

The Hows and Whys of Floods

On one level, floods are pretty easy to understand.

Most of us have studied the "water cycle", or "hydrological system", in school. Water circulates from clouds to the soil to streams to rivers to the oceans and then returns to the clouds. When that system backs-up there is a flood.

"There's more water flowing through the hydrological system than the system can draw off," says Frank Richards, a National Weather Service hydrologist (a water scientist). "A flood is an imbalance."

What causes a flood?

A number of factors can contribute to that imbalance, including:

- heavy, intense rainfall
- run-off from a deep snow cover
- over-saturated soil, when the ground can't hold anymore water.
- frozen soil
- high river, stream or reservoir levels caused by unusually large amounts of rain
- ice jams in rivers
- urbanization, or lots of buildings and parking lots

There are two basic types of floods. In a regular river flood, water slowly climbs over the edges of a river. The more dangerous type, a flash flood, occurs when a wall of water quickly sweeps over an area. Almost three-quarters of the approximately 92 deaths from floods each year are due to flash floods.

Conquering the Flash Flood.

"Because the rainfall associated with flash flooding is so intense, it is among the most challenging problems we have in meteorology," Richards says. "Bottom line is, we don't do a good of predicting exactly where that type of rainfall will fall."

But that may soon change. The National Weather Service is responsible for predicting the weather and warning people about severe weather. Up until now, meteorologists could only guess when a flash flood would occur. Now, they have a new tool, called Doppler radars, which can track rainfall street by street. This should provide more accurate flash flood warnings across the country. The new radar systems should allow meteorologists to provide warnings before a flash flood occurs.

Controlling the river flood.

River flooding, while often more damaging to property, is much easier to predict. The land around a river is called a watershed. When rain falls on a watershed, the land "sheds" the water into the river. "It's almost like a funnel," Richards says. "It's collecting water over a broad area and funnelling it this narrow strip that is the river."

Residents and scientists can tell when there has been an unusual amount of snow and rain, and they can see the river getting higher everyday. Early prediction gives emergency

officials time to evacuate residents in the danger areas. For example, during the spring of 1997, the heavy flooding of cities along the Red River in North Dakota and Minnesota was predicted two months in advance.

Another winter-related cause of river flooding is ice jams. At times, large chunks of floating ice will pile up if they hit bend, bridge or other obstruction and stop the river's flow.

"The phenomenon is very like when you were on an Interstate highway in an urban area, and there's some sort of construction area where you go from a certain number of lanes to one lane," Richards says. "The traffic backs up."

The '97 floods in the Upper Plains states were caused by heavy rainfall during the fall. Water from that record rainfall froze, and snow then fell on the ice. When the spring thaw came, not only the water from the winter snowfall but also the water from the earlier autumn rainfall rushed into the Red River.

Human progress vs. Mother Nature.

Human activity that changes the surface of the Earth also effects the water cycle, and can cause floods. Buildings, parking lots and roads, replace grass and dirt with concrete. Under normal circumstances, soil acts like a sponge and soaks up a fair portion of rainwater. But in crowded towns and cities, rainwater flows into storm sewers and drainage ditches, and, at times, overloads them. An urban area can be flooded by an amount of rainfall that would have had no impact in a rural area.

The destruction of the nation's wetlands may also contribute to moderate floods. The wetlands are the swampy land along the edges of some rivers. When it rains, the wet soil and mud of a wetland acts like a sponge and stores the extra water. But much of America's wetlands have been drained for farmland or to build houses. The only place flood water can go is up and over its normal riverbanks and into areas where it can cause major damage.

Floods are primarily natural events. Human activity influences the frequency and severity of floods, but they are created by Mother Nature. There is no really workable protection against major floods like those that hit Grand Forks in the spring of 1997 and the Mississippi River Basin in 1993. Our best defense against floods is an understanding of the way people treat their environment and better weather prediction.