

Understanding historical human impacts to conserve Trans-Himalayan rangelands

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INTRODUCTION

The high altitude Tibetan Plateau and its marginal mountains, called the Trans Himalayas, represent a vast rangeland system (2.6 million sq km) with a history of pastoral use dating back several millennia¹.

Despite being amongst the least productive grass-dominated ecosystems globally, Trans-Himalayan rangelands support a diverse assemblage of wild large herbivores and their predators such as the endangered snow leopard².

A history of intensive livestock grazing, however, has led to local extinctions of wild herbivores such as the Tibetan gazelle, wild yaks and argali from several regions³.

We have set out to understand the historical and current impacts of livestock grazing on rangeland vegetation in order to facilitate restoration and re-wilding.



CLIMATE & VEGETATION

The climate is arid and cold. The region receives <200 mm rainfall, and snow fall of about 155 mm of water equivalent annually⁴.

Altitudinal gradient, soil moisture and soil texture are important correlates of plant species richness and composition^{5,6}.

The main season of plant growth is between May–August⁷. Inter-annual variation in primary production is highly dependent on precipitation⁸.

The important plant families are Gramineae, Cyperaceae, Fabaceae, Ranunculaceae and Leguminosae.

Main vegetation formations include:

Open or desert steppe type dominated by grasses and sedges (species of *Stipa*, *Leymus*, *Festuca*, *Carex*)

Dwarf shrub steppes type dominated by shrubs such as *Caragana*, *Artemisia*, *Lonicera* and *Eurotia*

Moist soils near river valleys, springs and glaciers are covered by sedges with *Carex* and *Kobresia* spp¹



THE ROLE OF PALAEOECOLOGY

Currently, our understanding of past vegetation composition – which presumably supported a greater diversity of wild herbivores – is limited, making it difficult to plan restoration or re-wilding.

Against background variation in vegetation composition brought about by climatic changes, we intend to identify historical human (livestock) impact signatures on rangeland vegetation.

An understanding of vegetation response to livestock grazing over the last 3 millennia, and integrating that knowledge with current impacts of climate change and grazing practices can help inform rangeland restoration and wildlife conservation strategies.



Given the importance of these rangelands in the Trans-Himalayan landscape we have started on a project to recover proxy records such as pollen, carbon isotopes from the sediments .



WILDLIFE

The Trans-Himalayan rangeland system is one of the few unique places that continues to support Pleistocene period large wild herbivores with domestic ungulates sharing forage resources⁹.

The region harbours²:

- Wild herbivores – 20 species (7 families)
- Wild carnivores – 13 species (4 families)
- Birds – over 275 species (41 families)



HUMAN LANDUSE

Rangelands are often overstocked with livestock¹⁰. As local economies get integrated with global markets such as cashmere, grazing pressures are intensifying in the region.

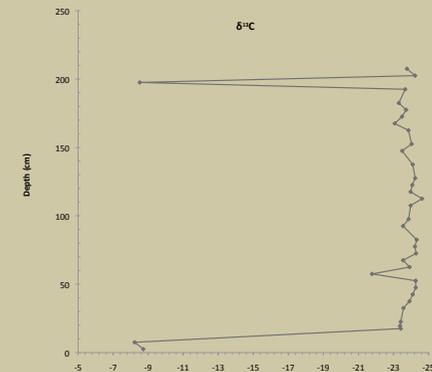


STUDY DETAILS

We collected soil samples at every 5 cm from a pit of 2.5m depth. The pit located (32.303202°N & 78.023019°E, c. 4,300m) on the Kibber plateau in Spiti Valley

PRELIMINARY RESULTS

Climatic signals captured in the sediments inferred through $\delta^{13}C$ values indicate both moist-warm, dry-cold conditions. The dominance of C_4 signature observed from the surface up to 10 cm depth in the profile indicates presence of stressed conditions in the recent times. A peak down in the profile (at 195–200cm) shows another episode of aridity in the past.



FUTURE WORK

- We plan to generate more baseline data from multiple sites spanning east (species rich) to west (species sparse) of the Himalayan region.

- We plan to conduct palynological studies that help us identify historical impacts of livestock on rangeland vegetation composition, especially over the last three millennia.

- To understand from pollen investigation whether predominance of C_3 signature is due to altitudinal shift of tree elements or expansion of grasses in the valley.

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