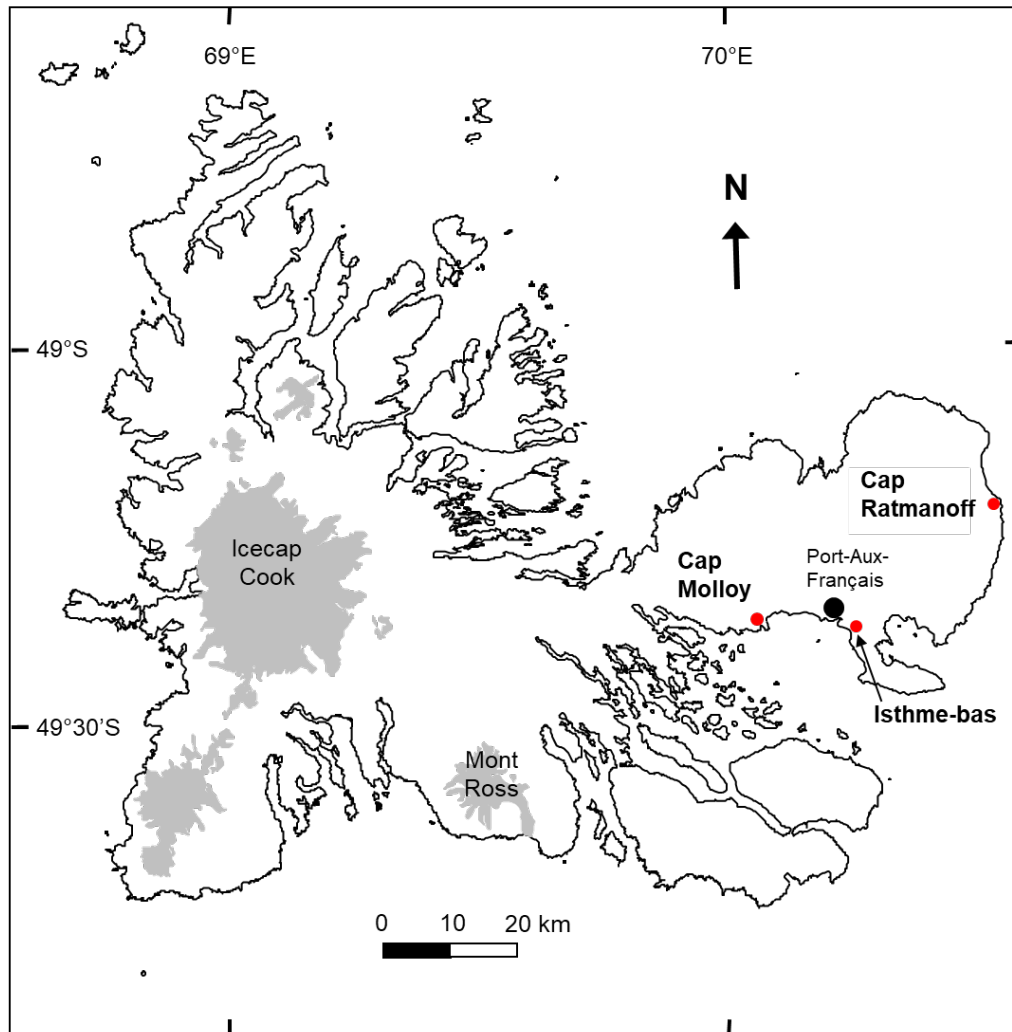


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**Appendix S1.** Locations (red points) of the three sampling sites in the French sub-Antarctic Iles Kerguelen (48°30–50°S, 68°27–70°35E). Black point: technical and scientific station.

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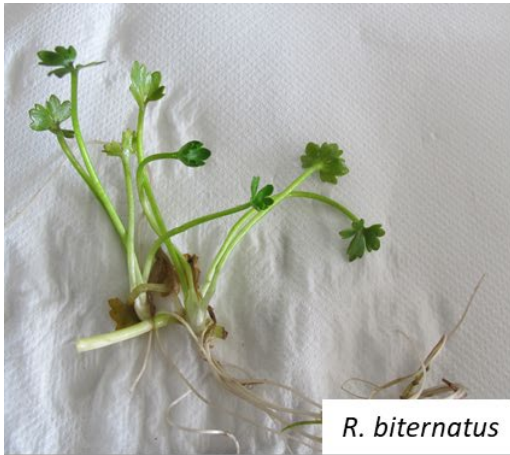
**Appendix S2.** Means  $\pm$  standard deviations for abiotic and biotic variables at the site scale.

