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A Long-term Perspective on Drought in the Great Plains and West

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Management of water resources requires an understanding of the full range of natural variability and its consequences. The weather record, which spans the last 100 years or so, provides a snapshot of the contemporary history of drought and its impacts, but this record is relatively short and is inadequate for understanding long-term trends or for evaluating the magnitude of human impacts. A variety of so-called **paleoclimatic records** - such as *tree rings*, *lake sediments*, and *sand dunes* - record the history of the environment and can be used to extend the record of climatic variation to older intervals of time. These historical archives can provide a perspective on whether or not the patterns of the 20th century are representative of long-term conditions and can be used to enhance management decisions that require long-range estimates of water availability.

One of the best archives of past climate is the tree-ring record. Although trees are relatively scarce in the Great Plains, they do occur in river valleys and some upland sites, as well as in other parts of western North America. Tree-ring records from the West, including some from Nebraska that span the last 300 years (Woodhouse and Brown 2001), show that droughts equivalent in magnitude to the Dust Bowl or 1950s droughts are recurrent events, occurring up to several times a century. More significant is the observation that at times in the recent past, *drought has been more persistent than in the 20th century*. Thus, most western tree-ring records show a period in the 16th century when drought persisted for up to 20 years – an interval called the 16th century megadrought, because of the long duration and widespread occurrence of drought (Stahle 2000).

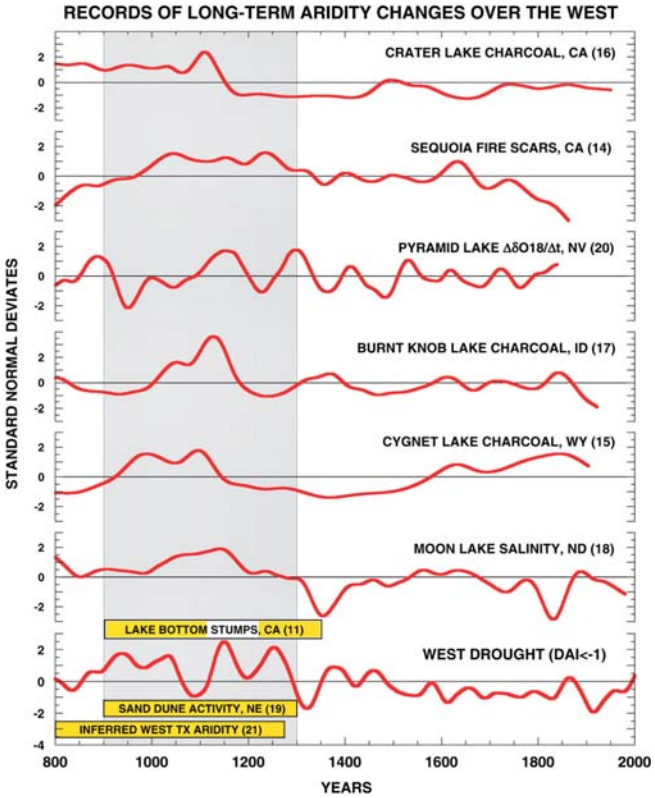

***Figure 1. Reconstruction of long-term aridity changes for 9 regions of western North America and a reconstruction of the proportion of western North America in drought (bottom curve). Areas above the horizontal line for each record indicate intervals when drought was more extreme than the long-term average. The gray shaded box shows the Medieval Period when persistent drought was characteristic of much of western North America. Taken from Cook *et al*. 2004.**

The interval from ~AD 1350 to 1850 is often referred to as the Little Ice Age, because of evidence for cooling in many parts of the Northern Hemisphere. This

interval of cool conditions may not be the best measure for comparison with modern or future conditions, and hence there is interest in extending paleoclimatic records back to earlier periods. Although a few tree-ring records extend this far back, the more common records are those from lakes and dunes. Tree-ring, lake sediment, and dune records clearly show that drought was particularly frequent and persistent throughout much of the West during Medieval times from ~ AD 900 to 1300 (Figure 1*), often lasting for decades and sometimes characterizing most of a given century (Fritz *et al*. 2000; Cook *et al*. 2004). In the Nebraska Sand Hills, dune records show that during this period, the grassland cover of the dunes was destroyed by major drought and that the dunes were mobile, therefore conditions were more extreme than anytime during the 20th century (Mason *et al*. 2004; Sridhar *et al*. 2006). Thus, multiple lines of evidence suggest during parts of the Medieval period, *drought was the dominant feature of climate rather than the exception*.

Clearly, we are not well prepared to deal with the current major drought that is ravaging much of the West, much less the prolonged droughts evident in the relatively recent past. Furthermore, in some regions our policies and laws governing water use were structured based on perceptions of natural water availability that we now know are shortsighted. For example, laws governing flow in the Colorado River basin were enacted in the early 1900s when stream flow was the highest that it has been in the last 700 years (Woodhouse 2001). Taken together, these data would suggest that we need to modify our perceptions of natural patterns of drought variation and to reassess our management strategies – and that this reassessment is necessary simply to deal with natural drought variation, let alone any amplification of drought that may result from human impacts on the climate system.

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