Field Notes

Devil's Advocate

By Lorraine A. Manz

This spring the water level in Devils Lake reached an historic high of 1449.17 feet (ft) above sea level (asl). The geologic mapping project of parts of the lake's north shore that I have been working on since last summer has grown proportionately smaller. Land areas on the 1994 edition of the USGS 7.5 minute series topographic quadrangle that I have been using as my base map are mere fragments of their former selves. On the map, the lake level is marked at 1425 ft asl - 24.08 feet lower than the elevation at which it was measured on 6th June this year. In a little over a decade more than 135 square miles of valuable pasture, cropland, and real estate have been inundated by the seemingly relentless rise of Devils Lake, to the tune of $350 million-worth of damages and drowned livelihoods.

Unusual and rapid changes in our natural environment inevitably give rise to a variety of explanations as to their cause or causes. Some are scientifically sound, applying known facts and an understanding of the physical and chemical processes involved to account for the phenomenon. Others are more hypothetical: propositions based on certain observations and as yet unproven assumptions, which may or may not turn out to be accurate. This is not to say that they are any less worthy of consideration, as most scientific theories begin life as hypotheses. If a hypothesis is proven beyond reasonable doubt by experimentation and scrutiny to be correct, it becomes a theory and is accepted as fact. Until, that is, someone comes along and provides an exception to the rule. Then the theory must be modified to accommodate the new information or be rejected as no longer valid.

Among the more interesting hypotheses that have been proposed to explain the behavior of Devils Lake is one which links it to the Missouri River Basin and Lake Sakakawea. It appears to be based on a simple observation: Devils Lake is rising while the waters in Lake Sakakawea are at an all-time low, and are continuing to fall. Coupled with the fact that Lake Sakakawea lies at an elevation approximately 400 feet higher than Devils Lake, some have concluded that water from the former must be leaking into the latter, or that in some way the hydrologic equilibrium has been disrupted by the formation of Lake Sakakawea, which is preventing Devils Lake from draining at its "normal" rate. It is an intriguing idea, and one that is extremely difficult, maybe even impossible to disprove. However, when the geology and hydrology of the region are taken into consideration, there are several reasons why it is not likely to be true.

As in most of the eastern and northeastern part of North Dakota, the surface and near-surface geology between the Missouri River and Devils Lake consists of layers of Pleistocene glacial sediment that vary in thickness from a few feet to several hundreds of feet. Within this sediment is a complex maze of buried and partly-buried river valleys and meltwater channels that are part of North Dakota's ancestral drainage system. The unconsolidated glaciofluvial sands and gravels that fill these channels form conduits through which water can readily move. In fact several of these deposits, which may occupy areas of many tens of square miles, are some of the most productive aquifers in the state. However, there is no evidence to suggest that there is a direct subsurface route via these channels that would allow water to travel from any part of the Missouri River, including Lake Sakakawea to Devils Lake. Of course, given enough time and resources a rigorous study of North Dakota's Pleistocene aquifer system may prove otherwise, but there are other factors that preclude this as the reason why the water levels in the two lakes are altering so dramatically. First, why only Devils Lake? If water from a lake the size of Lake Sakakawea (Fig. 1) is flowing into the buried channels the surface along whatever route it is taking to Devils Lake would be leaking like a sieve and we would expect to see an abnormal rise in the water levels in other lakes in the region. To date, no such observations have been made. High water levels that have been recorded in closed lake basins throughout the Missouri Coteau can be accounted for by surface water budgets (precipitation versus evaporation) alone. Furthermore, there have been no reports from communities in the region of changes in flow and/or water chemistry in local groundwater supplies (wells) that cannot be attributed to known factors.

The second problem with this scenario concerns hydrology. Lake Sakakawea and Devils Lake are separated by a distance of about 100 miles, considerably more in terms of groundwater flow. Given the change in surface elevation over this distance (about 400 ft, equivalent to a grade of 0.075%), and current hydrologic and geologic conditions, the time needed to effect a change in water levels would be much greater (by many orders of magnitude) than the ten or so years that have elapsed since the water in Devils Lake began to rise.

