

# TEAMWORK MAKES THE DREAMWORK: disentangling cross-taxon congruence across soil biota in *Pinus nigra* plantations

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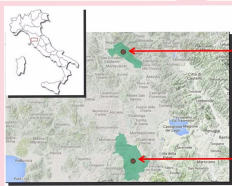
## Introduction

**WHO?** EU-Life project (SelPiBioLife, LIFE13 BIO/IT/000282)  
**WHEN?** 2014-2019 (IN PROGRESS)  
**WHAT?** application of an innovative forest management technique (selective thinning) along with its effects on soil biodiversity in *Pinus nigra* plantations  
**WHERE?** two mountain areas of the Apennines (Italy)

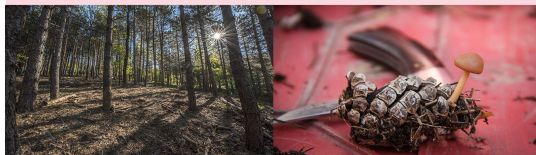
BEFORE  
SELVICULTURAL  
TREATMENT

AFTER  
SELVICULTURAL  
TREATMENT

in progress



"Pratomagno-Valdarno" - Pian della cucina- Municipality: Loro Ciuffenna (AR) PRATOMAGNO  
-Madonna delle Querce- -Il Lago- Municipality: Castiglione d'Orcia (SI) AMIATA



## Aims of the work

- to test the robustness of cross-taxon congruence across different groups of organisms
- to assess how abiotic (soil and spatial-topographic) and biotic (dendrometric) predictors drive the community concordances among taxa.
- to explore ecological linkages between above/below-ground biota in artificial black pine stands.

BEFORE  
SELVICULTURAL  
TREATMENT

## Data analyses

### Mantel and Partial Mantel tests

Taxa	Bacteria	Carabids	ECM	Microarthropods	Mushrooms	Mycelium	Nematodes	Vascular plants	Environment
Bacteria	-								
Carabids	0.416**	-							
ECM	0.592***	0.252*	-						
Microarthropods	0.391***	0.065	0.269**	-					
Mushrooms	0.683***	0.343**	0.284**	0.326**	-				
Mycelium	0.876***	0.380**	0.552***	0.316**	0.672***	-			
Nematodes	0.091	0.118	0.129	0.142	0.136	0.050	-		
Vascular plants	0.787***	0.325*	0.5401***	0.344**	0.513***	0.740***	-0.020	-	
Environment	0.966***	0.451**	0.615***	0.394**	0.692***	0.875***	0.110*	0.838***	-



Highly supported inter-group congruence and with the overall dataset of environmental predictors.

Taxa	Bacteria	Carabids	ECM	Microarthropods	Mushrooms	Mycelium	Nematodes	Vascular plants
Bacteria	-							
Carabids	-0.086	-						
ECM	-0.009	-0.036	-					
Microarthropods	0.047	-0.137	0.038	-				
Mushrooms	0.080	0.048	-0.247	0.081	-			
Mycelium	0.245**	-0.034	0.036	-0.063	0.192*	-		
Nematodes	-0.057	0.077	0.080	0.108	0.085	-0.094	-	
Vascular plants	-0.158	-0.107	0.057	0.027	-0.170	0.027	-0.207	-



Excluding environmental effect, only bacteria and mushrooms maintained a moderate and significant correlation with mycelium, independent of environmental factors. No other cross-taxon correlation remained significant.

## SelPiBio in numbers

8 groups of organisms



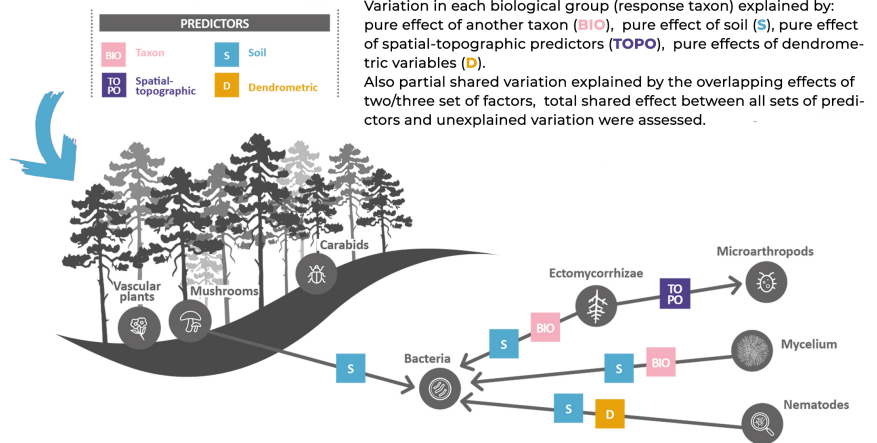
26 environmental predictors

**SPATIAL-TOPOGRAPHIC**  
aspect, elevation, roughness, TPI index, TRI index, geo coords...

**SOIL**  
% clay, % coarse sand, % fine sand, % organic matter, pH, electric conductivity...

**DENDROMETRIC**  
nr tree (ha), basal area (ha), av\_diameter and height, PAR...

## Variation partitioning



- Bacteria: response taxon most explained by the set of variables used in this study.
- Bacteria: involved in almost all the cases where the variance attributed solely to pure effect of biotic or abiotic predictors was significant.
- Ectomycorrhizae and Mycelium → Bacteria: pure taxon effect (BIO); cross-taxon congruence not associated with environmental-spatial predictors and hence related purely to proxies of potential biotic interactions.

## Materials & Methods

- **Mantel and Partial Mantel tests:** to perform pairwise cross-taxon correlation analysis among taxa, using Bray-Curtis dissimilarity matrices, considering and excluding environmental effect.
- **Variation partitioning:** to assess the total variance of each response taxon in the pure effect of another taxon (BIO), soil (S), spatial-topographic (TOPO) and dendrometric (D) factors, partial and total shared effect of all predictors.



## Discussion & Conclusions

- Fundamental role of soil microbiome (especially Bacterial-fungal interactions) in affecting the ecosystem functioning of artificial black pine stands
- Complex network of clutched ecological linkages in *Pinus nigra* soil
- Importance of the analysis of multiple taxa and their relationships with abiotic/abiotic features
- Impossibility to assess the mutual surrogate efficiency of taxa avoiding the environmental/habitat influence.