Peatlands occupy about 3% of land surface (Gorham 1991 *Ecol Appl*) but, due to high carbon (C) density, they are a globally important C (Leifeld, Menichetti 2017 *Nat Comm*) and nitrogen (N) store: ~21% of global soil organic C stock and up to 26 Pg N. Undisturbed peatlands are a C sink (~0.1 Pg C y^{-1}), a moderate source of CH_4 (~0.03 Pg CH_4 y^{-1}), and a very weak source of N_2O (~0.00002 Pg N_2O y^{-1}) (Frolking et al 2011 *Envir Rev*). Anthropogenic disturbance, primarily agriculture and forestry drainage (up to 20% of global peatlands) produce net carbon dioxide (CO_2) emissions (~0.1 Pg C y^{-1}), reduce CH_4 emissions (10% below natural conditions), and increase N_2O emissions (>20 times above natural peatlands; Pärn et al 2018 *Nat Comm*).

Man-induced drainage and climate warming-related droughts are the main factors damaging peatlands, causing C losses and increasing GHG emissions. Dry and wet peatlands can be C and GHG sinks while moderately moist peatlands are mostly C and GHG sources. Our global study on the peatlands' N-cycle microbiome indicated a leading role of diverse microbial communities in N_2O emission (Bahram et al. 2022 *Nat Comm*). High abundance of nitrifiers across all studied peatlands shows that they have suffered from drought or drainage at some time in history. Ongoing global warming and intensifying environmental change may boost archaeal nitrifiers, collectively transforming wetland soils to a greater source of N_2O.

Peatland forests, which are the dominant type of wetland in the tropics (Pangala et al 2018 *Nature*) and cover a significant part of boreal peatlands, provide challenges for GHG flux estimation. Although the forests' CO_2 capture is high, the role of trees and their canopy in N_2O and CH_4 budgets is largely unknown (Mander et al 2021 *npj Clim Atm Sci*).

Peatland restoration is the most effective way to facilitate C storage and minimize N_2O emissions (Leifeld, Menichetti 2017 *Nat Comm*). During the first 30–40 years after rewetting or establishment, C sequestration in sediments is offset by the radiative effect of CH_4 emission, however, in a 100-year perspective most peatlands may turn to net climate coolers (Mitsch et al 2013 *Landscape Ecol*).

We need to develop better linkages between time horizons of restored peatlands and the potential for C sequestration by peatland type, as well as to understand how we can sustain C storage in peatlands while continuing of human development.