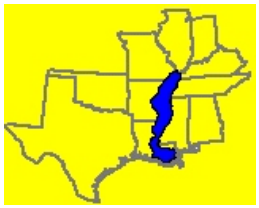
Lower Mississippi Valley Joint Venture

Migratory Bird Science Team - Technical Note #2 **Summer 2002**



Physiography of the Mississippi Alluvial Valley

LMVJV-Migratory Bird Science Team

Mission Statement

Provide scientific and technical support to the Lower Mississippi Valley Joint Venture in progressively refining the biological foundation underlying migratory bird conservation plans.

First, let's clarify some terms. Often, the Mississippi Alluvial Valley (MAV) is referred to as the Lower Mississippi Valley or Mississippi Alluvial Plain. Technically, the Lower Mississippi Valley includes the MAV plus the coastal Deltaic and Chenier Plains. The MAV only refers to areas within the Lower Mississippi Valley that are the result of riverine sedimentation and, depending on who's doing the interpretation, ends to the south somewhere between the head of the Atchafalaya River and a line between Donaldsonville and Franklin, Louisiana. The Mississippi Alluvial Plain is an area within the MAV that has been subject to flooding by the Mississippi River in recent times, and therefore excludes certain somewhat elevated sites, such as the Grand Prairie and Macon Ridge.

Readers should also note that boundaries of the MAV used by the Lower Mississippi Valley Joint Venture (LMVJV) follow national standards for defining bird conservation zones (U.S. Fish and Wildlife Service 2000) and therefore deviate somewhat from definitions used by geologists. Readers may find it helpful to explore the 'Physiography' and 'Level IV Ecoregions' data themes on the LMVJV Conservation Planning Atlas CD during or after reading this Fact Sheet.

Physiography is the physical component of a landscape and plays an important role in the development of plant and animal communities and ecosystems on which they depend. Some components of MAV physiography have been in place for long periods of geologic time, but the majority developed during and subsequent to the most recent glaciation. The following summary of MAV physiography is from the authoritative work of Saucier (1994a,b).

Overall, the MAV varies from 30 to 90 miles wide, and is widest and the latitude of Little Rock, Arkansas. The MAV begins in the north near Cape Girardeau, Missouri, not far from the confluence of the Mississippi and Ohio Rivers. The MAV is about

500 miles long and includes >21 million acres. Uplands within and adjacent to the MAV are elevated an average 200 feet above the valley floor.

There are 6 drainage basins within the MAV. The Western Lowlands extends south from Cape Girardeau, Missouri to Helena, Arkansas and west from Crowley's Ridge to the Ozark Uplands. The St. Francis Basin extends south from Cairo, Illinois to Helena, Arkansas and east from Crowley's Ridge to the Mississippi River. The largest drainage basin is the Yazoo, which extends south from Memphis, Tennesse to Vicksburg, Mississippi and includes the lowlands of western Mississippi. The Arkansas Lowland is the smallest basin and is confined between the natural levees of the Arkansas River and the Grand Prairie to the north. The Beouf Basin is a narrow drainage extending south from the Arkansas River to near Sicily, Louisiana, and is bounded to the east by Macon Ridge and to the west by the Ozark uplands. The Tensas basin extends south from the Arkansas River to the Red River and is bounded to the west by Macon Ridge and to the east by the Mississippi River.

One of the most distinct features of the MAV is a series of uplands extending from the Commerce Hills near Cape Girardeau, Missouri to the south end of Crowleys Ridge near Helena, Arkansas. Long ago, these hills were continuous and separated the Eastern Lowlands and the floodplain of the ancestral Ohio River from the Western Lowlands and floodplain of the Mississippi River. Now, remnants of the hills are interrupted by several gaps, which provided at various times outlets for the St. Francis, L'Anguille, and Mississippi Rivers. In age and geology, Crowley's Ridge most resembles uplands bounding the MAV to the east.

