

**Extended Data Table 1 Summary of the Linear Mixed Model for the dependent variable of tidal marsh soil carbon concentration (%C).** Analysis was restricted to the three soil depths for which %C data were most commonly available (0-20cm, 20-50cm, 50-100cm). Sieve size (mm) was included in the model as a random factor covariate.

<b>Source</b>	<b>Numerator df</b>	<b>Denominator df</b>	<b>F-value</b>	<b>P-value</b>
Intercept	1	328.9	28.134	<b>&lt;0.001</b>
Soil Depth	2	330.5	3.922	<b>0.021</b>
RSLR Zone	6	297.2	31.464	<b>&lt;0.001</b>
Köppen Climate Zone	2	326.4	1.657	0.192
Depth * RSLR Zone	14	333.0	1.847	<b>0.031</b>

**Extended Data Table 2** Summary of the Linear Mixed Model for the dependent variable of tidal marsh soil carbon concentration (%C). Analysis was restricted to the three soil depths for which %C data were most commonly available (0-20cm, 20-50cm, 50-100cm). Salinity was included in the model as a random factor covariate.

<b>Source</b>	<b>Numerator df</b>	<b>Denominator df</b>	<b>F-value</b>	<b>P-value</b>
Intercept	1	252.4	19.868	<b>&lt;0.001</b>
Soil Depth	2	335.0	4.171	<b>0.016</b>
RSLR Zone	6	332.246	34.931	<b>&lt;0.001</b>
Köppen Climate Zone	2	332.271	0.466	0.628
Depth * RSLR Zone	14	335.0	1.878	<b>0.028</b>

**Extended Data Table 3 Summary of Linear Mixed Model pairwise comparisons among Holocene Relative Sea-Level Rise (RSLR) zones for the dependent variable of tidal marsh soil carbon concentration (%C).** The top right of the table shows the direction of pairwise comparisons and the bottom left of the table shows corresponding P-values based on estimated marginal means with Bonferroni adjustment. Pairwise comparisons which are significantly different at  $P < 0.05$  are highlighted in bold. Values in parentheses indicate the number of soil cores included in analysis from each sea-level zone.

		RAPID HOLOCENE RSLR ZONES		STABLE HOLOCENE RSLR ZONES				
		RSLR zone	I-II transition (36)	II (156)	IV (68)	V (63)		
RAPID HOLOCENE RSLR ZONES	I-II transition (36)			<b>I-II &gt; II</b>	<b>I-II &gt; IV</b>	<b>I-II &gt; V</b>	<b>COMPARISON DIRECTION</b>	
	II (156)	<b>&lt;0.001</b>			<b>II &gt; IV</b>	<b>II &gt; V</b>		
STABLE HOLOCENE RSLR ZONES	IV (68)	<b>&lt;0.001</b>	<b>&lt;0.001</b>			IV ≈ V		
	V (63)	<b>&lt;0.001</b>	<b>&lt;0.001</b>	1.0				
		<b>P-VALUES</b>						

**Extended Data Table 4 Summary of global data compilation of saltmarsh soil carbon concentration (%C) and Repeated Measures Analyses of Variance (RM-ANOVA).**

Values reported are the number of distinct study locations for which relevant data were available as well as mean soil %C ( $\pm$  one standard error) for the most commonly reported depth intervals: 0-20cm, 20-50cm, 50-100cm. A separate RM-ANOVA was conducted for each data-rich Holocene Relative Sea-Level Zone to test for differences in tidal marsh soil carbon concentration (%C) between soil depths. P-values are based on estimated marginal means with Bonferroni adjustment, with values significant at  $P < 0.05$  highlighted in bold. Different superscript letters denote significantly different depth intervals within each sea-level rise zone.

Late-Holocene RSLR zone	Number of locations	%C by depth interval			RM-ANOVA		
		0-20cm	20-50cm	50-100cm	df	F-value	P-value
<b>Rapid RSLR zones:</b>							
I-II transition	36	23.6 $\pm$ 1.5 <sup>A</sup>	20.6 $\pm$ 1.7 <sup>B</sup>	18.1 $\pm$ 2.2 <sup>B</sup>	1.8, 60	7.771	<b>0.002</b>
II	156	10.9 $\pm$ 0.7 <sup>A</sup>	9.3 $\pm$ 0.7 <sup>B</sup>	9.5 $\pm$ 0.8 <sup>AB</sup>	1.5, 236	5.847	<b>0.007</b>
<b>Stable RSLR zones:</b>							
IV*	68	0.78 $\pm$ 0.07 <sup>A</sup>	0.62 $\pm$ 0.06 <sup>B</sup>	0.56 $\pm$ 0.07 <sup>C</sup>	1.4, 89	26.127	<b>&lt;0.001</b>
V	63	6.8 $\pm$ 0.9 <sup>A</sup>	3.4 $\pm$ 0.6 <sup>B</sup>	2.0 $\pm$ 0.3 <sup>C</sup>	1.4, 77	32.311	<b>&lt;0.001</b>
<b>Data Poor zones:</b>							
I*	2	8.2 $\pm$ 3.0	2.4 $\pm$ 1.2	0.7 $\pm$ 0.4			N/A
II-III transition	9	16.6 $\pm$ 6.2	13.1 $\pm$ 5.5	12.6 $\pm$ 4.3			N/A
III	7	4.5 $\pm$ 1.2	4.2 $\pm$ 1.4	3.1 $\pm$ 0.8			N/A
IV-V transition	3	6.2 $\pm$ 3.4	5.6 $\pm$ 4.4	4.6 $\pm$ 4.1			N/A

\* Soil %C values are low for Zone I and Zone IV in part due to the removal of roots prior to analysis (see Table S1).

