

Mississippi by car—through the nation's midsection and the great Louisiana delta. We watched the floodgates being closed at Cape Girardeau and Hannibal, Missouri, never dreaming that a second, unprecedented, midsummer crest would devastate low-lying communities and farmland from central Iowa to southern Illinois. We ate our way through the delta country of Louisiana, documenting the poignant demise of the Cajun lifestyle, and the inexorable loss of Louisiana's barrier islands and the nation's most expansive wetlands. Enjoyably, we had learned many years ago to catch and cook Louisiana redfish, blue crabs, and crawfish.

Through my avocations of hunting and fishing I think that I have gained insights that would have escaped me had I remained cloistered in my university ivory tower. My leisure activities have forced me to scrutinize Old Man River in all of his fickle moods—at sunrise, in the black of starless nights, during all seasons, during floods and droughts, and in fog, rain, and snow. Most important, my pursuits have enabled me to learn about the “real world” from an extensive cadre of “river rats” who have exploited, studied, and loved the river from within, rather than analytically studying and digitizing it from without—as desk-bound, computerized scientists and technicians are increasingly wont to do.

Introducing Old Man River

The Famous Mississippi

“Old Man River,” “Father of Waters”—the names conjure up images of Indians in birch bark canoes, explorers, fur traders, loggers, cotton plantations, southern mansions, live oaks festooned with Spanish moss, slaves, Civil War, steamboats, showboats, riverboat gamblers, Mark Twain, Tom Sawyer, Huck Finn, pearl button factories, dams, towboats, mud, and giant catfish.

Immortalized in prose, poetry, and song, the river has been a defining theme in the cultural life of the nation. The Mississippi River and its tributaries played major roles in the exploration and colonization of the midcontinent and in the westward expansion of the United States.

Along with the Grand Canyon of the Colorado River and Yellowstone Park, the Mississippi is the natural feature that foreign tourists want to see most when they visit the United States. The Mississippi River is a national treasure, and a gateway to the world.

Vital Statistics

The Mississippi River—the name is an Ojibwa (Chippewa) word meaning “great river” or “gathering of waters”—is the largest and longest river in North America.

Of the world’s rivers, the Mississippi is the third longest, has the third largest drainage basin, and is the eighth largest in average annual discharge (Nace 1970; Leopold 1994). With the Missouri, its longest tributary, it forms the world’s longest river system (4,321 miles), even surpassing the Nile.



The Mississippi drainage basin, or watershed, is shaped like a huge funnel, stretching from the Allegheny Mountains in the east to the Rocky Mountains in the west. It drains an area of 1.24 million square miles, about 40 percent of the contiguous United States and about one-eighth the area of North America. The river’s watershed includes all or parts of thirty-one states and two Canadian provinces (Meade 1995).

Flowing to the south, the Mississippi cuts through a cross section of America’s heartland. It wanders from its headwaters for 535 miles as a young, often rocky stream within Minnesota. Below Minneapolis it flows 1,766 miles as a much older, sediment-choked river along the borders of Minnesota and nine other states, gathering the waters of its many tributaries and pouring them into the Gulf of Mexico.

