2013 UMSRS Poster Abstract Guide

P-01: Deep Loess Soils, Streambed Stabilization, and a New Federal Initiative

John Thomas, *Hungry Canyons Alliance*

Stream downcutting and erosion is a major issue in the deep loess deposits of the central US. Channelization of streams and land use changes during the first half of the 1900's have caused stream channels to erode, causing damage to public and private infrastructure (bridges, culverts, utility lines, etc.), loss of farmland, and increased sediment loads. The channel erosion and damage to infrastructure continues today. A gap currently exists in federal programs/funding for grade control mitigation projects that control stream downcutting and erosion on small to medium sized streams, particularly in our region where there is a greater susceptibility to this problem due to our loess soils.

The Hungry Canyons Alliance (HCA) is a local, non-profit organization formed to research and implement solutions to the problem of streambed degradation in a 19 county area of the deep loess soils region of western Iowa. The HCA provides state and federal funds to its 19 member counties through a cost share program for grade control structures to protect county infrastructure. State support for the HCA program continues, however in 2011, federal funding (through an earmark appropriation) ceased.

The HCA has proposed that a new initiative through the NRCS be authorized to provide funding for grade control projects throughout the US in deep loess areas where streams are actively downcutting and eroding. This new initiative/program would be similar to the NRCS's Emergency Watershed Protection (EWP) Program in that funds could be directed to public entities, while also targeting specific areas (deep loess) and providing for non-emergency, mitigation projects. The NRCS would likely have a program coordinator/board at the national level that would send out RFP's and review the applications, awarding funding on a merit basis.

This initiative would fill the gap and add a federal funding mechanism that would benefit not just Iowa, but other states as well. The strength of this initiative lies in the support of as many states as a possible to make our regional issue a national one.

P-02: Reduction of Sediment and Nutrient Loads from Riparian Lands and Bank Erosion along a Southwest Missouri River

Ezekiel Kuehn, *Ozarks Environmental and Water Resource Institute at Missouri State University;* Marc Owen, Robert Pavlowsky, *Missouri State University;* Joseph Pitts, *James River Basin Partnership*

A new watershed protection program focusing on the use of conservation easements along riparian zones is being implemented in the James River Basin in the southwest Missouri Ozarks. The goal of the program is to reduce the long-term loads of sediment and nutrients into the river via urban and agricultural runoff and bank erosion. This study reports on field monitoring results and the load reduction assessment for one project located along a 7.4 km segment of the James River in Stone County, Missouri. The area is presently rural, but is being threatened by urban development spreading out from Springfield and Branson, Missouri. There are three components to the monitoring phase of the project: (1) rapid geomorphic bank assessments at 400 m intervals; and (3) historical aerial photograph analysis are used to evaluate bank erosion rates for the entire segment; and (3) erosion pin surveys are used to determine higher resolution bank erosion loads along a 100 m long willow bank stabilization reach. Load reduction is being accomplished through the use of sediment rating curve analysis, sediment budget methods, and STEP-L nonpoint modeling. This poster will report the initial findings of this project.

P-03: Envisioning the Future … Incorporating Stream Systems in Urban Design

Matthew Grootens, *Ozarks Environmental and Water Resource Institute at Missouri State University;* Robert Pavlowsky, *Missouri State University;*

