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1 Short Communication.

2 **Peatland initiation and carbon accumulation in the Falkland Islands.**

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9 Building, Aberdeen AB24 3UF, United Kingdom.

10 **ABSTRACT**

11 The Falkland Islands in the South Atlantic Ocean contain extensive peatlands at the edge of their  
12 global climatic envelope, but the long-term carbon dynamics of these sites is poorly quantified. We  
13 present new data for ten sites, compile previously-published data and produce a new synthesis.  
14 Many peatlands in the Falkland Islands developed notably early, with a fifth of basal <sup>14</sup>C dates pre-  
15 Holocene. Falkland Islands peats have high ash content, high carbon content and high bulk density  
16 compared to global norms. In many sites carbon accumulation rates are extremely low, which may  
17 partly relate to low average rainfall, or to carbon loss through burning and aeolian processes.  
18 However, in coastal Tussac peatlands carbon accumulation can be extremely rapid. Our re-analysis  
19 of published data from Beauchene Island, the southernmost of the Falkland Islands, yields an  
20 exceptional long-term apparent carbon accumulation rate of 139 g C m<sup>-2</sup> yr<sup>-1</sup>, to our knowledge the  
21 highest recorded for any global peatland. This high accumulation might relate to the combination of  
22 a long growing-season and marine nutrient inputs. Given extensive coverage and carbon-dense  
23 peats the carbon stock of Falkland Islands peatlands is clearly considerable but robust quantification  
24 will require the development of a reliable peat map. Falkland Island peatlands challenge many  
25 standard assumptions and deserve more detailed study.

26 **KEYWORDS:** South Atlantic; Carbon accumulation; Bog; Peat; Holocene.

27 **HIGHLIGHTS:**

- 28 • The Falkland Islands contain extensive and poorly-understood peatlands.  
29 • Peatlands are notably old with many pre-Holocene in age.  
30 • Long-term carbon accumulation rate is very variable between sites.  
31 • One site has the highest recorded carbon accumulation rate for any global peatland.  
32 • These unusual peatlands deserve further study.

33

## 34 INTRODUCTION

35 Global peatlands currently store around 400-600 Gt of carbon and the long-term evolution of this  
36 carbon pool has been an important focus for palaeoenvironmental research (Gorham, 1991;  
37 MacDonald et al., 2006; Yu, 2012). The most extensive peatlands today are in the northern boreal  
38 zone, in particular Western Siberia and the Hudson Bay Lowlands (Packalen et al., 2014; Sheng et al.,  
39 2004), with other substantial areas in the humid tropics of equatorial Southeast Asia, Africa and  
40 South America (Dargie et al., 2017; Page et al., 2011). Peatlands also occur in the high southern  
41 latitudes of Australasia, Africa and South America with Yu et al. (2011) estimating the carbon stock of  
42 these peatlands as 13-18 GtC. The largest proportion of this southern peatland carbon pool is  
43 located in South America where peatlands developed early, have accumulated carbon at a notably  
44 rapid rate and exist in a distinct climatic envelope (Loisel and Yu, 2013; Yu et al., 2011). Southern  
45 hemisphere peatlands are generally under-researched and there is a clear imperative to improve  
46 understanding both in order to fill gaps in global databases and to understand carbon accumulation  
47 in distinctive and unusual peat-forming environments.

48 The focus of this study is the Falkland Islands in the South Atlantic Ocean, located 500 km east of  
49 mainland South America (~51°41'S, 59°10'W). Peatlands are extensive in the archipelago to the  
50 extent that the Falkland Islands have been identified as having the highest proportional peat  
51 coverage of any nation or territory (Joosten, 2010; McAdam, 2013). However, there are open  
52 questions around whether these peatlands are continuing to accumulate carbon and how their  
53 carbon stock has been affected by climate change and land management (Otley et al., 2008). The  
54 peatland landscapes of the islands are unusual and varied, including some highly atypical peatland  
55 habitats with very tall grasses and extensive influence from marine birds and mammals (McAdam,  
56 2013; Smith and Karlsson, 2017). Prior to the first European settlement in the mid-18<sup>th</sup> century there  
57 were no mammalian herbivores on the islands, and the introduction of extensive livestock grazing  
58 has therefore led to major ecological change. Despite the presence of highly unusual peatland types,  
59 their extensive area, widespread evidence of human-induced modification, and the status of the  
60 islands as an Overseas Territory of the United Kingdom – which has considerable peat research  
61 capacity – surprisingly little research has been conducted. The carbon stock, current greenhouse gas  
62 balance, timing of peat development and rate of carbon accumulation in Falkland Island peatlands  
63 are all largely unquantified. Here we present new data and a synthesis of the fragmentary existing  
64 data in order to provide an initial assessment of peatland developmental history and long-term  
65 carbon accumulation.

## 66 SITES AND METHODS

67 Our sampling focussed on East Falkland, the largest island containing the greatest peat area, and  
68 aimed to sample a range of peatlands spanning much of the island (Table 1; Supplementary Fig. 2).  
69 We sampled five sites with vegetation dominated by Whitegrass (*Cortaderia pilosa*); typically in  
70 shallow basins, often with shallow peats. We sampled three sites with deeper peats and more varied  
71 vegetation, including the shrub *Empetrum rubrum* ('Diddle Dee'), the monocot *Astelia pumila* and a  
72 variety of graminoids, forbs and bryophytes. We sampled one coastal site with vegetation a near-  
73 monoculture of Tussac grass (*Poa flabellata*). These coastal peatlands are relatively restricted in  
74 distribution around the coastal fringe of the islands but have high above-ground carbon stocks and

75 can have deep peats (<11m)(Smith and Clymo, 1984; Smith and Karlsson, 2017). Finally, we sampled  
76 one site in a valley system with closely-cropped graminoid vegetation (Table 1).

