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FORESMIT

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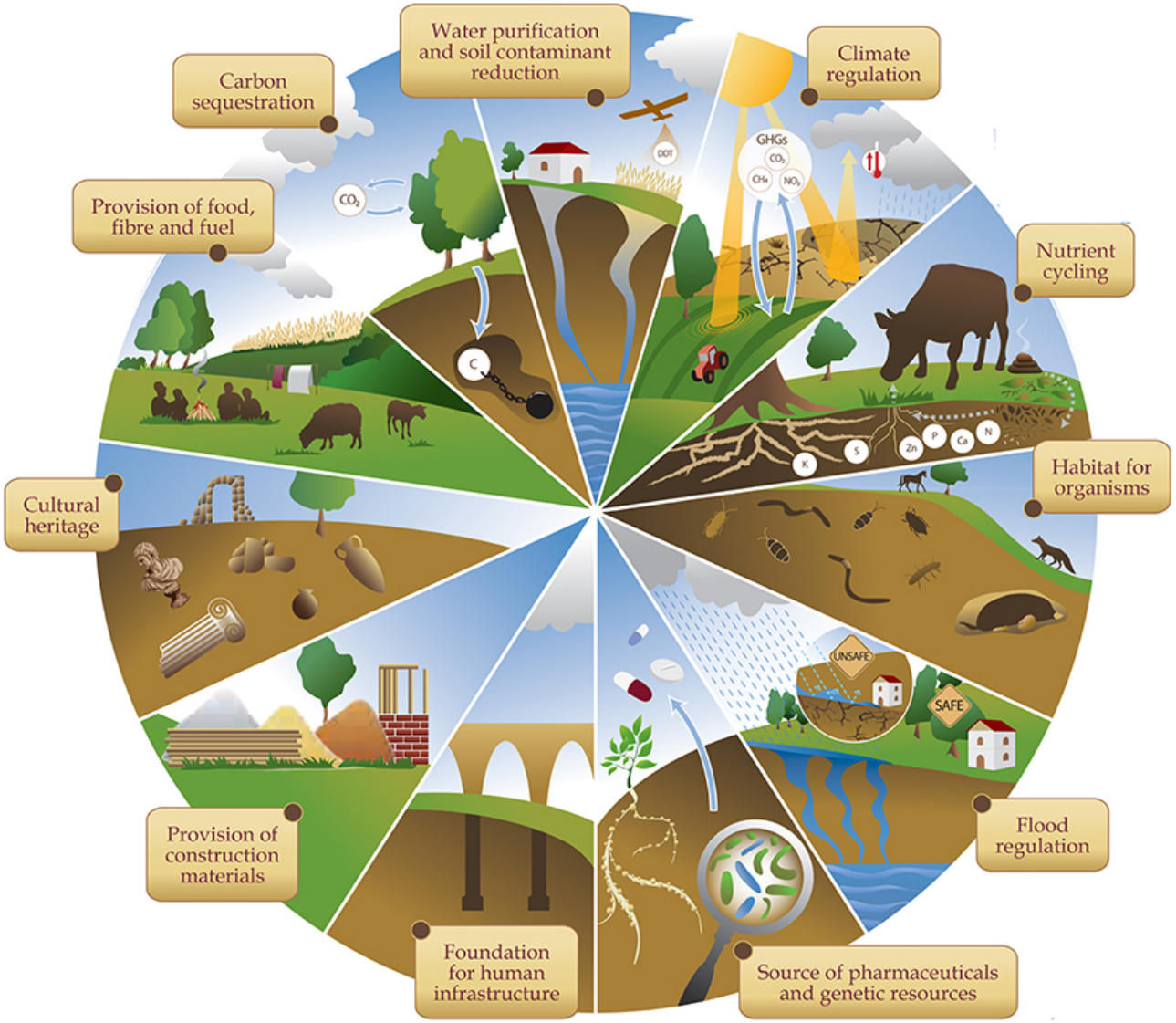
Effetti sulla biodiversità dei microorganismi del suolo/Effects on soil microbial diversity