**Extended Data Table 5 Summary of the Linear Mixed Model for the dependent variable of tidal marsh soil carbon density (g C cm<sup>-3</sup>).** Analysis was restricted to the three soil depths 0-20cm, 20-50cm and 50-100cm. Sieve size (mm) was included in the model as a random factor covariate.

<b>Source</b>	<b>Numerator df</b>	<b>Denominator df</b>	<b>F-value</b>	<b>P-value</b>
Intercept	1	331.629	192.586	<b>&lt;0.001</b>
Soil Depth	2	331.076	17.552	<b>&lt;0.001</b>
RSLR Zone	6	333.036	62.070	<b>&lt;0.001</b>
Köppen Climate Zone	2	332.151	1.084	0.339
Depth * RSLR Zone	14	348.530	3.822	<b>&lt;0.001</b>

**Extended Data Table 6** Summary of the Linear Mixed Model for the dependent variable of tidal marsh soil carbon density ( $\text{g C cm}^{-3}$ ). Analysis was restricted to the three soil depths 0-20cm, 20-50cm and 50-100cm. Salinity was included in the model as a random factor covariate.

<b>Source</b>	<b>Numerator df</b>	<b>Denominator df</b>	<b>F-value</b>	<b>P-value</b>
Intercept	1	285.765	14.538	<b>&lt;0.001</b>
Soil Depth	2	330.326	17.553	<b>&lt;0.001</b>
RSLR Zone	6	331.574	55.270	<b>&lt;0.001</b>
Köppen Climate Zone	2	330.375	1.349	0.261
Depth * RSLR Zone	14	346.841	3.792	<b>&lt;0.001</b>

**Extended Data Table 7 Summary of Linear Mixed Model pairwise comparisons among Holocene Relative Sea-Level Rise (RSLR) zones for the dependent variable of tidal marsh soil carbon density ( $\text{g C cm}^{-3}$ ).** The top right of the table shows the direction of pairwise comparisons and the bottom left of the table shows corresponding P-values based on estimated marginal means with Bonferroni adjustment. Pairwise comparisons which are significantly different at  $P < 0.05$  are highlighted in bold. Values in parentheses indicate the number of soil cores included in analysis from each sea-level zone.

		RAPID HOLOCENE RSLR ZONES		STABLE HOLOCENE RSLR ZONES				
		RSLR zone	I-II transition (36)	II (156)	IV (68)	V (63)		
RAPID HOLOCENE RSLR ZONES	I-II transition (36)			<b>I-II &gt; II</b>	<b>I-II &gt; IV</b>	<b>I-II &gt; V</b>	<b>COMPARISON DIRECTION</b>	
	II (156)	<b>0.006</b>			<b>II &gt; IV</b>	<b>II &gt; V</b>		
STABLE HOLOCENE RSLR ZONES	IV (68)	<b>&lt;0.001</b>	<b>&lt;0.001</b>			<b>IV &lt; V</b>		
	V (63)	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>				
		<b>P-VALUES</b>						

**Extended Data Table 8 Summary of global data compilation of saltmarsh soil carbon density (g C cm<sup>-3</sup>) and Repeated Measures Analyses of Variance (RM-ANOVA).** Values reported are the number of distinct study locations for which relevant data were available as well as mean soil C density (g C cm<sup>-3</sup>) ( $\pm$  one standard error) for the most commonly reported depth intervals: 0-20cm, 20-50cm, 50-100cm. A separate RM-ANOVA was conducted for each data-rich Holocene Relative Sea-Level Zone to test for differences in tidal marsh soil carbon density (g C cm<sup>-3</sup>) between soil depths. P-values are based on estimated marginal means with Bonferroni adjustment, with values significant at P<0.05 highlighted in bold. Different superscript letters denote significantly different depth intervals within each sea-level rise zone.

Late-Holocene RSLR zone	Number of locations	g C cm <sup>-3</sup> by depth interval			RM-ANOVA	
		0-20cm	20-50cm	50-100cm	F-df	P-value
<b>Rapid RSLR zones:</b>						
I-II transition	36	0.044 $\pm$ 0.001 <sup>A</sup>	0.042 $\pm$ 0.001 <sup>B</sup>	0.039 $\pm$ 0.001 <sup>C</sup>	1.4, 49	13.079< <b>0.001</b>
II	156	0.035 $\pm$ 0.001 <sup>A</sup>	0.032 $\pm$ 0.001 <sup>B</sup>	0.031 $\pm$ 0.001 <sup>B</sup>	1.5, 226	12.895< <b>0.001</b>
<b>Stable RSLR zones:</b>						
IV*	68	0.008 $\pm$ 0.001 <sup>A</sup>	0.006 $\pm$ 0.001 <sup>B</sup>	0.006 $\pm$ 0.001 <sup>C</sup>	1.5, 95	35.457< <b>0.001</b>
V	63	0.027 $\pm$ 0.002 <sup>A</sup>	0.018 $\pm$ 0.002 <sup>B</sup>	0.014 $\pm$ 0.001 <sup>C</sup>	1.6, 90	33.226< <b>0.001</b>
<b>Data Poor zones:</b>						
I*	2	0.034 $\pm$ 0.004	0.020 $\pm$ 0.006	0.009 $\pm$ 0.004	N/A	
II-III transition	9	0.034 $\pm$ 0.005	0.035 $\pm$ 0.006	0.034 $\pm$ 0.004	N/A	
III	7	0.040 $\pm$ 0.013	0.035 $\pm$ 0.011	0.031 $\pm$ 0.009	N/A	
IV-V transition	3	0.025 $\pm$ 0.006	0.020 $\pm$ 0.009	0.016 $\pm$ 0.010	N/A	

\* Soil C density values are low for Zone I and Zone IV in part due to the removal of roots prior to analysis (see Table S1).