

SEDIMENT AVAILABILITY

SAMUEL BENTLEY, CLINTON S. WILLSON, ANGELINA FREEMAN

QUESTION 1

IS THERE ENOUGH SEDIMENT REMAINING IN THE MISSISSIPPI RIVER TO PROVIDE WHAT IS NEEDED FOR RESTORATION?

Sediment diversions have been identified as important tools for restoring Louisiana's coast. However, upriver management practices have reduced the amount of Mississippi River sediment carried to coastal Louisiana. As a result, some have questioned whether there is enough sediment in the river to make large scale diversions a workable strategy.

OUR ANALYSIS

We wanted to provide accurate figures about the amount of sediment in the river. To put these figures in context, we looked at the natural cycles of the Mississippi River Delta over the last 7,500 years. Doing so gave us a long term view of the levels of sediment that the river has historically provided the coastal region. We assumed that the land building capacity of the river was proportional to the sediment supply.

WHAT THE SCIENCE SAYS

For the last 7,500 years or so, the delta has undergone cyclical changes of land building. Land would build in one small part of the delta, while the majority of the coastline was retreating. Thus, the coastal extent of land retreating has always been greater than the extent of land building. The locations of land retreat and building have shifted every 1,000 to 2,000 years with the river's changing course.

The sediment supply from the Mississippi River was approximately 400 million tons per year, before the river basin was modified by dams, levees, and other structures that capture and control sediment. Of that total natural

sediment supply, about 30 to 70 percent of the sediment was incorporated into the delta's landscape, while the remaining 70 to 30 percent was transported into the ocean. The present sediment supply carried by the river is approximately 200 million tons per year, making the modern land building capacity of the river about half of historic levels. Given the current amount of available sediment and understanding how the Louisiana coast was formed, today there is enough sediment to maintain about 20 percent of the Mississippi River lower delta plain, extending from the Chandeleur Islands in the east to Vermilion Bay and Marsh Island in the west.

Hurricanes and other tropical storms are another source of sediment for Louisiana's wetland ecosystems. Such storms stir up sediment from water bottoms and deposit it on the marsh surface. These fine sediments are particularly effective at maintaining existing marsh. In order to retain and consolidate this sediment, however, marshes must be healthy. For example, two different salt marshes—one at Old Oyster Bayou and one at Bayou Chitigue near lower Fourleague Bay—each received a great deal of storm driven sediment from Hurricane Andrew in 1992. Before the storm, the Old Oyster Bayou marshes were about 10 centimeters higher, had much higher soil strength in the root zone, and had been stable for over 50 years compared to Bayou Chitigue's salt marshes. Bayou Chitigue received twice as much sediment from the storm, but it retained less than half of this sediment. The healthier Old Oyster Bayou marshes retained almost all the storm driven sediment they received. This example demonstrates that for healthy marshes high enough to have adequate drainage, a little sediment can go a long way.

IMPLICATIONS FOR POLICY MAKERS

The Mississippi River does not now, nor has it ever supplied enough sediment to continuously sustain the entire delta coastline. There have always been areas that were building and areas that were eroding. In recent decades, we have reduced river sediment supply by approximately half, which constrains our ability to build land. Nevertheless, the available sediment supply is still huge and adequate to the challenge of sustaining targeted regions of coastal Louisiana, if we are able to use this valuable resource efficiently.

- As an upriver river management goal for the future, we should increase sediment flux by bypassing clogged dams, particularly on the Missouri River.
- Building diversions near upstream edges of basins with low rates of subsidence will take advantage of higher river stages and will produce the greatest and longest lasting land building effects. We recommend that these projects be constructed as quickly as possible to keep costs down.
- Some increase in river sediment is likely if high volume flood events become more common as a result of climate change.
- We should design river diversions to carry large sediment loads and deposit this sediment in relatively enclosed basins. This will ensure that the sediment is deposited in areas where it will not erode and be washed out to sea.
- Adding sediment to healthy marshes using pipelines can also be a good way to maintain existing wetlands, especially in areas distant from the river. For these projects to be successful, the marshes must be high enough to retain what is piped in.

