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Thursday, Nov. 12
1:30 PM – 3:00 PM
SESSION 69: Agricultural Hydrology

Erosion and Sedimentation Associated with Tracked Vehicle Training at Ft. Knox, KY - Jon Schoonover, Southern Illinois University Carbondale, Carbondale, IL (co-authors: Karl W.J. Williard, Jackie Crim)

A two phase project was initiated at U.S. Army Garrison Ft. Knox, KY in 2006 to quantify sediment loss from 2 heavily used tank training areas on the Army base. The training areas lie within an area rich in karst topography that has many sinkholes and belowground drainage networks. Numerous limestone caves provide habitat for a two endangered species, the Troglobitic crayfish (Orconectes inermis inermis) and the Indiana bat (Myotis sydalis). Also, a rainbow trout nursery exists immediately downstream from the tank training areas. Reducing the sedimentation in the caves and trout nursery is of major interest to the U.S. Army. During phase 1, an assessment of soils and vegetation was performed in the training areas and sedimentation rates were quantified within sinkholes and streams draining the training areas. Results demonstrate that large pulses of sediment are leaving the training areas during the rising limb of storm events. Detailed stream surveys were also performed during the initial phase in 4 intermittent streams draining the training areas, which have shown high instability in the channels. Historic sedimentation rates within the sinkholes were determined via dendrochronolgy techniques, and were estimated to be 1.27 cm yr-1. Current sedimentation rates are being measured using erosion pins, feldspar clay pads, and sedimentation bottles installed in the sinkholes. The second phase of the study will use data from phase 1 to develop best management practices for the base. According to Ft. Knox policy, a seventy-five foot vegetated buffer is required around each sinkhole on the training areas; however, many are bisected by roads or contain concentrated flow channels that bypass the vegetated buffers. A goal in the second phase is to restore vegetation within 75 feet of the sinkholes and to develop strategies to manage concentrated flow.

Agricultural Water Needs Assessment and Multi-Benefit, Multi-Party Solutions in Northwestern Colorado - Matthew Bliss, CDM, Denver, CO

The Agricultural Subcommittee of the Yampa, White, and Green River Basins Roundtable (a consortium of basin stakeholders) in northwestern Colorado is conducting a water needs assessment through a grant from the Colorado Water Conservation Board. The overarching intent of the study is to examine current agricultural shortages, evaluate potential future agricultural water shortages, and develop alternatives to reduce shortages. Consumptive use and water allocation models developed by the state of Colorado are used as a basis for the analyses. The study will update and refine previous estimates of current demands, supplies, and shortages, as well as identify and evaluate shortages for future agricultural demands. A key component of this study is the evaluation of climate change on water supply and demands. Rainfall-runoff modeling was performed under various climate change scenarios, using output from several global circulation models (GCMs). The resulting changes in runoff were applied to the water allocation model, and demands were updated with the associated change in temperature and precipitation. The resulting agricultural shortages were then compared to existing shortages for the various climate change scenarios. There is an abundance of oil shale in northwestern Colorado that could be developed if oil extraction technology improves or oil prices reach high enough levels to make oil shale an economically feasible energy supply. Many oil companies have filed conditional water rights or bought senior irrigation water rights in the basin that will have significant implications for agricultural water supply, not only in the Yampa, White, and Green basins, but for the entire Colorado River basin. This study will evaluate the impact of potential future water development by the energy sector on agricultural water supplies in the Yampa, White, and Green basins. It will also evaluate changes in water use from flood irrigation to higher efficiency sprinklers that may reduce late season river flows. Finally, the study will identify and investigate alternatives to satisfy the identified water shortages and develop multi-benefit, multi-party solutions to the basin's current and projected water shortages.

