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Weeks of Storms Test California's Approach to Taming Nature

As global warming brings more intense rainfall, experts say the state needs to give rivers more room to flood safely. But the obstacles are enormous.

By Christopher Flavelle and Raymond Zhong

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As California battles a third week of lashing rain and snow that have flooded communities, broken levees and toppled power lines, the state is facing questions about whether its approach to handling crippling storms is suited to 21st-century climate threats.

For decades, federal and state planners built dams and levees in California to store water and keep it at bay. But as climate change increases the risk of stronger and more destructive storms, experts and some policymakers are urging another approach: giving rivers room to overflow.

Moving levees farther away from waterways allows more rainwater and snowmelt to seep into underground aquifers, where it is essentially kept in reserve to help during periods of drought, and also protects people and property from floods. But doing so often requires government agencies to buy riverside land, something difficult to do in a state where land values are high and public finances are tight.

"You've got to find the room, you've got to find the support, and you've got to fund it," said Jane Dolan, president of the Central Valley Flood Protection Board, the state agency that oversees flood management in California's vast agricultural heartland.

As human activity continues to heat the planet, warmer air holds more moisture. That means storms that blow through California most winters, known as atmospheric rivers for their long shape and the huge amounts of water they carry, are more likely to be extremely intense.



(Above) Repairs to a levee on the Cosumnes River near Wilton, Calif., that was breached by heavy rains on Monday. *Fred Greaves/Reuters*

Atmospheric rivers that come in a rapid-fire procession, like those in California since late December, can be particularly dangerous. Land and streams already saturated from one downpour simply can't accommodate water from the next one, which amplifies the potential for flooding and landslides. The most catastrophic flooding in modern California history took place in the winter of 1861, when successive weeks of powerful storms caused epochal deluges across the West Coast. Climate scientists now say the risks of storm sequences of similar intensity are rising as Earth warms.

"At a point, rivers don't have time to recede," said Larry Schick, a meteorologist formerly with the Army Corps of Engineers. "That is when the trouble starts."

In California, dams, levees and other "gray infrastructure" —



so-called for its reliance on concrete and man-made structures — helped fuel the state’s prosperity. Much of the state’s economy is powered by agriculture in the Central Valley, which grows about a quarter of the nation’s food. But that success has come at a cost.

Levees can create an exaggerated sense of security, encouraging the construction of homes and businesses around them, according to Jeffrey Mount, a senior fellow at the Public Policy Institute of California, a research organization. Local officials have a financial incentive to allow that development: State law caps increases in property taxes, so the best way to come up with new tax revenue is to permit new homes.

“That pressure to grow has resulted in a pressure to put in as much gray infrastructure as you can,” Dr. Mount said. And as development increases, so does the potential for destruction if those levees fail.

Relying heavily on levees carries another type of cost, according to Joshua Viers, a watershed scientist at the University of California, Merced. By seeking to tame its rivers, California has reduced the amount of water reaching its underground aquifers — the same aquifers that farmers and towns are increasingly turning to during droughts.

The groundwater that feeds California’s drinking wells and many of its irrigation pumps is replenished when surface water seeps through the soil. By constraining the width of rivers, levees impede that process, limiting the amount of ground that water can reach and filter through.



(Above) Crews in Los Angeles worked to put in barriers to divert debris brought by heavy rainfall in the Laurel Canyon neighborhood on Wednesday. *Alisha Jucevic for The New York Times*

“We’ve cut off the very mechanism by which groundwater recharge used to happen,” Dr. Viers said.

