Landform Mapping of The Clarks River Alluvial System Using LiDAR DEM

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Abstract

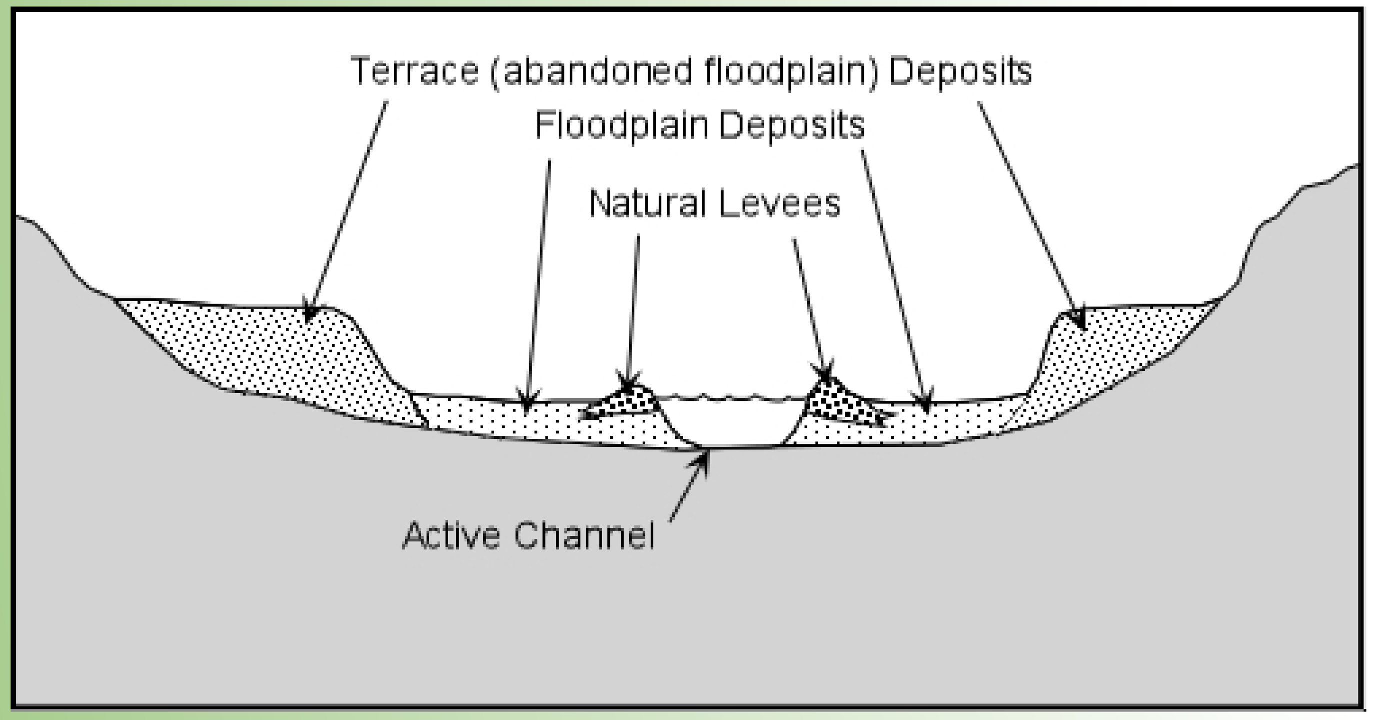
This project attempted to develop a landform map for a five square kilometer section of the east fork of the Clarks River, focusing on an area being monitored by Murray State University. Elevation data were obtained from five foot LiDAR digital elevation models (DEMs), and analyzed using 3D Analyst and Spatial Analyst tools in ArcMap. Transect lines were used in ArcMap to determine the location of different landforms in relation to the main channel of the Clarks River. Soils data were also added to determine how different soil types relate to differences in elevation.

Introduction

The Clarks River is located in western Kentucky near the city of Benton. It travels through and weathers lacustrine or lake deposits as well as fluvial or river deposits. These deposits are also overlain by loess deposited from the last glacial maximum. Historically, people have taken advantage of these rich deposits for agriculture which has led to increased settlement. With increased settlement, the river has experienced alteration. The west fork of the Clarks River has been channelized while the east fork of the Clarks River has managed to remain un-channelized and has since been allowed to run relatively freely.