Stefano Mocali

NUOVI APPROCCI PER LA GESTIONE SOSTENIBILE DEL PINO NERO:
biodiversità e mitigazione
MARTEDÌ 14 MAGGIO 2019 | 9.30 - 16.30
Firenze, Sala Giordano - Palazzo Medici-Riccardi

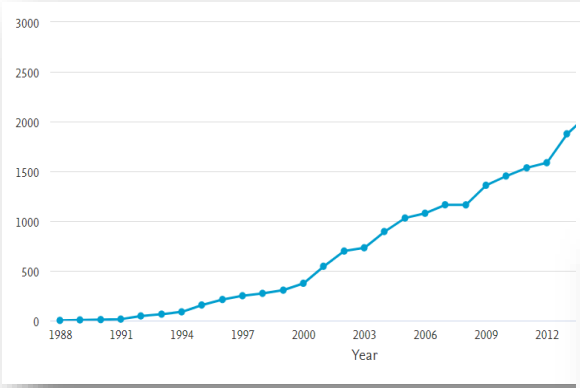
Soil ecosystem services



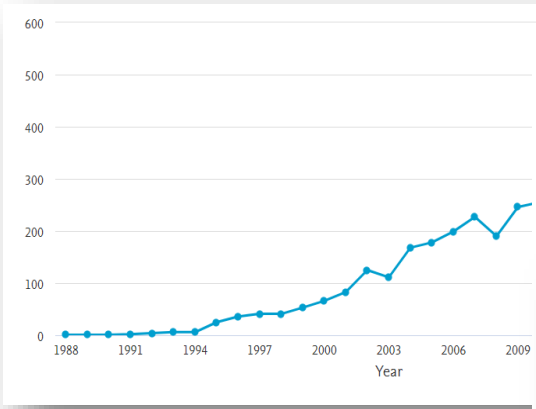
The main business of the soil "biota" is to create and refresh soil, the most essential food source on the planet. It provides the nutrients that plants need to grow and sustain animals, including by producing our own food, textile fibres, wood and ingredients for pharmaceuticals.

Research on «Forests and soil biodiversity» (1988-2018)

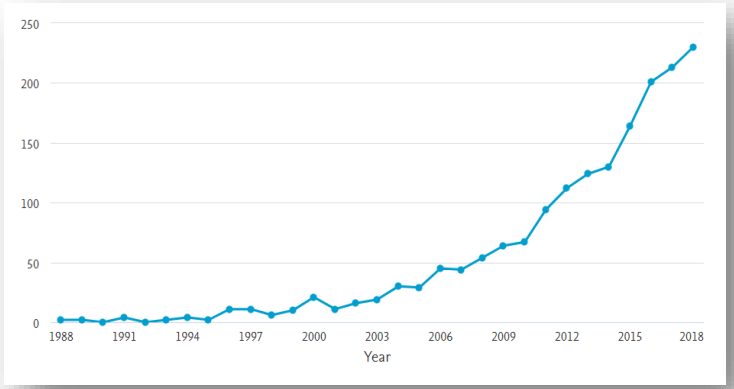
"Forest biodiversity"
(28700 documents)



"Forest soil biodiversity"
(5035 documents)



"Forest microbial diversity "
(1722 documents)



