

Carbon sequestration by upland sheep grazing management

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Background

The majority of European terrestrial carbon (C) is stored in upland soil. It is vital to manage upland ecosystems such that soil C loss is avoided. Livestock grazing dominates upland land use, but its impact on C sequestration is poorly understood. *Molinia caerulea* – Purple moor grass dominates 10 % of UK uplands, and it is likely to contribute substantially to soil C pools. It creates a sward of tussocks and inter-tussocks.

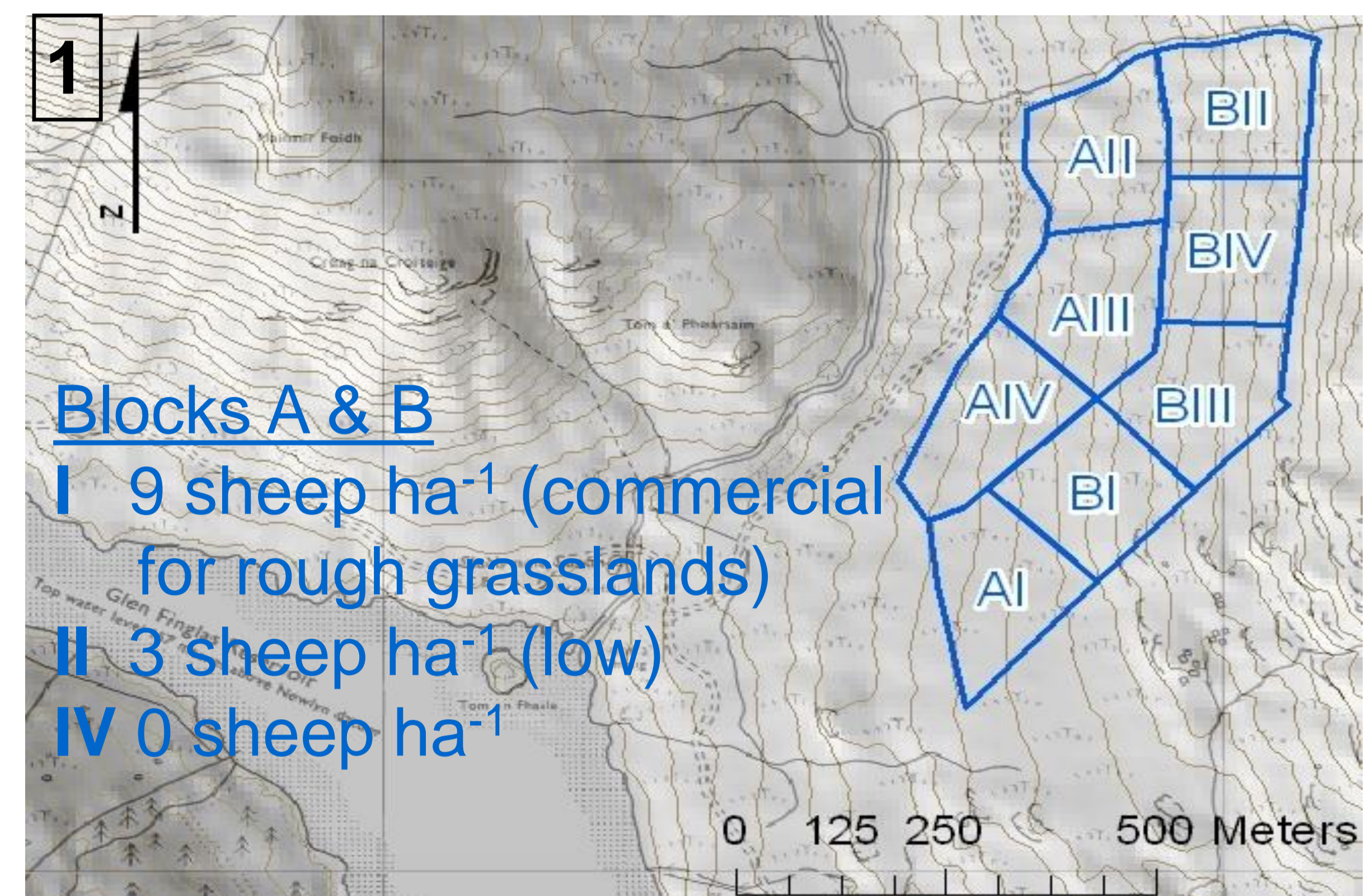
Aim: To quantify C stocks of *Molinia caerulea* swards under different sheep stocking densities.