Site	Area (m <sup>2</sup> )	Water								Sediments		Biotic parameters					
		Mean temp. (°C)	Water depth (cm)	EC ( $\mu\text{S.cm}^{-1}$ )	DO (mg.L <sup>-1</sup> )	pH	NH <sub>4</sub> <sup>+</sup> ( $\mu\text{g.L}^{-1}$ )	NO <sub>3</sub> <sup>-</sup> ( $\mu\text{g.L}^{-1}$ )	PO <sub>4</sub> <sup>3-</sup> ( $\mu\text{g.L}^{-1}$ )	C:N	P <sub>bio</sub> (mg.g <sup>-1</sup> )	Chl-a (.mL <sup>-1</sup> )	FD	Rich.	Eve-ness	Total macro. cover (%)	Total plant cover (macro. and terrestrial) (%)
Isthme Bas	9204.83	5.94	19.06	206.23	11.34	7.13	88.1	89.48	40.6	15.23	0.6	14.34	1.5	3.33	0.81	20.8	43.05
	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
	34984.56	0.42	11.98	29.72	2.46	0.61	31.22	32.98	47.53	1.01	0.32	8.07	0.62	1.05	0.15	10.79	18.63
Cap Molloy	87.83	6.73	19.04	123.99	11.75	4.82	403.89	107.92	6.44	14.28	0.73	12.35	1.61	3.13	0.75	14.89	27.30
	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
	91.89	0.27	5.66	42.31	1.93	0.31	494.63	90.24	3.01	1.06	0.31	7.22	0.47	0.52	0.13	12.60	15.94
Cap Ratmannoff	91.27	6.12	13.78	200.24	11.37	6.53	561.36	207.36	12.37	13.52	0.6	44.71	1.62	3.47	0.65	17.08	26.37
	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
	108.99	0.29	4.49	37.58	1.7	0.68	880.6	355.48	10.81	0.97	0.33	53.59	0.75	0.99	0.24	14.76	17.13

EC, electrical conductivity; DO, dissolved oxygen; P<sub>bio</sub>, bioavailable phosphorus; FD, functional diversity; Rich., species richness; macro., macrophytes. In total plant cover, terrestrial plant species are included that colonized pond edges (due to variations in water level).

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**Appendix S3.** Ramets of the six studied macrophyte species. Leaf morphology is homogeneous within ramets (no heterophyllia).

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**Appendix S4.** Eigenvector scores for the first axis of a principal component analysis (PCA 1) of water nutrient parameters measured at the pond level.

Abiotic variables	PCA 1 (42.06%)
N-NH <sub>4</sub> <sup>+</sup>	<b>-0.79</b>
N-NO <sub>3</sub> <sup>-</sup>	<b>-0.79</b>
P-PO <sub>4</sub> <sup>3-</sup>	-0.006

The two highest eigenvector scores are indicated in bold. The variance accounted for by the axis is indicated in parentheses. PCA 1 was related negatively to the N-NH<sub>4</sub><sup>+</sup> and N-NO<sub>3</sub><sup>-</sup> concentrations in the water column.

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**Appendix S5.** Eigenvector scores for the first axis of a principal component analysis (PCA 1) of sediment nutrient parameters measured at the pond level.

Abiotic variables	PCA 1 (58.59%)
C :N	-0.76
Bioavailable P	0.76

The variance accounted for by each axis is indicated in parentheses. PCA 1 was related negatively to the C:N ratio and positively to the amount of bioavailable P in sediments.

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**Appendix S6.** Eigenvector scores for the first three axes of a factorial correspondence analysis (FCAs 1–3) of macrophyte species abundances at the pond level.

