Holistic understanding: Ag chemicals in the environment

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An understanding how environmental processes and agricultural practices interact to determine the transport and fate of agricultural chemicals in the environment is essential for effectively addressing the widespread degradation of surface and ground waters from past, present, and future agricultural activities. While considerable research has been conducted at field or smaller scales, the holistic understanding of processes at the watershed scale, encompassing multiple environmental compartments, is generally lacking.

To improve understanding in this critical area, scientists at the US Geological Survey (USGS) have conducted studies in five diverse agricultural settings across the country as part of the USGS National Water-Quality Assessment Program. The holistic study design, which was employed at each setting, focused on the catchments of small streams and included all of the important environmental compartments – surface water, ground water, the unsaturated zone, the streambed, and the atmosphere.

A detailed description of this whole-system study approach is published in the May-June issue of the *Journal of Environmental Quality* and serves as an introduction to a group of thirteen companion papers that compare and contrast the results for the specific environmental compartments from the five settings in included the study.

Results from the companion papers show the value of this holistic study design. Conclusions drawn from the interpretations of data in each of the

environmental compartments are corroborated and enhanced by information from neighboring compartments.

Paul Capel, who lead the study, stated "Because of the holistic approach used, these investigations provide valuable information that can help optimize site-specific changes in agricultural practices to reduce the concentrations of nutrients, pesticides, and pesticide degradates in surface and ground waters and mitigate the impacts of agriculture on the environment."

At each of the five agricultural settings, a wide variety of field data—hydrologic, mineralogical, chemical, dissolved gas, and isotopic—were collected during 2003 and 2004. In addition, several numerical models were employed to help interpret and simulate water and chemical transport and transformation processes within and between environmental compartments.

This work shows the value of a thorough understanding of the hydrologic system and water budget for an agricultural setting when seeking to understand water-quality issues. It also demonstrates that modifications, such as irrigation and engineered drainage, can profoundly alter the magnitudes and rates at which chemicals are transported through the environment. These rates, in turn, control the degree to which contaminants are diluted or chemically transformed prior to reaching receiving water bodies.

To further increase the understanding of how environmental processes and agricultural practices interact, the USGS is currently conducting studies in two additional agricultural settings using the same holistic approach.

Source: American Society of Agronomy