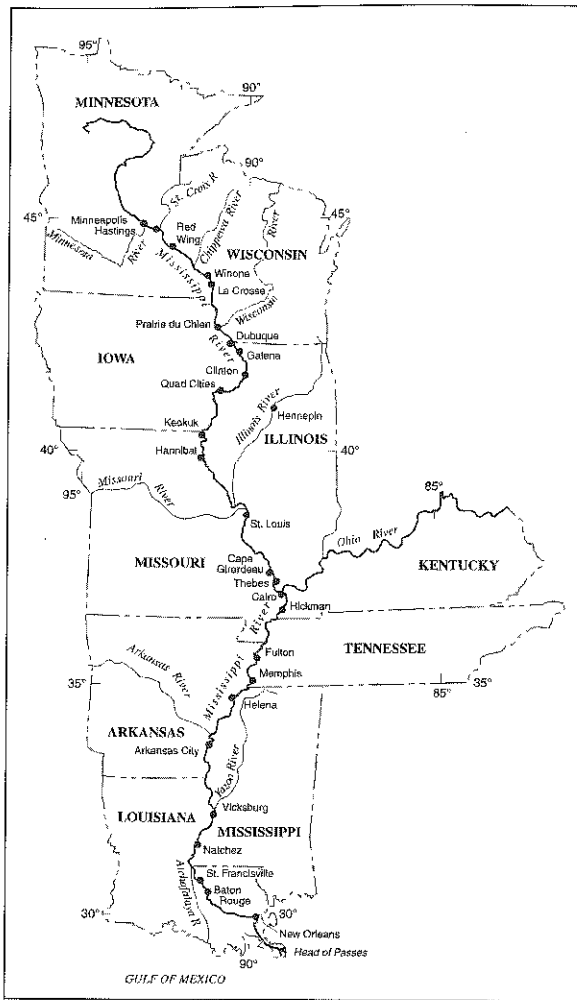
Down the Yellowstone, the Milk, the White and Cheyenne;
 The Cannonball, the Musselshell, the James and the Sioux;
 Down the Judith, the Grand, the Osage and the Platte,
 The Skunk, the Salt, the Black, and Minnesota;
 Down the Rock, the Illinois, and the Kankakee,
 The Allegheny, the Monongahela, Kanawha, and Muskingum;
 Down the Miami, the Wabash, the Licking and the Green,
 The Cumberland, the Kentucky, and the Tennessee;
 Down the Ouachita, the Wichita, the Red, and Yazoo—
 Down the Missouri, three thousand miles from the Rockies;
 Down the Ohio, a thousand miles from the Alleghenies;
 Down the Arkansas, fifteen hundred miles from the Great Divide;
 Down the Red, a thousand miles from Texas;
 Down the great Valley, twenty-five hundred miles from Minnesota,
 Carrying every rivulet and brook, creek, and rill,
 Carrying all the rivers that run down two-thirds the continent—
 The Mississippi runs to the Gulf.

The River, Pare Lorentz

The Mississippi is not just any river; it is the “Mighty Mississippi,” a busy, vital intracontinental water highway that connects North America’s “breadbasket” with the rest of the world.

The Mississippi basin is a supermarket to the world. Crops grown on some of the planet’s richest soils feed one in twelve of the world’s people. But over the years, the Mississippi, sometimes running like chocolate, has dumped unnumbered tons of the nation’s irreplaceable topsoil irretrievably into the Gulf of Mexico.

From its source at Lake Itasca, in Minnesota’s North Woods, the Mississippi runs 2,301 miles through the midcontinent, across the Gulf Coastal Plain, and through the subtropical great Louisiana delta to the Head-of-Passes. There it splits like the toes of a bird’s foot into several distributaries or outlet channels called “passes” that lead to the Gulf of Mexico. The major pass is about twenty miles long.



Map of the entire Mississippi River, showing major tributaries and selected cities. The Mississippi Headwaters includes the reach from the river's source at Lake Itasca in northern Minnesota downstream to St. Anthony Falls at Minneapolis, Minnesota. The Upper Mississippi includes the reach from Minneapolis downstream to Cairo, Illinois, at the mouth of the Ohio River. The Lower Mississippi includes the reach from Cairo to the Head of Passes in the Gulf of Mexico. The Atchafalaya River is the Mississippi's main distributary, diverting flow from the Mississippi directly into the Gulf of Mexico (adapted from Meade 1995).

The Mississippi River is customarily divided into three distinct segments: (1) the Headwaters—running 493 miles from the river's source (Lake Itasca in northern Minnesota) downstream to St. Anthony Falls in Minneapolis, Minnesota; (2) the Upper Mississippi River—running 854 miles from St. Anthony Falls downstream to the mouth of the Ohio River at Cairo (pronounced *kaye roe*), Illinois; and (3) the Lower Mississippi River—running 954 miles from Cairo to the Head-of-Passes in the Gulf of Mexico. Additionally, the 195-mile segment of the Upper Mississippi River from the mouth of the Missouri River (at St. Louis, Missouri) to Cairo is often referred to as the Middle Mississippi River because it is undammed and ecologically unique, mainly because of the influence of “Big Muddy”—the Missouri River.

