Livestock and the carbon stocks of **Falkland Islands' whitegrass camps**

Whitegrass is the dominant grass species across the Falkland Islands' camps © David Higgins

The Falkland Islands hold the highest proportion of peat-wetland cover of any part of the United Kingdom (UK), including the UK Overseas Territories, with carbon storage estimates of 934 million tonnes. As well as holding huge carbon stores these peatlands support valuable habitats containing globally important fauna and flora. The ecosystem benefits from these habitats include soil erosion protection, carbon storage, visually stunning landscapes as well as providing the major water catchments for the Islands. The Falklands Conservation (FC) Darwin Plus Peat-Wetland Project is working alongside the UK Centre for Ecology and Hydrology (CEH) and Royal Botanical Gardens, Kew, to develop deeper awareness of these habitats.

As part of the wider project the Department of Business, Energy and Industrial Strategy provided match funding to explore the potential for above ground carbon storage in whitegrass *Cortaderia pilosa* camps (large open pastures). Whitegrass is the dominant habitat across large swathes of the Falkland Islands and is most likely a climax vegetation. There are locations where whitegrass tussocks reach over one metre, offering potential for inclusion in future carbon offsetting schemes with additional benefits for biodiversity and reduced impacts to soils from wind-drying.

There have been suggestions that ungrazed tussock whitegrass could hold over 10 times the carbon stock of heavily grazed whitegrass camps. However, studies also point to a reduced standing crop of whitegrass under intensive grazing leading to the loss of large tussocks and the potential for habitat change, soil erosion and biodiversity impacts.

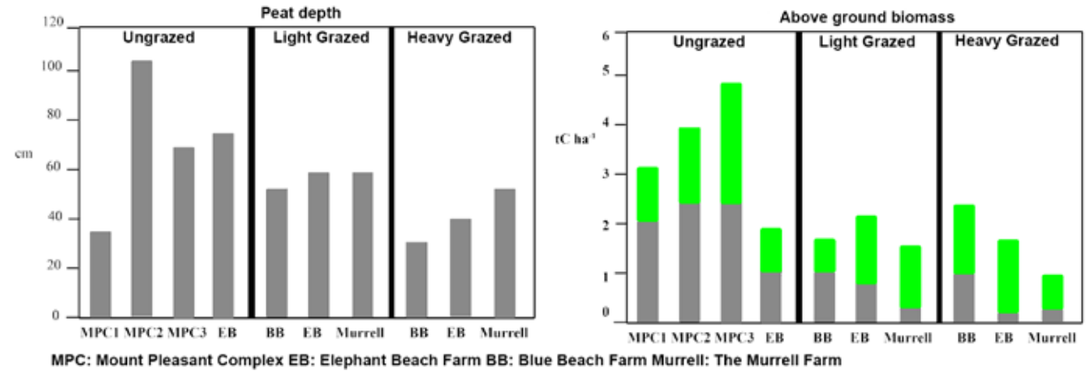
The whitegrass camps at the British Forces South Atlantic Islands (BFSAI) Mount Pleasant Complex (MPC) hold some of the densest whitegrass in the Falkland Islands. Many have been ungrazed for at least thirty years, offering opportunities to develop understanding of vegetation and soil trajectories when grazing is removed.

The hypothesis is that both above and below ground carbon will increase, with increased soil moisture and reduced soil erosion, if whitegrass camps are destocked. The MPC camps offer a window to this. Due to the absence of grazing, the whitegrass vegetation at MPC has developed a thick sward with an associated community of dwarf shrubs including fachine, Christmas bush, diddle-dee, mountainberry and teaberry, and an understory of more delicate species such as Antarctic bedstraw, small fern and emerald bog. In conjunction with these changes, it can be expected that peat soil development will be enhanced due to raised water tables, as well as decreased erosion risk and elevated carbon levels. If such patterns exist it would allow understanding of how the Falkland Islands' peat-wetlands may change if left ungrazed over decadal periods.

