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Direct evidence for 5,000 years of Alpine pastoralism: how lake sediments inform about animal diversity, soil erosion and vegetation change

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The introduction of vertical mobility for agro-pastoral activities marks an important change in prehistoric society, which has altered the socioeconomic structuring of Alpine areas. It has also had severe consequences for the high Alpine ecosystems, including the destabilisation of soils, sustained vegetation disturbance, and lake eutrophication. With climate change and increasing anthropogenic pressure to Alpine environments, it is critical to better characterise the interaction between natural and anthropogenic factors that have shaped Alpine environments during the last millennia.

We present a Holocene record of domestic and wild animal presence through sediment-DNA analysis from a lake sediment core from the Eastern Swiss Alps and study the effects on soil erosion and vegetation composition. We provide direct evidence for the onset of pastoralism around 5,000 years BP, after which the site became repeatedly abandoned and re-occupied. According to our sediment-DNA reconstructions, several domestic species are present during early occupational periods, while cattle herding has become dominant during the last millennium. The latter period also coincides with a severe change in vegetation composition. Pastoral activities have had marked effects on soil erosion, while catchment deforestation already occurred ~2,000 years prior to the first findings of DNA from domestic animals, suggesting that the onset of Alpine pastoralism did not cause severe vegetation changes in our catchment. Further, sediment-DNA findings indicate that wild animals avoided near-shore territories during periods of human occupation, but returned to the lake shore upon site abandonment.

Our study opens a new perspective on long-term human-environment interactions in Alpine environments by providing direct evidence for animal presence and diversity and linking this information to physical and ecological factors such as soil erosion and vegetation change.