Additional Information on . . .

# Understanding Continued Wide-spread Catastrophic Water Mounding in the Nebraska Sand Hills

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The rains had stopped—pretty much by July of 2020. So why are the water tables rising again on certain soils throughout this spring of 2021?

In my last paper, I mentioned that the dunes were filled-up to over-flowing back in 2018 and 2019. That is because fine sand (the major soil texture of the Sand Hills) can only hold about 3 to 3.5 inches of infiltrated water within a 60-inch vertical section. The water kept mounding higher and higher within the dunes until at some point, the adhesion properties that hold the water to the soil particles could no longer contain the water within the dune. If there was no water table for hundreds of feet below the dunes, the additional infiltrated rain and snow-melt water would just continue—on downward until it hit an impermeable layer or the regional water table.

But in Cherry County, and for that matter, most of the northern counties in the Nebraska Sand Hills, have a relatively shallow water table (often within 5 feet of the surface of the interdunes, and locally much shallower than that). Since water cannot be compressed, the water is going to flow outward from the dunes (anisotropic flow) into the interdunes. If there is an active stream such as Cherry County's major creeks and rivers, then the water will not linger in the interdune. However, if the interdune is relatively closed, with only a small stream or no stream present at all; then the water will begin to build up in the interdune.

The first build-up points that will be noticed are the small pockets on the low, rolling surfaces of the interdune very near the dunes or in the "passes" between the large dunes. This first photo shows the small pockets near the dunes or in the low passes between the dunes in 2013 [before the dunes filled up with water.]

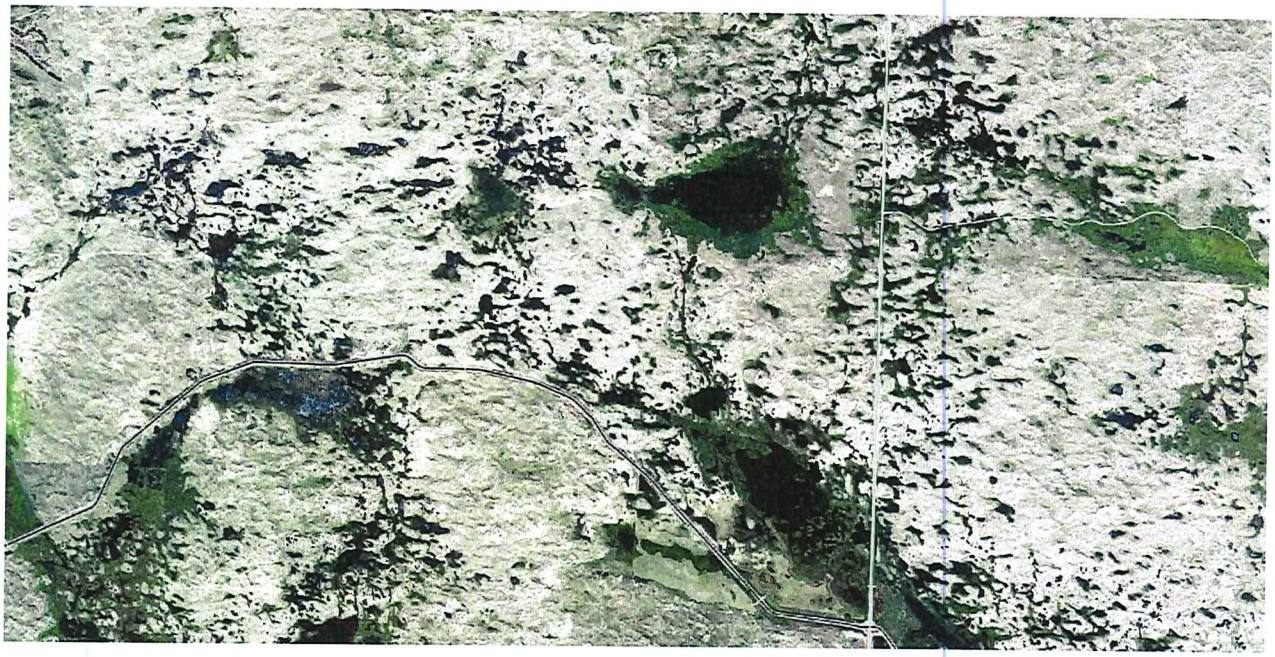

The second picture shows the dunes in mid-2016, the dunes are nearing capacity and *anisotropic-flow* has occurred outward to the pockets <u>closest to the dunes</u>. Note that the pockets closest to the dunes are wetter than the meadow, further below [at a lower elevation]. That is because the groundwater table arcs-upwards underneath the dunes . . . as the dunes are *major groundwater recharge areas*.