77 Cores were extracted from a representative location in each site using a Russian-pattern peat corer  
78 (Aaby and Digerfeldt, 1986) and were subsampled in the field into 10 cm sections (Fig. 1). Additional  
79 samples (c. 4 cm<sup>2</sup>) were taken from the interface of the lowermost peat and underlying sediment for  
80 dating. In the laboratory, sample volumes were determined by water displacement and samples  
81 oven dried at 105 °C to calculate dry bulk density (Chambers et al., 2011). Sub-samples were ground  
82 and incinerated at 550 °C to calculate loss on ignition (LOI) and a subset of 91 samples (60%) spread  
83 evenly across all the cores was analysed for carbon content using an Elementar vario MACRO  
84 elemental analyser with glutamic acid and peaty soil standards (Chambers et al., 2011). There was a  
85 strong and significant linear relationship between loss on ignition and carbon content ( $r=0.98$ ,  
86  $p<0.001$ ) which was used to calculate carbon content for all samples without direct measurements  
87 (Supplementary Fig. 3). Carbon density was calculated as the product of bulk density and measured  
88 or modelled carbon content. Core carbon stock was calculated as the product of mean carbon  
89 density and depth. Basal peat was disaggregated and inspected under low-powered microscopy  
90 before being prepared for AMS <sup>14</sup>C dating using an acid-base-acid protocol (Brock et al., 2016). For  
91 four sites (SSX, SWI, ORQ, DPO [Table 1]) it was possible to identify macrofossils suitable for dating,  
92 typically above-ground graminoid fragments. For the remaining six sites no suitable macrofossils  
93 could be identified so we dated the humate fraction of bulk peat following the removal of roots  
94 (Loisel et al., 2017; Shore et al., 1995). The resulting <sup>14</sup>C dates were calibrated using the SHCal13  
95 curve (Reimer et al., 2013) in Bchron (Parnell, 2016). The full-core long-term apparent rate of carbon  
96 accumulation (here termed LARCA<sub>FC</sub>) was calculated by dividing carbon stock by the calibrated basal  
97 date. To account for the complexity of the calibrated radiocarbon age estimates we re-sampled the  
98 individual probability distributions 1000 times and calculated LARCA<sub>FC</sub> for each; we present results  
99 on this basis as the mean and the 5<sup>th</sup> and 95<sup>th</sup> percentiles. We also calculated LARCA<sub>FC</sub> for a  
100 previously-published record from Beauchene Island (Smith and Prince, 1985; Smith and Clymo, 1984)  
101 by converting wet to dry bulk density on the basis of moisture content, converting loss on ignition to  
102 carbon content using the relationship derived in this study and interpolating between the measured  
103 depths. To test the representativeness of the core dataset in terms of peat depth we compared the  
104 dated core depths to a larger dataset of 805 depth measurements from 371 locations in East  
105 Falkland (Supplementary Fig. 2). Depth measurements in this dataset were made using either an  
106 avalanche probe or a soil corer, with a maximum recording depth of 2.5 m. Measurements were  
107 typically made along transects at a range of upland and lowland locations spanning peat/non-peat  
108 transitions. This dataset includes variable numbers of measurements in each peatland so we  
109 calculated site mean depths and compared these values to our dated core dataset using kernel  
110 density plots. The depth dataset is not considered to be representative of the peatland areas as a  
111 whole, but is both considerably larger than the core dataset and includes other areas of the island.

112 In parallel with our primary data collection we conducted a systematic search of the literature. We  
113 compiled datasets of <sup>14</sup>C dates representing peat initiation and individual site age-profiles and  
114 calibrated these dates based on the SHCal13 curve (Reimer et al., 2013) in Bchron (Parnell, 2016).  
115 Using both new and published basal peat radiocarbon dates we constructed a cumulative Summed  
116 Probability Distribution (cSPD) to quantify the timing of peat initiation in the Falkland Islands (Reyes  
117 and Cooke, 2011). To place these results in context we also constructed cSPDs for global and extra-  
118 tropical South American peatlands based on the database of Treat et al. (2017). For each site

119 containing at least two dated depths we constructed a Bayesian age-depth model using Bacon with  
120 default priors for accumulation rate and memory, accepting alternate suggestions where initial  
121 screening suggested these were inappropriate (Blaauw and Christen, 2011; Goring et al., 2012). We  
122 assigned the peat surface a calendar date based on the year of first data publication, unless peat was  
123 overlain by other sediment.

124 Quantifying temporal change in carbon accumulation requires cores with data on carbon density and  
125 adequate chronological control throughout the peat profile which is currently available for very few  
126 cores (Turney et al., 2016). However, several cores do have adequately constrained age-depth  
127 models and this study presents data on carbon density for a substantial number of samples. In order  
128 to use these data to make preliminary inferences about change in apparent carbon accumulation we  
129 adopted the empirically-based framework of Ratcliffe et al. (2018) whereby age-depth models are  
130 constructed for all available sites, levels are assigned carbon density values of an appropriate age  
131 through multiple iterations of random re-selection, results are aggregated across cores and weighted  
132 by age-depth model precision to produce an overall reconstruction. These results allow us to make  
133 some initial inferences about temporal variability in carbon accumulation across the study region.

