Elemental fluxes associated with agriculutral and restored prairie land uses

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Land use decisions can impact weathering and hydrologic fluxes within the critical zone. In the Midwestern United States, there has been extensive historic conversion from native prairie to agricultural uses. These disturbances have the potential to dramatically alter the geochemical processes associated with soil formation and weathering. The Glacier Creek Preserve in eastern Nebraska was formed in thick last-glacial Peoria Loess overlying glacial till, and the site is comprised of agricultural and restored prairie land uses. The site is drained by a single, forked creek. By dividing the drainage into sites more dominated by agricultural or restored prairie uses, elemental fluxes out of the system can be quantified based on land use type. The site has been instrumented with several automated systems collecting high-frequency data sets, including: an in-stream sonde, in-stream flow meter, meteorological stations, and ground water level loggers. Approximately monthly grab samples are also removed from precipitation, the stream, shallow groundwater wells and soil pore water samplers for full ionic analysis. Pore waters and select stream samples were also analyzed for DOC and oxygen isotopes. Prairie dominated stream locations tend to have much higher concentrations of major ions including Ca, Mg, Na, K, Fe, and Mn compared to sites dominated by agriculture suggesting more water-soil interactions under prairie soil than under agricultural soils. However, water flows are much higher out of the agricultural systems which leads to larger elemental fluxes from agricultural sites. Elemental porewater concentrations and groundwater concentrations tend to be higher under agricultural land use, suggesting that a significant amount of stream water flow is not interacting with the soil under agricultural conditions. Furthermore, speciation calculations point to solubility controls on elemental behaviors. The high-frequency data sets show several diurnal fluctuations including total stream flow, dissolved oxygen, and pH, consistent with biological and temperature controls.