To develop this understanding the project team needed to survey camps under a range of grazing pressures including highly grazed, low grazed and ungrazed to determine above ground carbon stocks and peat soil properties. While many of the Falkland Islands farms contain high and low grazed whitegrass camps, not all hold ungrazed camps. Due to this it was essential that the team worked directly with BFSAI at MPC. During the project

Site	Peat Depth	Biomass		
		Whitegrass	Other species	Total
	cm	t c ha $^{-1}$	t c ha $^{-1}$	t c ha $^{-2}$
MPC Ungrazed 1	30	1.98	1.32	3.30
MPC Ungrazed 2	>110	2.42	1.35	3.77
MPC Ungrazed 3	70	2.37	2.47	4.84
Elephant Beach Ungrazed	75	1.18	0.85	2.03
Blue Beach light grazed	50	0.95	0.78	1.73
Elephant Beach light grazed	55	0.76	1.41	2.17
Murrell light grazed	54	0.40	1.12	1.52
Blue Beach heavy grazed	30	0.98	1.57	2.55
Elephant Beach heavy grazed	41	0.34	1.32	1.66
Murrell heavy grazed	56	0.37	0.66	1.03

Mean peat depth and above ground biomass by grazing intensity © Chris Evans



Peat depth and estimated tC ha^{-1} for the survey sites © Chris Evans

the team worked on 13 camps based on five farms as well as Falkland Islands Government (FIG) common land and three ungrazed camps at MPC. As one of the few locations where the absence of grazing could be measured in decades, working at MPC enabled the team to meet their objectives.

The MPC field visit was facilitated and hosted by Kevin Lane, Theatre Environmental Protection Officer, who further assisted by volunteering during the surveys. At each camp four sample sites were identified at which all plant species were recorded within a 4m^2 quadrat. At the centre of the quadrat a smaller 50 x 50cm quadrat was created where all the vegetation was harvested down to soil level. The harvested vegetation was then separated into two components. The first fraction was whitegrass only with all other vegetation making up the second fraction. Measurements of average sward height and soil depth were then taken while a simple penetrometer was deployed to identify the depth of any soil compaction. Finally, soil samples were taken from the centre of the quadrats for soil bulk density, carbon and pH analysis.

The samples where later analysed at the FIG Department of Agriculture laboratories in Stanley. Both the whitegrass and all other vegetation fractions were sieved through a 2mm sieve to remove any soil present. Both sample types were dried at 60°C for 23 hours and then at 100°C for 1 hour to remove all water from the samples. The dried samples were weighed to provide an assessment of above ground biomass and then multiplied by 0.52 – a standard for calculating the carbon content of dried vegetation. The project provided understanding of soil properties under the different grazing regimes as well as an extrapolation of above ground biomass per hectare.

The most striking feature of the results is the higher biomass and carbon stock (accompanied by changes in other species present) at the MPC sites. As these sites have been ungrazed for over 30 years they appear a good indicator of the likely trajectory of vegetation change if grazing is ceased. The team noted other benefits at ungrazed sites e.g. both sward height and soil moisture levels increased, suggesting higher vegetation offers a buffer against the almost constant wind-drying impacts found in the Falkland Islands. With increased soil moisture comes a greater potential for peat formation and so the benefits of grazing stock removal cascade from vegetation growth to soil formation, offering a two step benefit for carbon accrual.

There are also benefits to biodiversity. At the MPC sites a shrubby layer of plant species had developed with good stands of fachine and other species including Christmas bush, teaberry and mountainberry. While the team did not record bird or invertebrate species it seems likely that increased habitat structure will benefit wildlife through heightened niche availability. This would offer potential for wider functional groups such as detritivores, predators and prey species enhancing ecological relationships at ungrazed sites and suggesting that management for carbon storage will also benefit wildlife.

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Landscape towards MPC overlooking Tumbledown, Mt Challenger, Mt Kent & the Two Sisters © David Higgins