## 134 **RESULTS AND DISCUSSION**

### 135 *Peatland initiation*

136 Basal peats in our study sites ranged in age from pre-Holocene (SWI) to late Holocene (WCR).  
137 Combining our ten new dates with other basal dates from the literature gives a total dataset of thirty  
138 peat initiation dates for the Falkland Islands. These suggest that peat formation began very early  
139 with six sites showing pre-Holocene peat initiation, and the oldest sample thus-far published dated  
140 at  $13475 \pm 50$  BP (calibrated weighted mean: 16163 cal. BP) (Wilson et al., 2002). The oldest dates  
141 are from the Lake Sullivan area of West Falkland (Wilson et al., 2002), but this is also the most  
142 intensively-studied area and it is probable that similarly old peat is present in other locations. The  
143 cSPD plots show that Falkland Island peatlands developed markedly earlier than the global norm, but  
144 early peatland development is not unusual for South America (Fig. 3). While considerably older  
145 peatlands are present around the world (Treat et al., 2019), many of these are in the tropics and  
146 Falkland Islands peatlands are atypically old for the temperate/boreal realm. This may relate to the  
147 limited extent of late Quaternary glaciation, which appears to have been restricted to cirques and  
148 small mountain glaciers, particularly in West Falkland (Clapperton, 1971; Clapperton and Suggern,  
149 1976; Roberts, 1984). The available stratigraphic evidence suggests that peat formation was  
150 dominated by primary development and paludification with hydrosere development rare. Rates of  
151 peat initiation appear to have been relatively consistent from the early Holocene to  $\sim 5$  ka cal. BP but  
152 then slowed (Fig. 4). However, comparing the cores dated in this study to a larger peat depth dataset  
153 from East Falkland suggests a bias towards deeper peats (Supplementary Fig. 4). This may have  
154 skewed the sample towards older dates, although it is notable that even some sites with shallow  
155 peat have early initiation dates (e.g. HOP) and comparison with the depth dataset is complicated by  
156 definitional issues and the fact that some locations in the depth dataset exceeded the maximum  
157 measurable depth. However representative they may be, our results demonstrate that the Falkland  
158 Islands contain a surprising number of very old peatlands which stresses the importance of including  
159 such under-studied regions in global datasets. Considerable work remains to be done to assess the

160 developmental history of South American peatlands and our combined dataset expands the current  
161 radiocarbon data resource by almost 50%, albeit with a focus on a single region.

### 162 *Peat properties*

163 The sedimentary properties of Falkland Islands peats differ from those of most global peatlands (Fig.  
164 1; Fig. 2). Ash content in these samples was relatively high with only a small proportion of samples  
165 having loss on ignition greater than 95% (15.2%), much less than the global mean (46%)(Fig. 2). Ash  
166 content was highest in SWI with sediments barely classifiable as peat (mean loss on ignition: 34%).  
167 Inorganic contents were comparatively high even in clearly ombrotrophic sites (e.g. SSX), suggesting  
168 that mineral dust transport in the very windy Falkland Islands climate may be the dominant reason  
169 for this high ash content. The nature of the inorganic component has not been investigated in detail  
170 but is likely to derive from both local aeolian processes and further-travelled mineral dust, with  
171 tephra from South America also recorded as highly abundant in Falkland Islands peats (Holmes et al.,  
172 1999). Peat bulk density and carbon content were high relative to global norms (Fig. 2). In the case  
173 of carbon content this may relate to the comparative rarity of *Sphagnum* in Falkland Island peatlands  
174 as *Sphagnum* peats skew carbon content towards lower values in global data (Loisel et al., 2014).  
175 The relatively high bulk density may be due to a combination of this relative scarcity of *Sphagnum*,  
176 high ash content and the highly humified nature of many peats. The combination of high bulk  
177 density and high carbon content means that the carbon density of peat also tends towards the  
178 upper end of the global range. Collectively these data demonstrate the importance of region-specific  
179 datasets in understanding peatland carbon stocks and dynamics; global values would not be  
180 appropriate for Falkland Islands peats.

### 181 *Carbon accumulation rate*

182 Long-term rates of carbon accumulation were highly variable between sites with  $LARCA_{FC}$  ranging  
183 from 2.6 to 32 g C m<sup>-2</sup> yr<sup>-1</sup>. Rates were lowest in the valley and Whitegrass dominated sites, higher in  
184 the Diddle Dee sites and highest in the Tussac site: Cape Dolphin. However, for the Tussac peatland  
185 on Beauchene Island investigated by Smith and Clymo (1984) we calculated an exceptionally high  
186  $LARCA_{FC}$  of 139 g C m<sup>-2</sup> yr<sup>-1</sup>. This is more than six times the global mean accumulation rate (Loisel et  
187 al., 2014) and more than 50% higher than the highest published LARCA figure of which we are aware  
188 (88.6 g C m<sup>-2</sup> yr<sup>-1</sup>: Tolonen and Turunen (1996)). Carbon accumulation in this site appears to be the  
189 highest documented in any global peatland and was justifiably termed 'extraordinary' by the original  
190 authors. While the peat accumulation rate and depth of this site are towards the upper end of the  
191 global distribution, the high rate of carbon accumulation is primarily attributable to the extremely  
192 high bulk density of the peat. Older data often needs to be treated with caution but in this case the  
193 original authors went to considerable efforts to validate their bulk density measurements and the  
194 chronology is plausible; there is currently little reason not to accept this as a valid result, although  
195 further work would clearly be desirable.

196 Falkland Islands peats appear to encompass a very large range of accumulation rates. In the majority  
197 of sites  $LARCA_{FC}$  was low to very low. Our data do not allow us to assess whether this is because of  
198 low initial carbon accumulation or subsequent carbon loss, but active peat erosion is clearly a  
199 feature of the Falklands peatlands landscape. Erosion features are widely visible and in two cores  
200 from West Falkland, Wilson et al. (2002) dated the upper surface of eroding peats to 13040 ± 50 BP  
201 and 13080 ± 60 BP respectively. It is also clear that fire has had a long-term role in Falkland peatland

202 carbon dynamics with macrofossil charcoal highly abundant in peat cores (Mauquoy, unpublished  
203 data). It is likely that factors such as natural and anthropogenic burning, overgrazing and aeolian  
204 erosion are at least part of the reason for the low rates observed in many sites.

205 The reasons for the extremely rapid carbon accumulation rates in the Tussac sites are similarly  
206 unclear. The Falklands are at the edge of the climatic envelope for global peatlands being relatively  
207 dry for their mild temperature, with mean annual precipitation a little over 600mm and mean annual  
208 temperature of around 6°C (Supplementary Fig. 5). The climate regime has a high degree of seasonal  
209 consistency in precipitation and relatively mild, relatively consistent temperature which may allow  
210 for a long growing season (Supplementary Fig. 6). This is similar to Patagonia where high carbon  
211 accumulation has been attributed to similar climatic conditions in – otherwise quite different –  
212 peatlands (Loisel and Yu, 2013). However, all Falkland Island peatlands experience a broadly similar  
213 climate and the distinguishing feature of Tussac sites is their coastal location. In these locations  
214 marine birds and mammals are likely to be a significant vector for nutrients as they shelter on or  
215 amongst the large grass tussocks. Nutrient inputs through faeces and carcasses may promote high  
216 rates of both primary production and decomposition, ultimately leading to the formation of very  
217 carbon-dense peat. The biogeochemistry of these highly unusual sites would clearly repay further  
218 detailed study.