If explorers had probed the Mississippi River from the Gulf of Mexico northward and seen the Missouri swollen with spring runoff, rushing huge trees along in its fast and dangerous current, they would have had good reason to think that the Missouri River was the real continuation of the main river or that the Upper Mississippi was only a large tributary.

The Missouri is more than sixteen hundred miles longer than the Upper Mississippi, and its drainage basin is about three times as large. Some have suggested that only that portion of the Mississippi from its source to the mouth of the Missouri should have been called “Mississippi” after its original Indian name. They have further suggested that the rest of the river that begins in Montana and ends in the Gulf of Mexico should have been called “Missouri River.”

The literature contains many differing figures for the length of the Mississippi River. Its length changed naturally over the years as the Lower Mississippi meandered about in its broad valley, sometimes shortening itself suddenly as it cut off meander loops. In modern times the Lower Mississippi has also been shortened many times by engineers who cut off meander loops to speed navigation. My 2,301-mile figure was determined by adding the mileages shown on the newest official maps of the U.S. Army Corps of Engineers, the Mississippi River Commission, and the Minnesota Department of Natural Resources. It is unlikely the river's length will change significantly in the near future because the river is now constrained by

Introducing Old Man River

massive channelization projects from the Twin Cities to the Gulf. Someday, however, it may spontaneously change its length a few miles in the Headwaters where it still meanders unfettered through flat glacial lakebeds. Because it occupies the bottom of a deep, relatively narrow trench, the Upper Mississippi from Minneapolis to St. Louis has not meandered significantly in the past ten thousand years.

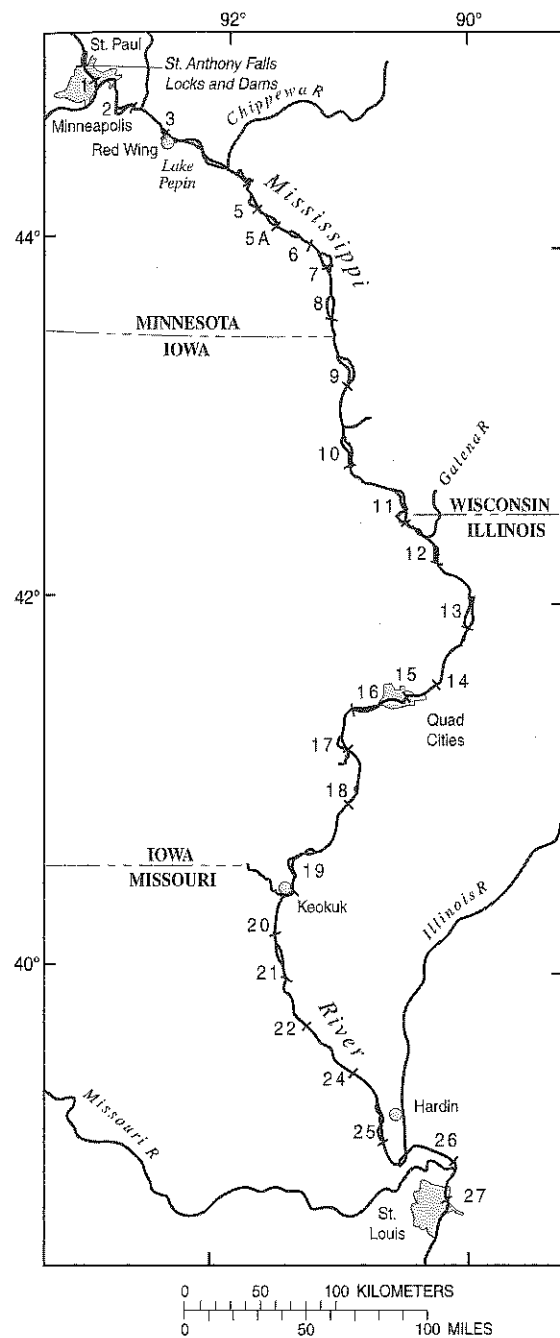
Locations along the river's main channel are given in River Miles (abbreviated RM), starting with RM 0.0 at the Head-of-Passes in the Gulf of Mexico and proceeding upstream to the mouth of the Ohio River at Cairo, Illinois (RM 953.8). At Cairo, numbering starts at RM 0.0 again and continues up the Mississippi to its source. From the Gulf of Mexico to Minneapolis, mileages are printed on permanent, lighted buoys or shore markers that, along with unlighted buoys and markers, identify the edges of the commercial navigation channel. They provide an accurate means of locating sites along the river. The Headwaters segment of the river is not officially marked with buoys or other navigation aids, but mileages are accurately shown on free, detailed maps produced by the Minnesota Department of Natural Resources.

