Importance of a sound hydrologic foundation for assessing the future of the High Plains Aquifer in Kansas

Steward et al. (1) assess the hydrologic and agricultural future of the High Plains Aquifer. We have many concerns about hydrologic aspects of their study and describe the most significant here.

The authors state "...the lines of recharge plus storage in Fig. 1*C* very closely approximate the recent data points of metered groundwater pumping...." That is not correct, as is clear from a comparison of reported pumping data (diamonds) and the authors' calculated groundwater use (solid line) for the SW region. There is a systematic deviation (authors' calculated use is increasing, whereas reported metered pumping data are decreasing), which persists even when uncertain pre-1990 pumping data are neglected. The authors' groundwater use is also markedly inconsistent with common experiences in western Kansas (2). The 2020–2025 (SW) and 2025–2030 (NW) peaks in the authors' groundwater use are simply a product of their logistic function representation (maximum use at normalized thickness of 0.5) and are in dramatic contrast to recorded pumping trends. Given that calculated groundwater use is input into the agricultural models, we question all of the agricultural projections.

The authors provide no objective basis for accepting the logistic function as an accurate tool for projecting water level declines. The comparisons in their table S1 do little to substantiate the use of the function given that the authors (*i*) adjust two parameters per well; (*ii*) adjust parameters at each well independently of the other 1,600 wells; and (*iii*) in aggregate, only assess the first 30% of depletion. A number of alternative functions could be found that would produce similar agreement with existing data but markedly different future projections.

We note the circularity of including extrapolated 2060 values in the dataset used to develop logistic curves that are then used to make future projections. The authors state "...and measurement points were added at 1930 and 2060 from a linear extrapolation of observations while keeping these points within the saturated aquifer." We are concerned about the sensitivity of future projections to inclusion of 1930 and 2060 "measurements" and to the process (unexplained) for "keeping these points within the saturated aquifer."

The authors state that "We computed recent recharge rates to preserve conservation of mass...." That cannot be correct, as is clear from a comparison of reported pumping data (diamonds) and the authors' calculated change in storage plus recharge (solid line) for the SW region in their figure 1*C*; a conservation of mass calculation would produce a line through the center of mass of the reported 1981–2009 data. The calculated recharge values appear to have been adjusted in an unexplained manner. Given that, we also question the significance of the match obtained for the groundwater-supported corn plot in their figure 3*A*. The comparisons in their table S3 do little to substantiate the authors' recharge estimates because of the above concerns and the lack of consistency with more recent process-based modeling investigations (3, 4).

We conclude that this is an interesting, but highly flawed, mathematical exercise that has little bearing on future conditions in the High Plains Aquifer in western Kansas.

James J. Butler, Jr.[1], Geoffrey C. Bohling, Andrea E. Brookfield, Gaisheng Liu, Donald O. Whittemore, and Blake B. Wilson

Geohydrology Section, Kansas Geological Survey, University of Kansas, Lawrence, KS 66047

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Author contributions: J.J.B., G.C.B., A.E.B., G.L., D.O.W., and B.B.W. analyzed data and wrote the paper.

The authors declare no conflict of interest.

[1]To whom correspondence should be addressed. E-mail: jbutler@kgs.ku.edu.