#### 219 *Variability in apparent carbon accumulation*

220 Two features are apparent in our carbon accumulation simulations (Fig. 4): an increase in peat and  
221 carbon accumulation in the late Holocene (last ~2ka) and, less clearly, an increase in carbon  
222 accumulation between 7.5 and 9.5ka cal. BP. The latter is based on a relatively limited number of  
223 cores and samples but is interesting as it parallels previous reconstructions from cores around the  
224 world and often attributed to the Holocene Thermal Maximum (HTM)(Loisel et al., 2014; Ratcliffe et  
225 al., 2018). The only previously published peatland carbon accumulation reconstruction does not  
226 extend back sufficiently far to address changes in this period (Turney et al., 2016). The Falklands  
227 climate is dominated by Westerly winds (Jones et al., 2016) and reduced wind speeds in the  
228 Southern Westerly belt have been reconstructed for the HTM (Saunders et al., 2018). Due to the  
229 position of the Falkland Islands in the lee of the Andean mountain chain, this may have led to  
230 enhanced precipitation on the Falkland Islands during this time interval given the negative  
231 correlation between 850-hPa zonal wind speed strength and precipitation in eastern Patagonia  
232 (Garreaud et al., 2013). In a previous Falkland Islands study Turney et al. (2016) attributed an  
233 increase in carbon accumulation at the top of their cores, similar to that we reconstruct, to recent  
234 climate change. However, this conclusion is unsafe because cores will inevitably show an increase in  
235 *apparent* carbon accumulation simply due to the transition to acrotelm peat which has not yet had  
236 the opportunity to decompose. This ‘near-surface uptick’ is widely reported and can be expected in  
237 all peat cores (Loisel et al., 2014). The result here should be considered an artefact pending  
238 compelling evidence to the contrary.

#### 239 *Carbon stock*

240 There is currently no established peat map for the Falkland Islands, which makes it impossible to  
241 accurately calculate the total carbon stock. A recent assessment by Evans et al. (2019) combined the  
242 peat depth survey described in this study with previous superficial deposit mapping by the British  
243 Geological Survey (Aldiss and Edwards, 1999) to produce an indicative estimate that 2820 km<sup>2</sup> ha of

244 the Falkland Islands (around one quarter of the total land area) is peat covered, noting that this  
245 estimate is highly uncertain. If we combine this estimate with the measured carbon densities  
246 obtained from our cores plus those of Smith and Prince (1985) (mean= 0.073 g C cm<sup>-3</sup>), and take our  
247 depth dataset as representative of peat depth (mean= 76cm), the total C stock would be 156 MtC.  
248 This approximate figure may be conservative (for example because peat depths > 2.5 m were not  
249 captured in the survey) but is, for instance, equivalent to more than 12,000 times the emissions  
250 associated with all annual energy consumption on the islands (2009 data: (iMC Worldwide, 2012))  
251 and considerably greater than a published assessment of the peatland carbon stock of Wales (~121  
252 MtC)(ECOSSE, 2007). Mapping of Falkland Islands peats is now underway which should allow this  
253 estimate to be better-constrained in the future.

254



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265 Author contributions: RJP secured funding. RJP, GR and CE conducted fieldwork. FR-H, DM, RJP and  
266 TS conducted laboratory work. FR-H and RJP conducted data compilation and RJP conducted data  
267 analysis. RJP wrote the first draft of the manuscript, to which all authors contributed with comments  
268 and interpretation.

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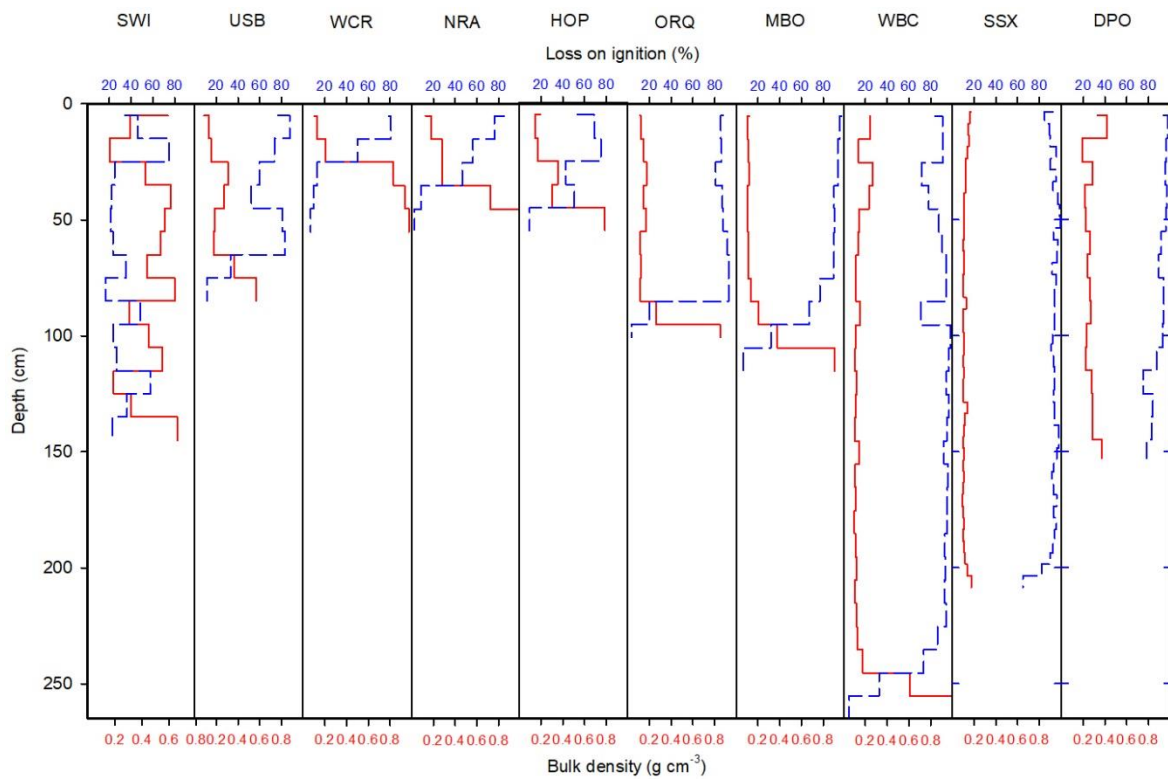
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281 **FIGURES AND TABLES**

