

The Mississippi Valley "Whole Lotta Shakin' Goin' On"



In the winter of 1811-12, the central Mississippi Valley was struck by three of the most powerful earthquakes in U.S. history. Even today, this region has more earthquakes than any other part of the United States east of the Rocky Mountains. Government agencies, universities, and private organizations are working to increase awareness of the earthquake threat and to reduce loss of life and property in future shocks.

The 400 terrified residents in the town of New Madrid (Missouri) were abruptly awakened by violent shaking and a tremendous roar. It was December 16, 1811, and a powerful earthquake had just struck. This was the first of three magnitude-8 earthquakes and thousands of aftershocks to rock the region that winter.

Survivors reported that the earthquakes caused cracks to open in the earth's surface, the ground to roll in visible waves, and large areas of land to sink or rise. The crew of the New Orleans (the first steamboat on the Mississippi, which was on her maiden voyage) reported mooring to an island only to awake in the morning and find that the island had disappeared below the waters of the Mississippi River. Damage was reported as far away as Charleston, South Carolina, and Washington, D.C.

These dramatic accounts clearly show that destructive earthquakes do not happen only in the western United States. In the past 20 years, scientists have learned that strong earthquakes in the central Mississippi Valley are not freak events but have occurred repeatedly in the geologic past. The area of major earthquake activity also has frequent minor shocks and is known as the New Madrid seismic zone.

Earthquakes in the central or eastern United States affect much larger areas than earthquakes of similar magnitude in the western United States. For example, the San Francisco, California, earthquake of 1906 (magnitude 7.8) was felt 350 miles away in the middle of Nevada, whereas the New Madrid earthquake of December 1811 (magnitude 8.0) rang church bells in Boston, Massachusetts, 1,000 miles away. Differences in geology east and west of the Rocky Mountains cause this strong contrast.

The loss of life and destruction in recent earthquakes of only moderate magnitude (for example, 33 lives and \$20 billion in the 1994 magnitude-6.7 Northridge, California, earthquake and 5,500 lives and \$100 billion in the 1995 magnitude-6.9 Kobe, Japan, earthquake) dramatically emphasize the need for residents of the Mississippi Valley to prepare further for an earthquake of such magnitude. Earthquakes of moderate magnitude occur much more frequently than powerful earthquakes of magnitude 8 to 9; the probability of a moderate earthquake occurring in the New Madrid seismic zone in the near future is high. Scientists estimate that the probability of a magnitude 6 to 7 earthquake occurring in this seismic zone within the next 50 years is higher than 90%. Such an earthquake could hit the Mississippi Valley at any time.

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In 1811, the central Mississippi Valley was sparsely populated. Today, the region is home to millions of people, including those in the cities of St. Louis, Missouri, and Memphis, Tennessee. Adding to the danger, most structures in the region were not built to withstand earthquake shaking, as they have been in California and Japan. Moreover, earthquake preparations also have lagged far behind.

The modern city of Memphis, Tennessee, is built on a high bluff overlooking the Mississippi River. During the New Madrid earthquakes of 1811-12, many landslides occurred along the river. The most devastating effects of the shocks, however, were on the Mississippi itself, where river traffic and commerce were disrupted and boatmen were killed.

AutoZone corporate headquarters in Memphis, Tennessee, is the first building in the central Mississippi Valley to use base isolation. This state-of-the-art engineering design reduces damage by cushioning buildings against earthquake shaking.

Recognizing these problems, the U.S. Geological Survey (USGS) and other organizations are joining in actions that will greatly reduce loss of life and property in future temblors:

- In 1983, the states of Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee formed the Central United States Earthquake Consortium (CUSEC). CUSEC improves public earthquake awareness and education; coordinates multistate planning for earthquake preparedness, response, and recovery; and encourages research in earthquake hazard reduction.
- In 1990, the USGS, advised by private, academic, and government experts, issued a plan for intensified study of the New Madrid seismic zone. At the same time, the National Earthquake Hazards Reduction Program expanded efforts in the central United States.
- Earthquake education is now part of the curriculum in the schools of many CUSEC states. In Kentucky, the state legislature has mandated that earthquake education be taught in schools.
- Earthquake Awareness Weeks have been held in Arkansas and Kentucky for several years, and in Tennessee starting in 1995.
- Volunteer earthquake advisory councils or similar organizations have been formed in most CUSEC states.
- In 1993, with USGS support and collaboration, the CUSEC state geologists began a significant effort to map earthquake hazards. In 1995 they completed a regional soils map that can be used to locate areas likely to experience intense shaking in earthquakes.
- Most CUSEC states have adopted building codes containing modern earthquake design standards.

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- Efforts to ensure the seismic safety of critical structures, such as dams, bridges, and highways, have accelerated. For example, in 1990, transportation agencies in Illinois, Kentucky, and Tennessee initiated programs to strengthen highway bridges that do not meet earthquake design standards.

The central Mississippi Valley is the most earthquake-prone region of the United States east of the Rocky Mountains. Crosses show the locations of the many earthquakes recorded in the New Madrid seismic zone since 1974.

Strong earthquakes in the New Madrid seismic zone are certain to occur in the future. In contrast to the western United States the causes and effects of earthquakes in the central and eastern United States are just beginning to be understood. Through better understanding of earthquake hazards and through public education, earth scientists and engineers are helping to protect the citizens of all parts the United States from loss of life and property in future earthquakes.

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