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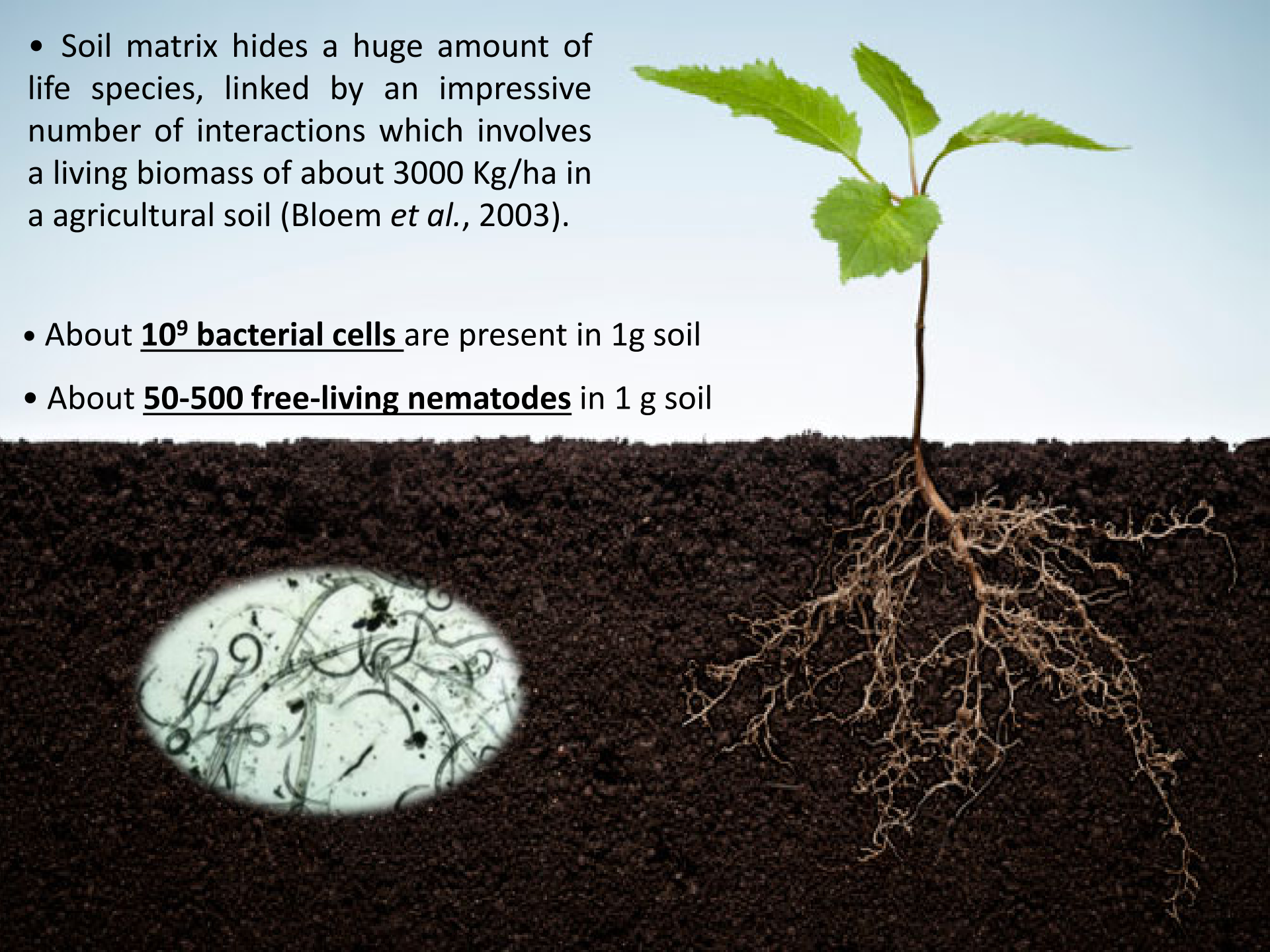
• Soil matrix hides a huge amount of life species, linked by an impressive number of interactions which involves a living biomass of about 3000 Kg/ha in a agricultural soil (Bloem *et al.*, 2003).