Sediment is considered one of the primary pollutants of river systems in the U.S. and mass wasting is generally the largest source of sediment to streams. Mass wasting is the downslope movement of large amounts of soil and associated large woody debris (LWD) under the force of gravity due to a decrease in material strength and/or increase in shear stress. The study segment is located south of St. Louis along the lower Big River (2,500 km2) in Jefferson County, Missouri. Floodplain deposits are heavily contaminated by lead released from the Old Lead Belt Mining District from 1864 to 1972. Moreover, bank erosion is believed to represent the largest source of contaminated sediment to the main stem of the Big River today. While the Big River has an approved TMDL for sediment and metals, the distribution and causes of mass wasting events (MWEs) as a source of sediment and lead inputs is poorly understood. The purpose of this study is to use readily available remote sensing imagery to map the distribution of MWEs and related LWD fields. These results are used to interpret the spatial patterns of MWEs and their geomorphic significance for bank erosion processes, historical channel changes, and contaminated sediment loadings to the Big River. Geospatial data are loaded into a database for spatial analysis using ArcMap. Moran's I spatial autocorrelation and cluster and outlier analysis will help determine the spatial distribution of the mass wasting and the associated attributes. The spatial distribution of MWEs will be compared to riparian corridor, land use, and soil type factors. There were 202 MWEs and 231 LWD pieces and jams identified in April 2010 along the lower 23 kilometers of the Big River. The geospatial results will be verified and compared to field data. Large woody debris distribution is correlated to both local riparian forest density and channel bank erosion rates including MWE frequency. Preliminary results suggest that MWEs are clustered in three reaches: (i) on the outside of large bends not yet in contact with bedrock bluffs, (ii) within localized reaches caused by excessive bar deposition and riparian buffer disturbances, and (iii) where channel banks are formed in relatively high and sandy alluvial terrace deposits.

P-04: Envisioning the Future … Incorporating Stream Systems in Urban Design

Suzanne Hoehne, *Biohabitats, Inc.*

For too long stream systems have been neglected in urban planning and development efforts throughout the United States. Only recently has the importance of restoring our stream systems come to forefront, with the realization of the advantages a functioning stream system can provide in terms of water quality, recreational, ecological, and economic benefits. In this presentation we will explore this increasing phenomenon through several case studies across the US. From a developer in Houston, Texas willing to take a risk and use environmental restoration as a selling point to the City of South Euclid, Ohio retrofitting an inline detention basin; each case study will address the intent, the process, and the outcomes of the project. Finally, the presentation will explore how we can take lessons learned from these case studies and apply them to development to lessen our impact on the ecosystems that we are modifying and create a more regenerative system.

P-05: Geomorphic Based Urban Stream Restoration Projects in Missouri and Kansas

Marc Owen, *Ozarks Environmental and Water Resources Institute, Missouri State University;* Robert T Pavlowsky, *Missouri State University*

Geomorphic instability of urban streams due to runoff from increased impervious surfaces has always been a problem facing watershed managers and stormwater engineers. Increasingly, municipal governments are seeking sustainable solutions to urban stream instability particularly when building or replacing bridges and other infrastructure that will reduce flooding, improve water quality, and enhance the aesthetic value of the stream. The Geomorphology River Assessment Program (Geo-RAP) at Missouri States University's Ozarks Environmental and Water Resources Institute (OEWRI) works with local engineering firms to investigate the existing geomorphic conditions of proposed stream restoration sites. Results of a Geo-RAP provide the following information which is vital to stream restoration design: (1) topographic survey information to support a restored channel design; (2) sediment transport information to understand the composition, supply, and transport of bed materials within the existing channel and; (3) bank stability analysis. This poster highlights two projects where Geo-RAP assessments were completed for projects in two disturbed urbanized channels. The Galloway Creek project in Springfield Missouri was located along a portion of the channel through a century old public park that was channelized in the 1930s. The other project was from Lenexa Kansas where a channel

was restored in an old rock quarry that was being redeveloped. In both projects the geomorphic conditions of a stable upstream reference reach were provided to the engineer and landscape architect that used this information to design a new channel in the disturbed section of stream. This poster emphasizes a multi-disciplinary approach to stream restoration projects that is gaining popularity in the region.

P-06: West Creek Ecosystem Restoration Project: Retrofitting Neighborhoods to Reduce Stormwater Quantity and Improve Water Quality

Jennifer Grieser, *Cleveland Metroparks;* Jim Rodstrom*, Cleveland Metroparks;* Derek Schafer*, West Creek Conservancy*

The West Creek Ecosystem Restoration Project is part of an overarching protection and restoration planning process where identifiable impairments have been clearly established, solutions to impairments have been identified, and broadly supported activities have been designed, resulting in high probability of significant, positive measurable results. This planning laid the groundwork for receiving a Great Lakes Restoration Initiative grant from the United States Environmental Protection Agency. With Cleveland Metroparks as the lead, other lead partners include West Creek Conservancy, Northeast Ohio Regional Sewer District (NEORSD), City of Parma and Northeast Ohio Areawide Coordinating Agency.

