River-floodplain connectivity and riparian management for nonpoint source in Blue River, metropolitan Kansas City, Missouri

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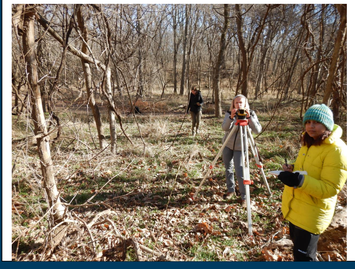
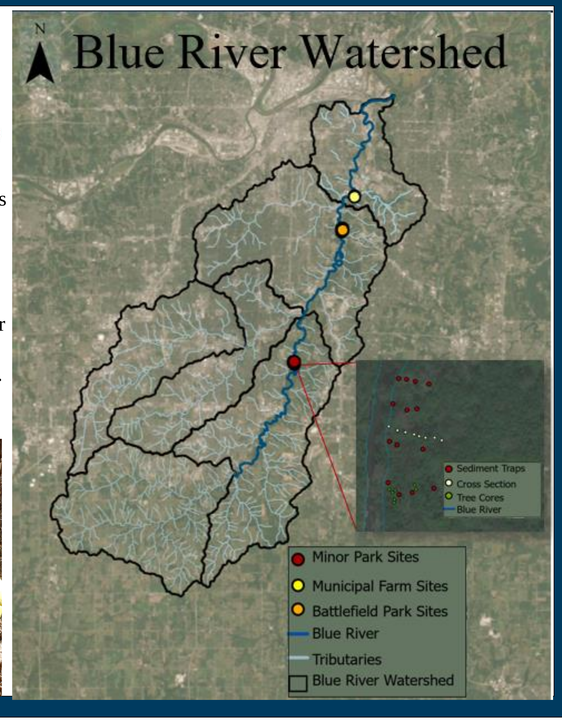
Abstract

Riparian corridors can provide water quality benefits through nonpoint source (NPS) reductions. However, few studies have examined the influence of human activities on channel-floodplain connectivity and riparian buffering capacity. As part of a larger NPS load modeling project, this study will evaluate the effects of land use change and riparian corridor characteristics on NPS loads in the Blue River watershed near Kansas City, Missouri. In addition, the Blue River Channel Modification Project was authorized by Congress under the Flood Control Act of 1970 resulting in the channelization of a 12-mile urban segment including numerous concrete slope stability structures along banks, grade controls, and flood walls. While channelization aims to contain flood events within the channel, it can degrade a healthy riparian vegetation zone and increase the risk of downstream floods. This presentation describes two studies aimed to assess the effects of past and present land use and channel modifications on the role of riparian corridors as NPS filters, buffers, and sources. The first will examine how hydrologically connected floodplain areas along the Blue River have been functioning as sinks and sources for sediment historically as land use has changed. The second study will focus on evaluating the effectiveness of riparian buffers in reducing contemporary NPS loads in the Blue River. These studies will provide information to better understand the NPS buffering capacity of riparian corridors and possible options for NPS management.

Study Area

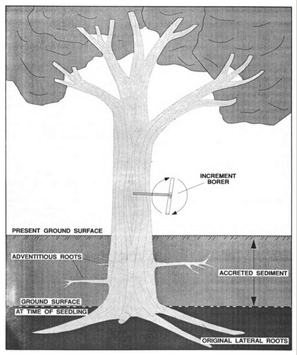
The Blue River, a tributary to the Missouri River, is primarily located in northwestern Jackson County, Missouri and continues into parts of Johnson County, Kansas. The three sites examine in this study are located throughout the watershed with varying degrees of disturbance. The Municipal farm is in the downstream heavily channelized portion of the water shed. Battlefield park, located farther upstream, has reinforced eroding banks. Minor park, located farthest upstream, has the least amount of disturbance.





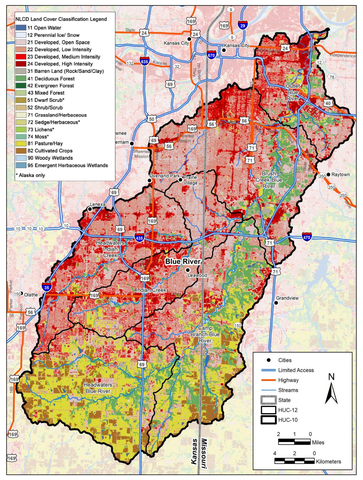
Methods

Artificial turf mats were installed to trap sediment from overbank floods. The artificial grass mats mimic natural vegetation conditions to help determine sedimentation rates over the period of one year. Bulk density sediment samples were collected where turf mats were installed. This will be used to determine soil compaction. Soil samples will also be analyzed for nitrogen and phosphorus. Dendrochronology and buried root crown were assessed which indicates intermediate sedimentation rates. Aerials from 1990 and 2015 were used to digitize the riverbanks of the Blue River and its tributaries to determine erosion from changes in channel width and lateral migration over 25 years. Floodplain coring will occur in the future to determine historic sedimentation rates and give more detail on soil history.