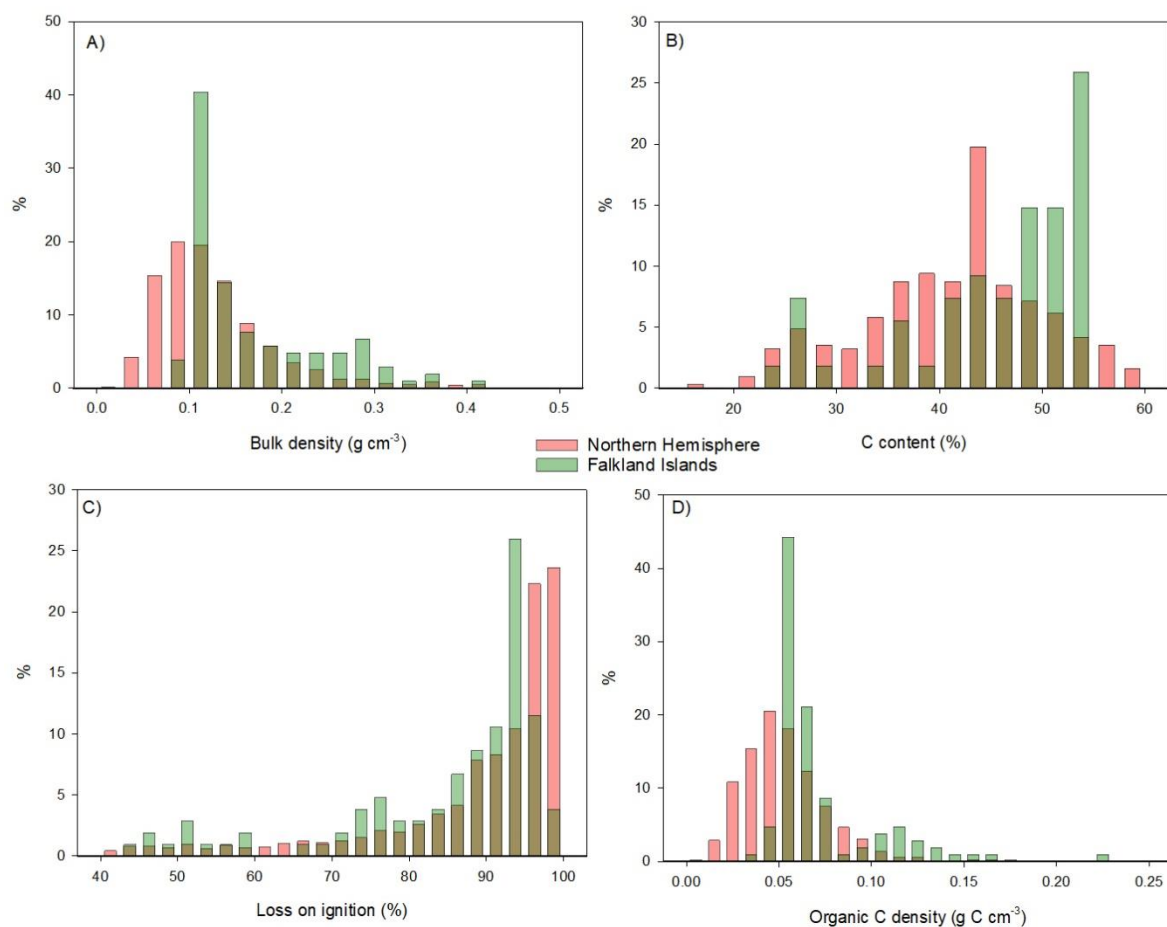
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284 Figure 1. Bulk density (red, solid line) and loss on ignition (blue, dashed line) profiles for the ten peat  
285 cores presented in this study.

