

SUPPLEMENT: *Does the mycorrhizal mediation hypothesis capture biogeographical patterns in plant-soil feedbacks? the case of conspecific negative density dependencies*

## Supplementary Materials

*Article Title: Does the mycorrhizal mediation hypothesis capture biogeographical patterns in plant-soil feedbacks? the case of conspecific negative density dependencies*

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## Appendix One: Annotated code:

```
data<-read.csv("PSF.csv", sep=",") #load the data
sites<-read.csv("sites.csv", sep=",")
index<-match(data$site, sites$Forest.inventory.plot)
sites<-sites[index,] # align the data
data$ECM2<-sites$Proportion.EM # save ECM information
data<-data[is.na(data$AM)==F,]
data<-data[is.na(data$ECM)==F,] # filter out sites without both AM and ECM data
ES<- (data$AM-data$ECM) / abs(data$AM) # calculate effect size
wilcox.test(ES~factor(data$ECM2<0.4)) # test results

#####ploting the results#####
library(ggplot2)
library(cowplot)
library(readr)
library(spatstat)
library(tidyverse)
library(gapminder)
library(ggtext)
library(ggrepel)
library(colorspace)
library(ragg)
library(ggdist)
source("https://gist.githubusercontent.com/benmarwick/2a1bb0133ff568cbe28d/raw/fb53bd97121f7f9ce947837ef1a4c65a73bffb3f/geom_flat_violin.R")
data$ES<-ES
data$type<-data$ECM2<0.4
data$type[data$type==T]<-"AM"
data$type[data$type==F]<-"ECM"
add_sample <- function(x){
  return(c(y = max(x) + .035,
          label = length(x)))
}
ggplot(data=data, aes(x=type, y=ES))+
  geom_abline(intercept = 0, slope = 0, color=after_scale(desaturate("brown", .8, space =
"HLS")), size=1.0)+
  geom_boxplot(aes(color = type, color = after_scale(darken(color, .1, space = "HLS")),
fill = after_scale(desaturate(lighten(color, .8), .4))), width = .42, outlier.shape = NA)+
  geom_point(aes(color = type, color = after_scale(darken(color, .1, space = "HLS"))),
fill = "white", shape = 21, stroke = .4, size = 5, position = position_jitter(seed = 1, width
= .12))+
  geom_point(aes(fill = type), color = "transparent", shape = 21, stroke = .4, size = 5,
alpha = .3, position = position_jitter(seed = 1, width = .12))+
  stat_summary(geom = "text", fun = "median", aes(label = round(..y.., 2), color = type,
color = after_scale(darken(color, .1, space = "HLS"))), family = "Roboto Mono", fontface =
"bold", size = 6, vjust = -2)+
  stat_summary(geom = "text", fun.data = add_sample, aes(label = paste("n =", ..label..),
color = type, color = after_scale(darken(color, .1, space = "HLS"))), family = "Roboto
Condensed", size = 5, hjust = 0)+
  coord_flip(clip = "off") +
  scale_y_continuous(limits=c(-2.5, 2.5))+scale_x_discrete(labels=c("AM (ECM<0.4)", "ECM
(ECM>0.4)")))+
  labs(x = "", y = 'CNDNs Effect Size (AM-ECM / |AM|)', title = "", subtitle = "",
caption = "W=88, <i>P</i>=0.03")+

  theme_minimal(base_family = "Zilla Slab", base_size = 15)+
  theme(panel.grid.minor = element_blank(), panel.grid.major.y = element_blank(),
axis.ticks = element_blank(),
axis.text.x = element_markdown(family = "Roboto Mono"), axis.text.y =
element_text(size = 16, color=after_scale(desaturate("brown", .8, space = "HLS"))),
axis.title.x = element_text(size = 16,
color=after_scale(desaturate("blue", .8, space = "HLS"))),
```