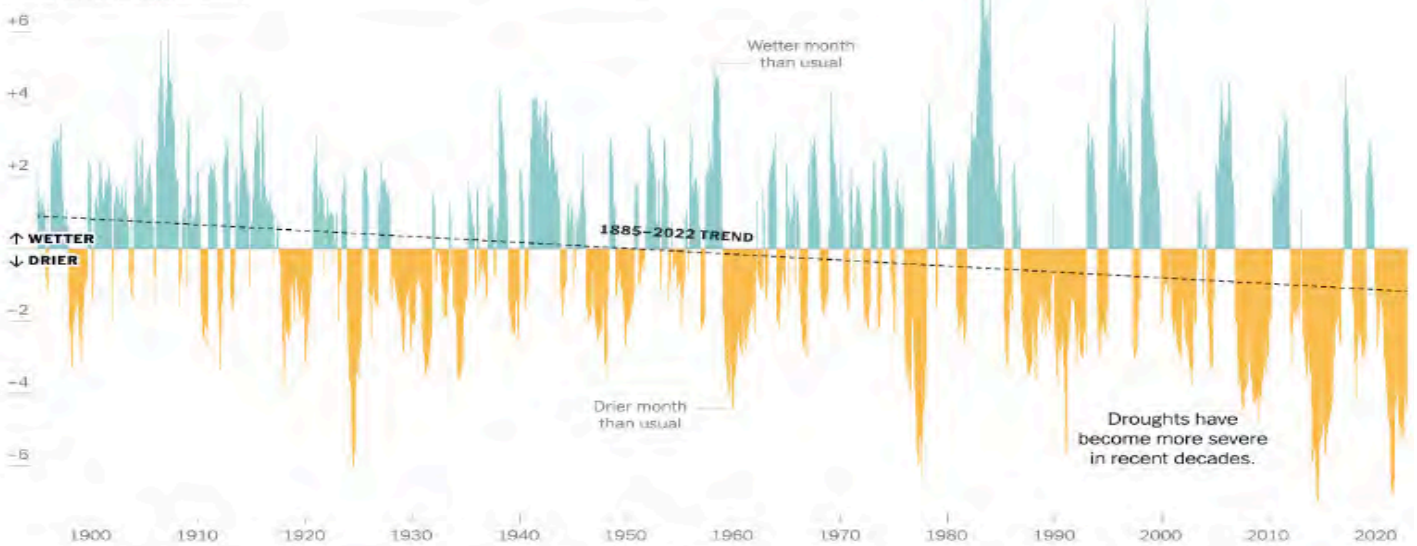
The state has already adjusted some policies to acknowledge, at least implicitly, that levees and other infrastructure can’t prevent all flooding, and that the priority must be to ensure flooding happens in places where it won’t be most catastrophic.

In the Central Valley, California since 2007 has mandated a two-tier system of levees. In more-populated areas, they must be designed to withstand floods that have a 1-in-200, or 0.5 percent,

California’s Water Whiplash

Recent storms come amid one of the worst droughts the state has seen. Intense rainfall during droughts is dangerous because parched ground becomes less absorbent and more prone to runoff and landslides.

Palmer Drought Severity Index



Source: NOAA National Centers for Environmental Information By Mira Rojanasakul

chance of occurring in any year. But levees in rural areas don't need to be as robust.

The dual standard helps prioritize investment in the valley's most-populated regions. But in some river systems, it also represents an unspoken strategy for managing deluges: During large storms, upstream agricultural areas become more likely to flood first, absorbing water so cities downstream might be spared the worst.

Some parts of the state have begun experimenting with moving people and development away from rivers. In the city of West Sacramento, a stretch of the Sacramento River has more room to flow thanks to a new "setback" levee, which is essentially a second levee farther from the river.

Before the project was started in 2011, homes and farmland sat right behind the main levee, exposing them to flooding. Now, when the river is high, water sweeps through the tree-filled space between the two levees instead, as it has during the recent rains.

The Army Corps of Engineers, which is responsible for planning and designing federally funded levees, has become more open to the concept of creating additional room for rivers.

Beth Salyers, the deputy district engineer for the Corps's Sacramento District, which includes much of the central and northern part of the state, said her agency was increasingly embracing what she called "engineering with nature."

"As we do our flood projects, ecosystem restoration is something that we're starting to see incorporated," Ms. Salyers said. "As time goes on, we learn and we grow."

It's not clear how much the Corps's stated support has translated into flood management projects.

Efforts to pull levees back from rivers face big challenges. To complete the setback levee project in West Sacramento, the city had to relocate roughly a dozen households near the river, said Paul Dirksen, the flood protection planner for the city. Some of the negotiations with property owners were tough.

Mr. Dirksen remembers one case particularly clearly. "It was a grand house," he said. "And that person thought that they were going to live there for the rest of their life. So they had a lot of emotion around that."

Local officials in California can be reluctant to take farmland near rivers out of production, said Julie Rentner, president of River Partners, an environmental group that works on floodplain restoration projects in the state. "Land that's making a product like milk or almonds or walnuts pays higher property taxes than land that's providing wildlife habitat and flood relief," she said.

River Partners played a key role in creating the Dos Rios Ranch Preserve, a 2,100-acre floodway expansion near the confluence of the San Joaquin and Tuolumne rivers. The area was once a dairy and cattle operation but is now a verdant habitat for birds and fish. If the rivers overtop their banks, water can inundate the plot safely, reducing flood risk downriver.



(Above) A flooded area of Sacramento County this week.
Fred Greaves/Reuters

The project took years to complete, though, and lots of delicate work to cobble together government funding, Ms. Rentner said. It was 2006 when River Partners began working on buying Dos Rios Ranch from the family that owned it, she said. The deal closed in 2012.

"Six years of trying to secure the money to do one land transaction," she said. "Absurd."

The biggest obstacle to making room for rivers might be changing how the state views its relationship with the natural world, said Dr. Viers of the University of California.

"We've spent 150 years in the West trying to tame nature," he said. "The idea of letting nature go runs counter to 150 years of practice. That's the hard part."

Christopher Flavelle is a Washington-based climate reporter for The Times, focusing on how people, governments and industries try to cope with the effects of global warming.

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