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How do leaf trait values change spatially and temporally with light availability in a grassland diversity experiment? – Oikos doi: 10.1111/oik.04533

## Appendix 1

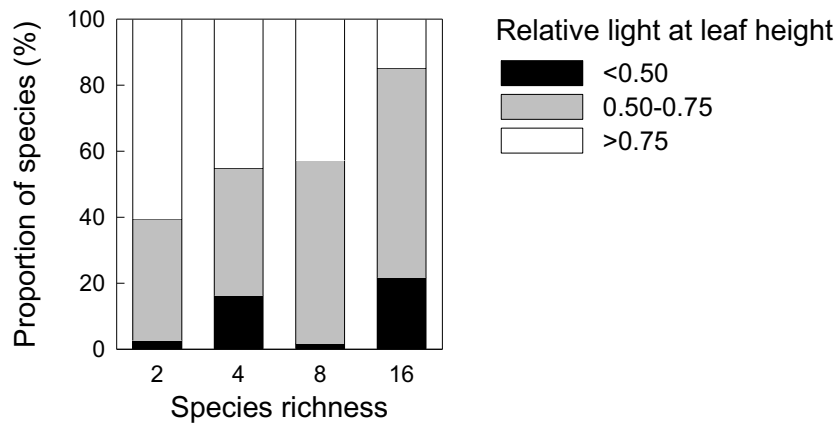


Figure A1. Proportion of species per species-richness level (averaged across mixtures and both times of peak canopy development; May, August) exposed to different levels of relative light availability at leaf height.

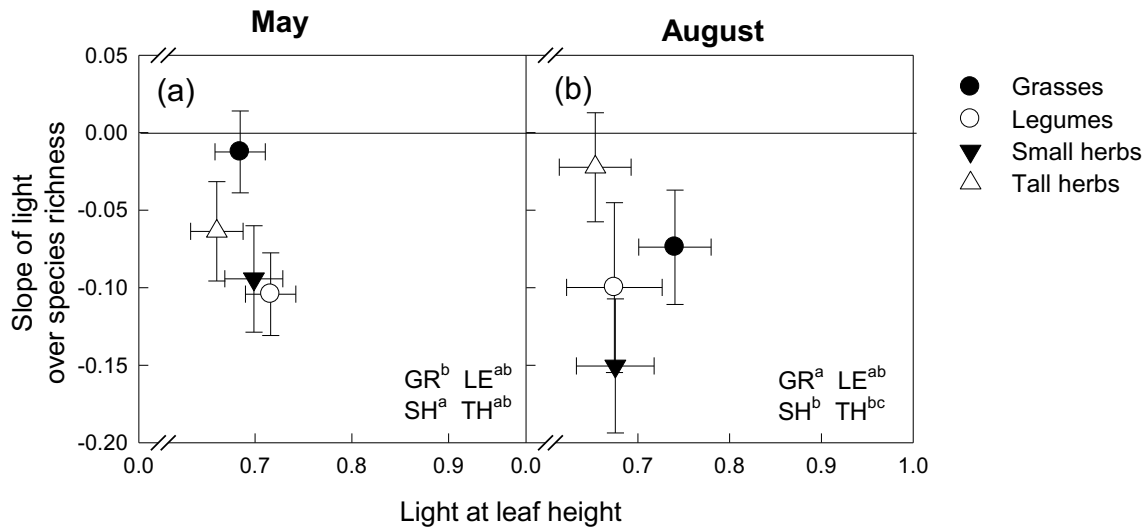


Figure A2. Variation in light availability at leaf height in response to species richness plotted against means ( $\pm 1$ SE) of light at leaf height per functional group at times of peak canopy development in May 2011 (a), and August 2011 (b). Cases above zero indicate increasing values in response to increasing species richness, while cases below zero indicate decreasing values in response to increasing species richness. Variation in response to increasing species richness was calculated based on linear mixed-effects models as described in the methods for different functional groups with plot nested in block and species identity as random effects and species richness as fixed effect. Superscripted small letters indicate results of Tukey's HSD test applied to test for differences in light at leaf height among functional groups.

Table A1. Summary of mixed-effects model analyses testing the effects of plant diversity (species and functional group richness), height of measurement and time of year (May, August) on relative light transmission. Significant factors and interactions are formatted in bold. df = degrees of freedom.

