Biomarker signatures from California impoundment reflect climate and anthropogenic impacts in the watershed

C.R. PONDELL* AND E.A. CANUEL

Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA 23062, USA (*correspondence: cpondell@vims.edu)

Each year the amount of organic carbon trapped in impoundments is comparable to the amount of organic carbon accumulating on the ocean floor [1]. The high trapping efficiency of dams and impoundments prevents the transport of sediment and organic material by rivers, and creates an ideal system in which to examine records of change in the terrestrial ecosystem over decadal to century-long timescales. This study uses the sediment record from an impoundment in northern California to examine the response of organic matter accumulation to flood events and land-use impacts in a mountainous watershed during the last century. Characteristics of the organic matter accumulation in impoundments were analyzed with stable carbon and nitrogen isotopes, lignin biomarkers, and lipid biomarkers (ie, sterols and fatty acids) from sediment cores collected from Englebright Lake.

Biomarker signatures in Englebright Lake recorded the response of organic matter sources to the influence of dams and flood events in the watershed. The impact of dams on the transport of organic matter in the watershed was observed as an increase in the proportion of select sterol and long chain fatty acids after the construction of a dam across one tributary to Englebright Lake ($p < 0.01$). Additionally, sediments collected near the delta front captured the response of organic matter delivery associated with 1997 and 1964 flood events, as evidenced by higher concentrations of lignin biomarkers, indicative of terrestrial matter inputs, during these periods of accumulation ($p < 0.01$). The largest human impact to the Englebright Lake watershed, hydraulic gold mining, was observed in near-zero concentrations of lipid and lignin biomarkers, reflecting the extreme proccessing of sediments during the gold extraction procedure.

Here we discuss the relationship between biomarkers and environmental impacts to demonstrate the value of examining sediments trapped behind dams as a way to measure the response of the terrestrial ecosystem to recent regional disturbances.

[1] Downing *et al* (2008) *Global Biogeochem. Cycles* **22**.