Changes in climate over the last 3,000 years triggered marked changes in a Western Himalayan peatland, India

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1. ABSTRACT

The western Himalaya region of northern India is an important region for climatic studies as it is located within the Indian Ocean Monsoon (IOM) system. Glaciers are common at higher elevations and together with monsoon rains provide water to this densely populated region.

We provide diatom and pollen-based evidence from a peat deposit that the last three millennia oscillated between wet and dry periods. However, the abruptness and magnitude of change over the last ca. 200 years exceeded that of all previous intervals, with an ecosystem turnover to a much wetter state. This increase in moisture is likely a result of both direct and indirect associations with global warming.

2. STUDY SITE

The study site, located in the Pinder Valley, is a peatland area that was deposited at an altitude of 2,800 m.a.s.l. from the Pinder Valley (30° 03’ N, 79° 56’ E) in the Kumaon Higher Himalayas, Northwest India.

3. ENVIRONMENTAL INDICATORS

Diatoms, pollen, and phytoliths were used to assess past environmental conditions.

- Magnetic Susceptibility
- Loss-On-Ignition

4. RESULTS & INTERPRETATION

The diatom and pollen taxa are expressed in percent relative abundances. Phytolith relative abundances were calculated relative to the sum of all siliceous microfossils. Radiocarbon dates were calibrated with the standard data set INTCAL98.

5. INTERPRETING BIOLOGICAL PROXIES

- Algae – free-floating, open water diatom. Indicative of increased wetness in peatland
- Compositae – typical of dry environments
- Grass phytoliths – in situ indicator of dry conditions
- Poaceae (grass) – grows in dry environments
- Quercus (oak) – typical of dry environments
- Abies (fir) – prefers wetter conditions
- Pinus (pine) – typical of wet environments
- Alnus (alder) – grows in drier environments

6. IMPLICATIONS AND CONCLUSIONS

- The ~3500 year Pinder Valley peat core records clear shifts between wet and dry periods
- Changes are consistent with changes in monsoon strength (precipitation and wind strength).
- The amount of precipitation delivered in winter is much less than during the summer monsoon and therefore likely does not account for the magnitude of change recorded by our proxy indicators.

7. THE BOTTOM LINE

- Peat deposits are sensitive recorders of shifts between wet and dry periods in this monsoon region
- Ecological reorganizations of warming over last few centuries in Himalayas may be unexpected (e.g. increased wetness in valley etc.)
- Both local and larger-scale forcings must be considered when interpreting environmental change