West Creek (14 mi2), a subwatershed of the Cuyahoga River Watershed, is part of the Cuyahoga River Area of Concern for Lake Erie. This urban watershed contains ~35% impervious surface. This Project aims to address directly connected impervious area (DCIA) with a street level, experimental approach by consolidating stormwater control measures such as rain gardens, right-of-way bioswales, rain barrels and street trees along two streets adjacent to West Creek Reservation, property of Cleveland Metroparks. One pair of streets – a treatment and a control street - has generally 0.1-0.2 ac. lots with homes circa 1950s, while the other pair of streets has 0.5-0.75 ac. lot with homes circa 1970s. A Before-After-Control-Impact study design evaluating biology and hydrology will quantify the effectiveness of these measures to reduce DCIA to thresholds that will allow West Creek to attain warm water habitat.

P-07: Field-based Measurements of Bed-load Transport in an Urban Stream in the Missouri Ozarks

Kris Breckenridge, *Missouri State University;* Robert Pavlowsky, *Missouri State University*

Predictions of bed load mobility and transport in a stream channel are useful for restoration and management purposes. This study uses native gravel tracers to determine field-based transport distances for bed load in an urban Ozark stream reach during high flow events. The objectives of this project are to (i) determine downstream transport distances of painted tracers of different sizes over a range of flow conditions; (ii) evaluate the influence of channel unit and thalweg location on transport; and (iii) compare field results to those predicted by mobility equations and the BAGS bedload transport model. The study site is located on South Creek, which drains Springfield, Missouri. The study reach is 132 m long and averages about 5.8 m wide with a bankfull depth of 0.97 m. A USGS discharge gage (#07052120, drainage area= 27.2 km2) is located 80 m above the study reach Painted tracers of four different sizes were released to the stream including the D50 (16 mm), D75 (22.6 mm), D84 (32 mm) and D90 (45 mm). Tracers were placed within three different channel units including a pool, riffle crest, and glide. As expected, higher flows moved all tracer sizes farther distances. After a near bankfull flow event, many tracers could not be located implying that the tracers were either carried out of the study reach or buried in bar deposits. During this event, 34 D50 tracers were deployed, 79% were not recovered, and 7 tracers traveled an average distance of 64 m. Thirty-three D75 tracers were deployed, similarly 79% were not recovered, and 7 traveled an average distance of 43 m. Thirty D84 tracers were deployed, again 80% were not recovered, and 6 were transported an average distance of 63 m per tracer. For the largest size class tested, 30 D90 tracers were deployed, 47% were not recovered, and 16 moved an average of 35 m. More effort will be placed on locating missing tracers. The findings of this study will be used to validate bedload model results and evaluate expected gravel bar migration rates to better understand bed form changes in Ozark streams.

