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The Peatland Paleo Proxy Database

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The PAGES Data Stewardship Scholarship program allowed us to organize and archive multiple published peat-based paleoecological datasets, increasing their accesibility and visiblity via cross-platform linking.

For many years now, the C-PEAT working group (pastglobalchanges.org/c-peat) has made available hundreds of peatland-carbon datasets. So far, these datasets only include limited information, namely age-depth model and peat geochemical data (bulk density, carbon and nitrogen content, etc.). But there is a wealth of peat-based paleo-proxy data that remains sparse in public repositories. The PAGES Data Stewardship Scholarship has allowed us to build a framework to organize and archive our community's peat-based paleoecological datasets. We are also integrating this dataset to the Neotoma database (neotomadb.org). The interest has been high among the peat community to see peat records further integrated to regional paleoclimate reconstructions, such as the 2k Network (pastglobalchanges.org/2k). Increasing the accessibility and visibility of peat-core paleoproxy data should help to fulfill this goal. We hope we can convince paleoclimatologists working with lake sediments, speleothems, tree rings, ice cores, and other archives of peat's promise!

Peatland archives

Peatlands are arguably the very first recognized paleoclimate archives. In the 19th century, the alternating dark and light layers from European peat deposits were interpreted as indications of warmer/drier and wetter/cooler conditions, respectively (Blytt 1876). These records of past climate change, which were based on plant macrofossils and pollen assemblages, led to the development of the first deglacial paleoclimate sequence: the Blytt-Sernander classification (Blytt 1876; Sernander 1908). Today, with thousands of peat profiles described and analyzed from every continent, peat-based paleoclimate work remains an active field of research.

Despite this long history and the large number of published studies, peat-based paleorecords remain somewhat underutilized. They are also seldom combined with those from other terrestrial archives, such as lakes, trees, and ice. Here we contend that peatland archives can offer complementary insights in Holocene paleoclimatology due to: (1) their global distribution, including regions where other terrestrial archives are rare; (2) their temporal coverage and resolution, which can offer decadal-scale Holocene reconstructions; and (3) their capacity to record changes in temperature, moisture source, or other climate components.

Data aggregation and formatting

Over the past two years, C-PEAT Data Steward Nicole Sanderson has gathered as many peat-based paleoecological datasets as possible. She led a number of "peat proxy happy hour" sessions to engage with data owners and facilitate data transfer. She trained a couple of undergraduate researchers (Kendahl Hejl and Daniel Maraldo) in data formatting and quality control. She became a Neotoma data steward and has been actively discussing the Peatland dataset with Neotoma leaders. These efforts have paid off: 182 chronologically constrained paleorecords from 101 cores have recently been processed by our team (Fig. 1). Those cores are globally distributed, though most of them are located in the Northern Hemisphere. The dataset includes chronologically constrained testate amoebae, plant macrofossil, and geochemical records, as well as novel proxies such as biomarkers and stable isotopes (Fig. 1). Prior to our work, Neotoma only contained 18 peat-based paleorecords. The newly formatted records are being integrated on Neotoma and should be available sometime this year.

Current and future plans

The Peatland Paleo Proxy Database will be available for community use on Neotoma, and we aim to continue to expand its contents in order to improve process-based models. This new C-PEAT database will be used to assess ecosystem responses to past environmental drivers, including recovery from past abrupt changes in water table depth and temperature, as well as building carbon trajectories. We also aim to integrate the peat-based paleorecords with other terrestrial records (e.g. lake sediments, tree rings) in regional paleoclimate reconstructions. Our team is preparing a manuscript that describes the proxies included in the dataset and the methods used to format, synthesize, and analyze the paleo peatland records. Ultimately, we aim to link this dataset through LiPD (lipd.net).

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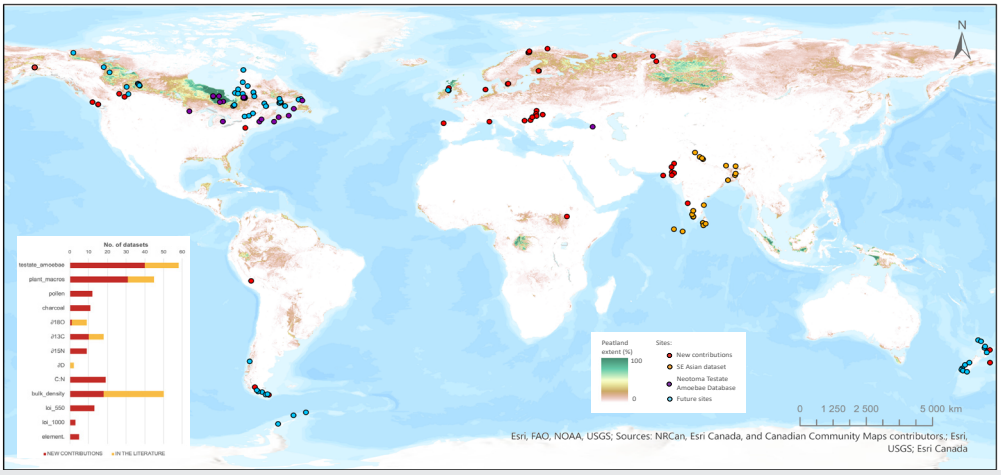

Figure 1: The Peatland Paleo Proxy Database as of 31 December 2022. It comprises 182 records from 101 cores. Orange = Neotoma Testate Amoebae Database; red = new proxy data contributions; blue = metadata only (for now). Modified from Melton et al. (2021).