USGS science for a changing world

North Dakota State Water Commission

Red River Watershed Management Board

Red River Joint Water Resource District

Upper Sheyenne River Joint Water Resource Board

A HISTORY of Flooding in the Red River Basin

Major Red River of the North (Red River) Floods

- 1700s Large flood in 1776 according to anecdotal accounts; floods in Canada, especially in 1747 and 1762, substantiated by tree-ring evidence.
- 1826 Flood of record in Canada that destroyed settlements.
- 1882 Large flood at Fargo, N. Dak./ Moorhead, Minn., and Grand Forks, N. Dak./East Grand Forks, Minn.
- 1897 Largest flood on record at Fargo.
- 1916 Large flood in Fargo and on upstream reaches; sizeable flood in Canada.
- 1943 Large flood in Fargo/Moorhead; in an 11-day period, the Red River rose about 23 feet; St. John's hospital was engulfed and 270 families were forced from their homes.
- 1950 Flood that caused most severe damage ever sustained up to this point--extended time for flooding; major disaster in Winnipeg with one-third of city evacuated.
- 1965 Widespread flooding caused by heavy rain on frozen ground.
- 1966 Severe flooding from United States/Canada border to Winnipeg.
- 1969 Maximum discharge recorded on the Red River at Fargo/Moorhead and Wahpeton, N. Dak./Breckenridge, Minn., and in some areas on the Sheyenne River to this date; first flood to be diverted around Winnipeg by Red River floodway.
- 1975 Flood that included two peaks, in spring and summer.
- 1979 Second largest flood after 1897 (to this date) at Grand Forks and in Canada.
- 1989 Flood that severely damaged the cities of Wahpeton and Breckenridge.
- 1993 Summer flood caused by a series of intense thunderstorms at various locations throughout the basin.
- 1997 Major flooding in United States and Canada; largest recorded flood in Grand Forks/East Grand Forks; second largest in Fargo/Moorhead and Wahpeton/Breckenridge.
- 2001 Significant flooding caused by heavy rains on frozen ground in addition to above-average snowfall.
- 2002 June flooding in northwestern Minnesota, especially in Roseau, Minn., and northeastern North Dakota caused by intense rainfall.
- 2006 Spring flooding throughout basin; most cities well prepared because of improvements made since 1997.

View of East Grand Forks, Minn., during Red River flood of 1897. Center span of Northern Pacific Railroad bridge pivoted horizontally to allow ice to flow past. Engines are parked on stationary spans to weigh down bridge ▶

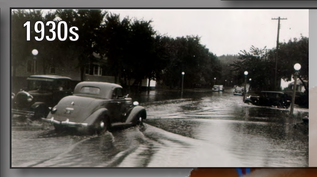
U.S. Geological Survey employees transported by National Guard personnel to site on Sorlie Bridge between Grand Forks, N. Dak., and East Grand Forks, Minn., during Red River flood of 1997 ▼

▲ Obelisk standing in 2006 Red River floodwaters at Grand Forks, N. Dak., showing flood peak elevations for other significant Red River floods

Diked homes at Grand Forks, N. Dak., during Red River flood, spring 1997 ▼

Flooded street in Valley City, N. Dak., during Sheyenne River flood in 1930s
(Photo from Barnes County Historical Society) ▶

▲ Dike construction to protect home from floodwaters during Sheyenne River flood of 1979
(Photo from Barnes County Historical Society)



▲ Viking Bridge in Valley City, N. Dak., during Sheyenne River flood of 1969, at gage height of 17.63 feet
(Photo from Barnes County Historical Society)

▲ Wooden blocks that once paved the streets of Fargo, N. Dak., piled up during Red River flood of 1897
(Photo from Institute for Regional Studies, North Dakota State University, Fargo 2006.83.19)

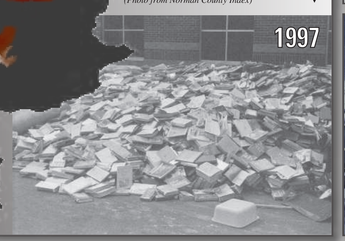
Red Owl Super Market in flooded area of Fargo, N. Dak., during Red River flood of 1943
(Photo from State Historical Society of North Dakota 0378-015) ▶

Headwaters of Red River in Breckenridge, Minn., during spring 2001 ▼

◄ Man rowing boat in Moorhead, Minn., during Red River flood of 1897
(Photo from Institute for Regional Studies, North Dakota State University, Fargo 328.2.14)

Corner of Fifth Street and Hill Avenue in Grafton, N. Dak., during Park River flood of 1950 ▼

The Ada Public Library in Ada, Minn., lost its entire collection to the Wild Rice River flood of 1997 *(Photo from Norman County Index)* ▼



▲ USGS personnel measuring flood overflow at bridge on Red River east of Thompson, N. Dak., during Red River flood of 2001

◄ Aerial south-facing (downstream) view of Red River south of Drayton, N. Dak., during flood of 1950
(Photo from Elwyn B. Robinson Department of Special Collections, Chester Fritz Library, University of North Dakota)

Crookston Mayor Oppegaarde and Governor Youngdahl view Red Lake River flood at Crookston, Minn., in 1950
(Photo from Minnesota State Historical Society) ▼

