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Morpho-tectonic control on the distribution of C₃-C₄ plants during Late Plio-Pleistocene in the central Himalayan Siwaliks

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The Siwalik deposits of Himalayan foreland basin (HFB) preserved the Miocene records of the Himalayan tectonics, monsoonal variation and evolution of C₄ plants. Previous vegetation reconstructions emphasized the Late Miocene expansion of C₄ plants (ca. 7 Ma) with an implicit assumption that the vegetation thrived in the floodplain of lowland rivers. The coarsening-upward sequence of the Siwalik Group suggests deposition in an alluvial fan setting in which the Middle and Lower Siwaliks are deposits of distal area whereas the Upper Siwaliks represent proximal areas of the fan. The modern alluvial fans forming in the Himalayan foothills show a significant difference in elevation and vegetational composition between proximal and distal areas. In the HFB, the elevation difference between the proximal and distal areas is expected to be more pronounced due to surface exhumation of the Siwalik deposits. The increased elevation would have had affected the vegetation distribution in the Upper Siwaliks which implies that vegetation in proximal part of the fan might not represent lowland floodplain. However, the vegetation composition is less understood from the Upper Siwaliks region as conventional proxies are scanty in these younger foreland deposits.

In the present study, the impact of elevation on vegetation distribution in the HFB is examined from comparatively higher exhumed Late Plio-Pleistocene Siwalik deposits at SuraiKhola (Nepal). The $\delta^{13}\text{C}$ values of bulk soil organic matter (SOM), n-alkane and n-alkanoic acid from the SuraiKholapaleosols suggest most commonly observed expansion of the C₄ plants at ca. 7 Ma, and a unique second phase of expansion of C₃ plants after ca. 3 Ma. The higher δD values in n-alkane and n-alkanoic acid suggest that the climate was drier in last 4 Myr; most likely driven by the onset of the Northern Hemisphere Glaciation (NHG). The growth of C₃ plants was favored due to cool climatic condition induced by higher elevation in the proximal part of the fan. The water-bearing conglomerate units in the Upper Siwaliks helped the C₃ plants to thrive in a relatively drier climate. Therefore, the higher abundance of C₃ plants in the Upper Siwaliks suggests morpho-tectonic control on vegetation with the possible influence of NHG.