P-08: Stream Restoration at Road Crossings in Northern Wisconsin

Dale Higgins, *USDA Forest Service Chequamegon-Nicolet National Forest*

Poorly designed and constructed road crossings can have multiple impacts to stream ecology and morphology. These impacts typically result from culverts that are undersized and set too high. They include disruption of aquatic organism passage (AOP); impacts to channel profile, dimension and pattern; and water quality impacts from sedimentation and water temperature increases. Culverts with steep slopes or drops at the outlet can prevent the movement of many species and life stages of aquatic organisms. Undersized culverts set too high can cause both downstream scour and upstream aggradation. Those that fail frequently also cause downstream aggradation and an adverse profile on low gradient streams. The Chequamegon-Nicolet National Forest in northern Wisconsin has replaced over 200 road and trail stream crossings in the past 15 years to restore streams while also providing a safe, efficient, low maintenance transportation network. The primary solutions to these problems are design of adequately sized culverts, set at the proper elevation, with good permanent erosion control, sound construction practices and in-stream restoration where appropriate. Culvert sizing is based on a combination of bankfull width and hydraulic modeling to ensure the 100-yr flood has a HW/D<1. Culvert invert elevations are specified based on an analysis of the longitudinal profile of the stream taking into account impacts to channel morphology from the existing crossing. For low gradient streams (typically <0.5%), a no slope, tailwater control design approach is commonly used where the tailwater will provide sufficient depth and velocity in the structure to allow AOP. In these situations the culvert is frequently set flat at an elevation that will restore or maintain channel morphology and the natural transport of sediment and organic matter. For high gradient streams (typically >1.0%), a stream simulation approach is used where a reference reach is used to design and construct a channel through the structure that will pass aquatic organisms, sediment and organic matter at the same rate as the channel upstream and down. This technique requires a structure greater than bankfull width to accommodate stream banks and with sufficient height to allow for an adjustable bed and enough clearance that the 100-yr flood will have a HW/D<0.8. In some cases, in-stream work is necessary to restore a channel profile, braiding, an abandoned meander or alignment.

P-09: Application of Urban-source Metals for Stratigraphic Tracers in Floodplain Deposits along an Ozarks Stream

Aubree Vaughan, *Ozarks Environmental and Water Resources Institute at Missouri State University;* Marc Owen, Robert Pavlowsky and Lindsay Olson, *Missouri State University*

Elevated concentrations of toxic metals in sediments represent an environmental threat and can also be used as tracers for dating floodplain deposits, particularly if the pollution history is known. Following, metal profile variations within floodplain soil cores affected by mining inputs or urban releases can provide an understanding of human-related watershed changes and geomorphic history. Wilson Creek in Springfield, Missouri drains the old industrial center of the city that dates back to the mid-1800s. Previous studies found high levels of lead, zinc, and copper in near channel floodplain deposits downstream of the industrial center. However, less is understood about the age of the deposits and lateral variability metal concentrations within the valley floor. The purpose of this study is to investigate the geomorphic history of urban floodplain deposition along a 1-kilometer long segment of Wilson Creek. The drainage area of this segment of Wilson Creek is 81.326 km2. Soil samples were extracted with a Giddings coring machine and analyzed for metal concentrations with an X-MET3000TXS+ Handheld X-Ray Fluorescence Analyzer. Sampled locations were surveyed and mapped with accurate coordinates to display variability of elevation in the land. Aerial photography is also used to compare channel location and land use changes since the 1930's. Understanding historical land use changes and the effects on channel stability and soil contamination can help provide a baseline for better environmental management in the future. Furthermore, remobilization of contaminants in floodplain soils is a major concern as further urbanization can cause channel instability.

P-10: Streambank Stabilization of a Constricted Channel Using Stormwater Wetlands

Michael Malon, *Jo Daviess County Soil and Water Conservation District*

Constricted streams require relief under heavy storm flows. In many cases reconnection with the floodplain is not possible. To address this, a former pond structure was converted to a stormwater wetland to achieve flow relief under

out of bank flows in a highly channelized stream reach in Northwest Illinois. This structure also protects the lake downstream from excessive sedimentation and improves water quality. This stream was no longer connected to the floodplain due to development and heavy flows had no area to dissipate energy. A previous streambank stabilization project was completed in 1999 creating a series of rock riffles to provide grade stabilization. Extreme rainfall events in 2010 and 2011 heavily scoured areas and made large deposits of Dolomite cobble into the recreational reservoir downstream. Implementation of this wetland structure will cause flows to slow and sediment and cobble to be deposited before reaching the impoundment where removal is costly. Inlet to the wetland was constructed at the bankfull stage elevation. When the basin is full stormwater can reenter the stream downstream. Inlets and outlets were protected with rock riffles. The wetland area provides filtration and valuable habitat when not functioning as an emergency spillway.