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```
axis.title.y = element_text(size = 16,  
color=after_scale(desaturate("blue", .8, space = "HLS")),  
plot.caption = element_markdown(margin = margin(t = 10), color="darkgrey",  
size=12),  
plot.title = NULL,  
plot.subtitle = NULL) + theme(plot.margin = unit(c(0,2,0,0), "lines"))+  
theme(legend.position="none")
```

Appendix Two: CNDD data, extracted from the original publication. We report on site properties in Appendix Three. Abbreviations are as follows: AM: arbuscular mycorrhizal associating species (mean CNDD). AMCI: mean CNDD for arbuscular mycorrhizal associating species minus the standard error. ECM and ECMCI are the respective figures for ectomycorrhiza associating tree species.

Site	AM	AMCI	ECM	ECMCI
Scotty Creek			-0.2586	-1.2640
Speulderbos	-0.7345	-1.9916	-0.0604	-1.3215
Wytham Woods	-0.1403	-1.0117	0.1889	-1.0779
Zofin	-0.9746	-2.2247	0.0461	-1.1865
Wind River	-1.4733	-2.3662	-1.6757	-2.5562
Wabikon	-0.6934	-1.3505	-0.2392	-0.9208
Low Elevation Andrews Satellite Plot	0.0151	-1.7706	-0.0695	-1.3191
Andrews	-1.2550	-2.2906	-0.0531	-1.3027
High Elevation Andrews Satellite Plot	-0.4036	-1.2821	-0.3378	-1.3602
Niobrara	-0.3309	-0.9880	-0.2816	-1.1621
Harvard Forest	-0.6509	-1.1009	-0.3959	-0.8390
Michigan Big Woods	-0.4353	-1.0353	-0.9759	-1.5553
Indian Cave	-1.2554	-1.7625	-0.8289	-1.4481
Temple University	-0.0898	-0.9612	-0.1877	-1.9600
University of Maryland Baltimore County	-1.3813	-2.017	-0.7110	-1.9606
Lilly Dickey Woods	-1.3799	-1.9370	-0.8707	-1.6603
Smithsonian Conservation Biology Institute	-1.0286	-1.4572	-0.4226	-0.9622
Smithsonian Environmental 1 Research Center	-1.0058	-1.4630	-1.4287	-2.3035
Tyson Research Center	-0.5259	-1.0474	-0.5659	-1.1964
Yosemite	-0.0603	-1.3103	-0.044	-1.0551
Utah	-1.1518	-2.9303	-0.2491	-0.9194
University of California Santa Cruz	-0.8862	-1.6076	-0.0112	-0.6815
Tiantongshan	-0.8420	-1.0705	-0.9208	-1.4434
Ordway Swisher	-2.4978	-4.2621	-0.8249	-1.7224
Baishanzu	-1.2250	-1.4321	-0.5813	-1.1152
Fushan	-1.2737	-1.5237	-0.9739	-1.5930
Lienhuachih	-1.1509	-1.3723	-0.4917	-1.2756
Heishiding	-3.6781	-3.9209	-4.3380	-4.9856
Kenting	-1.2553	-1.5767		
Laupahoehoe	-0.5111	-1.0897		
Palamanui	-0.0455	-0.7812		

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Luquillo	-1.2013	-1.4656	3.98282	-5.7381
Palanan	-2.2214	-2.3642	0.43319	-1.0751
Mo Singto	-2.0915	-2.2701	1.47906	-2.2118
San Lorenzo	-1.6044	-1.7973		
Barro Colorado Island	-2.8031	-2.9388	3.87189	-4.8773
Cocoli	-1.0088	-1.3589	0.99254	-2.2593
Sinharaja	-1.4290	-1.5932	0.16385	-0.7035
Wanang	-2.6491	-2.7705	0.30652	-1.5619
Danum Valley	-2.7977	-2.8977	2.52827	-2.8861
Korup	-0.5035	-0.6463	0.06358	-0.9668
Rabi	-1.5736	-1.7022	0.56414	-0.9845
La Planada	-2.1580	-2.3436		