In contrast, RM 0.0 on the Ohio River is at Pittsburgh, Pennsylvania, at the confluence of the Allegheny and Monongahela Rivers. Mileages increase downstream to RM 981 at Cairo, Illinois, where the Ohio joins the Mississippi. This apparent anomaly is because exploration of the Ohio and the flow of manufactured goods were in a downstream direction. Mileages indicated how far downstream keelboaters were from homeport.

Nearly one half of the water discharged into the Gulf of Mexico is contributed by the Ohio River. The Mississippi and the Atchafalaya River, the Mississippi's main distributary, together discharge an average of about 420 billion gallons of fresh water per day to the Gulf (U.S. Geological Survey Circular 1133, 1995).

A Water Highway to the Sea

The Mississippi, its navigable tributaries, and man's engineering projects have created a water highway to the interior of the continent—and to the sea. For example, I could launch my sixteen-foot fishing boat just fifteen minutes from my home at Winona, Minnesota, and



The Upper Mississippi River is partly impounded by locks and dams, built mostly for navigation, that control the depth and, to a lesser extent the flow of the river between Minneapolis and St. Louis. From Minneapolis downstream, the locks and dams are numbered from 1 to 27. There is no Lock and Dam 23, but there is an "extra one" at Winona, Minnesota (Lock and Dam 5A). With the Upper and Lower St. Anthony Locks and Dams in Minneapolis they total twenty-nine. There are no dams below St. Louis. The two largest impoundments are Lake Pepin, a natural lake formed by the partial damming of the Mississippi by the delta of the Chippewa River, and Pool 19, behind the hydroelectric dam at Keokuk, Iowa (adapted from Meade 1995).