Riparian Buffer Impacts on Water Quality at the Watershed Scale - Julia Friedmann, Southern Illinois University Carbondale, Carbondale, IL (co-authors: Charnsmorn R. Hwang, Jon E. Schoonover, Karl W.J. Williard)

Agricultural runoff is a major non-point source pollutant and is the leading impairment of streams and rivers in the United States. The majority of water quality studies in agricultural areas have been conducted at the field scale, which does not account for multiple land covers within a watershed and other landscape metrics. Thus, this study examines the effects of agricultural land cover and riparian buffers on water quality at the watershed level. Forty three catchments ranging from 12 to 50 km2 were selected based on a land cover gradient within Richland and Silver Creek watersheds, tributaries of the Lower Kaskaskia River Watershed in Illinois. Grab samples were collected twice a month during wet seasons and once a month during dry conditions for the past 17 months and analyzed for nutrients (ammonium, nitrate, and orthophosphate), bacteria (total coliform, fecal coliform, and E. coli), and total suspended solids (TSS). Regression analysis was performed on the preliminary data to determine relationships between the water quality variables, percent agriculture land cover, percent forest land cover, and percent canopy cover within 10 m, 30, and 50 m buffers. There was a significant positive relationship between percent agriculture land cover and TSS at baseflow. Percent canopy cover at 30 m and 50 m had a significant negative relationship with ammonium at stormflow. There was also a significant negative relationship between canopy cover at 50 m and TSS at baseflow. Further analysis will be done on buffer gaps lengths and locations of buffers within watersheds. Understanding riparian buffer metrics (e.g., location, gap length and canopy cover) will allow managers to effectively design and locate buffers within a watershed.

Relating Nutrient and Herbicide Fate with Land Use Parameters in the Tuckahoe Creek Sub-Basin of the Choptank River, MD - W. Dean Hively, USGS Eastern Geographic Science Center, Beltsville, MD (co-authors: Cathleen Hapeman, Laura McConnell, Greg McCarty, Ali Sadeghi, David Whitall)

Nutrients and agrochemical lost from non-point sources can threaten water quality, with loading rates related to landuse, crop management, hydrology, and pollutant fate and transport processes. This project, conducted in the Choptank River USDA-ARS Benchmark Watershed (Conservation Effects Assessment Project), linked land use to observed water quality in monthly baseflow samples (2005 to 2007) collected from 15 streams draining agricultural subwatersheds of the Choptank River, a significant tributary to the Chesapeake Bay. Samples were analyzed for nutrients (nitrate, orthophosphate), herbicides (atrazine, metolachlor) and herbicide degradation products (CIAT, CEAT, MESA). Stream gauging was used to calculate loading rates. Land use maps were created using National Aerial Imagery Program orthophotos. Seasonal peaks in concentrations of herbicide parent compounds were observed following the springtime row-crop planting season. Concentrations of nitrates and herbicide degradation products were more influenced by landuse and geomorphology than by season, likely because stream baseflow results primarily from groundwater contributions. Nitrate and pesticide concentrations were higher in well-drained uplands (WDU) than in poorly-drained uplands (PDU), suggesting increased denitrification and herbicide degradation in the PDU landscape due to the prevalence of hydric soils. Observed nitrate concentrations (overall mean 4.9 mg/L) were also correlated positively with percent agriculture (R^2 = 0.60) and negatively with percent forest (R^2 = 0.75). Springtime atrazine concentrations (overall mean 0.29 µg/L) were higher in the WDU landscape, where riparian stream buffers were prevalent, than in PDU subwatersheds, where forested patches are typically not found near streams. A strong, positive correlation with percent forest in the WDU subwatersheds provided evidence for capture of herbicide drift by the riparian forest canopy and subsequent wash-off during rainfall. Loading rates for atrazine, metolachlor, MESA, and nitrate ranged from 0.1-7 g/y/ha, 0.2-2.7 g/y/ha, 6-89 g/y/ha, and 8-100 kg/y/ha, respectively. Improved understanding of landscape processes affecting non-point source pollutant fate and transport will contribute to targeted implementation of conservation practices to critical landscape areas.