USGS Community for Data Integration Request for Proposals for Fiscal Year 2014 - Statement of Interest

SECTION 1. PROJECT ADMINISTRATIVE INFORMATION

CDI SSF Category 3: Data and Information Assets

Project Title: Geomorphic derivatives for stream channels from LIDAR-based elevation sources - error quantification

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Short Description: High resolution elevation data will be used to develop and validate a framework to incorporate LIDAR data in geomorphic metrics for physical habitat assessments of stream channels. For two Virginia streams, high-resolution LIDAR and lower resolution NED will be compared to traditional field surveys of stream channels to quantify the utility of LIDAR-derived metrics and the errors associated with them.

SECTION 2: PROJECT SUMMARY

Traditional techniques for describing and understanding aquatic physical habitat in streams have focused on manual measurements of channel morphology. Geomorphic measurements include, channel width and depth, channel slope, bank heights and angles, and sinuosity. The need for aquatic physical habitat assessments is national in scope and is performed by local jurisdictions (counties), State and Federal agencies. Examples of national Federal programs include the USGS-National Water-Quality Assessment (NAWQA), and the USEPA Environmental Monitoring and Assessment Program (EMAP) programs.

Physical habitat assessments typically involve field mapping techniques that are costly and labor-intensive and are usually limited to infrequent local reach-scale surveys during low-flow conditions. It can be logistically prohibitive to conduct the field surveys at spatial and temporal scales appropriate for some aquatic species. For example, an optimal survey scheme could dictate repeated measurements along the channel but funding may only allow seasonal surveys at widely dispersed sites. LIDAR data has the ability to quantify 3-D channel morphology for entire stream reaches. This study will develop and validate a framework to incorporate LIDAR data in physical habitat assessments.

To evaluate the utility of LIDAR to derive morphology, LIDAR-derived channel metrics will be compared to the metrics from traditional field surveys of cross-sections along the streams. This will allow the quantification of the errors associated with LIDAR-derived and field collected metrics. If the field-derived morphologic characteristics are statistically similar to the LIDAR-derived characteristics, historic cross-sections can be compared to current LIDAR-derived results to efficiently conduct a temporal analysis, saving time and funds. These methods should be applicable to many local, state, and Federal studies throughout the country that require geomorphology to be characterized for a stream channel.

Datasets Used/Impacted/Exposed:

Because LIDAR data is collected at different resolutions nationally, comparisons of the field data will be done with two resolutions of LIDAR-derived elevation models. LIDAR collections, funded in part by the USGS, NOAA and FEMA will be used (NOAA, 2013). The USGS National Elevation Dataset (NED), will also be used to download coarser, more readily available elevation data (USGS, 2013). The NED provides preprocessed surface elevation data, derived from local LIDAR data, resampled to 3-meter spacing. If the 3-meter NED is adequate, it will save substantial time and costs associated with pre-processing LIDAR data.

Smith Creek, Virginia is a 242 square kilometer (km^2), USDA-NRCS Showcase Watershed in the Chesapeake Bay watershed that is part of a study partnership with USGS. Geomorphic currently being conducted in Smith Creek include channel morphologic changes and sediment source assessment. Difficult Run, Virginia has a drainage area of 150 km^2, and is part of the USGS Chesapeake Bay small watershed program. Nutrient and geomorphic studies are being conducted in Difficult Run to describe responses in water quality and relate those changes to watershed processes, Best Management Practices, and other watershed changes. Geomorphic studies being conducted in Difficult Run include analysis of channel morphologic changes and sediment source assessment. To date, 25 reaches, each with 2 to 3 surveyed cross sections, have been established in both the Smith Creek and Difficult Run basins. Cross sections are surveyed every 3 years to quantify channel change.

The NAWQA program's Integrated Watershed Studies team and the Regional Stream-Quality Assessment team are working within these basins, and historical stream channel surveys from the 1990's exist that will be used to test change in channel morphology.

Context:
By looking only at watersheds in the Piedmont Level III Ecoregion, error and uncertainty will be specific to that hydrogeologic setting: however, the methods are applicable nationally. The watersheds that are planned for the analysis exhibit a wide range of geomorphic conditions that are present in other areas of the country. The watersheds contain anthropogenically disturbed and non-disturbed areas and contain a range of urban and agricultural practices representing a variety of channel bank conditions.

Expected products to be generated:
Datasets and methods will be published in a USGS open file report. GIS datasets of cross-sections, elevation sources, stream bank and centerlines will be fully documented with FGDC metadata and available for download.

BUDGET:

Budget Category	Federal Funding "Requested"	Matching Funds "Proposed"
1. SALARIES (including Benefits):		
Personnel:		
Silvia Terziotti, 480 hours at GS 12/10 (PI, GIS Specialist, Assoc. Geospatial Liaison for Water Communities of Use)	$31,200.00	
Christopher Konrad, 176 hours (Hydrologist - lidar processing, automating channel corridor		$15,200.00
Allen Gellis, 176 hours (Research Hydrologist, - geomorphology)		$15,200.00
Peter Van Metre, 40 hours, (Research Hydrologist, Regional Stream-Quality Assessment Team Coordinator - channel properties)		$3,300.00
Paul Capel, 40 hours, (Research Hydrologist, Integrated Watershed Studies Team Coordinator - GW/SW integration)		$3,390.00
Total Salaries:	**$31,200.00**	**$37,090.00**
2. TRAVEL EXPENSES:		
Trip 1 (CDI Conference, 2 days, 2 travelers)		
Per Diem:	$624.00	
Transportation (Airfare + Mileage/Shuttle):	$800.00	
Other Expense (Registration fees):	$386.00	
Total Travel Expenses:	**$1,810.00**	**$0.00**
3. OTHER DIRECT COSTS: (itemize)		
Equipment (inc. software, hardware, purchases/rentals):		
Publication costs:	$1,000.00	
Office supplies:		
Training:		
Other expenses (specify):		
Total Other Direct Costs:	**$1,000.00**	**$0.00**
Total Direct Costs:	$34,010.00	$37,090.00
Indirect Costs (24%)	$8,162.40	$8,901.60
GRAND TOTAL:	$42,172.40	$45,991.60

REFERENCES:

David P. Thoma, Satish C. Gupta, Marvin E. Bauer, C.E. Kirchoff, Airborne laser scanning for riverbank erosion assessment, Remote Sensing of Environment, Volume 95, Issue 4, 30 April 2005, Pages 493–501, http://dx.doi.org/10.1016/j.rse.2005.01.012

"Digital Coast. More than Just Data." *United States Interagency Elevation Inventory*. NOAA, Web. 30 Oct. 2013, http://www.csc.noaa.gov/digitalcoast/tools/inventory.

"The National Map: Elevation." *The National Map: Elevation*. USGS, Web. 30 Oct. 2013, http://nationalmap.gov/elevation.html.