P-11: Source of mining sediment contamination in historical overbank floodplain deposits along the Big River, Meramec River Basin, MO

Andrea Mayus, *Ozark Environmental and Water Resources Institute, Missouri State University;* Robert Pavlowsky and Marc Owen*, Missouri State University*

Historical mining for lead (Pb) and (Zn) has left a legacy of floodplain soil contamination along 170 km the main stem of the Big River to depths >3 meters. The Big River watershed (2,500 km2) is located south of St. Louis within the Meramec River Basin which drains the Ozarks Highlands of Missouri. Mining occurred in two areas within the Big River watershed. Upstream in St. Francois County, large-scale underground Pb-Zn mining from 1900 to 1962 produced large volumes of dolomite-rich tailings which were left as large piles or washed into the river. Downstream in Washington County, Pb mining in crude surface pits began around 1800 and ended by 1920. However, more intensive and productive open pit surface mining for Barite (Ba) occurred until the 1990s. While it is well known that floodplains are contaminated along the Big River, it is not clear what proportion of the contamination was from St. Francois or Washington County. The purpose of this study is to quantify the percentage of contaminated sediment within the Big River floodplain that originated from Washington County compared to St. Francois County. High resolution sediment cores were collected from floodplain deposits of the Big River at locations both upstream and downstream of Washington County influence to evaluate geochemical and sedimentological profiles. Analytical methods included gamma spectrometry for Cs-137, X-ray fluorescence for metals, laser diffraction for particle size analysis, and CNS analysis. The relative contribution of each mining source area was assessed using geochemical ratios among calcium, iron, Pb, and Ba. Lead trends in core profiles closely matched the production records for the St. Francois County mines. Preliminary results suggest that St. Francois County is the predominant source (>95%) of lead contamination within the floodplains along the middle and lower Big River below Washington County.

P-12: Pike River Ecosystem Restoration Project - Hydrologic & Hydraulics

Caroline Ubing, *W.F. Baird & Associates;* Laura S. Rozumalski, *W.F. Baird & Associates*

The purpose of the Pike River Ecosystem Restoration Project is to restore and rehabilitate both the biology (particularly potamodromous fish and prairie habitat) and fluvial geomorphology within portions of the northern reaches of the river located in the Village of Mount Pleasant, Racine County, WI. Baird & Associates was retained by the U.S. Army Corps of Engineers – Detroit District to perform a hydrologic and hydraulic study in HEC-RAS to analyze the effects the restoration project will have on the floodplain and determine any potential flooding impacts over a range of flow conditions. Two design alternatives were analyzed and compared to existing conditions during both flood events and low flow conditions. A prairie inundation duration calculation was performed to determine the number of days that the flow will exceed the wet prairie elevation. This was very relevant to restoration efforts, as the frequency of wetland saturation can influence the type of plants included in the newly created prairies and wetlands and is reflective of the type of wetland habitat that will be created. The design alternative that incorporated channel meanders in the restoration nearly tripled the number of days per year the floodplain is estimated to inundate. This poster will summarize the results of the feasibility analysis, as well as the results for the hydraulic analysis.

P-13: An Assessment of Habitat Quality Using Dissolved Oxygen Concentrations in Flooplain Water Bodies

John Stofleth, *cbec Inc;* Jason White and Betty Andrews*, ESA PWA;* Charles Mesing*, Florida Fish and Wildlife Conservation Commission*

The floodplains of the Apalachicola River, Florida include an intricate network of sloughs, lakes and wetlands. These floodplain water bodies provide essential spawning and nursery areas for a diverse array of aquatic organisms. The frequency and duration of Apalachicola River flows sufficient to hydraulically connect and thereby activate these floodplain features has decreased over time due to upstream dams, diversions, and modification to the channel geometry (incision and widening). The main objective of this study is to characterize the relationship between a key water quality parameter, dissolved oxygen (DO), to the hydraulic connectivity of the ecologically-important large slough systems within the Apalachicola River floodplain over a range of flow conditions. When DO concentrations drop, the quality of habitat for fish, invertebrates and other aquatic organisms are impacted. Hydraulic connection between the river and the floodplain sloughs contributes markedly to DO levels in the sloughs. To characterize the relationship between hydraulic connectivity and water quality, water level, DO, and temperature data were continuously monitored within four (4) major floodplain sloughs, one (1) oxbow lake, and mainstem (control) from August 2009 to January 2011. A comparison was made between statistically representative DO concentrations (daily mean, diurnal range, daily minimum and maximum) for each site and in the river. River discharge was estimated at each site from nearby gages. By examining distinct changes in DO signatures with increasing flow, it was possible to determine the approximate flow at which the sloughs and oxbow lakes begin to become activated or hydraulically connected (flowing condition) to the mainstem of the Apalachicola River, and at what flow rates these floodplain wetlands become fully connected. Based on this data, we drew conclusions about the availability of suitable habitat for native fish species in these slough systems across a range of Apalachicola River flow conditions. We also reviewed the historic flow record to infer how habitat availability has likely changed over time in response to a decline in the frequency of hydraulic connection between the river and its floodplain sloughs. The relationships developed in this study can be used to develop restoration alternatives that aim to improve the ecological function of the backwater slough systems by increasing the frequency and duration of hydraulic connectivity with mainstem of the Apalachicola River.

