Exploring BMP Practices for Decreasing Selenium in the Lower Arkansas River Valley

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Abstract. Levels of selenium (Se) in groundwater and surface water are above regulatory standards and threaten aquatic life and livestock in Colorado's Lower Arkansas River Valley (LARV). Se is present naturally in the shale of the area; furthermore, excess nitrate from irrigation practices interacts with and increases mobilization and transport of selenium in the system. In this study, we employ a previously calibrated MODFLOW groundwater flow model and UZF-RT3D groundwater chemical transport model, which simulates the dynamic reactive transport of Se species, nitrogen species, and other species, in a 50,400 ha (125,000 acres) region of the LARV to explore Se remediation strategies within the groundwater system. The model accounts for Se and nitrate cycling and transport in agricultural groundwater systems and incorporates determination of daily mass transfer of chemical species within the aquifer and mass loadings to the river. Five key Best Management Practices (BMPs) were analyzed: reducing irrigation volumes, lease fallowing of irrigated land, enhancing riparian buffer zones, reducing fertilizer loading, and sealing earthen irrigation canals. The impact of each of these BMPs is tested individually over three degrees of application (low, medium, high) over the entire region. In addition, various combinations of BMPs are compared including the most effective combinations of three and four BMPs, most effective combination of any BMPs, and least effective combination of BMPs. Future work will extend the model to the river network to predict in-stream concentrations of Se for comparison to regulatory standards.