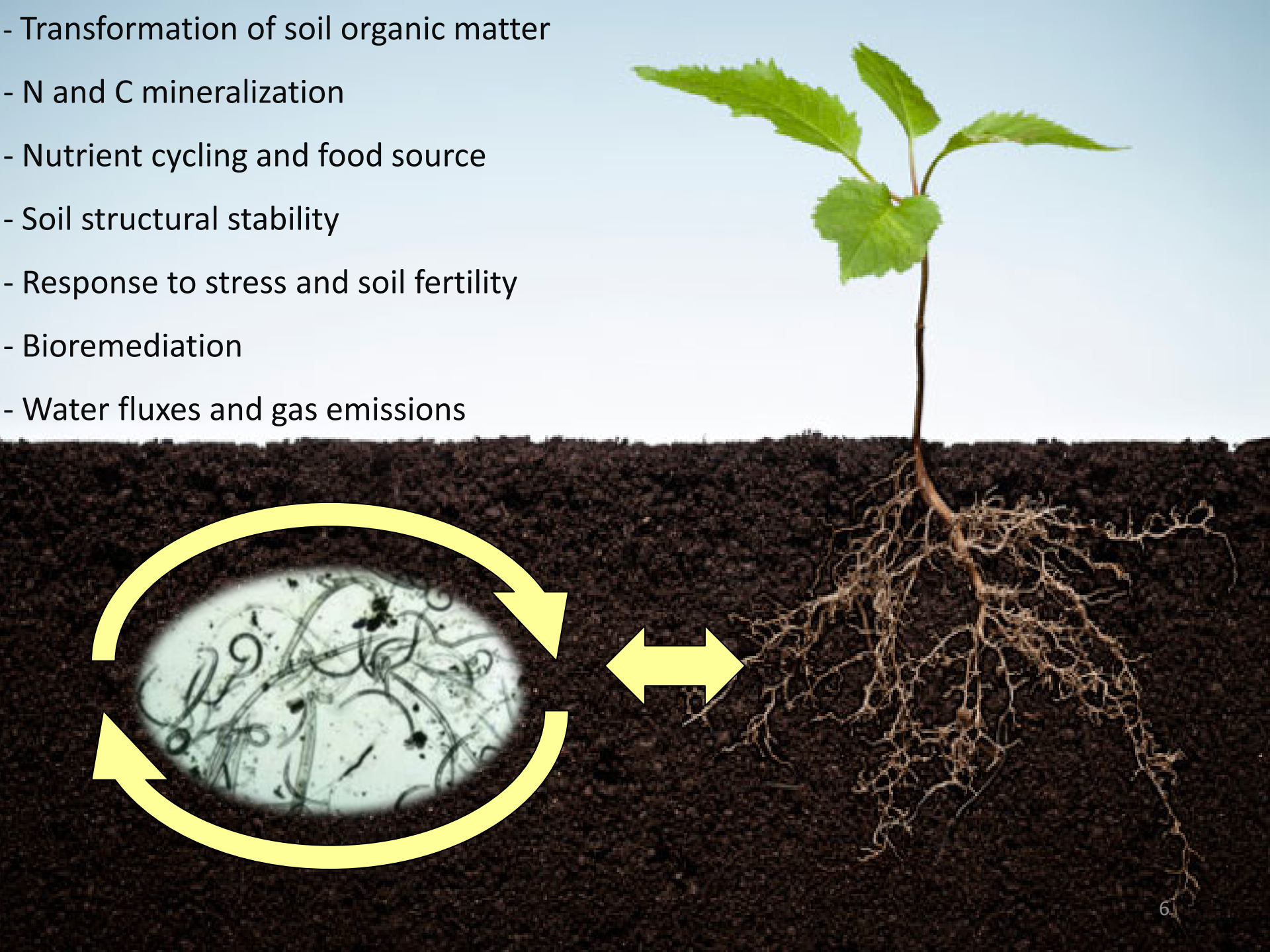
• Soil matrix hides a huge amount of life species, linked by an impressive number of interactions which involves a living biomass of about 3000 Kg/ha in a agricultural soil (Bloem *et al.*, 2003).

• About **10^9 bacterial cells** are present in 1g soil

• About **50-500 free-living nematodes** in 1 g soil



- Transformation of soil organic matter
- N and C mineralization
- Nutrient cycling and food source
- Soil structural stability
- Response to stress and soil fertility
- Bioremediation
- Water fluxes and gas emissions



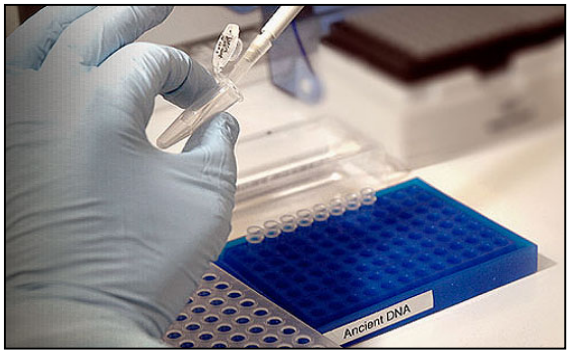
METHODS

SOIL

Microbial C biomass
(Vance et al., 1987)

