

Unusual climate conditions influenced WWI mortality and subsequent Spanish flu pandemic

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American Expeditionary Force victims of the Spanish flu at U.S. Army Camp Hospital no. 45 in Aix-les-Bains, France, in 1918. Credit: Uncredited US Army photographer; public domain

Scientists have spotted a once-in-a-century climate anomaly during World War I that likely increased mortality during the war and the influenza pandemic in the years that followed.

Well-documented torrential rains and unusually [cold temperatures](#) affected the outcomes of many major battles on the Western Front during the war years of 1914 to 1918. Most notably, the poor conditions played a role in the battles of Verdun and the Somme, during which more than one million soldiers were killed or wounded.

The [bad weather](#) may also have exacerbated the Spanish flu pandemic that claimed 50 to 100 million lives between 1917 and 1919, according to the new study. Scientists have long studied the spread of the H1N1 influenza strain that caused the pandemic, but little research has focused on whether [environmental conditions](#) played a role.

In a new study in AGU's journal *GeoHealth*, scientists analyzed an ice core taken from a glacier in the European Alps to reconstruct climate conditions during the war years. They found an extremely unusual influx of air from the North Atlantic Ocean affected weather on the European continent from 1914 to 1919. The incessant rain and cold caused by this influx of ocean air hung over major battlefields on the Western Front but also affected the migratory patterns of mallard ducks, the main animal host for H1N1 flu virus strains.

Mallard ducks likely stayed put in western Europe in the autumns of 1917 and 1918 because of the bad weather, rather than migrating northeast to Russia as they normally do, according to the new study. This kept them close to military and civilian populations and may have allowed the birds to transfer a particularly virulent strain of H1N1 influenza to humans through bodies of water. Listen to the latest episode of AGU's podcast Third Pod from the Sun to learn more about climate and pandemics.

The findings help scientists better understand the factors that contributed to making the war and pandemic so deadly, according to Alexander More, a climate scientist and historian at the Harvard University/Climate Change Institute, associate professor of environmental health at Long Island University and lead author of the new study.

"I'm not saying that this was 'the' cause of the pandemic, but it was certainly a potentiator, an added exacerbating factor to an already explosive situation," More said.

"It's interesting to think that very heavy rainfall may have accelerated the spread of the virus," said Philip Landrigan, director of the Global Public Health Program at Boston College who was not connected to the new study. "One of the things we've learned in the COVID pandemic is that some viruses seem to stay viable for longer time periods in humid air than in dry air. So it makes sense that if the air in Europe were unusually wet and humid during the years of World War I, transmission of the virus might have been accelerated."

War and weather

The rainy, cold, muddy landscapes of the Western Front are well documented by historians. Poet Mary Borden described it as "the liquid grave of our armies" in her poem "The Song of the Mud" about 1916's Battle of the Somme.

Historical accounts of early battles in France describe how the intense rain affected British, French and German troops. Newly dug trenches and tunnels filled with rainwater; muddy fields slowed the movement of troops during the day; and cold nighttime temperatures caused thousands to endure frostbite. However, little research has been done on the environmental conditions that may have caused the [torrential rains](#) and unusual cold.

In the new study, More and his colleagues reconstructed the environmental conditions over Europe during the war using data from an ice core taken from the Alps. They then compared the environmental conditions to historical records of deaths during the war years.

They found mortality in Europe peaked three times during the war, and these peaks occurred during or soon after periods of cold temperatures and heavy rain caused by extremely unusual influxes of ocean air in the winters of 1915, 1916 and 1918.

"Atmospheric circulation changed and there was much more rain, much colder weather all over Europe for six years," More said. "In this particular case, it was a once in a 100-year anomaly."

The new ice core record corroborates historical accounts of torrential rain on battlefields of the Western Front, which caused many soldiers to die from drowning, exposure, pneumonia and other infections.

Interestingly, the results suggest the bad weather may have kept mallard ducks and other migratory birds in Europe during the war years, where they could easily transmit influenza to humans by water contaminated with their fecal droppings. Mallard ducks are the main animal reservoir of H1N1 flu viruses and as many as 60 percent of mallard ducks can be infected with H1N1 every year. Previous research has shown that migratory patterns of mallards and other birds are disrupted during bouts of unusual weather.

"Mallards have been shown to be very sensitive to climate anomalies in their migration patterns," More said. "So it is likely is that they stayed put for much of that period."

The first wave of H1N1 influenza infection in Europe occurred in the spring of 1918, most likely originating among allied troops arriving in

France from Asia in the fall and winter of 1917, according to previous research. The new study found the deadliest wave of the pandemic in Europe began in the autumn of 1918, closely following a period of heavy precipitation and cold temperatures.

"These atmospheric reorganizations happen and they affect people," More said. "They affect how we move, how much water is available, what animals are around. Animals bring their own diseases with them in their movements, and their migrations are due to the environment and how it changes, or how we change it."

"I think it's a very credible, provocative study that makes us think in new ways about the interplay between infectious diseases and the environment," Landrigan said.

More information: Alexander F. More et al, The Impact of a Six-Year Climate Anomaly on the "Spanish Flu" Pandemic and WWI, *GeoHealth* (2020). [DOI: 10.1029/2020GH000277](https://doi.org/10.1029/2020GH000277)

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