LOW-INTENSITY SHEEP GRAZING STORES CARBON AND CONSERVES UPLAND SPECIES



Stuart Smith*1,2,3, Charlotte Vandenberghe⁴, Astley Hasting¹, René van der Wal², Sarah Woodin¹, David Johnson¹ and Robin Pakeman³ *Corresponding author: s.w.smith@abdn.ac.uk

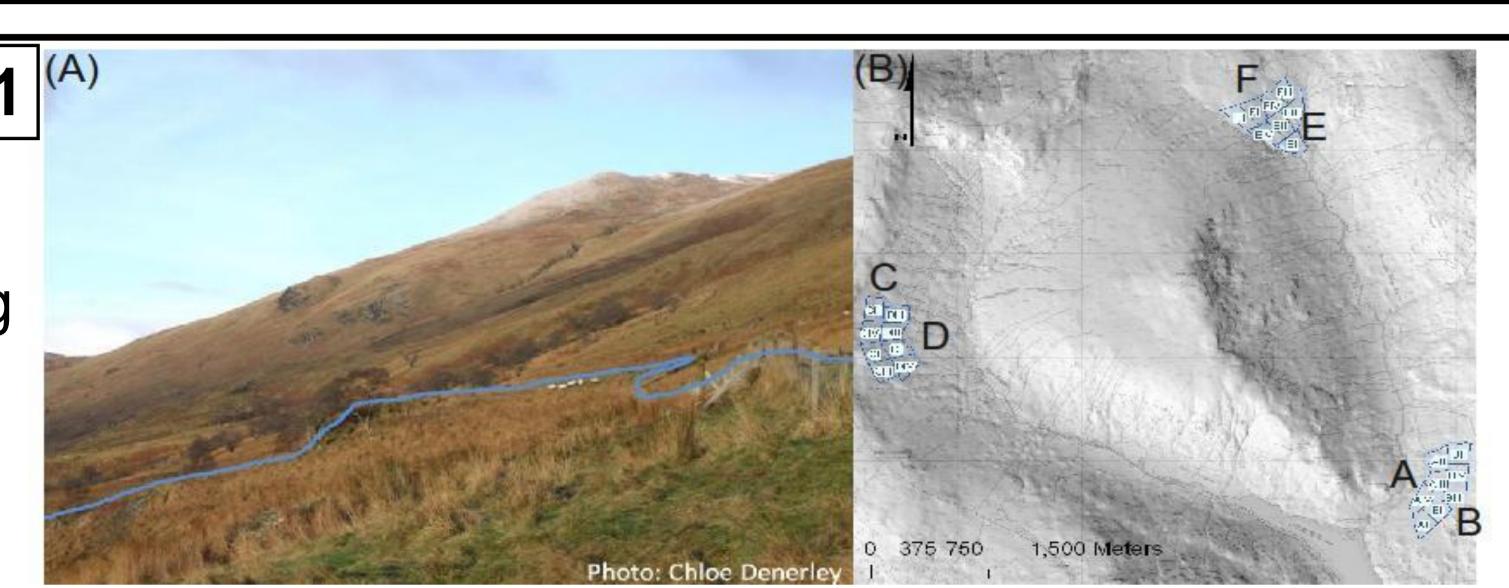
¹IBES, University of Aberdeen, St Machar Drive, Aberdeen AB24 3UU, UK, ²ACES, University of Aberdeen, St Machar Drive, Aberdeen AB24 3UU, UK, ³James Hutton Institute, Craigiebuckler, Aberdeen AB15 8QH, UK. ⁴ÉPFL, Route Cantonale, 1015 Lausanne, Switzerland, CH-1015.

Background

Upland soils in the UK hold approximately one-third of the national terrestrial carbon (C) stores. It is vital to manage upland ecosystems so that soil C loss is avoided. Livestock grazing dominates upland land use, yet our understanding of the impact of grazing on C storage has been dogged by presence vs. absence (exclosure) studies. Using a long-term (est. 2003) and large-scale grazing experiment (Fig. 1) we provide evidence of the impact of different sheep grazing intensities on upland C storage and species abundance and diversity.

Approach

- (1) Quantify C stored in dominant plant community *Molinia caerulea* (purple moor grass) after 7 years.
- (2) Predict soil C storage based on plant C inputs using an organic turnover model (RothC) over 100 years.
- (3) Compare long-term plant and soil C storage with long-term surveys quantifying the abundance and diversity of animal and plant species.



(A) Single 3.3 ha grazing plot (B) Glen Finglas grazing experiment (6 treatment blocks A-F).

How does sheep grazing intensity impact upland C storage and species abundance and diversity? **High-intensity** Low-intensity No grazing Ewes ha⁻¹ 0.9 CO₂ equivalent tonnes ha⁻¹ (± 1 SE) **522** 470 384 (± 48) 100 CO₂ equivalent (± 46) (± 32) tonnes ha-1 Soil (2009-2109) **25** 18 14 (± 4) Plant (2003-2009) (± 6) (± 3) **Meadow pipits** (average abundance 2003-2009) Field voles (average abundance indices 2003-2009) **Plant diversity** (average Shannon-Wiener index 2003-2011) **Moth diversity** (average number of species 2007-2008)

Conclusion Our findings suggest that to minimise trade-offs between multiple upland land-use objectives low-intensity sheep grazing is a better upland management practice than high-intensity sheep grazing and/or a cessation of grazing altogether.

