

Scientists Link Wind Shift, Medieval Mega-drought in Sandhills

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Today, Nebraska's Sandhills, a region of gently rolling sand dunes blanketed with prairie grasses and wetlands that cover a quarter of the state, provide ideal habitat for wildlife and livestock. During medieval times 800 to 1,000 years ago, however, the region was a swirling desert, far worse than the Dust Bowl of the 1930s.

University of Nebraska-Lincoln scientists outline their discovery of weather conditions that existed the last time the dunes were on the move about a thousand years ago in the July 21 issue of the journal *Science*. If those conditions return, the tranquil, verdant Sandhills could once more turn into an unlivable wasteland.

This research indicates a historically unprecedented, large-scale shift in wind direction that cut off moisture to the region during the growing season. Researchers believe dune development was part of a larger climate shift during the Medieval Warm Period that created a mega-drought in much of the western North America.

"Our state has a climactic setting that is a little intimidating," said UNL geoscientist David Loope. Nebraska relies on a single source for its spring and summer precipitation: southerly winds that bring up moisture from the Gulf of Mexico. Those few months of rain allow prairie grasses to grow, which stabilize the dunes. Although Nebraska experiences droughts every few decades, including the current one, modern droughts haven't been severe enough to destabilize the dunes.

The largest sand dune area in the Western Hemisphere, the Sandhills cover more than 22,000 square miles of north central Nebraska and are vital to the region's environmental and economic health. The Sandhills' native grassland supports ranching and cattle production and its porous soil supplies more than a third of the groundwater that recharges the Ogallala Aquifer, one of the world's

largest underground reservoirs that extends into Texas.

Although the Sandhills probably were created hundreds of thousands of years ago from the eroding Rocky Mountains, most of the dunes as they exist today were formed within the last 15,000 years. The youngest dunes, about 1,000 years old, exist on the Sandhills southeastern edge. UNL scientists determined when dunes formed using optically-stimulated luminescence, a technique that measures radiation emissions. Sand grains store radiation until exposed to sunlight. By taking core samples and measuring the radiation given off, scientists determine how long the sand has been in the dark, which reveals the dune's age.

Loope and his colleagues analyzed these young dune formations and identified the circumstances that created them. Using a computer program that calculates sand drift under differing conditions, they discovered that the modern southerly wind flow would create asymmetrical dune crests oriented southwest to northeast, not the symmetrical dunes oriented northwest to southeast as is the case with these young dunes.

By working backward from the dunes' pattern, they determined that the winds that created them must have come from the southwest out of what is now west Texas and New Mexico, deserts that would not have brought moisture to Nebraska. As the area dried, fewer plants survived, wetlands dried up and the soil retained less moisture. These conditions heated the land surface, further strengthening the southwesterly wind flow in a kind of intensifying feedback loop. As the drought worsened, grasses died off completely, allowing sand to blow in the strong wind.

"We think we know drought but that's probably wrong," said Loope. "It was a whole different scene in medieval time than it was in the 1930s and '50s."

Southwesterly winds flow high in Nebraska's atmosphere, but researchers aren't sure what brought those winds to the surface, altering the wind flow, or what might cause it to recur. The last occurrence came during an era termed the Medieval Warm Period, when records identify a warm, dry episode in western North America.

Although they can't say why it occurred, knowing it has happened in the past indicates it can happen in the future.

"The Sandhills of Nebraska are clear testimony of prolonged drought," said Loope. "If these conditions return, it will be really bad and there's nothing we can do about it. That these conditions existed only a thousand years ago is sobering."

The *Science* article is co-authored by Loope, Venkataramana Sridhar, James Swinehart, Robert Oglesby and Clinton Rowe from UNL's Department of Geosciences and School of Natural Resources, and Joseph Mason now at the University of Wisconsin. *Science* is published by the American Association for the Advancement of Science, the world's largest general scientific organization.

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