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1 **EFFECTS OF LOCAL FOREST CONTINUITY ON THE DIVERSITY OF FUNGI ON STANDING**  
2 **DEAD PINES**

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5 **APPENDIX B. Responses of individual species**

6 In the main text of this article we report the results of the community analyses. Here we report analyses on  
7 the responses of single species analyses using the same explanatory variables. We also briefly report the  
8 methods of the single species analyses and shortly discuss the results.

9 **METHODS**

10 Responses of single species were analyzed with a Mixed Effects Logistic Regression (n = 52). The aim was  
11 to study which environmental variables explain occurrences of each species the best. Species that occurred  
12 on  $\geq 10$  study trunks were included into the analysis (n = 14). A Mixed Effects Logistic Regression with a  
13 binomial distribution and a log-linear link function was conducted separately for each species. Explanatory  
14 variables were the same as in the GLMM (see the main text). Site and trunk identities were included into the  
15 model as hierarchically structured random effects by nesting trunks within sites. The model selection was  
16 conducted as in the GLMM. The analysis was performed in R (version 3.3.2; R Core Team, 2016) using  
17 function “glmer” from the package “lme4” (Bates et al., 2016).

18 **RESULTS**

19 Studied variables explained the presence of four species altogether. For the rest, the final models did not  
20 include any statistically significant variables. Occurrences of *Actidium hysterooides* were negatively affected  
21 by years from death (Table B.1). The final model also included dead wood diversity that had a marginally  
22 significant negative effect on the species (Table B.1). Occurrences of *Chaenothecopsis pusiola* were best  
23 explained by a negative effect of dead wood diversity, a negative effect of age at death, and a positive effect  
24 of years from death (Table B.1). These were all variables included in the final model. Canopy openness  
25 appeared to have a positive effect on the occurrences of *Glonium nitidum* (Table B.1). Number of stumps  
26 and years from death were the other variables included in the final model (Table B.1). The negative effect of

27 years from death was marginally significant (Table B.1). Occurrences of *Micarea elachista* were best  
28 explained by a negative effect of dead wood diversity (Table B.1). Another variable included in the final  
29 model was the number of stumps that had a marginally significant positive effect on the species as well  
30 (Table B.1).

31 Species final models of which included marginally significant effects of certain variables were  
32 *Micarea prasina* (a positive effect of years from death), *Mycocalicium subtile* “thin” (a negative effect of  
33 management intensity), *Pyrenomycete* sp. 4 (a negative effect of dead wood diversity, and a positive effect  
34 of canopy openness), and *Trichaptum fuscoviolaceum* (a negative effect of years from death) (Table B.1).

35 **Table B.1.** Results from the Mixed Effects Logistic Regression for individual species (n = 52 for each). Cells  
 36 show estimates (B), standard errors (SE), z values, and statistical significances (P). Dead wood (DW)  
 37 diversity was calculated with Shannon's diversity index. The units used for variables are in brackets.  
 38 Abbreviations: YFD = years from death, AAD = age at death, stumps = management intensity, canopy =  
 39 canopy openness.

Species		B	SE	z value	P
<i>Actidium hysteroioides</i>	(Intercept)	-1.72	0.76	-2.27	0.023
	DW diversity	-1.09	0.62	-1.75	0.081
	YFD (y)	-1.42	0.69	-2.07	0.039
<i>Chaenothecopsis pusiola</i>	(Intercept)	-0.75	0.35	-2.16	0.031
	DW diversity	-0.76	0.37	-2.05	0.041
	AAD (y)	-0.81	0.41	-1.97	0.049
<i>Glonium nitidum</i>	YFD (y)	0.97	0.41	2.38	0.017
	(Intercept)	0.18	0.61	0.30	0.763
	Stumps (pc ha <sup>-1</sup> )	1.00	0.67	1.48	0.138
<i>Micarea contexta</i>	YFD (y)	-1.04	0.55	-1.90	0.058
	Canopy (%)	1.75	0.78	2.25	0.025
	(Intercept)	-1.73	0.69	-2.51	0.012
<i>Micarea elachista</i>	YFD (y)	0.55	0.44	1.25	0.213
	(Intercept)	-3.19	0.92	-3.46	< 0.001
	DW diversity	-2.58	0.92	-2.81	0.005
<i>Micarea melaena</i>	Stumps (pc ha <sup>-1</sup> )	0.84	0.47	1.80	0.072
	(Intercept)	0.81	0.46	1.77	0.076
	AAD (y)	-0.43	0.43	-1.01	0.315
<i>Micarea misella</i>	(Intercept)	-0.59	0.41	-1.44	0.149
	YFD (y)	0.12	0.34	0.35	0.728
	(Intercept)	-1.20	0.71	-1.69	0.091
<i>Micarea prasina</i>	YFD (y)	0.74	0.44	1.68	0.093
	(Intercept)	-0.86	0.32	-2.74	0.006
	AAD (y)	-0.51	0.36	-1.44	0.150
<i>Mycocalicium subtile "big"</i>	(Intercept)	-2.34	1.15	-2.03	0.043
	Stumps (pc ha <sup>-1</sup> )	-1.70	0.99	-1.72	0.085
	(Intercept)	-1.31	0.34	-3.82	< 0.001
Pyrenomycete sp. 1	Canopy (%)	0.33	0.39	0.85	0.398
	(Intercept)	-2.46	2.55	-0.96	0.335
	DW diversity	-1.15	1.28	-0.90	0.370
Pyrenomycete sp. 2	AAD (y)	-1.25	1.33	-0.94	0.346
	YFD (y)	-1.04	1.21	-0.86	0.388
	(Intercept)	-0.65	0.44	-1.49	0.136
Pyrenomycete sp. 4	DW diversity	-0.82	0.43	-1.94	0.053
	Canopy (%)	0.99	0.51	1.93	0.053
	(Intercept)	-1.71	0.61	-2.83	0.005
<i>Trichaptum fuscoviolaceum</i>	YFD (y)	-0.84	0.49	-1.70	0.089

