1. Background

- Most mosses are desiccation tolerant: rapidly resuming normal metabolism on rehydration.
- Sucrose is the only sugar available for cellular protection so may accumulate during drying.
- Sucrose acts as a compatible solute and facilitates cytosolic vitrification: the formation of a bio-glass with low molecular mobility.

2. Species of Interest

- **Sphagnum (peat) Mosses**
  - Drought avoidant so maintain high relative water content (RWC)
  - Hyaline cells for water storage
- **Dicranum scoparium & Polytrichum commune**
  - analogues of Antarctic species lab works with
- **Calliergonella cuspidata**
  - grows in many different environments

3. Quantifying sucrose in field moss samples

![Graph showing sucrose content (nmol/mg dry weight) as a function of relative water content (RWC).](image)

- Mosses with higher RWC at field harvest have lower sucrose content.
- Sphagnum mosses have significantly lower sucrose content than non-Sphagnum species (W = 108, P<0.01).
- Sphagnums avoid desiccation so may require less cellular protection.

4. Increasing sucrose content during desiccation?

- Some evidence that bryophyte sucrose content increases during rapid dehydration\(^1\).
- We found no change in sucrose content of *Calliergonella* after rapid drying (591 nmol mg\(^{-1}\) compared to 601 nmol mg\(^{-1}\) initially, ●).
- See a fall in sucrose content to 70 nmol mg\(^{-1}\) after rehydration in a recovery medium (▲).
- Consistent with substantial sucrose leakage in the aquatic bryophyte *Fontinalis antipyretica*\(^1\).

5. Stable isotope composition of sugars

- External water layer limits CO\(_2\) diffusion into moss tissue so reduces CO\(_2\) pool for assimilation.
- Rubisco discriminates against \(^{13}\)CO\(_2\), but when CO\(_2\) tissue pool is replenished slowly, more \(^{13}\)CO\(_2\) is fixed
- Measured stable isotope signals (\(^{13}\)C/\(^{12}\)C, \(^{18}\)O/\(^{16}\)O) of soluble sugars in field and lab extracts, in relation to data on RWC, cellulose isotopic composition, and photosynthesis (awaiting isotope results)
- This allows us to link information about isotope composition to environmental conditions during growth

References: 1 Cruz de Carvalho, R. et al. 2015 Environ. Exp. Bot. 120:18-22
Acknowledgements: Natural England (fieldwork permission)