How resilient are NZ restiad bogs to drought?

Associate Professor Dave Campbell[1], Dr Jordan Goodrich[1,2]
[1]University Of Waikato, [2]San Diego University

As the global hydrological cycle accelerates due to a warming climate, the frequency and magnitude of climatic extreme events such as droughts and floods is expected to increase. Droughts have been shown to perturb the carbon (C) sink strength of many terrestrial ecosystems, including peatlands.

At Kopuatai, NZ's largest raised peat bog, we used the eddy covariance technique to measure the components of the ecosystem C balance (CO2, CH4, dissolved C) for Empodisma robustum – dominated rushland for four years. 2012 had a relatively wet summer, while 2013-15 had severe late summer droughts which cause the water table to draw down for several months.

The droughts caused water table lowering that exposed more peat to aerobic decomposition so that ecosystem respiration was ~11% greater in these years, while gross primary production was unaffected. Methane emissions also reduced by a third in drought years. Overall, the bog ecosystem was a strong C sink during all four years, with the wet year 205 gC m-2 yr-1 and drought years averaging (mean 157 gC m-2 yr-1).

These results suggest that restiad peat bogs are robust sinks for carbon, even during years with severe droughts. The key factor influencing C-sink strength is the water table position relative to the peat surface. Extremely low evaporation rates from the E. robustum canopy during summertime contributes to this this C-sink resilience.