



Project Status Report

Upper Mississippi River
Long Term Resource Monitoring Program
U.S. Geological Survey

Longitudinal Changes in Mississippi River Floodplain Structure

by
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The Mississippi River is by far the largest riverine ecosystem in North America and the third largest in the world; the River's floodplain and deltaic plain encompass nearly 30 million acres. Draining 41% of the contiguous United States, the River is one of the most significant environmental factors affecting the Gulf of Mexico. Valued as a natural, historical, cultural, commercial, recreational, and transportation resource, the Mississippi River has had a major influence on the settlement and development of the United States. The River's 1,250,000-square-mile drainage basin is dominated by agricultural activities and the associated millions of pounds of herbicides, insecticides, and nitrogen based fertilizers that are applied annually for purposes of increasing crop yields. Many of these chemical compounds are transported into the Mississippi River and subsequently discharged into the Gulf of Mexico, where they may be contributing to a growing 7,000-square-mile hypoxic zone within the Gulf.

This main inland transportation artery moves nearly 500 million tons of goods yearly, including nearly

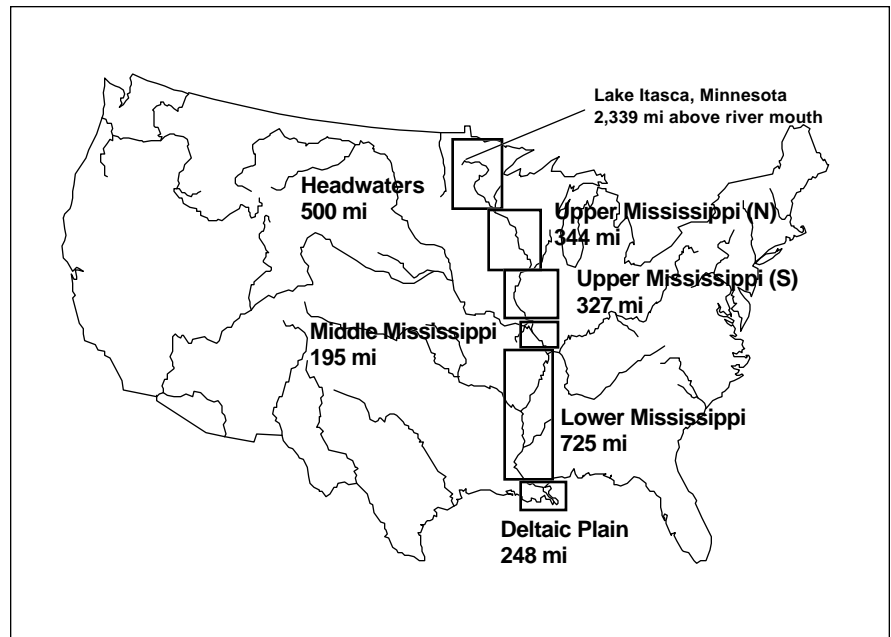


Figure 1. Mississippi River Segments

42% of the grain exported from the United States. Roughly 12 million people live along the mainstem of the River and annually generate about \$7.1 billion in agricultural and forest products and \$429 billion in manufactured goods. Recreational use and tourism along the River account for more than \$10 billion in annual revenues. The River and its tributaries still support a broad array of fish and

wildlife, including 241 fish species, approximately 50 species of mammals, 45 species of reptiles and amphibians, and 37 species of mussels. The river corridor functions as a migratory flyway for up to 40% of all North American waterfowl and 60% of all U.S. bird species.

During the past 200 years, the Mississippi River and its floodplain have been-and continue to be-

(over)

seriously degraded by extensive water pollution, wetland drainage, deforestation, habitat fragmentation, water-flow modification, and floodplain development. Two of the most deleterious river modifications have been (1) levee construction, resulting in a 90% reduction in the amount of seasonally inundated floodplain and (2) alignment and maintenance of the navigation channel traversing 85% of the River's length. Altered hydrology and sedimentation patterns have progressed to the point that geomorphic processes have been severely disrupted.

A growing body of evidence indicates that physical (geomorphic) processes and features control the biological structure and diversity of large floodplain rivers, particularly at large spatial scales. Scientists generally agree that the ecological diversity and integrity of large floodplain rivers are maintained by fluvial dynamics (annual flood pulses and channel-forming floods) and river-floodplain connectivity. Anything that tends to suppress the natural flood regime or constrain channel migration will disrupt these interactive pathways and lead to reduced ecological diversity and integrity.

This investigation applies the above assumptions about large floodplain rivers to the mainstem floodplain of the 2,339-mile Mississippi River. Figure 1 divides and names segments along the Mississippi River on the general basis of common geomorphic structure. Along roughly 80% of the River's length, including the upper, middle, lower, and deltaic plain segments, the channel is fixed in place as a commercial navigation channel by a variety of

Table 1. Mississippi River Floodplain

<i>River Segment</i>	<i>Approximate Floodplain Acres in 1,000s</i>	<i>Percent of Floodplain Behind Levees</i>
Headwaters	328	<0.01%
Upper Mississippi (N)	496	3%
Upper Mississippi (S)	1,006	53%
Middle Mississippi	663	82%
Lower Mississippi	25,000	93%
Deltaic Plain	3,000	96%
TOTALS	30,493	90%

channel training structures (wing dams, dikes, and revetments). The fluvial dynamics once responsible for channel migration across the floodplain, for alternating terrestrial and aquatic phases on the floodplain surface, and for sustaining a diverse array of aquatic habitat types and alluvial forest successional stages have largely been arrested along 80% of the River's length. Table 1 compares each river segment's total floodplain acreage with the percentage of floodplain that has been isolated from the main river channel. Note that there is a progressive downstream isolation of the floodplain, with 90% of the total Mississippi River floodplain largely isolated from the main channel by levees. If the applied assumptions are correct—that geomorphic structure, fluvial dynamics, and river-floodplain connectivity largely control ecological diversity and integrity of large floodplain rivers—then, given the current influences along the mainstem floodplain of the Mississippi River, future ecological conditions can be expected to deteriorate progressively downstream. To arrest deteriorating ecological conditions, some level of physical remedial action, including habitat rehabilitation and enhancement, will be necessary and will likely require sustained efforts. □

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