

Forests and Flooding



At its root, the flood equation is pretty simple: If a river cannot handle the load of water it's required to carry, it must rise. With enough water, it must rise above its banks and flood.

The faster water runs from the watershed into the river, the higher a flood will be. Thus anything that increases runoff speed -- like excessive pavement or ditching of farmland -- will contribute to floods.

Deforestation plays several roles in the flooding equation because trees prevent sediment runoff and forests hold and use more water than farms or grasslands.

Some rainwater stays on the leaves, and it may evaporate directly to the air (the more water used in the watershed, the less remains to run off).

Leaves reduce raindrop impact, and gentler rain causes less erosion.

Tree roots absorb water from the soil, making the soil drier and able to store more rainwater.

Tree roots hold the soil in place, reducing the movement of sediment that can shrink river channels downstream.

The loss of trees played a major role in the huge Yangtze flood of 1998, says Janet Abramovitz of Worldwatch, who observes that the Yangtze watershed had lost 85 percent of its forest cover in the past few decades. Although two other causes of trouble that we'll examine shortly were also at play -- loss of wetlands and river engineering -- Abramovitz says the Chinese government "was trying to blame it all on heavy rains, maybe El Nino or global warming." She says a new, \$2 billion plan to reforest the Yangtze basin is "Certainly ... a very clear sign from the government that deforestation was a problem."

Lotta logging

It doesn't take an environmentalist to hate a clear-cut -- acres of tree stumps make a lousy backdrop for Smoky the Bear. In terms of flooding, the unimpeded raindrop impact on bare ground leads to heavy erosion and quick runoff.

According to Susan Bolton of the University of Washington, the impact comes worst immediately after logging: For the first three or four years, she says, runoff and erosion are greatly increased.

Bolton says research in small watersheds shows that after logging, "you might get twice the peak flow, but only for a few years. In real forestry, you grow the trees back," she adds, so that after 30 or 40 years, runoff amounts fall to forested levels.

In larger watersheds, at least in the Pacific Northwest, logging tends to have less impact on peak flows, because only a small portion has been recently clear-cut, she adds. "The larger the watershed, the less impact the land use has," because land that's put to varying uses does not dump all the runoff at once to streams and rivers.

Deforestation has a second impact on flooding -- the release of sediment. Vast amounts of eroded soil wind up in river beds, shrinking channels and the river's ability to carry water without flooding. "The extreme deforestation in the Himalayas, in Nepal, undoubtedly contributes to the sedimentation problem in rivers draining the region," Bolton says. "The same amount of water floods more than before."

Rotten roads, dastardly development

While Bolton says logging has a substantial but temporary impact, roads built to haul logs have a more malignant effect on floods because roads tend to be permanent. Roads cause soil compaction, and the culverts that funnel water beneath them focus the runoff in gullies. As a result, she says, there's "an increasing emphasis on roads in forestry right now."

Traditionally, roads were sloped so water gathers on the uphill side, only to be drained through culverts, which cause great erosion. Some roads are now sloped so water spills directly onto the slope, Bolton says, reducing the gullying and improving infiltration into the soil.

New roads are one thing. But there are literally millions of miles of roads in U.S. forests, and while the U.S. Forest Service does have a program to remove some, Bolton admits "It's not like you can just erase 50 years of history just like that." Road removal, she says, "can be more expensive than building them in the first place."

Large amounts of pavement speed runoff and hinder infiltration. The result is faster, higher floods downstream.

Even more problematic than roads, says Bolton, is suburban development, which is "permanent and very pavement-oriented. There's no doubt in my mind that's the biggest source of flooding" in many areas. Developers can reduce the rate of runoff by finding alternatives to paving, building catch basins to recharge the groundwater, avoiding stream channelization (so water reaches the rivers more slowly) and restoring damaged wetlands.