

Human, swine waste pose dual threats to water quality after flooding

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Credit: North Carolina National Guard

A study that monitored surface waters in the wake of 2018's Hurricane Florence finds that waters contaminated by fecal bacteria were affected by both human and swine waste.

"We found that [surface waters](#) in eastern North Carolina were more likely to face dual contamination than to be contaminated by either [human waste](#) or swine waste by themselves," says Angela Harris, corresponding author of the study and an assistant professor of civil, construction and [environmental engineering](#) at North Carolina State University.

"This means people are dealing with multiple hazards," Harris says. "It also means there are two sources of fecal contamination that need to be addressed. It's not just the swine industry, and it's not just wastewater treatment plants or septic systems."

For the study, researchers collected surface water samples at 40 sites across eastern N.C. Samples were collected one week after Hurricane Florence made landfall in September 2018, and again one month after landfall. These samples are referred to as Phase 1 and Phase 2, respectively.

The researchers tested the water samples for a variety of bacteria. Specifically, the samples were tested for: *E. coli*—an indicator species used to identify fecal contamination and the likelihood that there are pathogens present; pathogens such as *Arcobacter butzleri* and various *Listeria* species; and bacterial species associated specifically with either swine or humans, so that researchers could trace contamination back to its source.

"About 30% of the surface water sites we tested had levels of bacteria that would have made those waters unsafe for swimming," Harris said.

The most commonly found pathogen was *Arcobacter*, a finding the research team published late last year. The new study reports that the presence of *Arcobacter* wasn't associated with human or swine fecal markers. In other words, it's not clear where the pathogen is coming

from.

Another mystery was that the levels of E. coli in Phase 2 samples taken from permanent water channels (as opposed to floodplains) were actually higher than the levels of E. coli in the Phase 1 samples.

"We're not sure why E. coli levels jumped in those Phase 2 samples," Harris says. "It could be because water levels were decreasing, so there was less dilution. It could be due to temporary changes in regulatory requirements in the wake of the hurricane. It could be some other variable we haven't identified. We need a lot more monitoring data to begin to tease that apart.

"A lot of post-flooding work has been done in urban areas," Harris says. "This is one of the few studies that looks at post-flooding water quality impacts in rural, agricultural areas. And our findings suggest that this merits a much closer look. This work highlights the need for more routine water quality monitoring in these areas that tests for the bacteria we were looking at here. That could help us establish broader baseline measures for [water](#) quality.

"This is particularly important given concerns around antibiotic-resistant pathogens and the likelihood that we'll be seeing more extreme wet weather events in the future."

The study, "Microbial Contamination in Environmental Waters of Rural and Agriculturally-Dominated Landscapes Following Hurricane Florence," is published in the journal *ACS ES&T Water*.

More information: Angela R. Harris et al, Microbial Contamination in Environmental Waters of Rural and Agriculturally-Dominated Landscapes Following Hurricane Florence, *ACS ES&T Water* (2021). [DOI: 10.1021/acsestwater.1c00103](https://doi.org/10.1021/acsestwater.1c00103)

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