

Soil characteristics may be related to chronic wasting disease persistence, study finds

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Deer infected with chronic wasting disease are doomed to a slow and certain death, eventually wasting away as they lose the ability to eat and drink. There is no cure and no vaccine, and the number of infected deer continues to rise every year. But University of Illinois scientists recently published a new study that could help explain the movement of the disease across the landscape.

"Our biggest goal is to support the management of this non-curable [disease](#) in an animal that is an economically important resource for the state of Illinois," says Michelle Green, research assistant professor in the Department of Animal Sciences at U of I and co-author of the study.

Chronic wasting disease is caused by a prion, a sort of mutant protein with an unusual folding pattern that tricks the body's own proteins into mutating, too. After enough proteins get in on the act, holes begin to form in the brain, causing physiological and behavioral changes. The disease is part of a group known as [transmissible spongiform encephalopathies](#), which includes mad cow and a few other rare diseases.

A key element to managing the disease is reducing exposure to the prion. The disease is primarily passed from deer to deer through direct physical contact, but it can also be passed from mother to fetus or picked up indirectly when a deer comes in contact with the disease agent in the environment. The new study focuses on the indirect pathway.

"When infected deer urinate, defecate, or salivate, they can shed prions.

When a susceptible deer comes along and licks, ingests, or inhales infected [soil](#) it could pick up a prion. But soil is complex. It's not clear what soil characteristics are associated with the persistence of chronic wasting disease in deer," says Nohra Mateus-Pinilla, veterinary epidemiologist at the Illinois Natural History Survey-Prairie Research Institute and study co-author.

In the study, the team looked at the relationship between soil characteristics and presence of deer with the disease in five northern Illinois counties where infected deer are prevalent. They focused on seven physical and chemical properties of soil that could affect the ability for a prion to stick around in the environment.

"The goal was to identify which soil characteristics have a greater effect on the persistent presence of chronic wasting disease in the five counties," says Sheena Dorak, lead author of the study and research associate with the Illinois Natural History Survey.

The first step was to break the five-county area into 1-mile square sections that either had a strong history of the disease or not. The researchers laid this grid over a detailed soils map and created a statistical model to predict the likelihood that the disease would stick around based on the soils.

According to the analysis, the amount of clay in a given soil was a major determining factor to predict where the disease was more likely to persist. And the data clearly indicated a break point that could be useful in future management schemes: Soils with more than 18 percent clay were associated with a steep drop in cases of the disease.

"I think what's groundbreaking about this work is finding this threshold. It's like a switch," Green says.

"Clay can tend to immobilize molecules, and we think at these higher concentrations, clay is holding onto the prions so they're not bioavailable," Dorak says.

Soil pH was also influential, with more cases of the disease at a pH greater than 6.6. Again, changes in soil pH may relate to how "sticky" the soil environment is for prions. Above pH 6.6, prions don't stick as well to the soil and are free to be picked up by curious deer.

The researchers emphasize that their study is observational and based on data from large Natural Resources Conservation Service databases. As such, they cannot confirm exactly what's going on with prions in the soil based on their work. But they say their results are important because they provide a clear starting point for experimental follow-up.

"With these results, we can now look at the entire state and say, for example, there are a lot of infected deer in one area and not too far away, there are soils that have the right mix of conditions to hold prions persistently should an infected deer contaminate the area," Green says. "We would recommend a management scheme to keep the infected [deer](#) out of such high-risk areas."

The article, "Clay content and pH: soil characteristic associations with the persistent presence of [chronic wasting disease](#) in northern Illinois," is published in *Scientific Reports*.

More information: Sheena J. Dorak et al, Clay content and pH: soil characteristic associations with the persistent presence of chronic wasting disease in northern Illinois, *Scientific Reports* (2017). [DOI: 10.1038/s41598-017-18321-x](https://doi.org/10.1038/s41598-017-18321-x)

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