Lewis and Clark data show narrower, more flood-prone River

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A geologist at Washington University in St. Louis and his collaborator at Oxford University have interpreted data that Lewis and Clark collected during their famous expedition and found that the Missouri River has markedly narrowed and its water levels have become more variable over the past two hundred years.

This narrowing, or channeling, created by wing dikes and levees constructed mainly in the 20th century, has put the Missouri River at an increased risk of more damaging floods, the authors say. They blame the fact that the river cannot spread out as it did naturally at the turn of the 19th century, thus forcing water levels higher. River narrowing also leads to greater fluctuation in day-to-day and seasonal water level height which may be partly to blame for declines in river wildlife, especially shallow-water spawning fish, birds nesting on sandbars, and wetland vegetation.

"The contrast is amazing if you compare graphs of river height against time taken in the 19th century vs. the 20th century. You'd think you were looking at two different rivers. The river today is 'flashy' with rapid up and down jumps in river height." said Bethany Ehlmann, the study's lead author and a Washington University graduate and Rhodes Scholar, who completed the study for her master's degree at Oxford University. "But if you look at data collected by Lewis and Clark in 1804 it matches almost perfectly with the second oldest data we have from the 1860s."

The quantitative data that Lewis and Clark collected is solid science that has been overlooked these two hundred years, according to coauthor

Robert Criss, Ph.D., Washington University professor of earth and planetary sciences in Arts & Sciences.

"Little attention has been paid to the remarkable measurements that these explorers made," said Criss, who in 2003 interpreted Lewis and Clark measurements to provide the oldest determinations of the magnetic declination of America's interior. "These men were gifted quantitative scientists. They gathered lots of valuable, accurate data that has not been evaluated. Lewis and Clark's scientific legacy has been almost completely overshadowed by emphasis on the heroic and patriotic aspects of manifest destiny and westward expansion.

They killed a bear, they measured a river

"Now, that's a wonderful story, told repeatedly many times over. It's very fun and inspiring reading, but it's all this' We killed a bear' stuff. The neglected story is the value of the day-to-day quantitative measurements that Lewis and Clark made. Every page of their journals is full of numbers and scientific experiments. "They did a very fine job of measuring the river."

Criss said that Lewis and Clark at their Dubois and Fort Mandan river camps put sticks in the river each day and recorded in inches how much the river rose or fell each day. To get river width the Lewis and Clark explorers used surveying equipment, chains and compasses.

Criss and Ehlmann, now a doctoral candidate in geological sciences at Brown University, show many applications of Lewis and Clark's data in their paper published in the Nov. 2006 issue of *Geology*. For example, Lewis and Clark measured the Missouri River at St. Charles as 720 yards wide. Contemporary U.S. Army Corps of Engineers and United States Geological Services records show that the width now is just 470 yards across. Similarly, at the confluence of the Osage River and at Kansas

City, Lewis and Clark measured the width of the Missouri River as 875 and 500 yards, respectively, which compare with contemporary readings of 400 and 330 yards, respectively.

Human changes to the Missouri River for irrigation, flood control, and navigation began in the early 19th century, just shortly after the voyage of Lewis and Clark. However, river discharge volume was not regularly recorded until the 1930s, long after denuding the shore of forests and river channeling with wing dikes had severely impacted the character and ecology of the river.

"What was the river like before we changed it?" Ehlmann asked rhetorically. "No one had looked at records before the 20th century. So we took Lewis and Clark's data, stage [water level] data from government records published in the late 1800s, and modern electronic stage files and did the simplest thing possible to look at the 200 -year record." Because stage data was always recorded relative to something — "and we didn't know always what that something was," said Ehlmann — the authors measured change in height from day to day and change in maximum and minimum annual heights relative to the annual mean. The authors found the increased variability in both measures began around 1900, just as intensive channelization began.

"We now have a composite record for the Missouri river that's almost three times as long as the previous one," Criss said. "The Lewis and Clark data give us a benchmark for the natural condition, which is so important in ecological studies. Whether you're studying rivers, as I do, or global warming, you have to know what's 'normal' to understand the history of the natural world. We now have a pre-development baseline for the Missouri River."

"As policy makers balance different needs in deciding how to manage the river, we hope that this new record will aid in establishing better

flood control techniques and promoting ecosystem restoration," Ehlmann added. "Making room for the river, at least in some stretches, seems to solve both goals at the same time."

Source: Washington University in St. Louis, By Tony Fitzpatrick