

Late Holocene Landscape Collapse of a Trans-Himalayan Dryland: Human Impact and Aridification

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Soil degradation is a severe and growing threat to ecosystem services globally. Soil loss is often nonlinear, involving a rapid deterioration from a stable eco-geomorphic state once a tipping point is reached. Soil loss thresholds have been studied at plot scale, but for landscapes, quantitative constraints on the necessary and sufficient conditions for tipping points are rare. Here, we document a landscape-wide eco-geomorphic tipping point at the edge of the Tibetan Plateau and quantify its drivers and erosional consequences. We show that in the upper Kali Gandaki valley, Nepal, soil formation prevailed under wetter conditions during much of the Holocene. Our data suggest that after a period of human pressure and declining vegetation cover, a 20% reduction of relative humidity and precipitation below 200 mm/year halted soil formation after 1.6 ka and promoted widespread gullying and rapid soil loss, with irreversible consequences for ecosystem services. <https://doi.org/10.1029/2019GL084192>

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