Source of variation	Relative light transmission		
	df	$\chi^2$	p
Species richness (SR)	1	<b>10.16</b>	<b>0.001</b>
Functional group richness (FR)	1	0.19	0.662
Height	3	<b>186.99</b>	<b>&lt;0.001</b>
Height × SR	3	<b>13.58</b>	<b>0.004</b>
Height × FR	3	0.57	0.903
Time of year	1	1.49	0.223
Time of year × SR	1	1.42	0.233
Time of year × FR	1	1.06	0.321
Time of year × Height	3	6.68	0.083
Time of year × Height × SR	3	1.24	0.744
Time of year × Height × FR	3	2.05	0.562

Table A2. Summary of the mixed-effects model analyses testing the effects of plant diversity (species and functional group richness) and time of year on specific leaf area, leaf dry matter content, leaf greenness, and stomatal conductance separately for each functional group. Significant factors and interactions are formatted in bold. df = degrees of freedom. Note that daytime of measurement was added as a covariate in analyses of stomatal conductance to account for possible variation in stomatal conductance throughout the day.

	df	Specific leaf area		Leaf dry matter content		Leaf greenness		Stomatal conductance	
		$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p
<b>Small herbs</b>									
Daytime of measurement	1							<b>10.47</b>	<b>0.001</b>
Species richness (SR)	1	<b>6.60</b>	<b>0.010</b>	0.72	0.397	0.81	0.367	1.59	0.208
Functional group richness (FR)	1	0.22	0.636	0.59	0.441	0.63	0.429	0.20	0.659
Time of year	4	<b>98.80</b>	<b>&lt;0.001</b>	<b>81.23</b>	<b>&lt;0.001</b>	<b>113.66</b>	<b>&lt;0.001</b>	<b>18.95</b>	<b>0.001</b>
Time of year × SR	4	9.39	0.052	<b>13.50</b>	<b>0.009</b>	8.48	0.076	1.11	0.893
Time of year × FR	4	5.75	0.219	7.95	0.094	2.41	0.661	3.46	0.484
<b>Tall herbs</b>									
Daytime of measurement	1							<b>13.60</b>	<b>&lt;0.001</b>
Species richness (SR)	1	0.08	0.780	0.55	0.459	2.35	0.126	0.16	0.693
Functional group richness (FR)	1	0.01	0.915	2.92	0.088	0.34	0.560	1.09	0.296
Time of year	4	<b>115.85</b>	<b>&lt;0.001</b>	<b>109.15</b>	<b>&lt;0.001</b>	<b>86.10</b>	<b>&lt;0.001</b>	<b>29.51</b>	<b>&lt;0.001</b>
Time of year × SR	4	5.43	0.246	2.03	0.730	6.81	0.146	0.30	0.990
Time of year × FR	4	2.51	0.642	1.30	0.861	2.65	0.618	9.02	0.061
<b>Grasses</b>									
Daytime of measurement	1							<b>1.80</b>	<b>0.179</b>
Species richness (SR)	1	3.38	0.066	0.19	0.663	0.53	0.468	0.30	0.583
Functional group richness (FR)	1	0.36	0.551	0.03	0.869	0.20	0.653	0.01	0.919
Time of year	4	<b>22.86</b>	<b>&lt;0.001</b>	<b>131.53</b>	<b>&lt;0.001</b>	<b>62.76</b>	<b>&lt;0.001</b>	<b>65.07</b>	<b>&lt;0.001</b>
Time of year × SR	4	2.90	0.574	1.84	0.765	5.81	0.214	2.44	0.655
Time of year × FR	4	2.42	0.659	8.22	0.084	4.32	0.365	0.28	0.991
<b>Legumes</b>									
Daytime of measurement	1							0.58	0.447
Species richness (SR)	1	1.17	0.280	0.02	0.875	2.12	0.145	0.67	0.414
Functional group richness (FR)	1	0.62	0.432	0.21	0.647	0.01	0.927	0.70	0.404
Time of year	4	<b>10.60</b>	<b>0.031</b>	<b>40.62</b>	<b>&lt;0.001</b>	<b>27.82</b>	<b>&lt;0.001</b>	<b>35.69</b>	<b>&lt;0.001</b>
Time of year × SR	4	5.20	0.267	4.27	0.371	4.94	0.293	2.11	0.715
Time of year × FR	4	5.21	0.523	4.00	0.406	7.25	0.123	<b>12.14</b>	<b>0.016</b>

Table A3. Summary of the mixed-effects model analyses testing the effects of light at leaf height, plant diversity and time of year (May and August only) on specific leaf area, leaf dry matter content, leaf greenness, and stomatal conductance separately for each functional group. Significant factors and interactions are formatted in bold. df = degrees of freedom.