A short geologic chronology may help readers understand the sequence of events shaping the physiography of the MAV. First, because the southern midcontinent sloped down toward the Gulf and there was a trough between the Ozark and Appalachian uplands, a valley has existed in the location of the present Mississippi Valley for tens of millions of years. However, that valley was relatively small because drainage from the lake states was through the St. Lawrence Valley, and drainage from the Missouri and Ohio Rivers flowed to the Gulf separate from the ancestral lower Mississippi drainage. With the advent of the Pleistocene era about 2.5 million years ago, repeated cycles of continental glaciation realigned major drainages and the Lower Mississippi Valley became a giant sluiceway for glacial meltwater. Most sediments from early glacial cycles have been removed from the MAV by subsequent erosion but loess or windblown silt nearly 800,000 years old is present on upland hills southeast of the MAV. The next oldest feature is the Grand Prairie, a terrace elevated about 30 feet above the MAV; sediments in the Grand Prairie area were deposited by the Arkansas River during the Sangamon Period and may be 120,000 to 130,000 years old. The LMVJV includes the Grand Prairie as one of the Level IV Ecoregions of the MAV, although geologists often exclude it because they define the MAV by the extent of sediments deposited during and after the last or Wisconsin glaciation (i.e., in the last 70,000 years).

Most physiographic features in the MAV developed during the Wisconsin (70,000 to 12,000 years ago) and Holocene Periods (12,000 years ago until the present). During the early Wisconsin Period (70,000 to 30,000 years ago), glacial outwash filled most of the MAV. Much of the outwash was removed by subsequent erosion but some is present today in features such as Sikeston Ridge in southeast Missouri, Macon Ridge in southeast Arkansas and northeast Louisiana, and braided stream terraces in the Western Lowlands and St. Francis Basin.

About 14,000 years ago, the Mississippi and Ohio Rivers began for the first time to share a common channel east of Crowley's Ridge. Several important events occurred around the beginning of the Holocene (12,000 years ago): torrential meltwater ceased flowing through the MAV; the river channel changed from braided to meandering; and human occupation began.

Many new physiographic features developed during the Holocene as the Mississippi periodically overflowed and occasionally altered its meandering course. The most important of these relatively recent features are active and abandoned meander belts and their associated natural levees, ridges and swales, oxbows lakes, and backswamps. Natural levees of the Mississippi typically are 2 to 3 miles wide and 15 feet high; natural levees form because sand is deposited when currents loose energy and velocity as they flow over river banks. When river channels are abandoned, natural levees remain on the landscape as elevated features that support different forest types and provide attractive sites for human settlement, transportation routes, and certain type of agriculture (e.g., corn and cotton). The active meander belt of the present Mississippi River and sections of 5 former meander belts have been mapped, but dates and lengths of occupation of the channels have not been determined. Meander belts have affected physiography of the MAV most in the lower St. Francis, Yazoo, and Tensas Basins. Sediment dynamics in a meandering river are complex; basically, erosion occurs on the concave bank of a loop and sediments are moved downstream and deposited in the next convex bank or point bar. These processes depend in part on the size of floods and stability of sediments on the concave bank; thus, the extent of change varies among years and flood events. The periodic deposits that occur on convex banks are separated from one another by depressions; this creates the ridge and swale topography characteristic of meander belts. If meandering of the river course becomes extreme, the channel can 'cut off' a loop and create an oxbow lake or abandoned channel segment. If the abandoned channel segment retains a hydrologic connection to the river, the oxbow fills rapidly with sand and other sediment. When no hydrologic connection remains, only fine sediments enter the oxbow and only during overbank floods. In this case, the lake remains as open water or, if enough time passes, fine sediment fills the lake and the only evidence of the former oxbow is the presence of a 'clay plug' at the location. Backswamps are areas not occupied by glacial outwash, as described earlier, or by recent meander belts. They are areas lying between major natural levee systems or between natural levees and uplands. Subject to little disturbance, backswamps gradually accumulate large amounts of fine silt and clay over long periods of time. Generally, backswamps are relatively flat with few distinctive features, and drainage is poorly developed. Large areas of backswamp occur in the Yazoo and Tensas Basins and throughout the Atchafalaya Basin.

No discussion of physiography in the MAV would be complete without mention of earthquakes. The last major earthquake occurred and was observed by settlers in 1811-1812. It was located in the New Madrid Seismic Zone, a complex rift between the Ozark and Appalachian uplands. The main axes of the fault run from Dyersburg, Tennessee north-northwest to New Madrid, Missouri and from Marked Tree, Arkansas northeast to Caruthersville, Missouri. The New Madrid Earthquakes of 1811-1812 included 4 major shocks and resulted in widespread reports of land fissures, sand blows, and local flooding. Evidence also indicates that Big Lake and Reelfoot Lake were deepened by the earthquakes; however, there is no evidence that these lakes

were created solely as a result of the earthquakes, as some have suggested. Minor quakes continue to occur in the New Madrid Seismic Zone but it is unlikely that any other quakes of the magnitude of those of 1811-1812 have occurred in the last 10,000 years.

References

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