Abiotic variables	FCA 1 (33.81%)	FCA 2 (24.99%)	FCA 3 (16.99%)
<i>C. antarctica</i>	<b>-0.97</b>	0.08	0.38
<i>J. scheuchzerioides</i>	0.43	-0.43	-0.03
<i>L. australis</i>	0.04	<b>-0.99</b>	<b>1.73</b>
<i>R. biternatus</i>	-0.23	0.03	<b>-0.73</b>
<i>R. moseleyi</i>	<b>1.49</b>	0.99	0.56
<i>R. pseudotrullifolius</i>	-0.03	<b>1.72</b>	-0.10

The two highest eigenvector scores for each FCA are indicated in bold. The variance accounted for by the axes is indicated in parentheses. FCA 1 was related positively to the abundance of *R. moseleyi* and negatively to the abundance of *C. antarctica*. FCA 2 was related positively to the abundance of *R. pseudotrullifolius* and negatively to the abundance of *L. australis*. FCA 3 was related positively to the abundance of *L. australis* and negatively to the abundance of *R. biternatus*.

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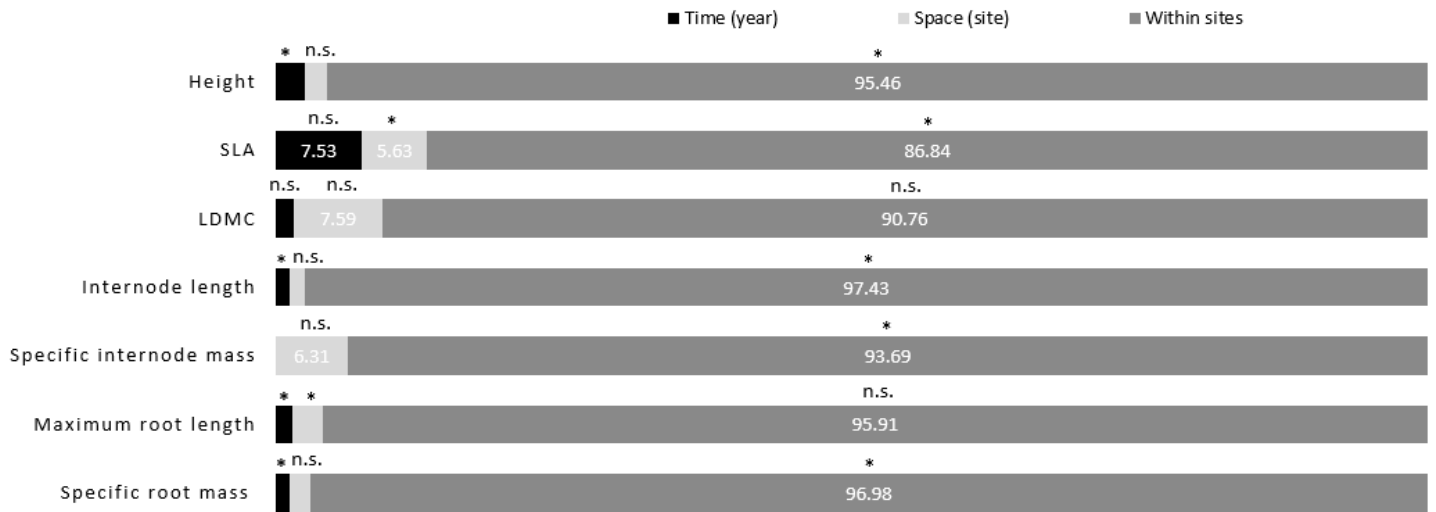
**Appendix S7.** Numbers of collected and measured samples per species, site, and year.

Site	Species	November 2017	November 2018	November 2019	November 2020
IB	<i>C. antarctica</i>	37	8	36	30
	<i>J. scheuchzerioides</i>	17	2	34	24
	<i>L. australis</i>	11	0	1	0
	<i>R. biternatus</i>	47	31	46	36
	<i>R. moseleyi</i>	6	0	0	0
	<i>R. pseudotrullifolius</i>	15	1	7	8
MOL	<i>C. antarctica</i>	15	9	29	19
	<i>J. scheuchzerioides</i>	16	1	29	34
	<i>L. australis</i>	12	8	10	6
	<i>R. biternatus</i>	32	23	48	39
	<i>R. moseleyi</i>	9	1	4	5
	<i>R. pseudotrullifolius</i>	1	0	0	0
RAT	<i>C. antarctica</i>	33	13	31	24
	<i>J. scheuchzerioides</i>	15	0	25	35
	<i>L. australis</i>	18	7	8	7
	<i>R. biternatus</i>	36	33	45	28
	<i>R. moseleyi</i>	7	5	3	9
	<i>R. pseudotrullifolius</i>	11	8	13	6

IB, Isthme Bas; MOL, Cap Molloy; RAT, Cap Ratmanoff.