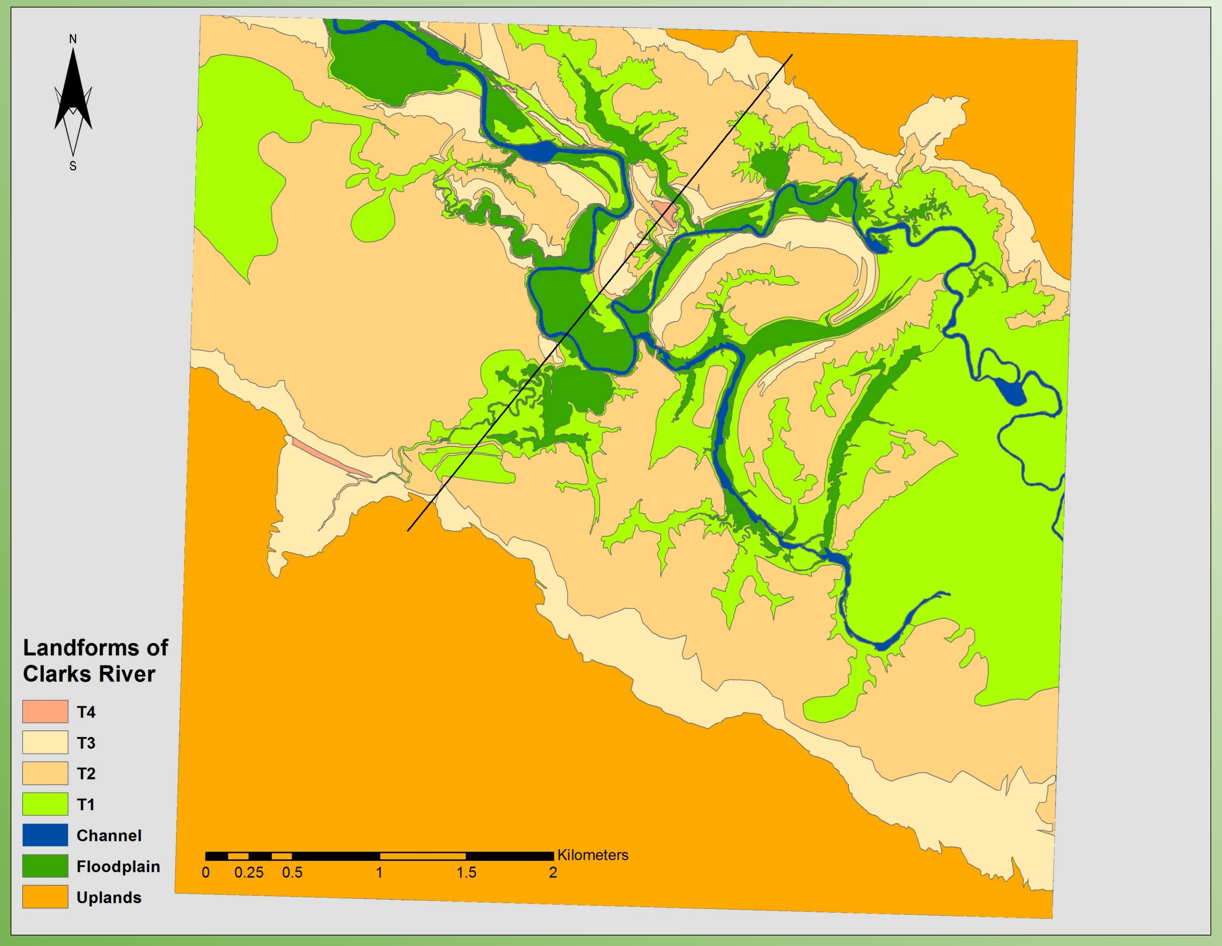
Study Area

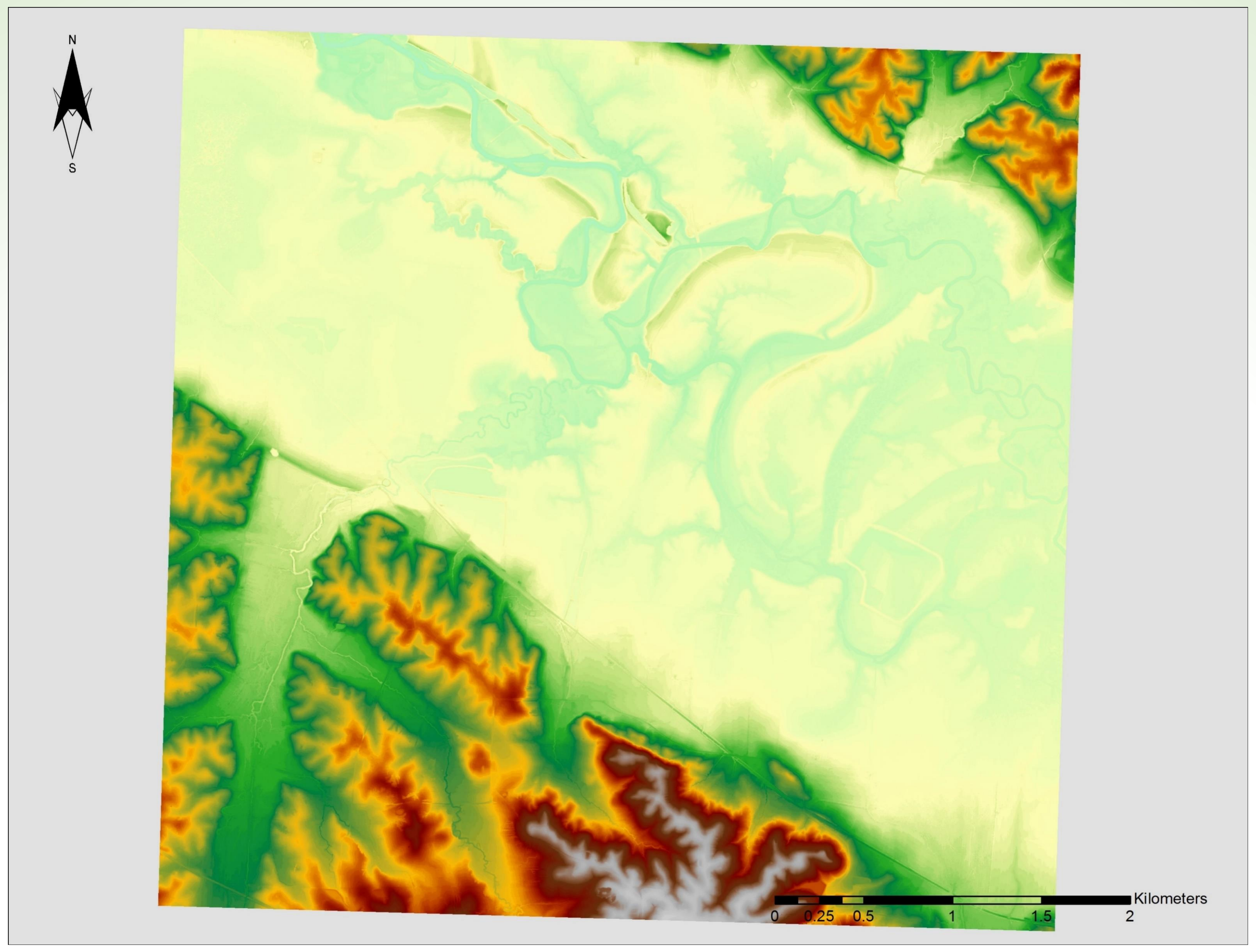
This study focused on a five square kilometer area in the Clarks River National Wildlife Refuge. This area is currently under observation using lysimeter to measure water content. The elevation within the area surrounding the channel changes very subtly, and so landforms have a difference of only a few feet. This provided a challenge when analyzing the LiDAR data. People do live in this area and the effects of human development can be seen in the data. Bridges, roads, ditches and homes do appear in the original DEM.