Soil microbial respiration
(Alef, 1995)

Microbial diversity (NGS):
bacteria, fungi



Assessing soil microbial diversity

Untreated control

Traditional thinning

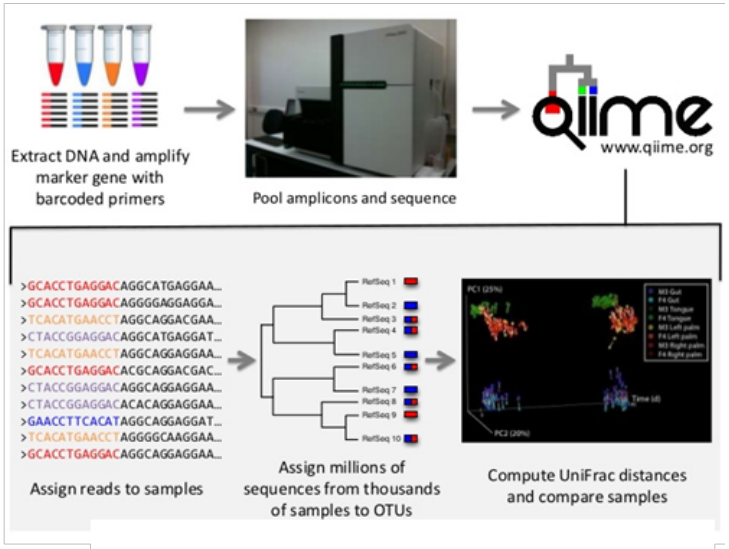
Selective thinning

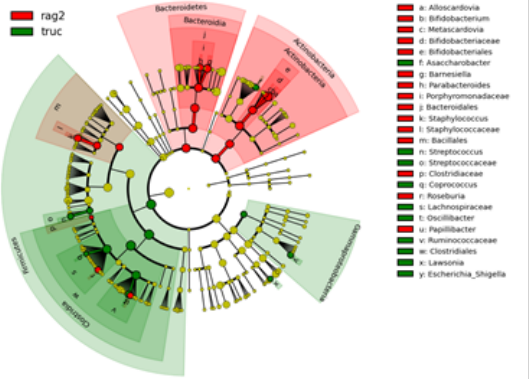
Genomic DNA extraction

PCR

Library (16S/ITS)