Methods

C stocks were estimated for three sheep stocking densities, across a landscape-scale grazing experiment at the Glen Finglas estate, Scotland, established in 2002 (partly shown in Fig 1).

C was estimated at two spatial scales:

- (1) Tussock scale (20 cm x 20 cm): partitioning C into plant parts (shoots, shoot bases, shallow and deep roots) ($n = 4$).
- (2) Sward scale (2 m x 10 m): accounting for total area of tussock and inter-tussock using transect measurements ($n = 16$).



Results

Tussock-scale C

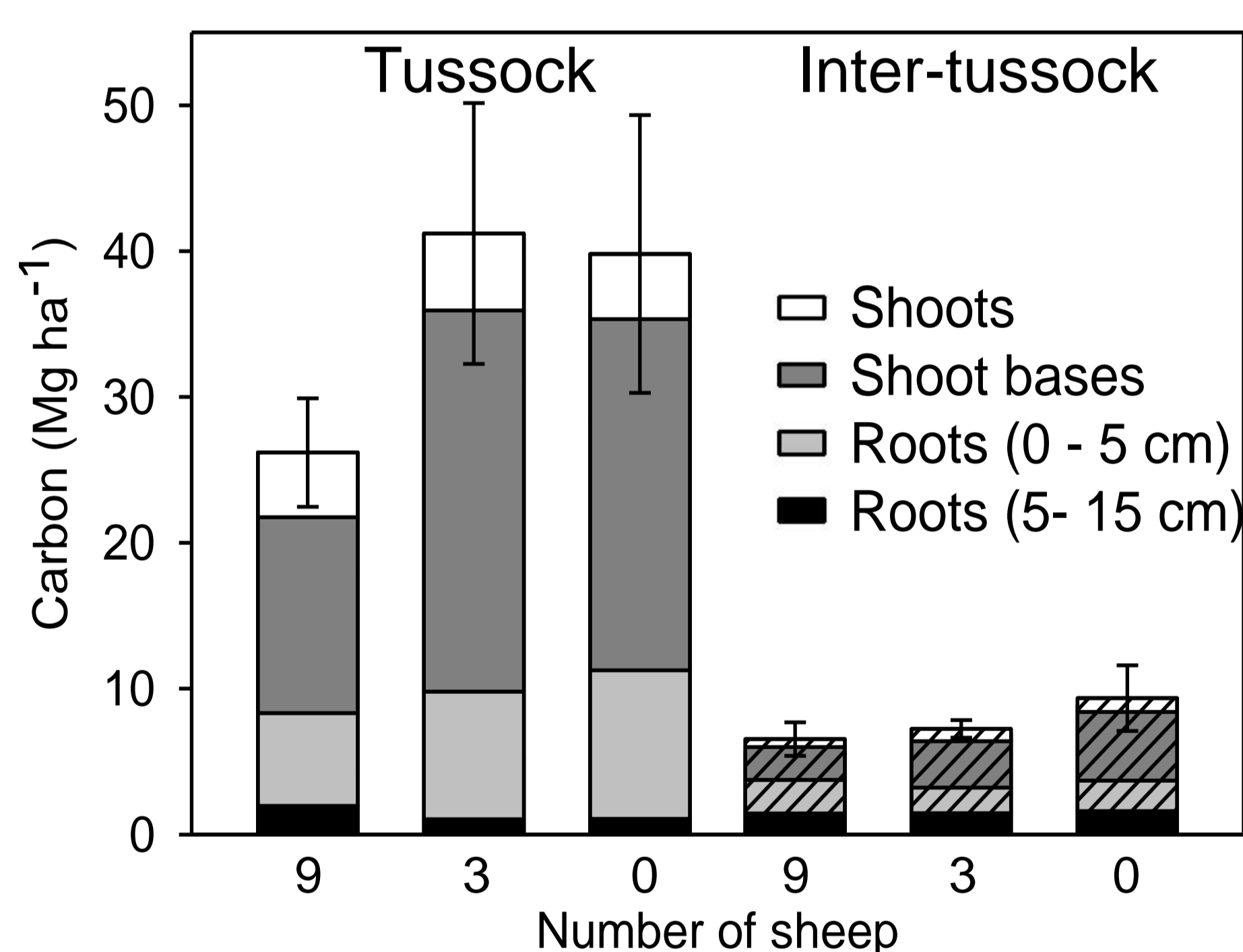


Fig 2: *M. caerulea* shoot bases were the largest plant C pool and most sensitive to sheep grazing pressure.