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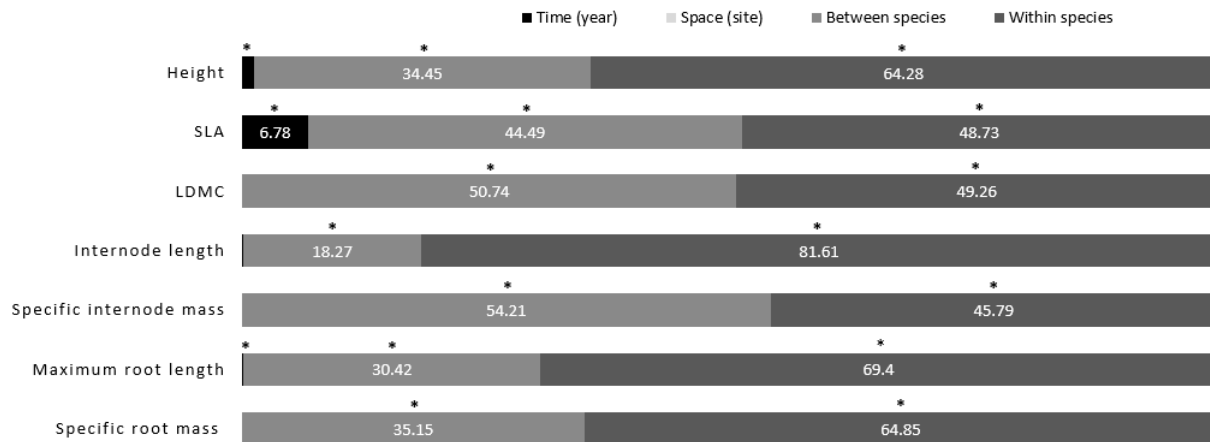
**Appendix S8.** Variance partitioning of individual traits across three nested scales: year, site and within-site, with no distinction of the inter- and intraspecific variance. Data were log or square-root transformed, and standardized to equalize the weight of each trait dimension. This figure is complementary to Fig. 1. We ran this alternative model of variance partitioning without the species level, and obtained similar results as when working with the imperfect nesting of species within sites.



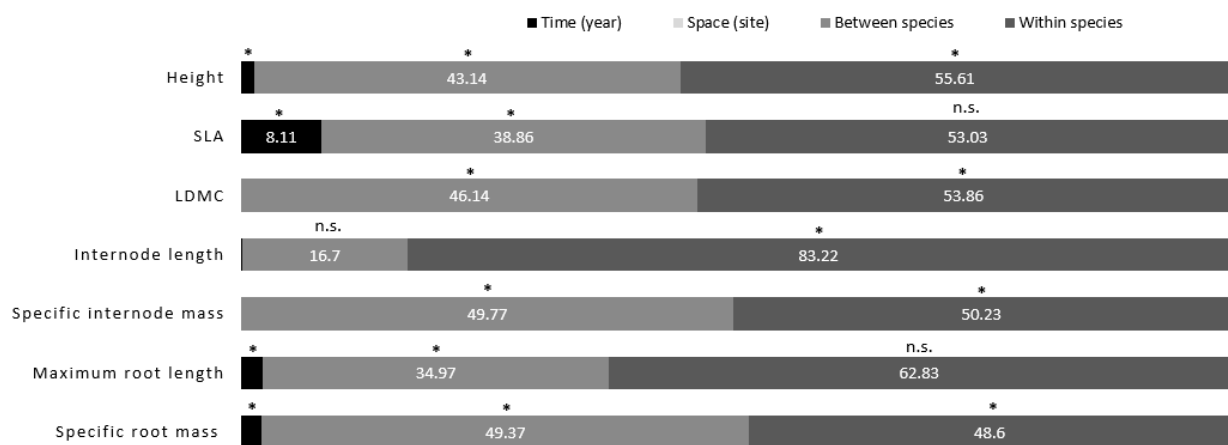
Supporting information to the paper

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a)



b)