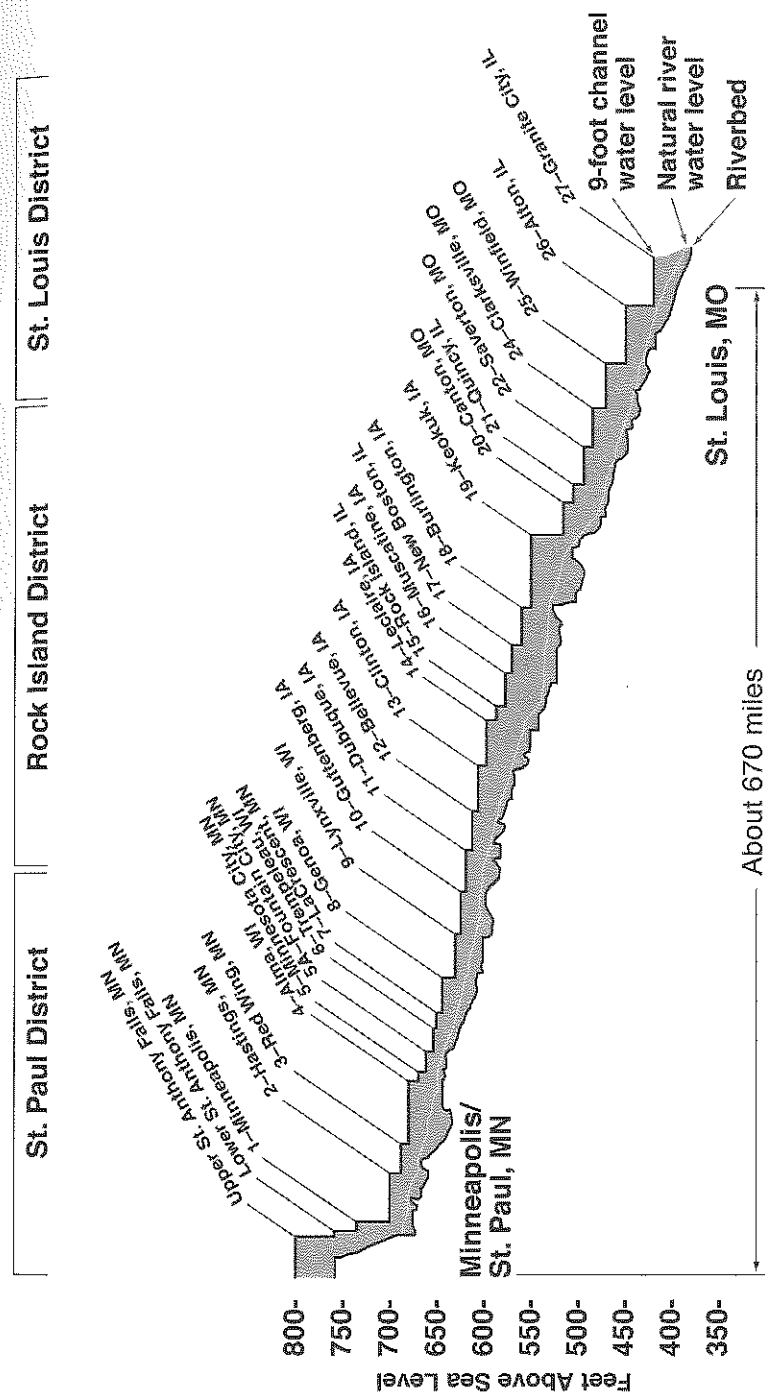


A diesel-powered towboat pushes twenty barges of grain downstream below St. Louis. In this undammed reach, forty-barge tows are common, and most towboats produce about 10,000 horsepower. Upstream from St. Louis, where the river is dammed, tows seldom exceed fifteen barges due to the size of the navigation locks. Towboats in the upriver reach average about 5,400 horsepower.

travel 140 miles upstream to the Coon Rapids dam in north Minneapolis without ever taking it out of the water. Similarly, I could run downstream to New Orleans and continue into the Gulf of Mexico or enter the Gulf Intracoastal Waterway, and travel hundreds of miles along the Gulf and Atlantic coasts. Halfway down the Mississippi, I could detour up the Illinois River to Chicago, lock into Lake Michigan and the St. Lawrence Seaway, ultimately to enter the North Atlantic Ocean via the St. Lawrence River.

Commercial riverboats, once apparently doomed by railroads, now provide intense competition for all transporters of bulk commodities such as grain, coal, oil, gasoline, molasses, cement, and fertilizers. Modern towboats on the Upper Mississippi River push as many as fifteen barges and can carry the equivalent tonnage of approximately 225 rail cars.

The U.S. Army Corps of Engineers is responsible for maintaining



A "Stairway of Water" makes commercial navigation possible between Minneapolis and St. Louis (U.S. Army Corps of Engineers, St. Paul District).

federal dams in the Headwaters, federal flood levees system-wide, and the commercial nine-foot river channel from the Twin Cities southward. The twenty-nine navigation locks and dams are operated and maintained by the U.S. Army Corps of Engineers. The U.S. Coast Guard maintains the system of navigation aids that guides modern diesel-powered towboats (and thousands of pleasure boats) as they navigate the Upper Mississippi around the clock from early spring until early winter. Maintenance includes painting and repositioning buoys, and servicing lighted markers.

Recreation is a major use of the Mississippi River. Fishing and boating are among the most popular pastimes, but hunting, camping, swimming, birding, and visits to historic towns, archeological sites, and locks and dams are other common activities. On the Upper Mississippi alone, the national impact of recreation has been estimated to exceed \$1.1 billion annually (U.S. Army Corps of Engineers 1993). This does not include the value of recreationally intense Headwaters and the hundreds of lakes that drain into it. The lakes are ringed with resorts, summer cabins, campgrounds, and year-round homes. Boating, fishing, and swimming are popular sports, and there is generally a high level of environmental awareness.

