

# Simulating the long term impacts of peatland drainage and restoration

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## Background:

Many peatlands have been drained artificially or by gully systems which can destabilise carbon stores that are centuries old.

Studies that monitor the effects of drains and their restoration are necessarily limited to several years or a few decades. Therefore, the longer-term impacts are poorly understood.

We used a 2-D version of the DigiBog peatland development model to simulate how ditch creation and restoration affect peat accumulation, water-table dynamics, and peat structure (not shown here) over centuries.

## Key findings:

### Peat accumulation

- The ditch caused a rapid loss of peat due to increased oxic decomposition (Fig 1.). Peat surface height fell by 30–40%.
- Most peat loss occurred in < 100 years. Losses were negligible by 300 years after drainage (no restoration).
- Peat accumulated 2000–2500 years before drainage was exposed to oxic decomposition.
- Ditch damming reversed losses in favour of accumulation. But the initial losses were not replaced after 200 years of restoration.
- The effect of drainage and restoration varied according to upslope/downslope proximity to the ditch. Restoration had little effect on topslope peat.

### Water-table dynamics

- Water tables became deeper on drainage (Fig 2.) and gradually became shallower over time (even without restoration).
- Water tables did not rise back to the original surface.
- Apparent water table changes were due to reduced hydraulic conductivity and, importantly, subsidence of the peat surface.

Fig 1. Peat surface

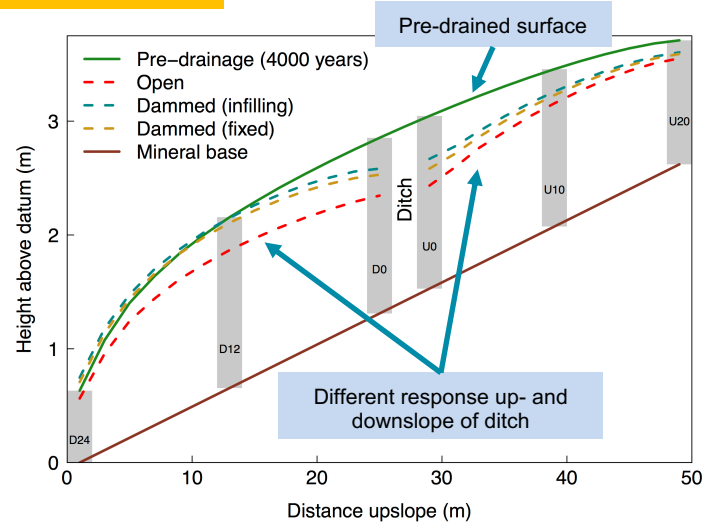


Fig 2. Water tables

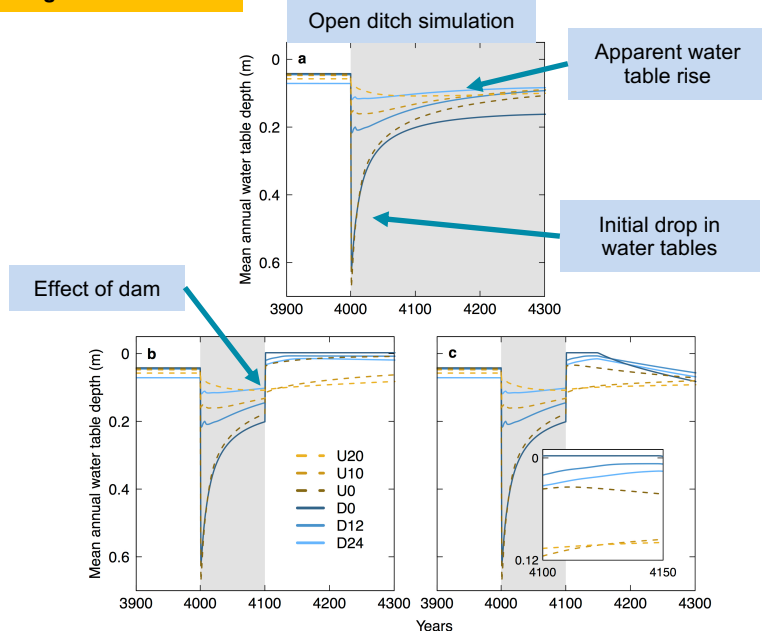


Fig 2. Simulated water tables. a) Open ditch, b) infilling ditch, and c) fixed height ditch dam (inset of water tables in the first 50 years after damming).

Column ID based on upslope (U) or downslope (D) position in relation to distance from ditch (m).

**Ditch creation and restoration.** There were four simulations: 1) control over 4300 years (no drainage); 2) ditch created at 4000 years and left open for 300 years; 3) ditch created after 4000 years and left open for 100 years before damming with a fixed height dam for 200 years; and 4) as 3) but the dam was allowed to 'infill' and rise with the peat surface.