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A multi-proxy reconstruction of millennial scale drought history for Northern England

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Drought is one of the major natural hazards experienced worldwide; they are complex with both causes and multifaceted impacts poorly understood. Few studies of drought events from a long-term perspective have been undertaken in the UK. This presents problems in determining important drought characteristics such as duration, frequency and severity. In order to undertake robust drought analyses reliable long-term data are required. Historical records have long been recognised as valuable data sources within historical climatology; however, the application of historical records in drought analysis is in its infancy, with few historical studies considering drought. This paper presents a reconstruction of drought events for NW England, from around AD 1000 to 2009, drawing upon instrumental, historical and sedimentary records. The drought record is extended to a millennial timescale by coupling the long, continuous instrumental meteorological records available for this area since the late 18th century, with descriptive historical accounts of droughts (since c.AD 1600) and a sedimentary peat sequences from an ombrotrophic mire (Butterburn Flow), where a water table variation history has been inferred from sub-fossil testate amoebae. The testate amoebae analyses were undertaken at 3mm sampling resolution, providing a sub-decadal (2-5 year) sample resolution. Calibration of the sedimentary sequences to the instrument series over the last c.250 years, coupled with chronological control provided by air fall pollutants (Pb and Zn) histories and radiocarbon dating, reveals a detailed millennial drought-dry phase history. The results identify a number of severe droughts - dry phases that have been of longer duration and of greater severity than the 1976 drought, the most memorable drought in living memory in the UK. The results of this work illustrate that current water resource management plans within the UK would struggle to maintain potable water supplies, indicating the need for greater resilience within current water management plans.