Title:	Signatures of natural to anthropogenic transition in lake sediments from the Central Himalaya using stable isotopes
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Abstract:	Stable isotopic compositions of carbon (C) and nitrogen (N) in lake sediments have the potential to decipher natural and anthropogenic influences in a region, which has undergone significant cultural changes in the recent past. In this study, using carbon (δ13C) and nitrogen (δ15N) isotopic compositions of organic matter along with C isotopic ratio of black carbon (δ13CBC) in sediments collected from a lake in the Lesser Himalaya, an attempt has been made to decipher the biogeochemical changes in the lake under natural and anthropogenic stresses along with fire history of the region. The sediment core, dated using 210Pb and 137Cs, went back to 1949 AD, where isotopic compositions and elemental ratios (TOC/TN) suggested that the lake biogeochemistry was largely controlled by in-lake primary productivity. A noticeable change in isotopic compositions and elemental ratios was observed in the early 1970s, possibly due to increased input of soil organic matter from the catchment, which coincided with the urbanization and other human interventions in the region. At the same time, a consistent increase in differences between the measured and Suess effect corrected δ13C of organic matter from the early 1970s to 2016 AD indicated towards the increased utilization of fossil fuel-induced atmospheric CO2 by the lake biota. Also, a sudden shift in δ13CBC in the early 1970s showed an increase in fossil fuel-induced black C in the region during that time. Overall, a comparison of the current study with other lakes in the region revealed the effect of land use change and population growth on the lake biogeochemistry, which was clearly recorded in elemental contents and stable isotopic composition of different components of lake sediments. However, the response of each lake depended on the location (i.e., distance from the city) and size of the catchment. The larger lakes in the region appeared to have suffered the anthropogenic stress through both atmospheric and terrestrial routes, whereas the smaller and secluded lake, as in the present study, was largely influenced via atmospheric factors.
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