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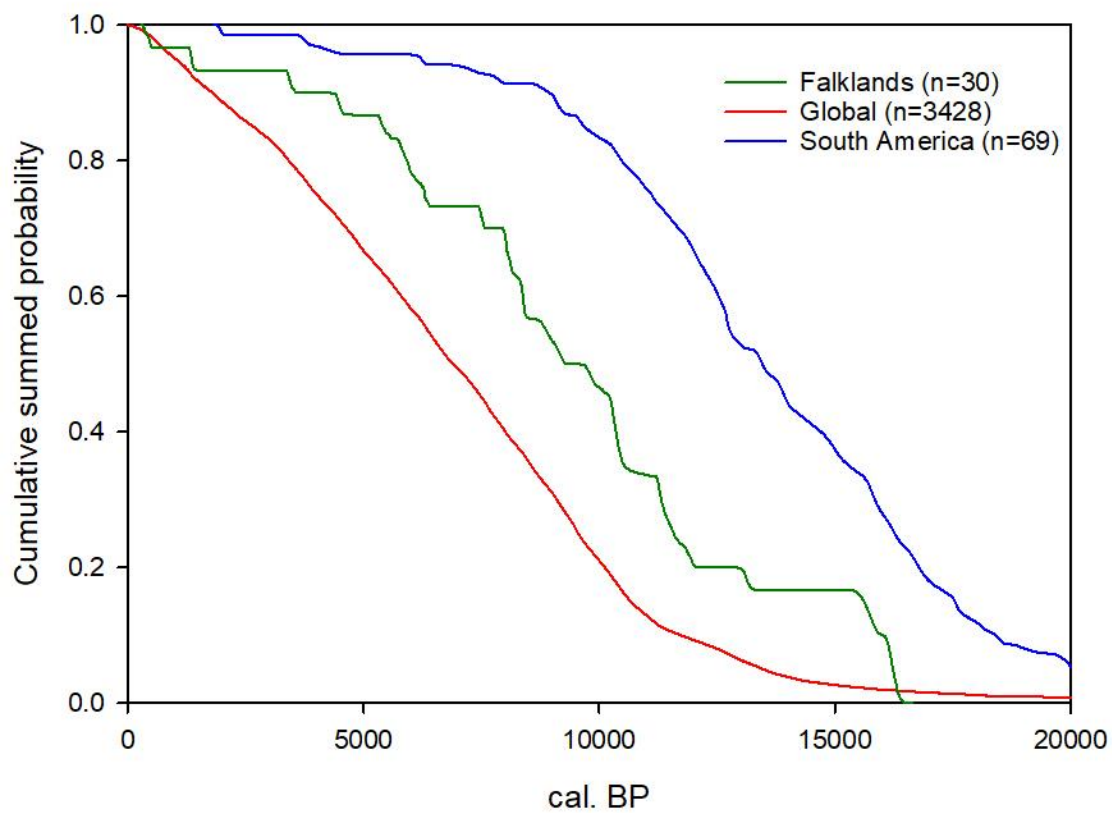


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288 Figure 2. Comparison of peat properties from sites sampled here to the Northern Hemisphere  
 289 dataset of Loisel et al. (2014). To avoid over-representing results from cores sampled at high  
 290 resolution, all cores were reduced to 10cm increment means. Samples with LOI<40% or BD>0.5g cm<sup>-3</sup>  
 291 were excluded.

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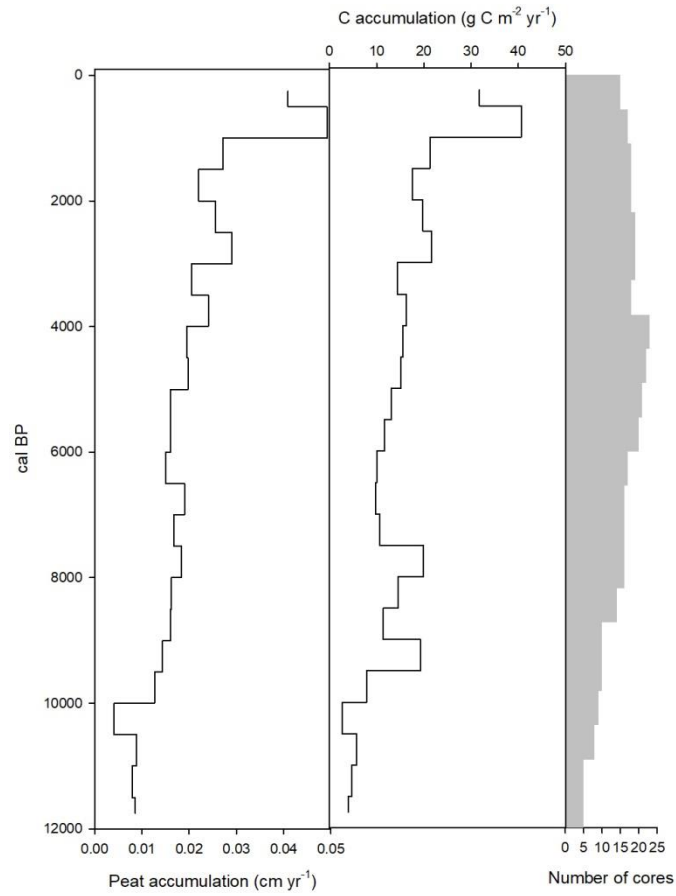


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296 Figure 3. Cumulative summed probability distribution plot of peat initiation <sup>14</sup>C dates for Falkland  
 297 Island peatlands (this study) compared to previously-presented datasets for global peat and extra-  
 298 tropical South America (Treat et al., 2017).

299



300

301

302 Figure 4. Inferred peat and carbon accumulation in Falkland Island peatlands, based on available  
 303 data: a) aggregated peat accumulation rate across all sites; b) simulated carbon accumulation; c)  
 304 number of dated core records contributing to the results.

305

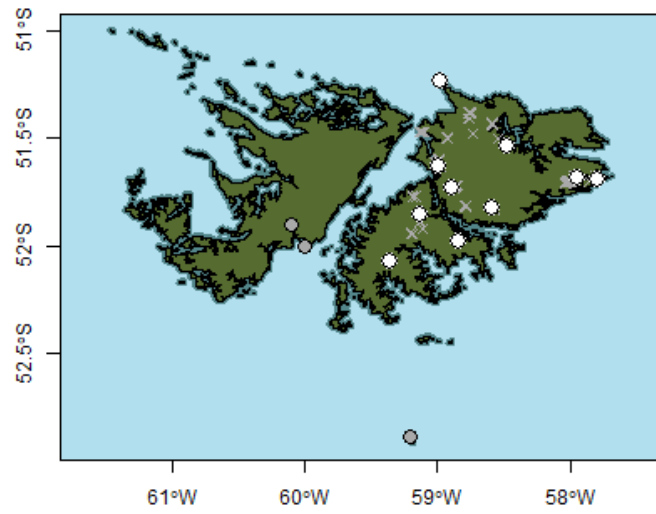
Table 1. Details of sites, basal dates, peat depth and (full-core) long-term apparent rate of carbon accumulation (LARCA<sub>FC</sub>) for sites in this study.