Lastly, we must look at the historical and geologic

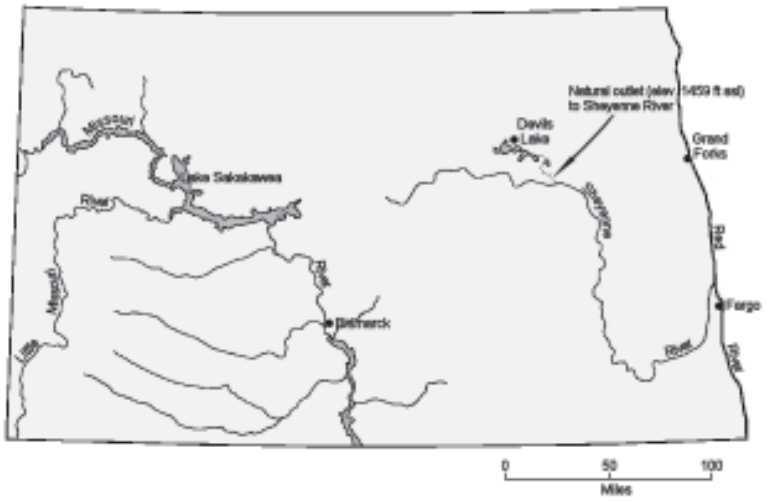

Figure 1. Simplified map of North Dakota's modern drainage system showing the locations of Lake Sakakawea and Devils Lake.

records. In his magnificent treatise on Lake Agassiz, Warren Upham (1896, p. 595) notes that 66 years earlier, in 1830, Devils Lake stood at a height of 1446 ft asl. This level was obtained indirectly from the growth rings of trees bordering the lake. The first actual measurement, taken in 1867, recorded a level of 1438 ft asl. In 1940 Devils Lake fell to a record low of 1400.9 ft asl, and was almost dry. From 1867 to 1993 the elevation of the lake fluctuated between these maximum and minimum recorded values. The current rise that began in 1993, and which some consider to be caused by Lake Sakakawea or some other anthropogenic cause, is not without precedent, however.

Devils Lake is a product of Late Wisconsinan glaciation and is about 10,000 years old. Studies of the sediments in its natural outlets to the Sheyenne River (e.g. Callender, 1968; Bluemle, 1991; Murphy and others, 2002) show that the lake has overflowed into the Sheyenne River on at least six occasions during this time period, the last event occurring sometime prior to 1,100 years ago - more than 1,000 years before Lake Sakakawea came into being. (Lake Sakakawea began to fill when Garrison Dam was closed in 1953.)

The water level in Devils Lake rises and falls naturally in response to changes in local and regional climate. (Wiche and others, 2000). At the present time water levels throughout the Devils Lake Basin continue to respond to the effects of a very active El Nino cycle that began in the late 1970's, and which has, since then, given rise to generally higher than normal levels of precipitation and cooler than average annual temperatures in the region. In fact the entire northeastern portion of the Great Plains is under the same influence and has been experiencing high water levels for the last decade or so. Water levels in many of the lakes that drain into the Red River and upper Mississippi are elevated, as, consequently, are the rivers themselves, but since they do not pose a serious threat to local communities, they are rarely publicized. (Catastrophes like the 1997 Grand Forks flood are a notable exception.). What is happening to Devils Lake is not an isolated event. In fact, Devils Lake is currently behaving in a perfectly "normal" fashion, rising (or falling) constantly in response to climate changes as it has throughout its 10,000-year history.

In conclusion, let us recall the words of William of Ockham, a 14th Century philosopher and theologian, whose statement: *"Non sunt multiplicanda entia praeter necessitatem"* (entities are not to be multiplied beyond necessity) seems particularly appropriate here. Known as Ockham's razor, or the "law of parsimony", it emphasizes simplicity by rejecting unproven hypotheses in favor of solid data. We complicate our lives needlessly by succumbing to predispositions that defy fact. Devils Lake is behaving normally because radiocarbon dates, climatic, stratigraphic, and hydrologic data tell us that it is so. There is nothing, however, to suggest that Lake Sakakawea is in any way involved, yet the notion persists, even though Ockham's razor declares that it should not. But unfortunately, because the Devils Lake/Lake Sakakawea connection is an opinion that is psychological rather than cognitive, any amount of factual information is not going to make it go away.

These arguments against the hypothesis that a connection exists between the rapidly changing water levels of Devils Lake and Lake Sakakawea are not exhaustive. I am not a hydrologist, and there are many who are better qualified and can provide the hard data, and thus more compelling evidence, that such a scenario is unlikely. My intent is simply to provide some food for thought. Bon appétit.

References

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