River Markers

Hundreds of red day markers denote the right side of the nine-foot-deep, commercial channel as boaters proceed upstream ("red right returning"). Similar green markers mark the left side of the channel. Numbering at the top of the marker tells the boater how far upstream she or he is from the mouth of the Ohio River at Cairo, Illinois. A solar-powered light (with storage battery) blinks twenty-four hours per day but is only visible at night or in dim light. A steady "on-off-on" signifies the left side of the channel. An intermittent "on-on-off-on-on" signifies the right. Lighted markers are usually located on bends, and successive markers are usually within sight of each other, making navigation possible at night. Floating red and green buoys also mark channel borders. By staying between the red navigation aids and green navigation aids, boaters are assured of at least nine feet of depth. Danger, in the form of rocks and stumps, lurks outside the marked channel. The U.S. Coast Guard maintains the navigation aids.

The river is more than a commercial or recreational resource. Its role in the natural ecology of the continent is unique and irreplaceable. The Mississippi River serves as a migration corridor for more than two hundred species of birds. Its backwaters are habitats to a vast array of mammals—such as beaver, otter, mink, muskrat, and raccoon. The 195 species of freshwater fish that occur in the Mississippi River comprise nearly one-third of the approximately six hundred freshwater fishes of North America. Because it is so ancient, the Mississippi is a virtual "Cretaceous Park," home to relict fishes about the same age as dinosaurs.

Today, most of the Mississippi River south of St. Paul, Minnesota, is a "working river," dominated by powerful, ponderous towboats. On their way downstream, the big ones wrestle six acres of grain-laden barges toward the deep-water ports of Baton Rouge and New Orleans. There the corn and soybeans are transferred to oceangoing freighters that distribute the grain worldwide. On their return trip upstream, the towboats may push barges of fertilizer for the farmers who raised the corn and soybeans, or fuel for cars and farm machinery.

Coal is shuttled upstream as well as downstream to supply the power plants that generate much of the electrical energy that runs the farms, cities, and industries. Coal goes both directions so that power plants can meet air pollution standards. Cheap high-sulfur coal from Kentucky may be blended with more expensive low-sulfur coal from Wyoming. The "cowboy coal" may be shipped directly to the power plants by rail or off-loaded to river barges near the Twin Cities and then barged downstream. Thus, the Mississippi is one of the world's most important commercial rivers and one of the most severely regulated. "Regulated river" is a recent euphemism describing rivers that are dammed and constrained.

Human influence on the river begins virtually at its source. The Headwaters segment of the Mississippi flows through nine natural lakes and the impoundments created by eleven dams. Some of the natural lakes have been increased in size by dams at their outlets. The dams have no locks, and there is no commercial boat traffic (except for charter fishing boats on the largest lakes).

Recreational boaters are advised that their boats must be properly equipped with personal floatation devices, running lights, and other

safety gear because they may be inspected by law enforcement personnel of the U.S. Coast Guard, conservation officers of the U.S. Fish and Wildlife Service, conservation officers of states that border the river, and the river patrols of many counties and cities.

The Upper Mississippi River has been intensively channelized for navigation beginning in 1878. Broad, shallow impoundments were created on the Upper Mississippi when twenty-nine navigation dams were constructed, mainly during the 1930s, to create a slack-water navigation channel nine feet deep between St. Louis and Minneapolis. River travelers are usually surprised at the width of the Upper Mississippi in its impounded reaches where it is much wider (but much shallower) than it is at St. Louis or New Orleans where the river is undammed.

Because the impoundments alone are insufficient to maintain the nine-foot commercial channel, the river's main channel is routinely dredged in some reaches. Almost all sand islands along the main channel have been placed there as result of dredging. In recent years, attempts have been made to minimize the adverse environmental impacts of this practice.

The Lower Mississippi River has been channelized and shortened 142 miles, and its velocity has been increased commensurately. It remains undammed, but its floodplain has been reduced about 90 percent by levee construction begun in 1727 near New Orleans. About 40 percent of the runoff from the continental United States is carried by the Mississippi River system (Leopold 1994).

Downstream from Minneapolis, the Mississippi River has been intensively managed for the transport of commercial cargoes and for flood control for more than two hundred years. The U.S. Army Corps of Engineers, as mandated by the U.S. Congress, maintains a navigable channel nine feet deep from Minneapolis, Minnesota, to Vicksburg, Mississippi; a twelve-foot channel from Vicksburg to Baton Rouge, Louisiana; and a ship channel forty feet deep from there to the open waters of the Gulf.