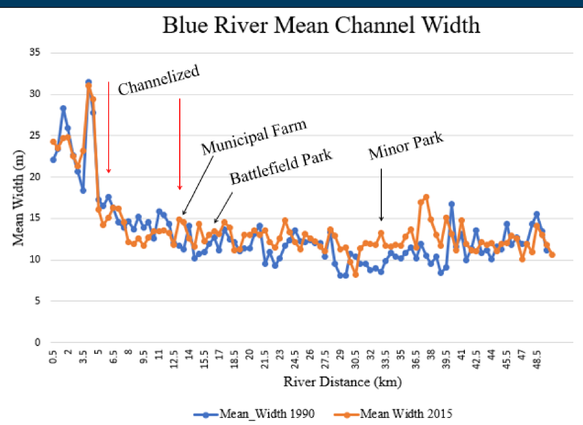


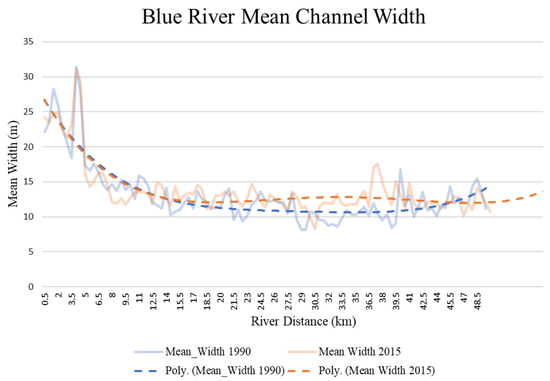
Background

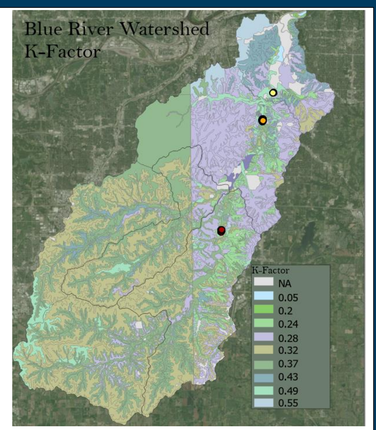
Many river systems in highly urbanized areas respond to disturbance with erosion and sedimentation. The Blue River watershed in Kansas City, Missouri has been experiencing the effects of degraded riparian zones, increased erosion, and stream contaminants due to the long history of urban development and channelization in the watershed. These anthropogenic disturbances began as early as 1950 and continued through the Blue River Modification project which was authorized in 1970. While these channelization practices aimed to dissipate the river's energy and contain flood waters to the channel, it resulted in degradation of healthy riparian vegetation zones and increased risk of downstream floods. This study aims to examine the influence of human activities on channel-floodplain connectivity and riparian buffering capacity

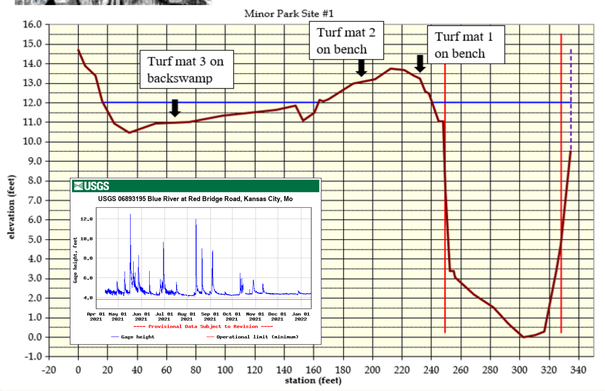


Preliminary Results







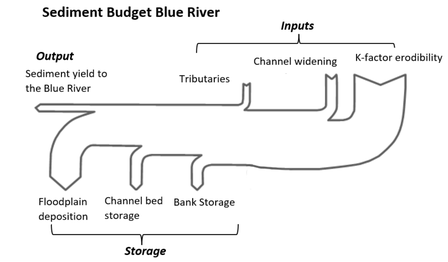


Discussion

This study is part of an ongoing NPS load modeling project and the first step in creating a sediment budget for the Blue River. It shows an initial assessment of channel width change and the process for recording contemporary sedimentation rates:

- Total river distance decreased by 8 km. This suggests the channel slope may be steeper which contributes to higher stream power, flow velocity, shear stress and, therefore, higher erosion capabilities.
- Initial assessments of channel width show there is an approximate 15% increase in channel width between 20-40 km
- K-Factor is 0.24 at Minor Park, 0.37 at Battlefield Park, and 0.49 at the Municipal Farm showing a trend of increased erodibility downstream.

Future work will consist of recording lateral migration throughout the watershed as another assessment of channel change and erosion. The next step is investigating total sediment loads in the watershed: coring for historic sedimentation rates and the sediment traps for contemporary rates



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