Site details				Basal <sup>14</sup> C date			Depth (cm)	LARCA <sub>FC</sub> (g C m <sup>-2</sup> yr <sup>-1</sup> )		
Name	Code	S	W	Code	BP	Error		Mean	5 <sup>th</sup>	95 <sup>th</sup>
<i>Valley fen</i>										
Swan Inlet	SWI	-51.82	-58.59	D-AMS-029687	13516	60	145	5.21	5.18	5.25
<i>Whitegrass</i>										
Mt. Usborne	USB	-51.73	-58.89	D-AMS-030520	10002	47	70	4.07	4	4.11
Walker Creek	WCR	-51.98	-58.84	D-AMS-030519	1520	34	34	12.08	11.62	12.48
North Arm	NRA	-52.07	-59.36	D-AMS-030518	6657	42	47	4.02	3.99	4.06
Hope Cottage	HOP	-51.54	-58.48	D-AMS-030521	9924	47	50	2.65	2.62	2.66
Orqueta	ORQ	-51.85	-59.13	D-AMS-029690	4740	42	97	10.8	10.54	11
<i>Diddle dee</i>										
Moody Brook	MBO	-51.69	-57.95	D-AMS-030516	7277	38	105	7.13	7.05	7.2
Whalebone Cove	WBC	-51.69	-57.80	D-AMS-030517	8041	46	255	19	18.73	19.34
Sussex Mountains	SSX	-51.63	-59.00	D-AMS-029686	10089	42	210	10.67	10.51	10.83
<i>Tussac</i>										
Cape Dolphin	DPO	-51.24	-58.99	D-AMS-029694	5542	45	156	32.18	31.76	32.6

## SUPPLEMENTARY FIGURES AND TABLES

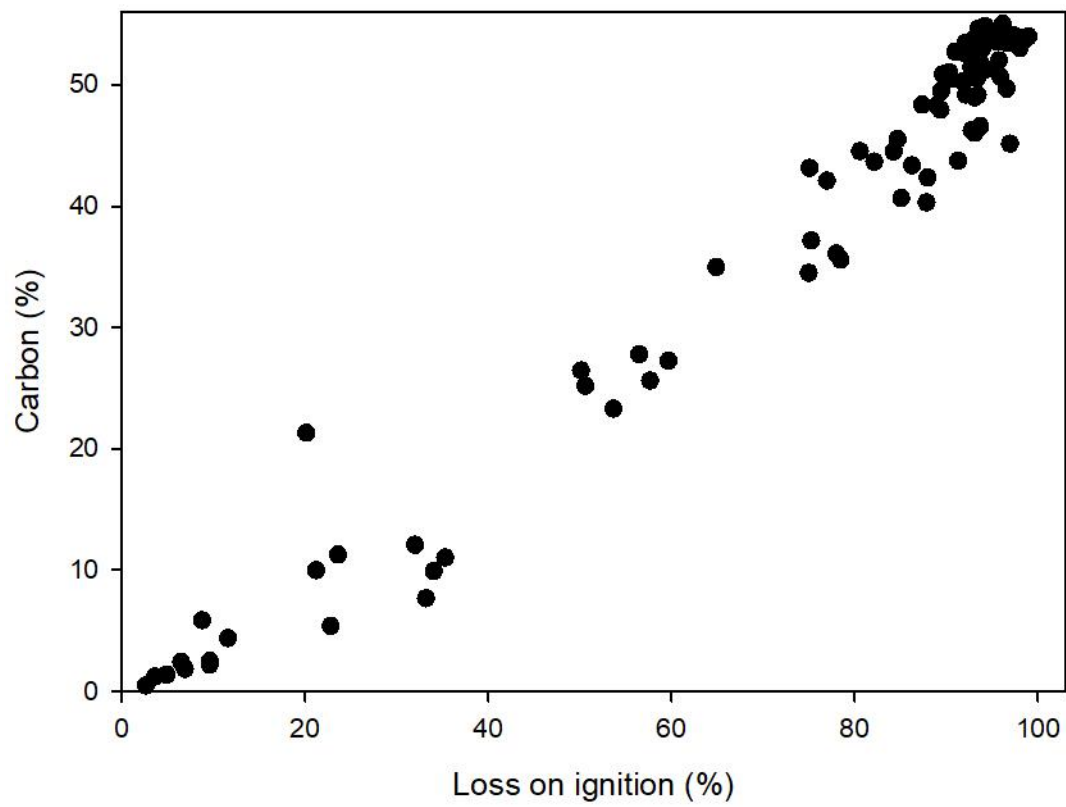


Supplementary Figure 1. Selected images of study sites, demonstrating different types of Falkland Island peatlands: A) Cape Dolphin (Tussac); B) Hope Cottage (Whitegrass); C) Whalebone Cove (Diddle Dee); D) Swan Inlet (Valley).

