

## **Hazards Associated with Flooding**

Hazards associated with flooding can be divided into primary hazards that occur due to contact with water, secondary effects that occur because of the flooding, such as disruption of services, health impacts such as famine and disease, and tertiary effects such as changes in the position of river channels. Throughout the last century flooding has been one of the most costly disasters in terms of both property damage and human casualties. Major floods in China, for example, killed about 2 million people in 1887, nearly 4 million in 1931, and about 1 million in 1938. The 1993 flood on the upper Mississippi River and Midwest killed only 47 people, but the U.S. Army Corps of Engineers estimates the total economic loss at between 15 and 20 billion dollars.

### **Primary Effects**

Again, the primary effects of floods are those due to direct contact with the flood waters. Water velocities tend to be high in floods. As discharge increases velocity increases.

- With higher velocities, streams are able to transport larger particles as suspended load. Such large particles include not only rocks and sediment, but, during a flood, could include such large objects as automobiles, houses and bridges.
- Massive amounts of erosion can be accomplished by flood waters. Such erosion can undermine bridge structures, levees, and buildings causing their collapse.
- Water entering human built structures cause water damage. Even with minor flooding of homes, furniture is ruined, floors and walls are damaged, and anything that comes in contact with the water is likely to be damaged or lost. Flooding of automobiles usually results in damage that cannot easily be repaired.
- The high velocity of flood waters allows the water to carry more sediment as suspended load. When the flood waters retreat, velocity is generally much lower and sediment is deposited. After retreat of the floodwaters everything is usually covered with a thick layer of stream deposited mud, including the interior of buildings.
- Flooding of farmland usually results in crop loss. Livestock, pets, and other animals are often carried away and drown.
- Humans that get caught in the high velocity flood waters are often drowned by the water.
- Floodwaters can concentrate garbage, debris, and toxic pollutants that can cause the secondary effects of health hazards.

### **Secondary and Tertiary Effects**

Remember that secondary effects are those that occur because of the primary effects and tertiary effects are the long term changes that take place. Among the secondary effects of a flood are:

- Disruption of services –
  - Drinking water supplies may become polluted, especially if sewerage treatment plants are flooded. This may result in disease and other health effects, especially in under developed countries.
  - Gas and electrical service may be disrupted.

- Transportation systems may be disrupted, resulting in shortages of food and clean-up supplies. In under developed countries food shortages often lead to starvation.
- Long - term effects (tertiary effects)-
  - Location of river channels may change as the result of flooding, new channels develop, leaving the old channels dry.
  - Sediment deposited by flooding may destroy farm land (although silt deposited by floodwaters could also help to increase agricultural productivity).
  - Jobs may be lost due to the disruption of services, destruction of business, etc. (although jobs may be gained in the construction industry to help rebuild or repair flood damage).
  - Insurance rates may increase.
  - Corruption may result from misuse of relief funds.
  - Destruction of wildlife habitat.

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[http://www.tulane.edu/~sanelson/Natural\\_Disasters/floodhaz.htm](http://www.tulane.edu/~sanelson/Natural_Disasters/floodhaz.htm)

### **Flood and other Risk Resources**

Discovery Report Brandywine-Christina Watershed, HUC 02040205 Specific flood risks for Chester, Delaware, and Lancaster Counties, Pennsylvania, Cecil County, Maryland and New Castle County, Delaware

<https://www.rampp-team.com/documents/pennsylvania/watershed/Brandywine-Christina/BCReport-FINAL.pdf>

Multi-Jurisdictional Hazard Mitigation Plan Chester County

<https://chesco.org/DocumentCenter/View/31981>

Health risks and hazards caused by floods Naoki Minamiguchi

[https://www.ssi.dk/~media/Indhold/DK%20-](https://www.ssi.dk/~media/Indhold/DK%20-%20dansk/Smitteberedskab/Infektionshygiejne/Vandskade/Health%20risks%20and%20hazards%20caused%20by%20floods.ashx)

[%20dansk/Smitteberedskab/Infektionshygiejne/Vandskade/Health%20risks%20and%20hazards%20caused%20by%20floods.ashx](https://www.ssi.dk/~media/Indhold/DK%20-%20dansk/Smitteberedskab/Infektionshygiejne/Vandskade/Health%20risks%20and%20hazards%20caused%20by%20floods.ashx)

The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment

<https://health2016.globalchange.gov/>