Mapping rivers and preserving livelihoods

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River scientists and marine geophysicists from the US and UK have teamed up for a unique collaboration that could help protect the lives of thousands of people who live close to the banks of some of South Asia's biggest rivers.

Led by the University of Birmingham with the universities of Exeter and Southampton, and featuring input from academics at the University of Illinois at Urbana-Champaign and Vanderbilt University, the research is focused around the pinpointing of dramatic river features called megascours. Megascours are large depressions eroded into riverbeds that can be up to a kilometre wide and 50 metres deep, or the height of a 16-storey building.

A common feature of rivers is that at bends, or where two channels join, they scour out their beds to depths that greatly exceed the average. In the world's largest rivers, such as those found in Bangladesh and India, these features are gigantic, due to the amount of water they discharge. For example, at peak flow, the Ganges-Brahmaputra-Meghna River system in Bangladesh – where the international team is focusing its research – discharges enough water every second into the Bay of Bengal to fill 64 Olympic-sized swimming pools.

Research is being carried out by the team from a boat at targeted locations where the Brahmaputra and Meghna Rivers are at their most dynamic and have the greatest potential to erode their banks. This includes where the river narrows, at sharp bends and when the rivers join.

Megascours can move several kilometres in a year, destroying property and infrastructure as a result of erosion at the riverbed and banks. Therefore, being able to predict how they form and grow will allow scientists to understand how large rivers evolve and lead to better predictive methods to offset the effects of bank erosion in the future.

However, despite their widespread occurrence, these dramatic river features have never previously been studied in any great detail, in part due to the difficulties of obtaining measurements from such large-scale systems.

The current Megascours research collaboration is unique in that it employs high-resolution geophysical techniques normally used in the ocean on these rivers. These acoustic technologies use sound to map the shape of the riverbed (multibeam echosounder) and the structures within the sediment beneath (seismic surveys).

By analysing the sediment below the riverbed, the experts are able to

work out the river's position in the past, which is crucial in predicting where erosion may occur in the future. The academics involved will be also using these geophysical techniques to explore how manmade reinforcements to riverbanks influence the river's evolution.

Dr Greg Sambrook Smith is Reader (Associate Professor), School of Geography, Earth and Environmental Sciences at the University Birmingham and Team Leader for this project. He uses geophysical tools to image and quantify the sediment below the surface. He said:

"In terms of water discharge, the Brahmaputra is the third-largest river on Earth, yet there is still much to learn about the scale and dynamics of the erosion it causes. No multibeam echosounder or seismic data had ever been recorded for the Brahmaputra until our work started.

"By working closely with organisations such as the Center for Environmental and Geographic Information Services (CEGIS) in Bangladesh's capital, Dhaka, we aim to contribute to the understanding of these large rivers where it matters most. CEGIS uses remote sensing tools for generating annual predictions of erosion for the hundreds of thousands of people living near the river banks. We hope that the new data and numerical models we are developing regarding the scale and dynamics of megascours will assist in these efforts, which is critically important for low-lying countries, such as Bangladesh, which are under constant threat from the cycle of erosion."

Jim Best, Jack & Richard Threet Professor of Sedimentary Geology at the University of Illinois at Urbana-Champaign and Visiting Researcher on the Megascours project added:

"Many big rivers around the world are also under increasing stress from a whole variety of factors, including climate-change and manmade changes to their river basins – such as large-scale hydropower damming.

In order to understand and predict the effects of these changes, we really need a far better knowledge of how these huge scours work, what drives their evolution and stability, and what they look like in the subsurface.

"New technologies are allowing us the first ever glimpse of these dynamic features, and showing us their sedimentary product. Hopefully our research will have relevance for the behaviour of such megascours in many of the world's biggest river channels."

Provided by University of Birmingham