



2009 CSREES National Water Conference; St. Louis, MO

Mapping Ground Water Vulnerability to Nitrate Contamination in Arizona

Kristine Uhlman *, Tauhid Rahman, Erin Westfall, Ari Posner
University of Arizona Water Resources Research Center
*kuhlman@ag.arizona.edu

Abstract:

Nitrate is a common contaminant in ground water in Arizona, exceeding maximum contaminant levels (MCL) in many regions the state. So as to model and map the risk of ground water contamination by nitrate, drinking water and other ground water quality data was joined directly with well location data, with a final data set of 6,802 wells across the state with unique locations, IDs, and associated nitrate data. Working within a GIS platform, well location data was used to map and attribute a table of hydrogeologic and anthropogenic characteristics from existing data sources for each location. Multivariate logistic regression was used to relate the probability of nitrate concentrations exceeding pre-specified threshold values of nitrate-N, with potential explanatory variables representing the well attributes. The statistical analysis identified statistically significant predictors of nitrate exceeding pre-defined threshold values.

To map the state, we created a polygonal grid at 1,500 meters (approximately 0.9 square mile) and attributed the grid with the various data sets that were used in the analysis, for a total of 274,945 points across the state. Using predicted probabilities we generated three maps of the state, showing aquifer vulnerability to nitrate contamination at 3, 5, and 10 mg/L nitrate-N. The GIS and logistic regression analysis described in this study quantifies the magnitude, extent, distribution, and uncertainty of current and anticipated nitrate risks. We have predicted the vulnerability of ground water to nitrate contamination in the areas of state where nitrate information is not available. This work is assisting ADEQ and local water managers protect water supplies by targeting land-use planning solutions and implementing monitoring programs where ground water may be vulnerable.

Impact Statement:

The Arizona Department of Environmental Quality (ADEQ) recently bolstered the Aquifer Protection Permit (APP) rules with provisions intended to reduce or eliminate sources of nitrogen pollution to ground water. For example, for areas with existing or potential contamination that will contribute to exceeding nitrate thresholds from the Aquifer Water Quality Standard, ADEQ has established a process to designate 'Nitrogen Management Areas' to authorize controls and regulations for nitrogen sources. To support implementation of this important regulatory approach and other management strategies, the University of Arizona developed a multivariate logistic regression model to predict the probability of nitrate contamination in ground water.

Category: Other Water Resource Topics

Type of Presentation: Oral Presentation