## 41 **DISCUSSION**

42 Occurrences of *Chaenothecopsis pusiola* showed a positive association with time since tree death, and for  
43 *Micarea prasina* the positive effect was nearly statistically significant. The species occurred more likely on  
44 trunks that had died longer time ago. The positive effect of time since tree death on *C. pusiola* might be  
45 explained by its suggested parasitic relationship with lichens and non-symbiotic algal colonies (Tuovila,  
46 2013). Also, more suitable habitats form with time, as the species prefers decorticated wood (Lõhmus and  
47 Lõhmus, 2001). *M. prasina* is a crustose lichen especially common in old-growth forests (Stenroos et al.,  
48 2015). Presumably, this slow-growing species (Stenroos et al., 2011) benefits from long periods since tree  
49 death like lichens in general.

50 Years from death had a negative effect on pyrenomycetes *Actidium hysteroioides* and *Glonium nitidum*  
51 and polypore *Trichaptum fuscoviolaceum*, yet the effect was not statistically significant for the latter two. All  
52 these species might be early successional species. Many pyrenomycetes latent in the wood are abundant in  
53 initial decay stages (Heilmann-Clausen, 2001; Hendry et al., 2002). Additionally, increasing moisture  
54 content with proceeding decomposition (Sollins et al., 1987) might hinder these species adapted to dry  
55 conditions (Boddy et al., 1989, 1985). *T. fuscoviolaceum* is a pioneer species that is often among the initial  
56 decomposers (Niemelä et al., 1995; Renvall, 1995). The species loses in competitive ability or due to  
57 depleting resources when late-stage specialists colonize the community (Rayner and Boddy, 1988; Stokland  
58 et al., 2012).

59 *C. pusiola* responded negatively to the increasing trunk age at death. The species seems to occur  
60 frequently on decorticated, decayed surfaces on the base of the boles (Hanna Tuovila, personal  
61 communication). Such microhabitat patches might be more common in younger trunks due to the differences  
62 in decay succession. Old standing kelo trees, for example, rarely offer such microhabitats. Therefore, the  
63 species might prefer trunks that have died at younger age.

64 Dead wood diversity had a negative effect on *C. pusiola*, *Micarea elachista*, *A. hysteroioides* and  
65 Pyrenomycete sp. 4, although the effect was not statistically significant for the latter two. *C. pusiola* also  
66 occurs in managed forests as long as suitable substrates are available (Hanna Tuovila, personal  
67 communication), and therefore the species might not be dependent on old-growth forests *per se*. The

68 negative effect on *M. elachista* might indicate that the species is not dead wood dependent as such since it  
69 can also grow on old living trees (Coppins, 1983; Czarnota, 2007). Like many pyrenomycetes, also *A.*  
70 *hysterioides* and Pyrenomycete sp. 4 might be associated with early stages of decomposition (Heilmann-  
71 Clausen, 2001; Hendry et al., 2002). The emergence of more specialized species with increasing dead wood  
72 diversity might have an adverse effect on these species.

73 Pyrenomycetes *G. nitidum* Ellis and Pyrenomycete sp. 4 showed a positive response to canopy  
74 openness, yet the effect was not statistically significant for the latter. Pyrenomycetes in general are  
75 characterized by high resistance to water stress (Boddy et al., 1989, 1985). Consequently, the competitive  
76 superiority of these species in dry circumstances might explain the result.

77 Altogether, negative responses to local continuity were predominant among individual species. Such  
78 responses could be expected from generalists that lose to late-stage specialists in competitiveness (Marvier et  
79 al., 2004). Kruys et al. (1999) hypothesized that species dependent on dead wood continuity require habitats  
80 that are scarce within a landscape. Presumably, these species are specialists and rare. In our study, such  
81 species did not probably have enough occurrences to be included in the analyses. Some of these species  
82 might be *e.g.* veteran tree specialists that inhabit the oldest trunks for which the age parameters were not  
83 successfully quantified. Therefore, more research on rare and specialized species is required to clarify their  
84 relationship with local continuity.

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