Total tussock area

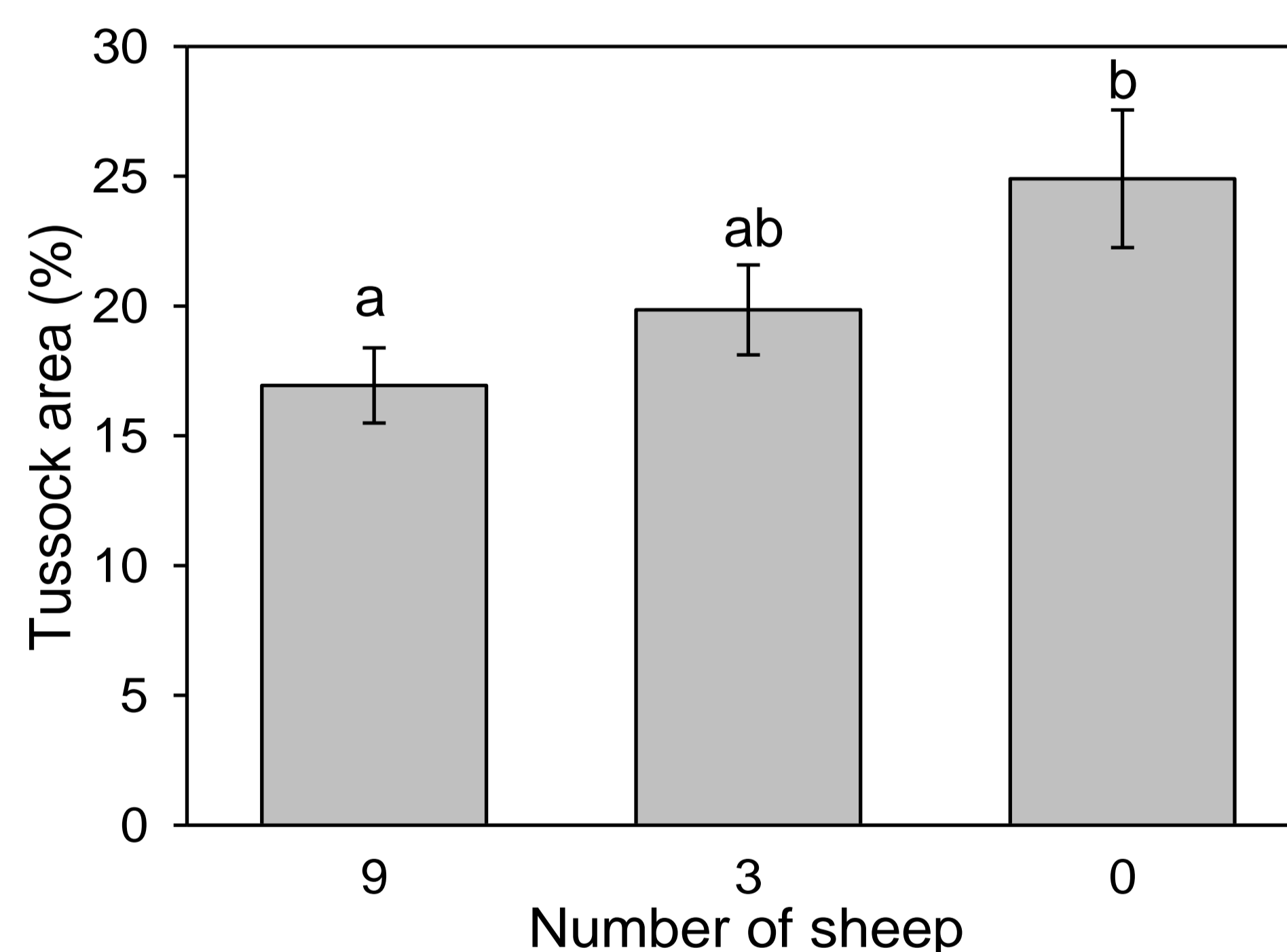


Fig 3: Removal of sheep caused an increase in tussock number and thereby tussock area.