First-time visitors to New Orleans are usually surprised to learn that the Mississippi is only about 2,200 feet wide at the foot of Canal Street. Equally surprising is that the river is 240 feet deep in the sharp bend just off the Esplanade Wharf at the edge of New Orleans'

French Quarter. For the last 450 miles of its run to the sea, the Mississippi's bed lies below sea level. Protected by massive levees, much of New Orleans lies below sea level, and virtually all of it lies below river level.

From New Orleans upstream to Dubuque, Iowa, the Mississippi is flanked continuously by massive flood-control levees or steep natural banks. Upstream from Dubuque, additional flood levees protect most low-lying cities.

The mainline flood levees are usually armored with rock; and along the Lower Mississippi even the riverbanks and portions of the riverbed are armored, usually with concrete or asphalt. With minor exceptions (St. Anthony Falls, Rock Island Rapids, Keokuk Rapids, and Chain of Rocks at St. Louis), virtually every rock larger than a cantaloupe—from Minneapolis to the Gulf of Mexico—has been placed there by the U.S. Army Corps of Engineers or the Corps' contractors.

A River in Trouble

The Mississippi River has suffered at the hand of man. Dams and levees, which aid navigation and floodplain agriculture, have reduced the river's natural ability to create habitat for fish and wildlife during periods of high flow. Floods have increased in frequency and severity. Navigation impoundments, side channels, and sloughs are filling with sediment—and the rate of filling may be exacerbated by proposed increases in commercial traffic.

Some river reaches are severely polluted. Exotic plants and animals are competing with native species, and whole ecosystems seem to be unraveling. Yet, we are exponentially increasing our demands on this diminishing resource. While the myriad manmade problems affecting the Mississippi are of recent origin, they have their foundation in the natural forces that shaped the river and its enormous watershed. A basic understanding of that fascinating geological history is necessary to appreciate today's magnificent river and its ills.

This book tells the story of the evolution of the modern Upper Mississippi River. The story is a long one, spanning about six hundred million years of earth's history, and it melds information from geology, ecology, and human history.

Rivers versus Lakes

If you were to guess which last longer—rivers, mountains, or lakes—which would you choose? Lakes, especially those that are products of the ice age, disappear with astonishing speed in geologic terms. Mountains, often taken as symbols of rugged endurance, are thrown down by the relentless forces of erosion a few million years after their uplift has ceased. . . . Rivers, on the other hand, can last scores or even hundreds of millions of years.

Wiggers 1997

Lakes are temporary features on the land; rivers are virtually immortal. They are relentless shapers of the land. The source of the Mississippi has not long been at Lake Itasca in northern Minnesota. The modern Headwaters is only about ten thousand years old—a mere toddler in geologic time—its present course set when the last glacier retreated across Minnesota. Within the last twenty thousand years, alternate sources have included two vast glacial lakes—Lake Agassiz and Lake Duluth.

Most of the Mississippi's course, from Minneapolis, Minnesota, to Cairo, Illinois, was determined over a million years ago as meltwaters etched a path along the eastern edge of the great Nebraskan glacier. The river's gorge was enlarged by meltwaters of subsequent glaciers.

The general course of the Lower Mississippi may be as old as the Atlantic Ocean. It has probably flowed into the Mississippi Embayment—the troughlike structure that reaches northward from the Gulf of Mexico to Cairo, Illinois—for more than 250 million years. "Rivers are born traveling, always wanting to move on, intolerant of restraint and interference—itinerant workers always rambling down the line to see what's around the next bend, growling or singing songs, depending on how things suit them. Now, a lake never goes anywhere or does much. It just sort of lies there, slowly dying in the same bed in which it was born. The lake is a set of more or less predictable conditions—at least, compared to the swiftly changing stream of physical, chemical, and biological variables that constitute a living river" (Madson 1985, 8).



The River Primeval



Immortal River

The Upper Mississippi in
Ancient and Modern Times

Calvin R. Fremling

THE UNIVERSITY OF WISCONSIN PRESS