Source of variation	Specific leaf area				Leaf dry matter content				Leaf greenness				Stomatal conductance				
	df	Model A		Model B		Model A		Model B		Model A		Model B		Model A		Model B	
		$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	P	$\chi^2$	P
<b>Small herbs</b>																	
Daytime of measurement	1													<0.01	0.989	<0.01	0.989
Light at leaf height	1			<b>10.53</b>	<b>0.001</b>			<0.01	>0.999			<b>23.21</b>	<b>&lt;0.001</b>			<b>44.92</b>	<b>&lt;0.001</b>
Species richness (SR)	1	<b>7.21</b>	<b>0.007</b>	0.98	0.323	0.58	0.447	0.49	0.483	0.67	0.413	0.95	0.330	2.00	0.157	3.09	0.079
Functional group richness (FR)	1	0.17	0.683	1.91	0.167	0.05	0.819	0.66	0.416	0.37	0.544	0.54	0.465	0.27	0.606	<0.01	0.971
Time of year	1	<b>62.11</b>	<b>&lt;0.001</b>	<b>51.99</b>	<b>&lt;0.001</b>	<b>77.87</b>	<b>&lt;0.001</b>	<b>66.70</b>	<b>&lt;0.001</b>	<b>24.94</b>	<b>&lt;0.001</b>	<b>23.54</b>	<b>&lt;0.001</b>	0.38	0.540	0.08	0.781
Time of year × SR	1	1.85	0.174	2.23	0.136	1.43	0.232	1.53	0.216	0.96	0.328	1.83	0.177	1.28	0.258	1.33	0.248
Time of year × FR	1	0.08	0.776	0.64	0.425	1.74	0.188	1.03	0.310	0.45	0.503	0.50	0.482	0.52	0.472	1.62	0.203
<b>Tall herbs</b>																	
Daytime of measurement	1													<b>5.53</b>	<b>0.019</b>	<b>5.53</b>	<b>0.019</b>
Light at leaf height	1			<b>7.47</b>	<b>0.006</b>			<b>71.29</b>	<b>&lt;0.001</b>			<b>5.64</b>	<b>0.018</b>			<b>4.05</b>	<b>0.044</b>
Species richness (SR)	1	0.28	0.598	0.12	0.730	0.57	0.451	0.45	0.503	2.94	0.086	1.27	0.260	0.18	0.676	0.81	0.370
Functional group richness (FR)	1	0.39	0.534	<0.01	0.965	1.32	0.251	0.57	0.450	0.52	0.472	<0.01	0.978	0.02	0.885	0.02	0.904
Time of year	1	<b>59.82</b>	<b>&lt;0.001</b>	<b>52.31</b>	<b>&lt;0.001</b>	<b>42.57</b>	<b>&lt;0.001</b>	<b>39.88</b>	<b>&lt;0.001</b>	<b>23.54</b>	<b>&lt;0.001</b>	<b>22.80</b>	<b>&lt;0.001</b>	<b>12.76</b>	<b>&lt;0.001</b>	<b>11.43</b>	<b>&lt;0.001</b>
Time of year × SR	1	0.95	0.329	0.29	0.588	0.71	0.399	0.28	0.598	1.78	0.183	3.64	0.057	0.02	0.903	0.20	0.654
Time of year × FR	1	1.03	0.311	1.48	0.224	0.01	0.927	0.07	0.786	0.96	0.327	0.05	0.828	3.66	0.056	<b>5.76</b>	<b>0.016</b>
<b>Grasses</b>																	
Daytime of measurement	1													<0.01	0.963	<0.01	0.963
Light at leaf height	1			<b>105.52</b>	<b>&lt;0.001</b>			<b>162.74</b>	<b>&lt;0.001</b>			<b>51.56</b>	<b>&lt;0.001</b>			<b>11.86</b>	<b>&lt;0.001</b>
Species richness (SR)	1	<b>4.20</b>	<b>0.041</b>	2.57	0.109	0.10	0.755	0.17	0.680	2.04	0.154	1.32	0.251	<0.01	0.970	0.04	0.841
Functional group richness (FR)	1	0.20	0.657	0.26	0.610	0.09	0.761	<0.01	0.997	0.17	0.682	0.07	0.799	0.17	0.680	0.20	0.654
Time of year	1	<b>9.07</b>	<b>0.003</b>	<b>14.09</b>	<b>&lt;0.001</b>	<b>52.16</b>	<b>&lt;0.001</b>	<b>49.11</b>	<b>&lt;0.001</b>	2.37	0.124	<b>5.23</b>	<b>0.022</b>	<b>26.25</b>	<b>&lt;0.001</b>	<b>26.70</b>	<b>&lt;0.001</b>
Time of year × SR	1	0.45	0.504	0.14	0.713	1.11	0.293	1.02	0.313	0.22	0.638	0.87	0.352	0.01	0.909	0.01	0.910
Time of year × FR	1	2.46	0.117	2.28	0.131	<b>6.96</b>	<b>0.008</b>	<b>7.56</b>	<b>0.006</b>	0.55	0.457	0.71	0.400	<0.01	0.995	0.04	0.852
<b>Legumes</b>																	
Daytime of measurement	1													<0.01	0.960	<0.01	0.960
Light at leaf height	1			0.61	0.433			<b>111.69</b>	<b>&lt;0.001</b>			<b>19.72</b>	<b>&lt;0.001</b>			2.89	0.089
Species richness (SR)	1	1.76	0.185	<b>9.00</b>	<b>0.003</b>	0.02	0.893	1.94	0.163	<b>4.07</b>	<b>0.044</b>	<b>5.02</b>	<b>0.025</b>	0.83	0.362	0.83	0.364
Functional group richness (FR)	1	1.40	0.236	0.81	0.369	0.88	0.348	0.21	0.649	0.98	0.321	0.54	0.461	<b>6.31</b>	<b>0.012</b>	<b>6.10</b>	<b>0.014</b>
Time of year	1	<b>4.35</b>	<b>0.037</b>	<b>4.19</b>	<b>0.041</b>	<b>7.48</b>	<b>0.006</b>	<b>6.66</b>	<b>0.009</b>	3.33	0.068	3.79	0.052	<b>22.74</b>	<b>&lt;0.001</b>	<b>22.03</b>	<b>&lt;0.001</b>
Time of year × SR	1	2.46	0.117	1.83	0.177	<b>4.52</b>	<b>0.034</b>	3.73	0.054	0.02	0.893	0.04	0.835	0.25	0.616	0.18	0.671
Time of year × FR	1	1.78	0.182	<b>5.75</b>	<b>0.017</b>	3.00	0.084	<b>6.99</b>	<b>0.008</b>	<b>4.23</b>	<b>0.040</b>	<b>7.39</b>	<b>0.007</b>	0.03	0.857	0.19	0.666



