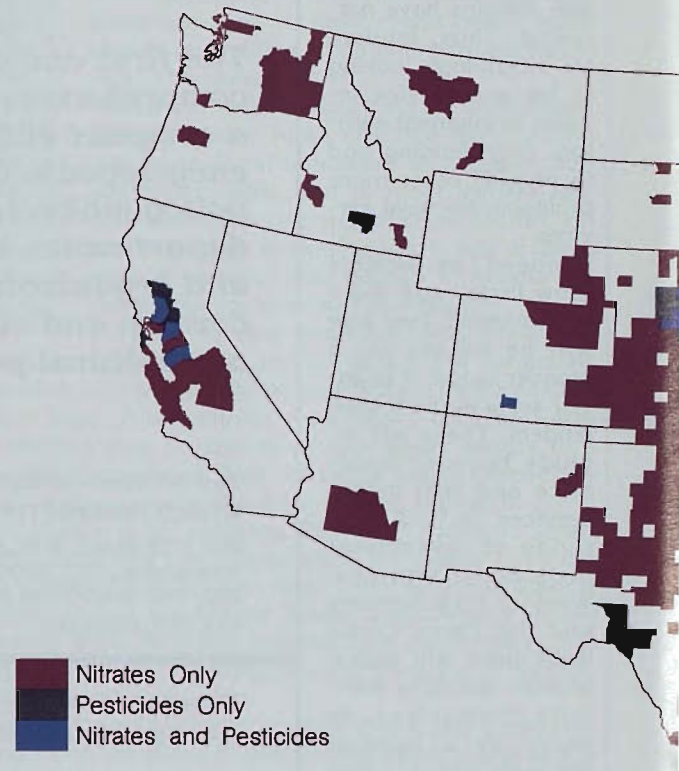
Areas of Potential Groundwat from Agricultural Chemicals



Data used to develop this map are reliable at a regional level. Individual counti be evaluated with additional local data.

Source: Nielsen and Lee, "The Magnitude and Costs of Groundwater Contami Agricultural Chemicals: A National Perspective." AER 576, USDA, ER

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graphic look at key economic figures

It Safe to Drink?

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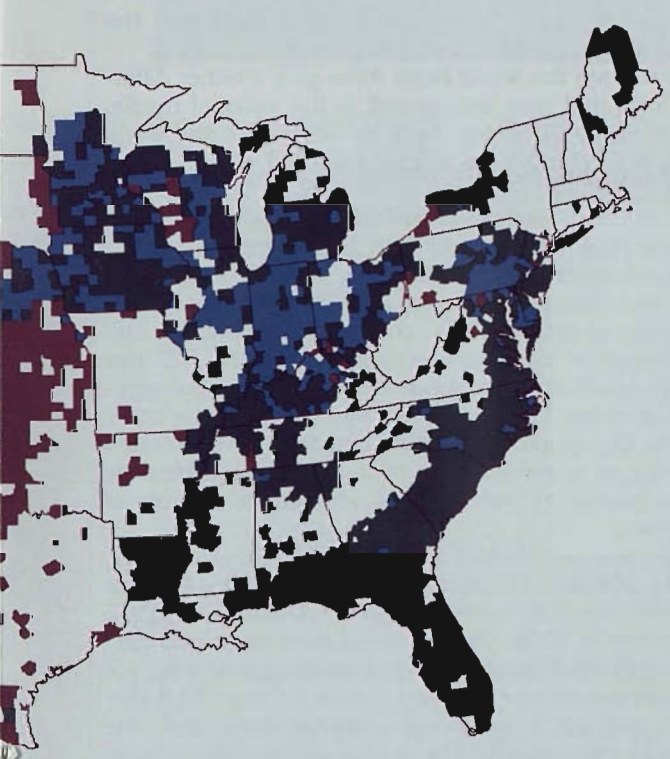

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Groundwater Potentially Contaminated With Farm Chemicals in Nearly Half of Counties

Almost 50 percent of the counties in the conterminous United States (1,437 counties) have potential groundwater contamination from farm chemicals. Slightly over 800 of these 1,437 counties have a potential contamination from pesticides only. These are located mainly along the Eastern Seaboard, Gulf Coast, and Upper Midwest.

Just over 300 of the counties have potential groundwater nitrate contamination. These counties are located principally in the Great Plains and portions of the Northwest and Southwest.

Another 314 counties exhibit both high pesticide and nitrate contamination potential. These counties are located chiefly in the Corn Belt, Lake States and Northeast.

The 1,437 counties with potential pesticide or nitrate contamination are intensively farmed. On average, one third of all land in the counties is in crops. This rate compares with 16 percent nationwide. More than 70 percent of the crop acreage in these counties is devoted to corn, wheat or soybeans. Though strongly agricultural, these counties are heavily populated—27 percent of the land in the conterminous U.S.—but 47 percent of the people.

Up to Fifty Million People Potentially Affected

Over 100 million people live in the regions with potential groundwater contamination. Many of these people are supplied water from surface sources—rivers, lakes, and reservoirs. But more than 50 million people rely on groundwater for their drinking water needs. Of these people, 31 million are supplied water from publicly operated wells. The other 19 million obtain their water from private wells. The distinction is important because private wells may be more vulnerable to contamination. They are often shallower than regulated public system wells, not tested regularly and not built as well.

There Are Many Uncertainties and Unknowns

The costs to society and individuals from agriculturally contaminated groundwater could be significant, particularly from the standpoint of human health. However, major uncertainties remain concerning the human health risks and economic costs associated with groundwater contamination by farm chemicals. Development of such cost estimates is dependent upon (1) the development of improved data that accurately describes the extent and degree of groundwater contamination; (2) a better understanding of the physical interaction between the application of agricultural chemicals, hydrogeologic and other soil and water conditions, and groundwater quality, and (3) the understanding of the effect of farm chemicals in drinking water on human health.