P-14: Unique behavior of an aquatic insect may allow it to overcome patterns of nutrient limitation in Southwestern Wisconsin streams

Robert Mooney, *University of Wisconsin - La Crosse;* Eric Strauss, Roger Haro*, University of Wisconsin - La Crosse*

Periphyton that colonize cobble substrates in open-canopy streams is the primary food resource for invertebrate grazers (i.e., herbivores) and plays a key role in the cycling of nutrients in stream ecosystems. Stream beds are a mosaic of heterogeneous patches of periphyton that vary in nutritional quality. Key nutrients (e.g., nitrogen (N) and phosphorus (P)) are vital components in animal diets and can limit an organism's growth when environmental supplies are short. The nutritional content of periphyton is dependent on the concentration of dissolved, inorganic nutrients in stream water. However, small-scale nutrient inputs, such as grazer excretion, often lead to patches of nutrient rich periphyton. Unfortunately, methods of determining the nutritional status of periphyton on stream beds are often based on ambient stream water chemistry and often overlook small-scale inputs. In this study, we used ecological stoichiometry (molar N:P) to study the consumer-driven nutrient cycling, or the feedback mechanism that links grazer excretion with algal (a major component of periphyton) nutritional status, between Glossosoma intermedium and its periphyton resources. The dome-cased caddisfly, G. intermedium is a grazing herbivore that inhabits Midwestern streams in high abundance and constructs a portable case for protection in the larval stage. The cases are composed of small gravel and sand particles held together by silk and subsequently serve as an alternative surface for periphyton colonization. When periphyton resources on stream cobble reach low levels, G. intermedium graze periphyton growing on cases of other Glossosoma larvae. We had hypothesized that the case periphyton would be nutrient-rich, relative to cobble periphyton, due to its consistent exposure to Glossosoma excreta. Total N and total P concentrations were determined for stream water, streambed cobble periphyton, G. intermedium larvae, their excreta, and case periphyton in 3 cold-water streams in southwestern Wisconsin. The N:P of cobble periphyton at two study sites suggested P limitation (194:1, 38:1), however; N:P of case periphyton at those 2 sites did not suggest P limitation (7:1, 11:1). Our results suggest that high P in G. intermedium excreta allows case periphyton to avoid P limitation. This alternative resource may serve as an important periphyton resource for G. intermedium and the entire grazing community not only when periphyton biomass is low, but at any time when a more nutrient-rich resource is needed. The case periphyton may have other positive

impacts on stream ecosystem functioning such as increasing biodiversity, stability, and the rate of P remineralization in P limited ecosystems.

P-15: Recent MN DNR Stream Restoration Projects

Amy Childers, *Minnesota Department of Natural Resources*

The MN DNR Stream Habitat Program is continuously involved in a variety of stream restoration projects throughout MN. The following projects are some of the more recent projects that include dam removal, dam modification, and channel restoration. Each project includes a full synopsis and photos, and including the following: Montevideo Dam removal/modification, Chippewa River; Minnesota Falls Dam removal, Minnesota River; Redby Dam removal and channel restoration, Mud River; Cross Lake Dam modification, Snake River; and the Christine and Hickson Dam modifications, Red River.