Groundwater and Surface Water Acidification by Increasing Carbon Dioxide, Konza Prairie LTER Site, Kansas USA

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Study Area

The Konza Prairie LTER Site is a midcontinent, mesic tallgrass prairie used exclusively for ecologic, hydrogeologic and geologic research. Water chemistry has been monitored quarterly to monthly in ground- and stream-water since 1990 in the lower one-fourth of an upland watershed. This headwater stream is unaffected by human-contamination except what may be delivered from the atmosphere. The watershed is burned every four years and a herd of ~250 bison roams freely over 10 km^2 of the research area, including the 1.2 km^2 study watershed.

Methods

Standard methods are used to collect and preserve groundwater and streamwater samples (Teflon bailer with removal of stagnant well water before sampling; delivery into precleaned bottles; filtering through 0.45μ single-use filters; cation preservation by acidification), and for chemical analysis (ICP-OES for cation determination, titration alkalinity, IC for other anion determination). pH is measured in the field, after meter calibration verification, in a closed, insulated container. pCO_2 is calculated using the method described in Macpherson et al (2008).

Results and Discussion

The data show increasing pCO_2 and decreasing pH. The trend identified by Macpherson et al (2008) through 2005 (~20% increase in groundwater pCO_2) continues to the present, although the rate of CO_2 increase in the past 4 years has decreased, probably because of drought. The increase in groundwater pCO_2 is accompanied by a decrease in pH: from 1990 to 2012, the average annual pH predicted from the pCO_2 decreased from about 7.6 to 7.5. However, measured field pH in 2011, for example, averaged about 7.0, suggesting the increase in groundwater pCO_2 is greater than predicted.

The stream draining the watershed is dominated by groundwater discharge and shows increased pCO_2, which partially degasses, and decreasing pH. These trends have serious implications to stream ecology and the global C cycle.

[1] Macpherson *et al* (2008), *Geochimica et Cosmochimica Acta* **72**, 5581-5599