After the recent floods, how much worse will it get with climate change, and could floodwaters be put to better use?

Reshaping the Mississippi

Climate change could well bring increased rainfall to North America, but deciding how – or whether – to reinforce the Mississippi river defences is a challenge.

This year’s floods have “set records in half a dozen places along the river”, says Mike Petersen, a spokesman for the US Army Corps of Engineers. However, the maximum flow at the intersection of the Ohio and Mississippi rivers – 680,000 cubic metres per second – is still similar to the maximum possible flow predicted in 1928. The question now is: will climate change tip flood flow rates beyond 20th-century predictions?

In short – and frustratingly – no one knows for sure. Eugene Takle of Iowa State University in Ames is studying how climate change will influence the water flowing through the Upper Mississippi river basin, but making predictions here is difficult: the area is very sensitive to change, as it lies at the intersection of the Pacific and Arctic air masses and those from the Gulf of Mexico.

One of Takle’s models, built in 2004, suggested flow at the confluence of the Mississippi and Missouri rivers could increase by 50 per cent (Journal of Geophysical Research, DOI: 10.1029/2003JD003686), but a follow-up study last year failed to produce such a clear result.

Meanwhile, the much larger Ohio river contributes far more to flooding in the southern US than the Upper Mississippi river. “Perhaps we should watch the Ohio river even more carefully,” says William Gutowski, also of Iowa State University.

Petersen says this year’s floods will prompt another look at flood flow frequency. But, he argues, the Corps of Engineers has a good track record of assessing future risk. “We are seeing living proof of that right now,” he says. Climate change will certainly be a factor in future, he adds – but it may be too early to say in what way.
Making Marshes on the Mississippi Delta

On 14 May the US Army Corps of Engineers opened a gate on the Morganza flood control structure for the first time since 1973 (see map). The Morganza Floodway, and the Old River control structures upstream, which were also opened, divert water from the main channel of the Mississippi through the Atchafalaya basin. Those living downstream are losing their property to protect Baton Rouge and New Orleans; opening the Bonnet Carré Spillway helped New Orleans too. But there should be ecological benefits. The waters contain sediment, which will be deposited to build new marsh. “There will be new land there,” says Denise Reed at the University of New Orleans. “I’m convinced of that.”

Any recovery of Louisiana’s eroded coastal marshes is welcome - but the most urgent need is to restore those to the south and east of New Orleans. The opening of the Morganza Spillway, argue ecologists, will bolster the case for similar diversions to deposit sediment downstream. In the aftermath of hurricane Katrina, the state of Louisiana started work on a “Master Plan” to allow more water to flow through the marshes south of New Orleans and deposit its sediment. Specific proposals already exist for two new diversions: the White Ditch and Myrtle Grove projects. These would divert water and sediment into degraded marshes on either side of the main river channel - but each would likely cost $100 million, says Kirk Rhinehart, head of planning with the Louisiana Office of Coastal Protection and Restoration.

Some people would lose out from such diversions: regular flows of fresh water into the marshes could threaten oyster and shrimp fisheries. But Reed thinks it’s a viable plan. She points to the successful operation of the Yolo Bypass on the Sacramento River in California. The plain is flooded in winter and spring to protect the city of Sacramento, but used for farming in the dry summer months.

Dead Seas

Floods may provide opportunities to restore Louisiana’s coastal marshes, but they are bad news out at sea. Floodwaters bring more nutrients into the Gulf, forming algal blooms, says Nancy Rabelais of the Louisiana Universities Marine Consortium in Chauvin. When the algae die, they are decomposed by bacteria. This sucks oxygen from the water to create a “dead zone”.

Initial calculations suggest that this year’s bloom may cover a record 24,000 square kilometres, partly because of the diversion of water down the Atchafalaya basin. Worse may follow with climate change. A doubling of atmospheric CO₂ from pre-industrial levels could lead to rising river flows, and this in turn could decrease summertime oxygen levels in the deep waters of the northern Gulf by 30 to 60 per cent, compared with the average between 1982 and 1995, say Rabelais and colleagues (Limnology and Oceanography, vol 41, p 992).