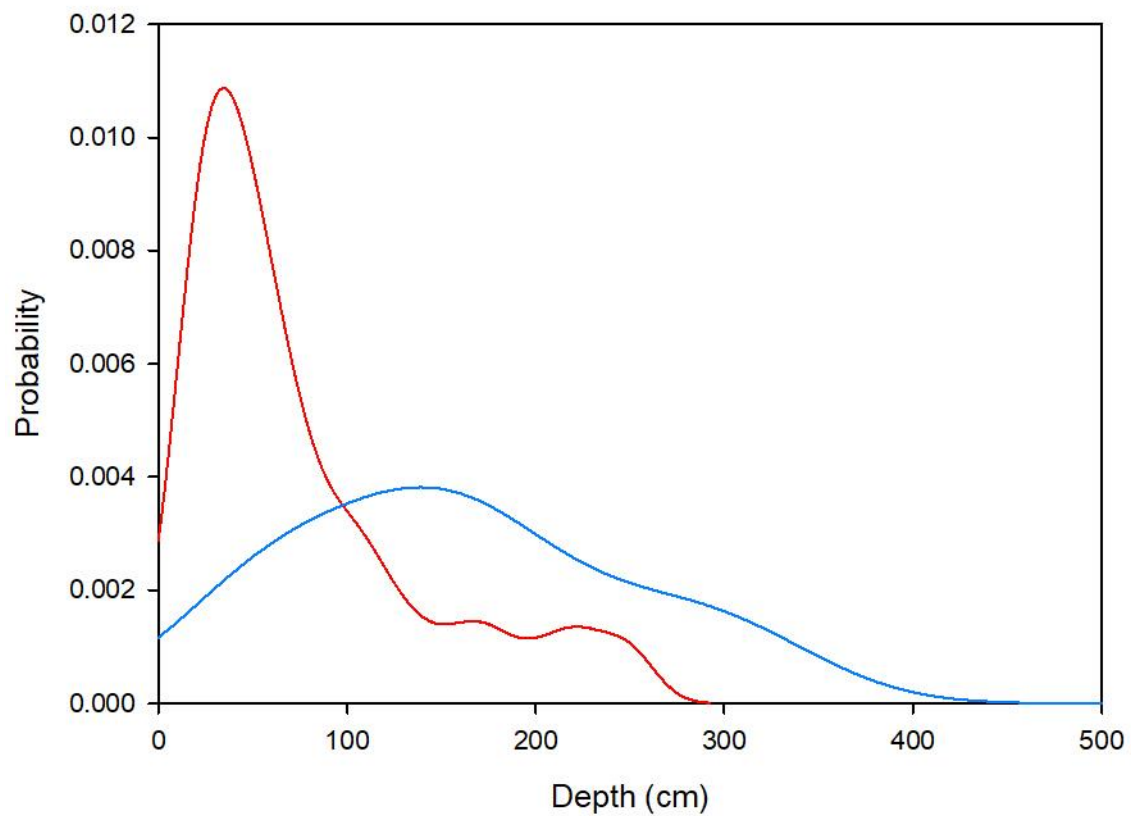


Supplementary Figure 2. Locations of sites considered in this study. Sites of new coring shown by white circles, previously studied coring sites shown by grey circles and sites of depth measurements shown by crosses.

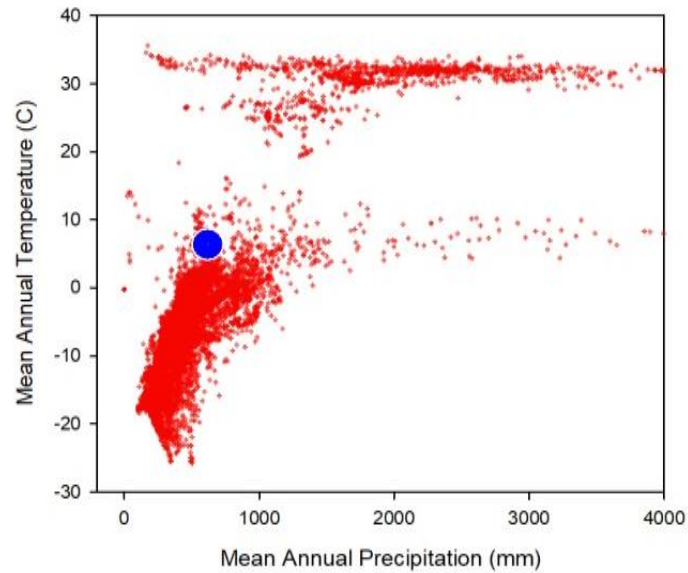




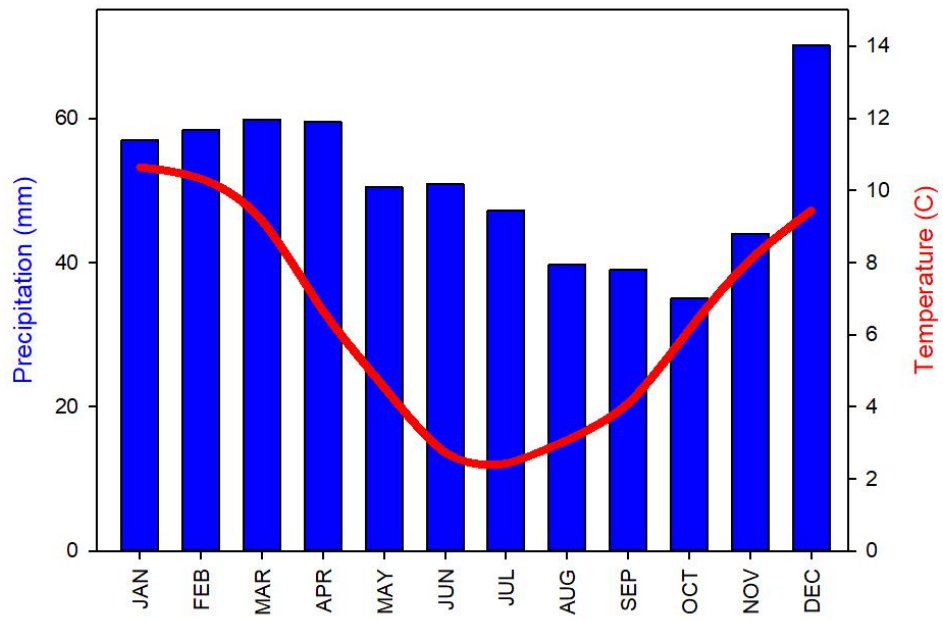
Supplementary Figure 3. Loss on ignition versus carbon content for Falkland Islands peat samples analysed in this study.



Supplementary Figure 4. Kernel density plot comparing total depths of dated cores (blue) to depths derived from a larger dataset of depth measurements from across East Falkland (red). See text for caveats on data quality and comparability.



Supplementary Figure 5. Climate space of global peatlands and the Falkland Islands. Red dots show 10,000 randomly positioned points on the global peat map of Yu et al. (2010) with mean annual temperature and precipitation data extracted from the database of Hijmans et al. (2005). Blue dot shows meteorological data for RAF Mountain Pleasant in central East Falkland (close to the SWI site) for the period 1985-2018. The bimodal temperature distribution of global peatlands represents the distinct climate spaces of tropical and temperate/high-latitude peatlands.



Supplementary Figure 6. Annual variability in precipitation and temperature (Station: RAF Mount Pleasant, 1985-2018).

**DATA AVAILABILITY**

Data underlying this study are available at: [URL to be added on acceptance]

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