Sward-scale C

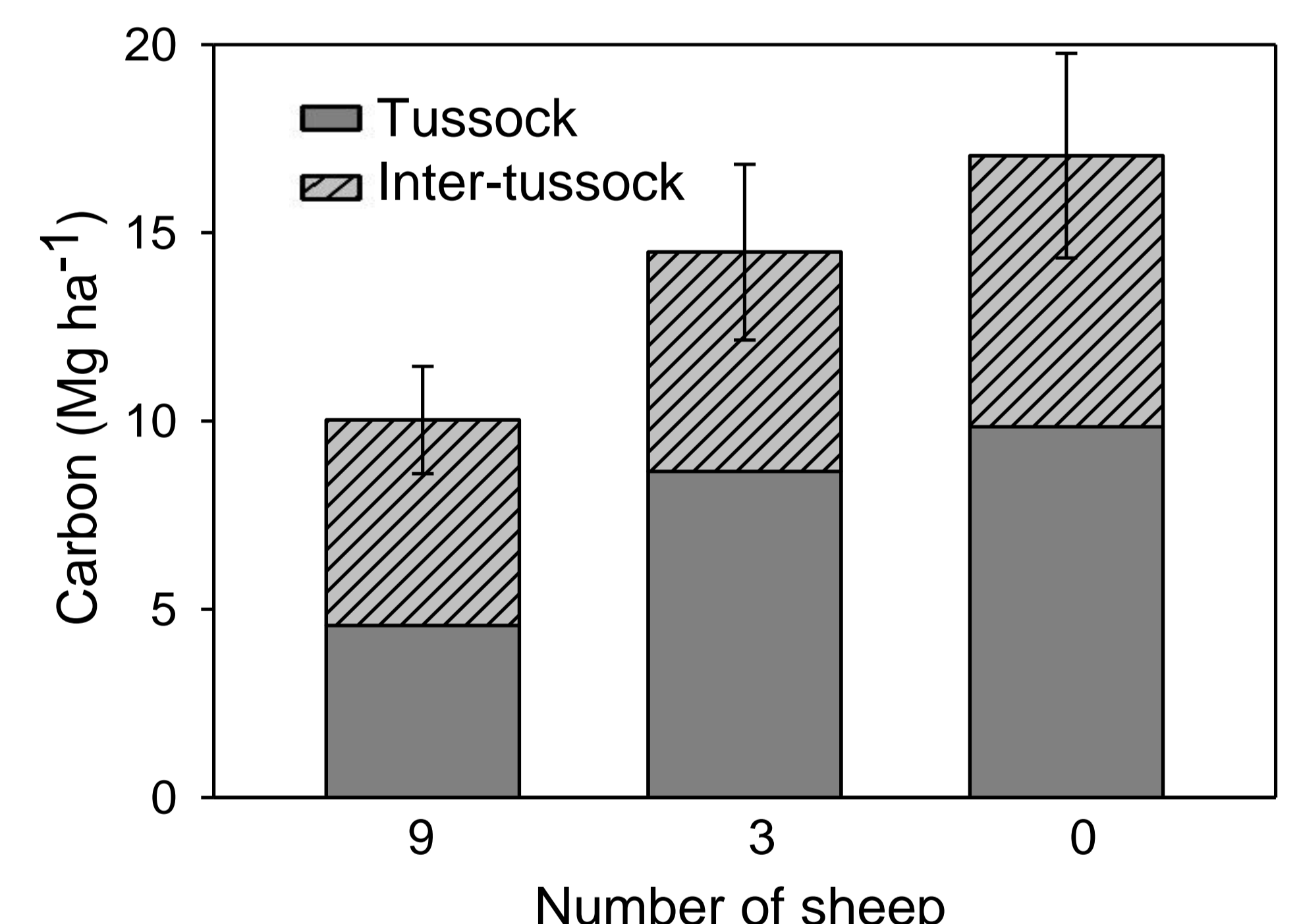


Fig 4: Across the sward, C stocks increased with decreased stocking density.

In comparison to commercial stocking density, removal of sheep resulted in an accumulation of $\sim 7.02 (\pm 2.11)$ Mg C ha⁻¹ (Fig 4), whilst reduction to low stocking density accrued $\sim 4.46 (\pm 3.76)$ Mg C ha⁻¹.

Conclusion

Removal of sheep from the uplands can increase plant C stocks, and potentially C inputs into the soil, over several years. However, the carbon benefit of low stocking density is smaller and more variable.