Table A4. Summary of the mixed-effects model analyses for non-legumes (grasses, small herbs, tall herbs) testing the effects of legume presence-absence, plant diversity, functional group identity and time of year on specific leaf area, leaf dry matter content, leaf greenness, and stomatal conductance. Note that daytime of measurement was added as a covariate in analyses of stomatal conductance to account for possible variation in stomatal conductance throughout the day. Significant factors and interactions are formatted in bold. df = degrees of freedom.

Source of variation	Specific leaf area			Leaf dry matter content		Leaf greenness		Stomatal conductance	
	df	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p
Daytime of measurement	1							<b>19.98</b>	<b>&lt;0.001</b>
Legume presence-absence	1	2.36	0.124	1.91	0.166	<b>6.82</b>	<b>0.009</b>	0.43	0.511
Species richness (SR)	1	<b>3.83</b>	<b>0.050</b>	0.06	0.810	<b>7.52</b>	<b>0.006</b>	1.30	0.253
Functional group richness (FR)	1	<0.01	0.946	0.70	0.402	<b>8.12</b>	<b>0.004</b>	0.95	0.329
Functional group identity (FG.ID)	3	5.16	0.076	<b>48.05</b>	<b>&lt;0.001</b>	0.36	0.834	<b>53.08</b>	<b>&lt;0.001</b>
FD.ID × SR	3	6.29	0.043	2.30	0.317	0.04	0.982	1.24	0.539
FG.ID × FR	3	2.26	0.324	2.16	0.340	2.98	0.226	0.87	0.649
Time of year	4	<b>154.5</b>	<b>&lt;0.001</b>	<b>283</b>	<b>&lt;0.001</b>	<b>249.8</b>	<b>&lt;0.001</b>	<b>92.59</b>	<b>&lt;0.001</b>
Time of year × SR	4	2.48	0.649	<b>9.97</b>	<b>0.041</b>	<b>13.73</b>	<b>0.008</b>	2.07	0.723
Time of year × FR	4	2.91	0.572	5.72	0.221	3.96	0.412	1.78	0.776
Time of year × FG.ID	12	<b>44.52</b>	<b>&lt;0.001</b>	<b>31.48</b>	<b>&lt;0.001</b>	7.71	0.462	<b>40.58</b>	<b>&lt;0.001</b>
Time of year × FG.ID × SR	12	<b>16.11</b>	<b>0.041</b>	7.77	0.456	7.14	0.521	2.57	0.959
Time of year × FG.ID × FR	12	10.03	0.263	11.17	0.192	5.22	0.734	8.44	0.392

Table A5. Summary of the mixed-effects model analyses for non-legumes (grasses, small herbs, tall herbs). Model A tests the effects of legume presence-absence, plant diversity, functional group identity and time of year on specific leaf area, leaf dry matter content, leaf greenness, and stomatal conductance. In model B, light at leaf height was added as covariate prior the other fixed factors to account for the effect of light availability. Note as well that daytime of measurement was added as a covariate in analyses of stomatal conductance to account for possible variation in stomatal conductance throughout the day. Significant factors and interactions are formatted in bold. df = degrees of freedom.

