Geophysical Research Abstracts
Vol. 17, EGU2015-2116, 2015
EGU General Assembly 2015

Tracing groundwater recharge in the San Luis Valley, Colorado: Groundwater contamination susceptibility in an agricultural watershed

Tanya Patel, Ruth Hindshaw, and Michael Singer
Department of Earth and Environmental Sciences, University of St Andrews, UK (tp22@st-andrews.ac.uk)

Water is a vital resource in any agricultural watershed, yet in the arid western United States farming practices threaten the quality and availability of groundwater. This is a pressing concern in the San Luis Valley, southern Colorado, where agriculture comprises 30% of the local economy, and employs over half the valley population. Although 54 % of the water used for irrigation is surface water, farmers do not usually apply this water directly to their fields. Instead, the water is often diverted into pits which recharge the aquifer, and the water is subsequently pumped during the following irrigation season. The Rio Grande Water Conservation District recognises that recharge to the unconfined aquifer has been outpaced by commercial irrigation for at least four decades, resulting in a decline in groundwater levels. Recycled irrigation water, and leakage from unlined canals now represent the greatest recharge contribution to the unconfined aquifer in this region. This makes the shallow groundwater particularly susceptible to agricultural contamination.

The purpose of this study is to assess groundwater contamination in the unconfined and upper confined aquifers of the San Luis Valley, which are the most susceptible to contamination due to their close proximity to the surface. Although concentrations of potentially harmful contaminants from agricultural runoff are regularly monitored, the large spatial and temporal fluctuations in values make it difficult to determine long-term trends. We have analysed δ^{18}O, δ^{2}H and major-ion chemistry of 57 groundwater, stream and precipitation samples, collected in June 2014, and interpreted them alongside regional stream flow data and groundwater levels. This will allow us to study the seasonality and locality of groundwater recharge to provide greater insight into the watershed's potential for pollution.

A groundwater vulnerability assessment was performed using the model DRASTIC (**D**epth to water, **R**echarge, **A**quifer media, **S**oil media, **T**opography, **I**nfluence of the vadose zone and hydraulic **C**onductivity). Each variable is assigned a weighting and rating, which provides a quantitative assessment of an area's pollution potential. Using this method of investigation, the groundwater vulnerability map produced classifies 5% of the area as having low pollution potential, 34% as having moderate pollution potential, and 61% as having high pollution potential. The groundwater vulnerability map may be used to predict the variation in agricultural contaminant concentrations in the unconfined aquifer. Major ion analyses revealed that nitrate concentrations are highly variable, varying between 0.435 and 949μM/L, and exceed the EPA maximum contaminant level at four sites. The spatial variability in nitrate concentrations, as well as sulphate and phosphate concentrations, is much greater than the differences predicted by the model. This suggests that this variability is not a result of differences in the hydrogeology between sites, but instead may be related to individual farm practices or a result of point sources such as animal waste, septic tanks and sewage release.

Understanding the impact of commercial irrigation on groundwater quality and availability is vital for developing effective strategies to stabilise groundwater levels, and protect the farmers and local population that rely on this water.