### Appendix Three: Site information

Forest inventory plot	Biome	Latitude	Longitude	Mean annual temperature	Annual precipitation	Species richness	Proportion EM
Baishanzu	Tropical	27.761	119.198	11.657	2121.436	178	0.107
Barro Colorado Island	Tropical	9.154	-79.846	25.457	3132.864	277	0.014
Cocoli	Tropical	8.988	-79.617	25.952	2460.069	158	0.019
Danum Valley	Tropical	5.102	117.688	25.157	2532.831	536	0.076
High Elevation Andrews Satellite Plot	Temperate	44.218	-122.243	10.343	2393.999	14	0.571
Low Elevation Andrews Satellite Plot	Temperate	44.275	-122.141	5.544	2902.765	9	0.778
Andrews	Temperate	44.261	-122.185	8.068	2457.735	14	0.643
Fushan	Tropical	24.761	121.555	19.333	4630.321	101	0.079
Harvard Forest	Temperate	42.539	-72.176	8.252	1262.944	52	0.481
Heishiding	Tropical	23.27	111.53	22.247	1441.292	176	0.108
Indian Cave	Temperate	40.247	-95.537	11.65	952.89	46	0.217
Kenting	Tropical	21.98	120.797	24.157	2461.634	80	NA
Korup	Tropical	5.074	8.855	24.442	3415.471	429	0.035
La Planada	Tropical	1.156	-77.994	17.032	6551.807	159	0.013
Laupahoehoe	Tropical	19.93	-155.287	16.367	4037.328	19	0.053
Lienhuachih	Tropical	23.914	120.879	19.772	3379.379	115	0.061
Lilly Dickey Woods	Temperate	39.236	-86.218	12.052	1218.747	33	0.394
Luquillo	Tropical	18.326	-65.816	23.962	2860.98	120	0.017
Michigan Big Woods	Temperate	42.467	-84	9.25	868.122	42	0.357
Mo Singto	Tropical	14.433	101.35	22.55	2735.861	257	0.043
Niobrara	Temperate	42.78	-100.021	9.253	546.285	22	0.273
Ordway Swisher	Temperate	29.691	-81.993	20.35	1316.956	11	0.818
Palamanui	Tropical	19.739	-155.994	21.94	991.757	12	NA
Palanan	Tropical	17.04	122.388	25.948	3557.002	301	0.043
Rabi	Tropical	-1.925	9.88	24.947	2542.003	314	0.061
San Lorenzo Smithsonian Conservation Biology Institute	Temperate	38.894	-78.145	12.247	1074.754	62	0.355
Scotty Creek Smithsonian Environmental 1 Research Center	Boreal	61.3	-121.3	-2.15	645.443	5	1
Sinharaja	Tropical	6.402	80.402	23.158	3316.173	217	0.065
Speulderbos	Temperate	52.253	5.702	9.753	968.047	13	0.769
Temple University	Temperate	40.164	-75.192	12.347	1215.899	57	0.316
Tiantongshan	Temperate	29.812	121.783	15.853	1819.889	142	0.127

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Tyson Research Center University of California Santa Cruz	Temperate	38.518	-90.558	13.25	1150.197	44	0.386
University of Maryland Baltimore County	Temperate	37.012	-122.075	12.453	897,378	32	0.406
Utah	Temperate	39.255	-76.708	13.35	1209.918	56	0.321
Wabikon	Temperate	37.662	-112.853	1.848	880.484	16	0.625
Wanang	Tropical	45.555	-88.795	5.152	885.436	34	0.471
Wind River	Temperate	-5.25	145.267	25.852	3062.931	476	0.008
Wytham Woods	Temperate	45.82	-121.956	9.553	2482.996	20	0.6
Yosemite	Temperate	51.774	-1.338	9.757	699.091	20	0.5
Zofin	Temperate	37.766	-119.819	7.173	1619.755	12	0.583
	Temperate	48.664	14.707	6.755	883.019	13	0.462