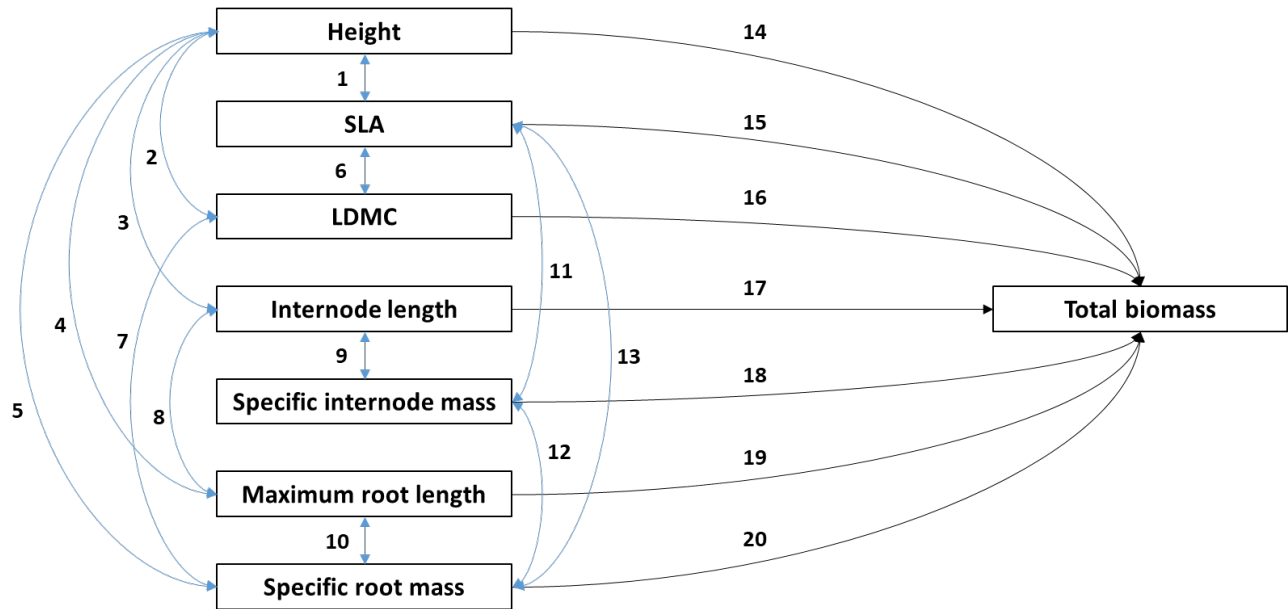


**Appendix S9.** Variance partitioning of individual traits across three nested scales: year, site and within-site, based on data excluding scarce species, *i.e.* a) *R. moseleyi* and *R. pseudotrullifolius*, or b) *L. australis*. Data were log or square-root transformed, and standardized to equalize the weight of each trait dimension. This figure is complementary to Fig. 2. We ran these alternative models of variance partitioning with only the most abundant species, and obtained similar results as when working with all the species (results presented in Fig. 2).

Supporting information to the paper

Douce, P. *et al.* How does trait variance partitioning help us to understand plant community assembly? The example of pond communities at the Kerguelen Islands. *Journal of Vegetation Science*.

**Appendix S10.** Theoretical structural equation model representing the direct and indirect effects of trait values measured in ponds on individual performance (total biomass). This model was reduced with the lavaan package through variable selection based on Akaike Information Criteria; results are presented in Fig. 2. Single dark-headed arrows indicate direct effects. Double-headed arrows indicate correlations between model variables. All trait values were averaged at the pond level.



Numbers indicate references supporting the tested relationships and correlations: 1, Díaz et al., 2016; 2, Garnier et al., 2001; 3, Wildová et al., 2007; 5 and 6, Wright et al., 2004; 7, Garnier et al., 2016; 8, Šmilauerová & Šmilauer, 2007; 9 and 10, Cornelissen et al., 2003; 11, Kleyer et al., 2019; 12 and 13, Fort et al., 2013; 14, Heinrichs et al., 2010; 15, Poorter & de Jong, 1999; 16, Pontes et al., 2007; 17, Weijsschedé et al., 2008; 19, Lynch, 1995; 4, 18, and 20, added to the test. SLA, specific leaf area; LDMC, leaf dry matter content.

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