Geospatial Analysis of the Occurrence and Transport of Antibiotics in Irrigation Ditches and the Poudre River in Weld County

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Abstract. A rural watershed in Northern Colorado has been studied for several years to understand the fate and transport of veterinary pharmaceuticals. The Cache la Poudre River is the primary watershed drainage with little input from secondary streams due to the arid nature of the area. There is however, an extensive system of irrigation ditches that act to supply and drain water from the many agricultural operations in the watershed. The concentration of antibiotics in aqueous and sediment matrices was measured in agricultural irrigation ditches bordering several animal-feeding operations and then compared to measured antibiotic levels in the watershed. In general, higher concentrations of antibiotics were observed in the aqueous phase of irrigation ditches than in aqueous watershed samples, while higher concentrations were measured in river sediment than in irrigation ditch sediment samples. There was a significant correlation between precipitation and measured concentration in aqueous samples from the irrigation ditches for five of the ten targeted antibiotics, indicating that surface runoff in conjunction with irrigation ditches could be an important transport mechanism for veterinary antibiotics from field to environment. A geospatial analysis of the number of animals and the amount of domestic wastewater flow upstream of each sampling point was completed using an inverse distance weighting approach. The results suggest that veterinary antibiotics are transported via irrigation ditches to the watershed. The correlation between surface runoff, irrigation ditch and river distances and antibiotic concentrations found in this study helps identify the transport pathway of antibiotics in the environment and provides critical information for development of mitigation strategies.