Microbial community structure





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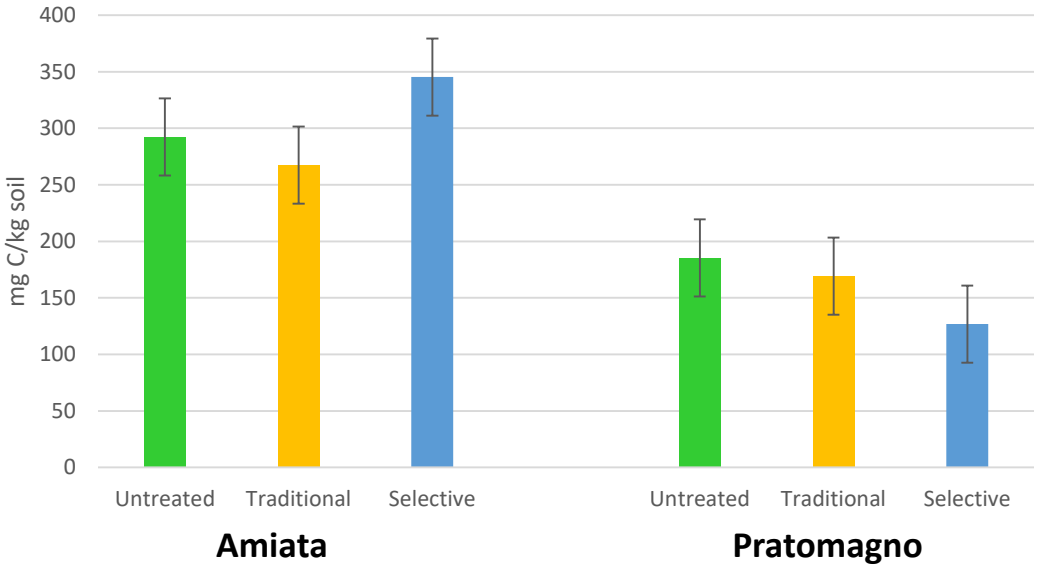
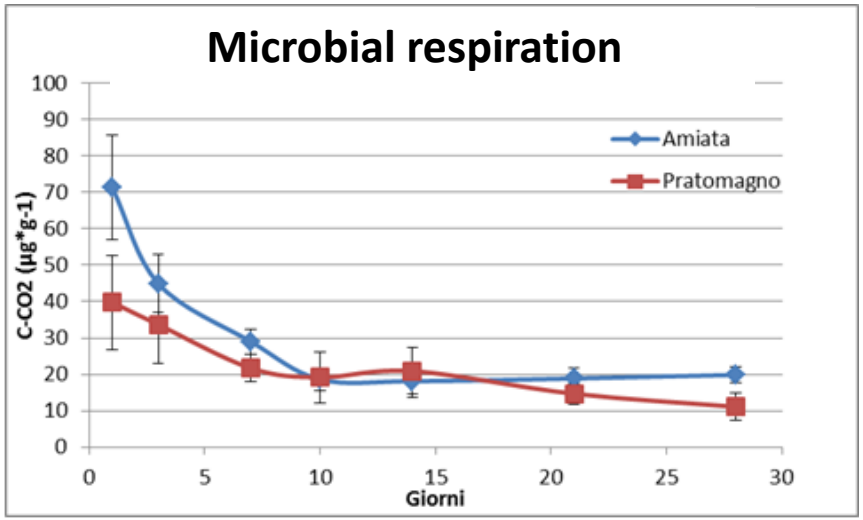
RESULTS

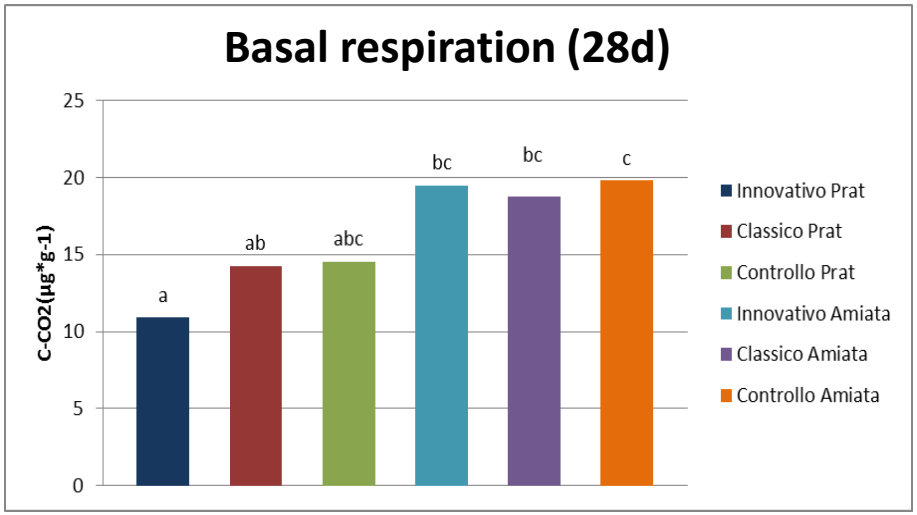
Microbial C biomass (2015)