Source of variation	df	Specific leaf area				Leaf dry matter content				Leaf greenness				Stomatal conductance			
		Model A		Model B		Model A		Model B		Model A		Model B		Model A		Model B	
		$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p
Daytime of measurement	1													<b>0.82</b>	<b>0.366</b>	0.82	0.366
Light at leaf height	1			<b>199.56</b>	<b>&lt;0.001</b>			<b>308.77</b>	<b>&lt;0.001</b>			<b>75.36</b>	<b>&lt;0.001</b>			<b>15.83</b>	<b>&lt;0.001</b>
Legume presence-absence	1	0.97	0.324	0.06	0.803	0.96	0.330	0.73	0.394	<b>6.40</b>	<b>0.012</b>	<b>11.05</b>	<b>&lt;0.001</b>	0.73	0.395	0.69	0.406
Species richness (SR)	1	<b>4.25</b>	<b>0.039</b>	1.29	0.256	0.12	0.730	0.23	0.632	<b>6.88</b>	<b>0.009</b>	<b>4.08</b>	<b>0.043</b>	0.39	0.533	0.57	0.449
Functional group richness (FR)	1	0.16	0.690	<0.01	0.983	2.05	0.153	2.64	0.104	<b>4.32</b>	<b>0.038</b>	<b>5.17</b>	<b>0.023</b>	1.39	0.238	1.28	0.257
Functional group identity (FG.ID)	3	<b>7.83</b>	<b>0.010</b>	<b>8.74</b>	<b>0.013</b>	<b>50.39</b>	<b>&lt;0.001</b>	<b>49.84</b>	<b>&lt;0.001</b>	1.64	0.44	2.10	0.349	<b>54.70</b>	<b>&lt;0.001</b>	<b>54.97</b>	<b>&lt;0.001</b>
FD.ID × SR	3	<b>8.46</b>	<b>0.015</b>	3.86	0.145	2.34	0.310	0.44	0.801	0.79	0.673	1.54	0.463	0.93	0.629	1.26	0.533
FG.ID × FR	3	0.24	0.886	1.17	0.558	0.57	0.753	0.01	0.996	0.06	0.973	0.62	0.734	0.80	0.671	0.54	0.764
Time of the year	4	<b>96.69</b>	<b>&lt;0.001</b>	<b>94.29</b>	<b>&lt;0.001</b>	<b>164.00</b>	<b>&lt;0.001</b>	<b>149.29</b>	<b>&lt;0.001</b>	<b>39.90</b>	<b>&lt;0.001</b>	<b>42.36</b>	<b>&lt;0.001</b>	<b>37.76</b>	<b>&lt;0.001</b>	<b>36.71</b>	<b>&lt;0.001</b>
Time of the year × SR	4	0.53	0.465	0.85	0.358	2.54	0.111	1.70	0.192	2.82	0.093	<b>0.80</b>	<b>0.373</b>	0.47	0.495	0.88	0.348
Time of the year × FR	4	2.10	0.147	3.11	0.078	1.37	0.241	2.48	0.116	2.02	0.155	2.80	0.095	1.26	0.262	1.71	0.191
Time of the year × FG.ID	12	<b>21.14</b>	<b>&lt;0.001</b>	<b>12.33</b>	<b>0.002</b>	1.41	0.494	2.20	0.334	5.29	0.071	2.72	0.257	<b>12.92</b>	<b>0.002</b>	<b>15.6</b>	<b>&lt;0.001</b>
Time of the year × FG.ID × SR	12	2.10	0.351	0.92	0.632	0.01	0.997	0.11	0.946	0.37	0.833	3.00	0.224	0.69	0.707	1.03	0.599
Time of the year × FG.ID × FR	12	1.26	0.534	0.68	0.711	<b>0.23</b>	<b>0.016</b>	<b>7.03</b>	<b>0.030</b>	0.04	0.983	0.14	0.931	0.78	0.676	0.68	0.711