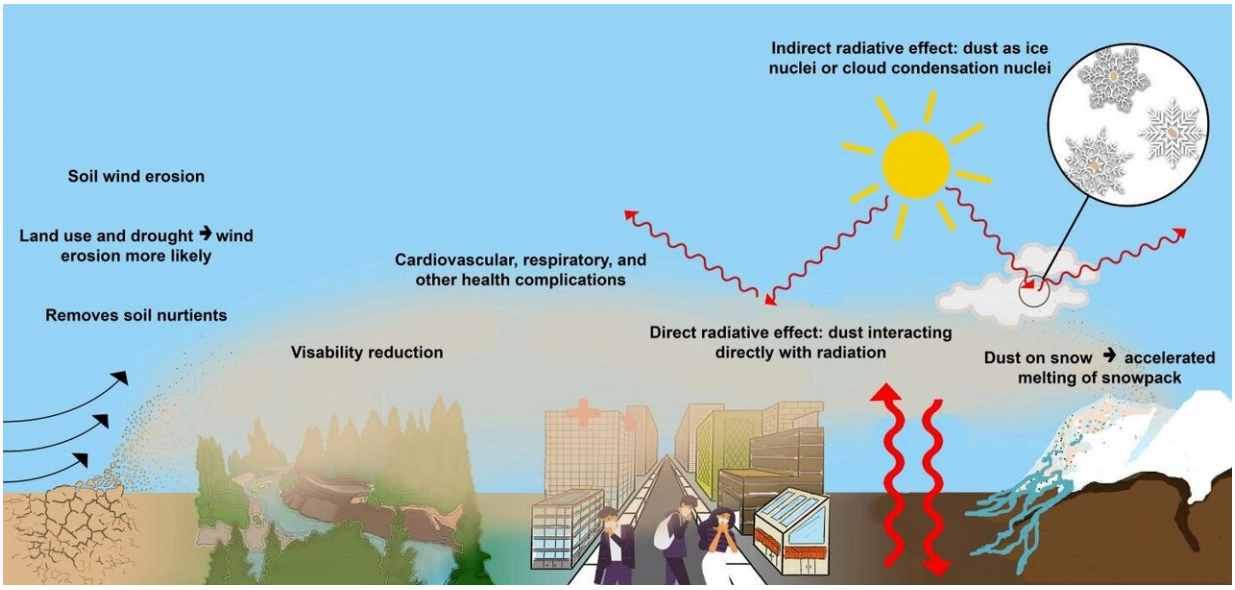
Atmospheric dust levels are rising in the Great Plains

October 13 2020



The hazards of increased atmospheric dust. Credit: Talie Lambert.

Got any spaces left on that 2020 bingo card? Pencil in "another Dust Bowl in the Great Plains." A study from University of Utah researchers and their colleagues finds that atmospheric dust levels are rising across the Great Plains at a rate of up to 5% per year.

The trend of rising dust parallels expansion of cropland and seasonal crop cycles, suggesting that farming practices are exposing more soil to wind erosion. And if the Great Plains becomes drier, a possibility under

climate change scenarios, then all the pieces are in place for a repeat of the Dust Bowl that devastated the Midwest in the 1930s.

"We can't make changes to the earth surface without some kind of consequence just as we can't burn fossil fuels without consequences," says Andy Lambert, lead author of the study and a recent U graduate. "So while the agriculture industry is absolutely important, we need to think more carefully about where and how we plant."

The research is published in *Geophysical Research Letters* and was funded by the Utah Science Technology and Research (USTAR) initiative, the Global Change and Sustainability Center at the University of Utah, and the Associated Students of the University of Utah.

The first Dust Bowl

In the 1930s, a drought blanketed the Great Plains, from Mexico to Canada. This wouldn't have been such a big deal except that in the 1920s Midwestern farmers had converted vast tracts of grassland into farmland using mechanical plows. When the crops failed in the drought the open areas of land that used to be covered by grass, which held soil tightly in place, were now bare dirt, vulnerable to wind erosion.

"The result was massive dust storms that we associate with the Dust Bowl," Lambert says. "These dust storms removed nutrients from the soil, making it more difficult for crops to grow and more likely for wind erosion to occur." After years of drought, dust and hardship, rain finally began to fall again, bringing the Dust Bowl to a close.

"But the damage was already done to the soil," Lambert says. "Some areas have still not fully recovered."

Around the 2000s, the growth in demand for biofuels spurred renewed

expansion of farmland to produce the needed crops. In an echo of the 1920s, this expansion replaced stable grasslands with vulnerable soil. Over five years, from 2006 to 2011, 2046 square miles (530,000 hectares) of grassland in five Midwestern states became farmland—an area a little smaller than Delaware.

At the same time, parts of the Great Plains experienced longer and more severe droughts in the 20th century. The future of drought in that region is, so far, uncertain, but the potential for a warmer, drier Great Plains has Lambert and co-author Gannet Hallar, associate professor of atmospheric sciences, bringing up the word "desertification" in relation to the potential future of the region.

Eyes in the dusty skies

The focus of the study by Lambert, Hallar and colleagues from the U, the University of Colorado-Boulder and Colorado State University, was to quantify how much the amount of dust in the atmosphere over the Great Plains had changed in recent decades. To do that, they tapped into instrumentation that measures atmospheric haziness from the ground up and from space down. From the ground, the IMPROVE monitoring network is run by several federal agencies and measures the amount of particulate matter in the air at sites, including national parks, around the country. Another ground-based network, the NASA-run AERONET, watches for how much incoming sunlight is blocked by dust and aerosol particles in the air. From space, an instrument called MODIS does the same job, looking at how much light reflected from the surface is similarly blocked by particles.

All together, the data cover years from 1988 to 2018. Dust, they found, is increasing in the atmosphere over the whole of the Great Plains by as much as 5% per year.

"The amount of increase is really the story here," Hallar says. "That 5% a year over two decades, of course, is a hundred percent increase in dust loading. This is not a small signal to find."

Correlating with crop timing

The researchers further found correlations between dust in the atmosphere and crop timings. In Iowa, where soybeans have been a major expanding crop, increases in dust appeared in June and October—planting and harvesting months, respectively, for soybeans. In the southern Great Plains states, where corn is a more dominant crop, dust increases appeared in March and October—again correlating to corn planting and harvesting seasons.

That was remarkable," Hallar says, "in the sense of how clear the signal was."

Are we seeing the beginnings of the second Dust Bowl?

"I think it's fair to say that what's happening with dust trends in the Midwest and the Great Plains is an indicator that the threat is real if crop land expansion continues to occur at this rate and drought risk does increase because of climate change," Lambert says. "Those would be the ingredients for another Dust Bowl."

"This is an example of the need for the agricultural community in the U.S. to think about adapting and mitigating to a changing climate," Hallar says. "So if we become more arid we will need to think about the impacts of land degradation in that changed climate. What we did in the past isn't necessarily what we can do in the future."

More information: Andrew Lambert et al, Dust Impacts of Rapid Agricultural Expansion on the Great Plains, *Geophysical Research Letters* (2020). DOI: 10.1029/2020GL090347

Provided by University of Utah