Now the mounding underneath each dune is not going to dissipate very quickly. It will take years for the water-mounds to settle back down to "normal" levels. In the meantime, any sizeable rain event or any sizeable snow-melt event is going to add water back into that mound underneath the dune. If the mound is still at or near that **anisotropic-flow threshold**, then the water table is going to rise outside the dune in the pockets and eventually, in the interdunes.

The two map units most likely to experience this rapid water-table rise following any new precipitation events are 4889 and 4861. This is because they already have a high water-table just beneath the surface of the pockets during normal precipitation years. However, they have low dunes [10 to 30 feet high] associated with these moderately-wet pockets. Those dunes do not have great volume and fill up quickly with only small-to-average precipitation events. Plus, the mega-dune structures are undoubtedly pushing water outwards into these areas, as well.

Now, because all these pockets are basically closed-depressional units there is not going to be much—if any surface flow to relieve them of that water. Thus, the rolling sand-sheet areas on either side of U.S. Highway 83 shortly after turning south away from U.S. Highway 20 still has deep-water ponding occurring in the plethora of pockets between the dune-like sand-sheets. This phenomenon will be repeated everywhere in the Sand Hills where such sand sheets exist.

It is believed, after mapping slightly over a million acres of Sand Hills and observing the entirety of the 12-million acres of the Nebraska Sand Hills over the past 38 years of my career, many of these sand-sheet areas were caused probably about 900 to 1000 years before present when the Sand Hills partially-devegetated during a 60+ year drought and sand sheets began to move from the dune-tops down onto wet meadows not previously covered by the dunes. When the rains returned, these sand sheet areas now trapped in their pockets, excess precipitation that these small dunes and hummocks could not soak up and hold.



I remember stopping in at the Big Creek Ranch [just off Hwy 97] in June of 2020. That producer had just completed placing culverts for the first time ever underneath his service trail west from the headquarters earlier that week. *Had to* . . . there was nothing left of his trail in multiple places! The trail used to be up on high and dry soils at least 6 to 10 feet above the spongy organic surfaces of that creek valley.

The night before I arrived there in the valley, it had rained . . . only 2/10$^{th}$ of an inch. That negligible amount of additional water immediately washed-out of the great dune to the north onto this 4861-soil and took-out every one of those culverts!

This summer's precipitation will determine whether the high-water mounding continues-on for one or more years longer—each-and-every time we get a significant rainfall. We really need low rainfall again this year—maybe next, as well. It's going to require patience. Something I understand *all too well* is growing in very short supply after these past five very painful years.

One more thing to add to the deep concern you are already feeling . . . some ranches have reported to our office outbreaks of myco-toxin poisonings. **Ergot** outbreaks are probably to blame.

Wet, cold springs and early summers followed by hot, dry conditions in late summer and fall periods are the ideal conditions for Ergot germination and propagation. Ergot affects [infects] only the *seed head* of range grasses. It is spread by wind and insects that carry spores from plant to plant. Be on the lookout for the black sclerotia that form in the seed head of your cool season grasses. Most hay meadows are dominated by cool season grasses. Virtually all meadow grasses in the Sand Hills are subject to infection from *Bluegrass species* to *creeping foxtail* and *northern/bluejoint reedgrass*. If the surface soil was wet and/or inundated in the winter and spring, and then dries out, that is ideal germination habitat for the Ergot fungus.

*[Contact your Extension Agent for details about control and specific avoidance-procedures if you suspect you have an infestation. There are specific signs of this poisoning to look for in your livestock.]*

Durum wheat infected with ergot.
Source Saskatchewan Ministry of Agriculture.

An ergot body that has germinated to produce drumstick-like structures that will release spores. Photo courtesy Robin Morrall
Source Saskatchewan Ministry of Agriculture.

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