

Floods which devastated Waverly, Tennessee driven by same processes as other extreme weather events fueled by man-made climate change

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Flash flooding in Tennessee last week that swept more than a dozen men, women and children to their deaths mirrored similar recent record-breaking and deadly flooding in Europe and elsewhere in the world which has been fueled by man-made climate change.

Rural Humphreys County and its county seat of Waverly, just over an hour west of Nashville, Tennessee, were soaked late last week by 17 inches of rain in less than 24 hours, far surpassing the previous state record of 13.6 inches that deluged Milan in Gibson County almost 40 years ago. Notably, Humphreys County's western border is the Tennessee River, which a number of small streams and rivers eventually empty into, unless a large river along the way swells and forces water back up those tributaries, causing them to flood.

In 2010, the Cumberland River that runs through Nashville experienced a "1,000-year flood" (a flood expected once every 1,000 years) resulting in the deaths of more than 20 people and doing more than a billion dollars of damage.

The number of dead from this latest flood disaster is 18 so far, as emergency management crews continue to look for three people still missing. Amid the tumble of cars, homes and trees, there is still lingering confusion in accounting for everyone.

When the dirty, brown flood waters began to recede on Monday, the extent of the damage could be seen—from houses ripped from their foundations, to cars and trucks wedged in piles under bridges. But even the flood waters could not prevent fires that continued to burn Monday from what officials described as blown

electrical and gas lines.

"[T]he chance of getting over 17 inches of rain in 24 hours in any year at Waverly, TN is much more rare than 1 in 1,000," Geoffrey Bonnin, a hydrologist retired from the National Oceanic and Atmospheric Administration (NOAA), said in a Facebook message to the Capital Weather Gang reported by the *Washington Post*. He noted that "that amount of rain is so rare that NOAA doesn't have sufficient historical data to quantify it any further."

Many commentators like Bonnin seemed shocked or puzzled at the amount of rain that fell. Local, regional and national media focused on personal tragedies and rescue efforts, only occasionally touching on the deeper issues of global warming and climate change.

"Tennessee's flash floods underscore the peril climate change poses even in inland areas, where people once thought themselves immune," the *Washington Post* reported. "A warmer atmosphere that holds more water, combined with rapid development and crumbling infrastructure, is turning once-rare disasters into common occurrences. Yet Americans, who often associate global warming with melting glaciers and intense heat, are not prepared for the coming deluge."

But across the globe the "coming deluge" has already arrived.

"It is unequivocal that human influence has warmed the atmosphere, ocean and land," the United Nations Intergovernmental Panel on Climate Change (IPCC) declared recently, with observable "changes in extremes such as heatwaves, heavy precipitation,

droughts, and tropical cyclones.”

In late June, for instance, most of British Columbia suffered under a record-breaking heat wave which killed more than 500 people and resulted in a “significant amount of snow melt” in mountainous regions leading to widespread flooding similar to what happened in Tennessee, according to globalnews.ca. The temperatures in Lytton, British Columbia, for three days that month were the hottest on record for the country, and on one day reached 49 degrees Celsius (or 120.2 degrees Fahrenheit) before the city was engulfed by a wildfire.

The foundation for understanding the relationship between rising temperatures and flooding was established by French scientist Benoît Paul Émile Clapeyron (1799-1864) and German scientist Rudolf Clausius (1822-1888). The pair discovered the relationship between temperature and the ability of the atmosphere to hold moisture, establishing the ratio. What is known as the Clausius-Clapeyron equation reveals that for every 1.8 degrees Fahrenheit (or 1 degree Celsius) of atmospheric warming, the air can hold 7 percent more moisture.

The applied result is obvious—greater rainfall, more intense storms and the potential for greater flooding, which overwhelms already inadequate and decaying infrastructure.

Recently released research into the causes of the July floods in Western Europe found that climate change has intensified regional rainfall by as much as 19 percent. The floods killed more than 220 people and were between 1.2 and nine times worse “than they would have been in a world unaltered by people” (i.e., climate change and global warming), according to research published by the World Weather Attribution (WWA) initiative.

The research study, entitled “Heavy rainfall which led to severe flooding in Western Europe made more likely by climate change,” focused on the July flooding in the German states of North Rhine-Westphalia and Rhineland-Palatinate and Luxembourg, and along the river Meuse and some of its tributaries in Belgium and the Netherlands.

“The flooding resulted in at least 184 fatalities in Germany and 38 in Belgium and considerable damage to infrastructure, including houses, motorways and railway lines and bridges and key income sources.

Road closures left some places inaccessible for days, cutting off some villages from evacuation routes and emergency response. The worst affected areas were around the rivers Ahr, Erft and Meuse,” WWA reported.

As the WWSWS has previously reported, heavy rainfall in Turkey’s Black Sea region caused flash flooding that has so far killed at least 82 people. Further severe and deadly floods have occurred in recent months in China, the United States, India, Pakistan, Japan, Afghanistan and New Zealand, killing thousands and impacting the lives of hundreds of millions.

The effects of global warming, left unchecked, pose a serious risk to the entire population of the planet. Approximately 2.3 billion of the world’s people—not including fatalities—were affected from 1995-2015 by flooding, according to the United Nations Office for Disaster Risk Reduction (UNDRR).



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