Factors contributing to flooding in the Red River Basin:

Landform factors

- A relatively shallow and meandering river channel–a shallow channel holds less water and the meandering can cause flow to slow down as the channel makes its turns, causing overbank flooding.
- A gentle slope (averaging 0.5 to 1.5 feet per mile) that inhibits channel flow and encourages overland flooding or water "ponding" (especially on even, saturated ground) in the basin.
- The northerly direction of flow–flow in the Red River travels from south (upstream) to north (downstream). The direction of flow becomes a critical factor in the spring when the southern (upstream) part of the Red River has thawed and the northern (downstream) part of the channel is still frozen. As water moves north toward the still frozen river channel, ice jams and substantial backwater flow and flooding can occur.

Weather factors

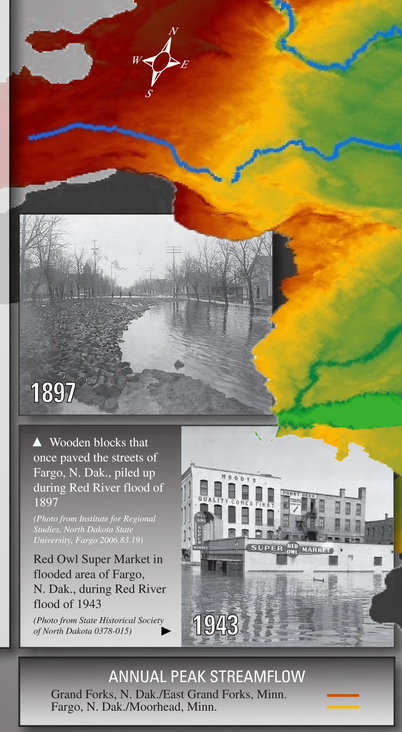
Spring (snowmelt) floods

- Above-normal amounts of precipitation in the fall of the year that produce high levels of soil moisture, particularly in flat surface areas, in the basin.
- Freezing of saturated ground in late fall or early winter, before significant snowfall occurs, that produces a hard, deep frost that limits infiltration of runoff during snowmelt.
- Above-normal winter snowfall in the basin.
- Above-normal precipitation during snowmelt.
- Above-normal temperatures during snowmelt.

Summer floods

- Above-normal or intense precipitation in the same area over a short duration from May through October.
- Saturated ground causing more runoff.
- Limited vegetative cover leading to less absorption of water and more runoff.

Landform factors, combined with any or all of the weather factors, determine the severity of flooding. For example, *below-normal fall precipitation* combined with *above-normal winter snowfall*, *above-normal temperatures* during snowmelt, and *above-normal precipitation* during snowmelt can lead to significant flooding. In contrast, *below-normal fall precipitation* combined with *above-normal winter snowfall*, *below normal temperatures* during snowmelt, and *little precipitation* during snowmelt may cause only minimal flooding. Most of the catastrophic floods that occurred in the Red River Basin were caused by a combination of landform factors, and most or all of the weather factors affected the magnitude of those floods.



THREE-DIMENSIONAL PERSPECTIVE OF THE RED RIVER OF THE NORTH BASIN IN THE UNITED STATES

Elevation (feet)
High : 2,000
Low : 750

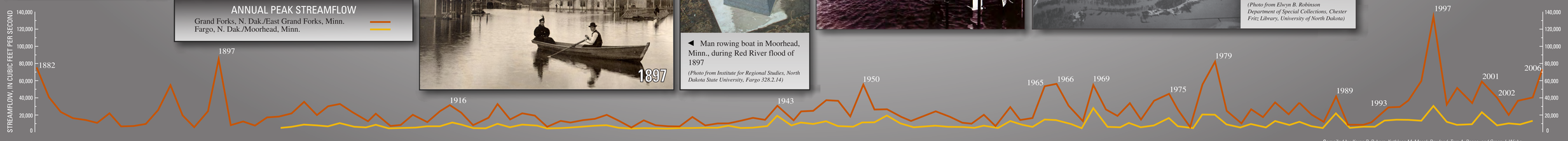
USGS gaging station at or near town indicated

City

The basin image is tilted to create three-dimensional perspective. This distorts distances, causing the southern end of the basin to be stretched and the northern end of the basin to be compressed.

ANNUAL PEAK STREAMFLOW

Grand Forks, N. Dak./East Grand Forks, Minn.
Fargo, N. Dak./Moorhead, Minn.



Sources of Information:
North Dakota State Water Commission Web Site -- http://swc.nd.gov/
Red River Watershed Management Board Web Site -- http://www.rrwmb.org/
U.S. Geological Survey Minnesota Water Science Center Web Site -- http://mn.water.usgs.gov
U.S. Geological Survey North Dakota Water Science Center Web Site -- http://nd.water.usgs.gov

The U.S. Geological Survey (USGS), one of the principal Federal agencies responsible for the collection and interpretation of water-resources data, works with other Federal, State, local, tribal, and academic entities to ensure that accurate and timely data are available for making decisions regarding public welfare and property during natural disasters and to increase public awareness of the hazards that occur with such disasters.

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