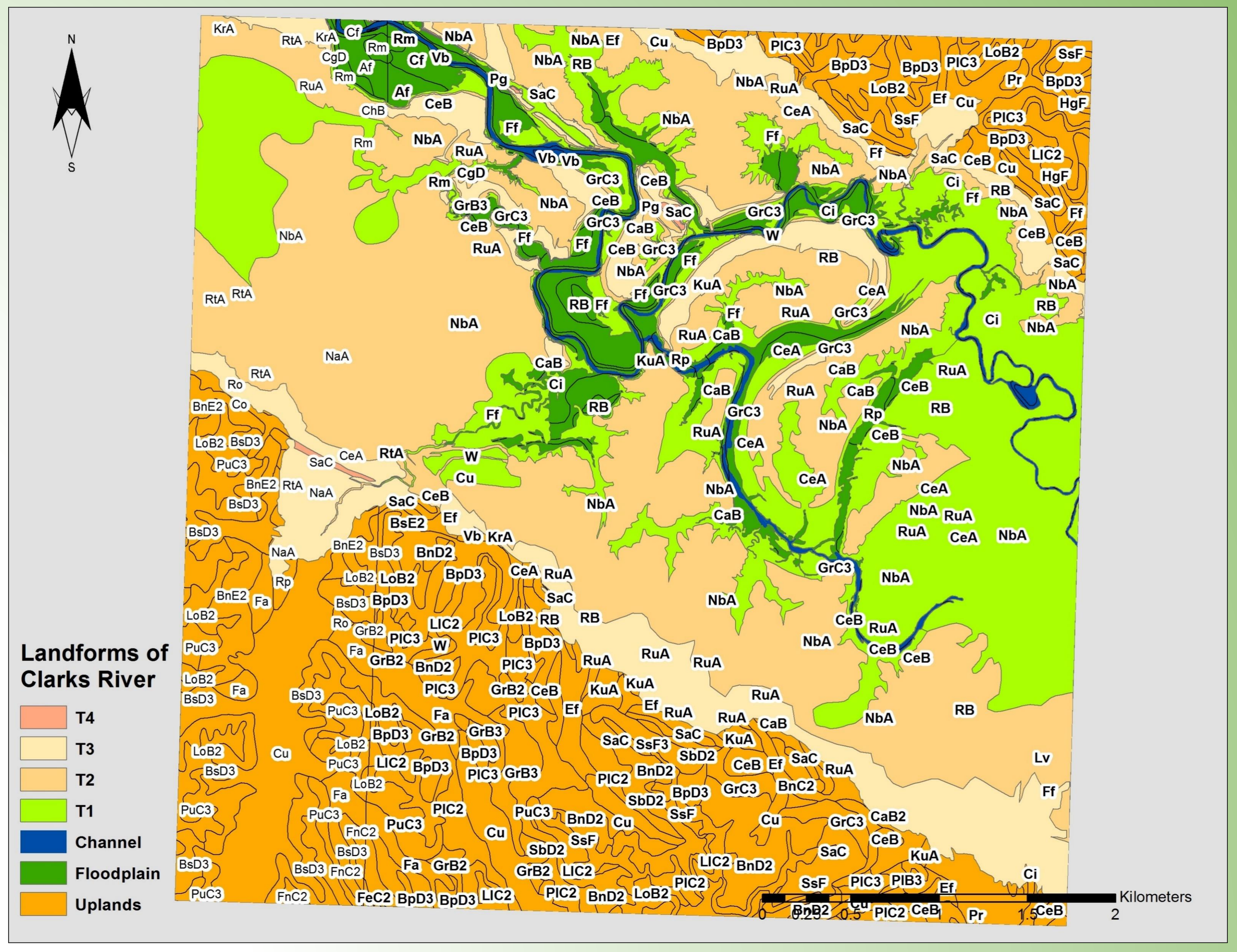
Methods

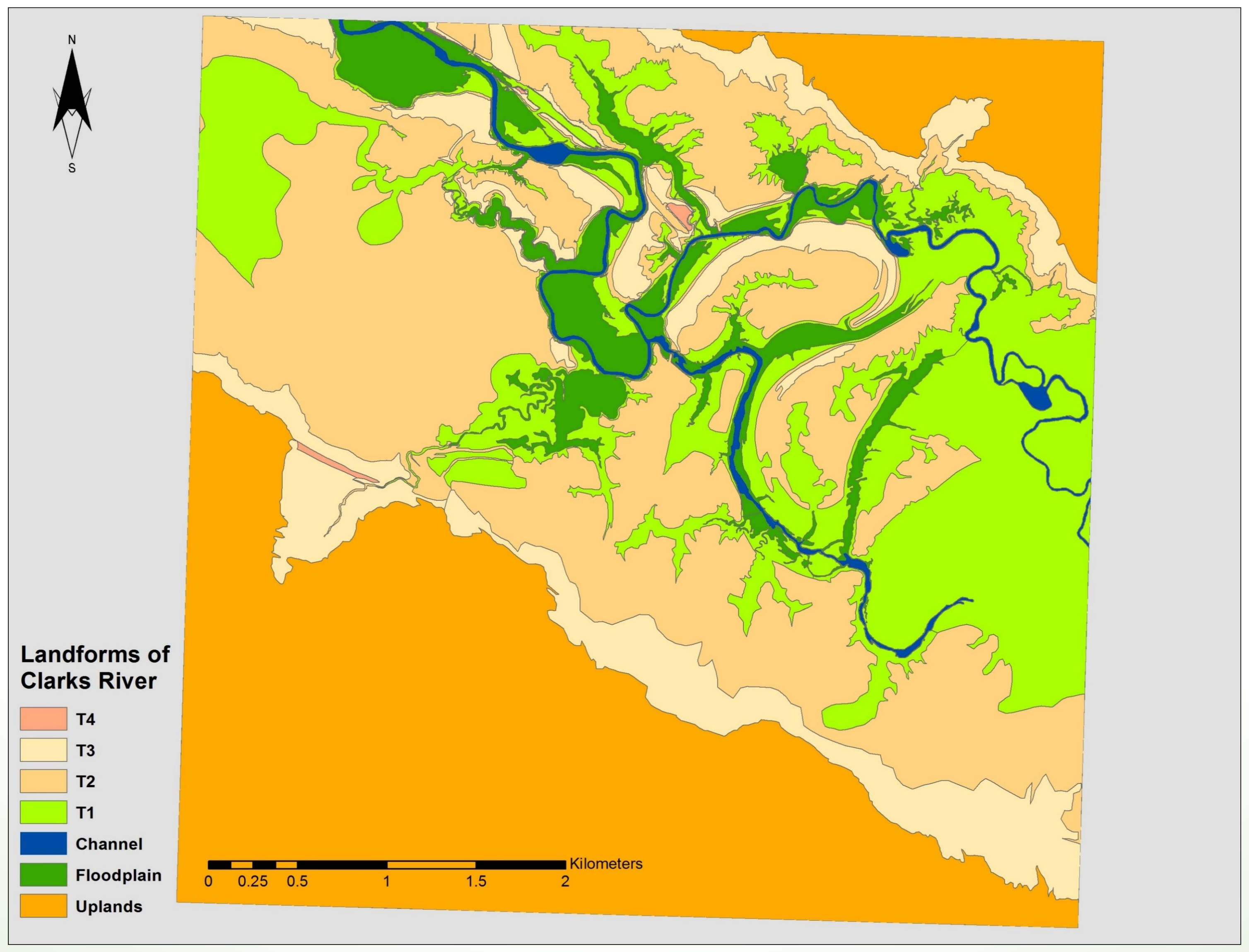
Analysis of LiDAR DEM using 3D Analyst and Spatial Analyst tools. Transect lines were used to show the differences in elevation. These differences were used to determine the boundaries between different landforms. The Editor tool was used to create a new shapefile and polygons were drawn around sections of the landforms. Soils taxonomy data were also added to see if certain soil types dominated certain landforms or were present at specific elevations.





LiDAR DEM provided by Jane Benson





Results

There were seven landforms identified in the analysis of the LiDAR DEM. Theses included the active channel, floodplain, four terraces, and uplands.
Certain landforms are dominated by specific soils. For example, the second terraces were dominated by Natalbany silt loams (NbA) and the fourth terraces were dominated by Saffell gravely sandy loam (SaC).

Conclusion

Landforms defined by this analysis were active channel, floodplain, terraces and uplands. The fourth terrace corresponded to gravel bars that were once the boundaries of a lake (Finch et al. 1964). LiDAR data are effective at determining differences in elevation within a fluvial system. This data also allows for effective mapping of fluvial landforms such as floodplains and terraces. Man made structures, such as roads and bridges, also appear in the data and need to be accounted for when mapping. There is also a relationship between the soils and landforms within this study area. They are related in terms of deposition and erosional processes.

Acknowledgments

Special thanks to Jane Benson and Dr. Gary Stinchcomb for providing the LiDAR data and providing advice

References

***USDA:NRCS:Geospatial Data Gateway:Order Data*. N.p., n.d. Web. 15 Oct. 2016.**

Finch, W., Olive, W., Wolfe, E., 1964, Ancient Lake in Western Kentucky and Southern Illinois, U.S. Geol. Survey Prof. Paper 501-C, pp. C130-C133.