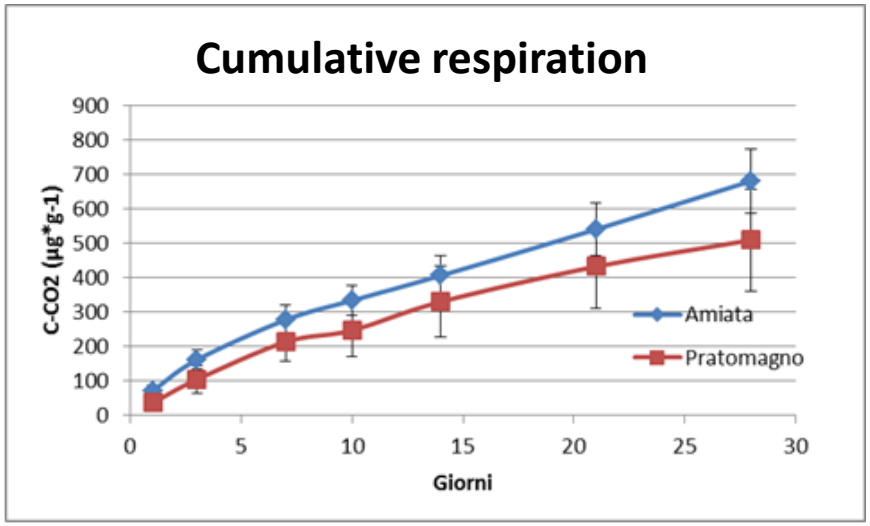


- **There is a higher content of microbial biomass in Amiata soils than in the pratomagno ones**

Microbial respiration (2015)



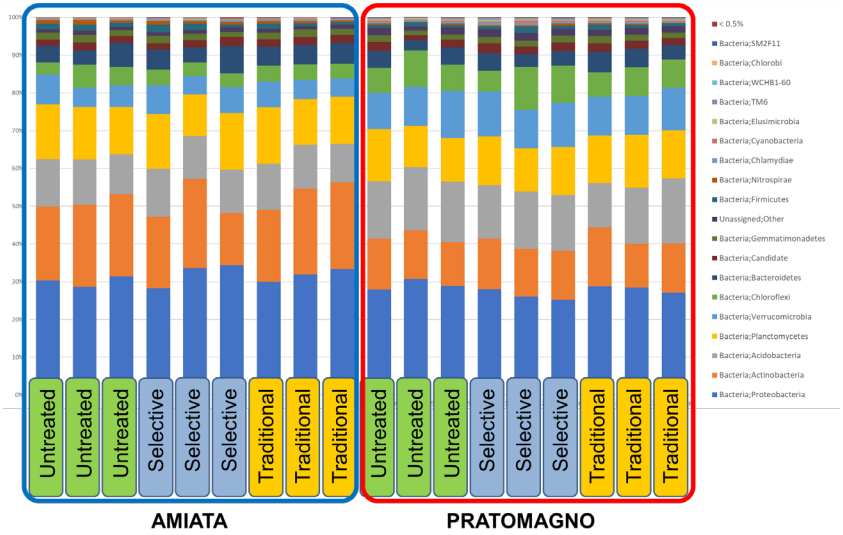




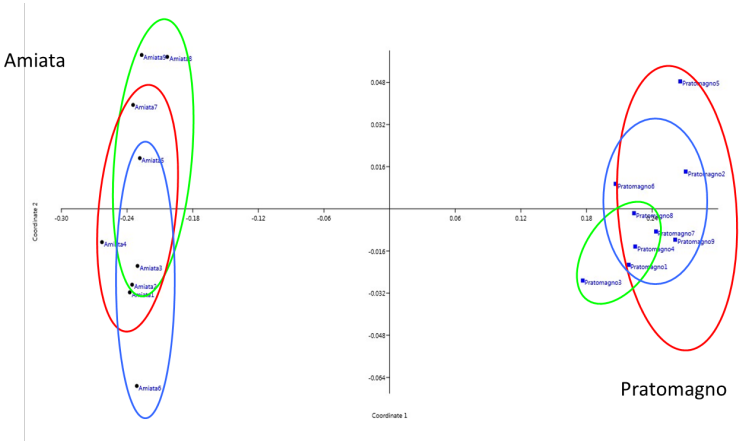
- In general, soils of AMIATA showed higher values than PRATOMAGNO

- Furthermore, values of basal respiration of Pratomagno soils are much more heterogeneous than those of Amiata

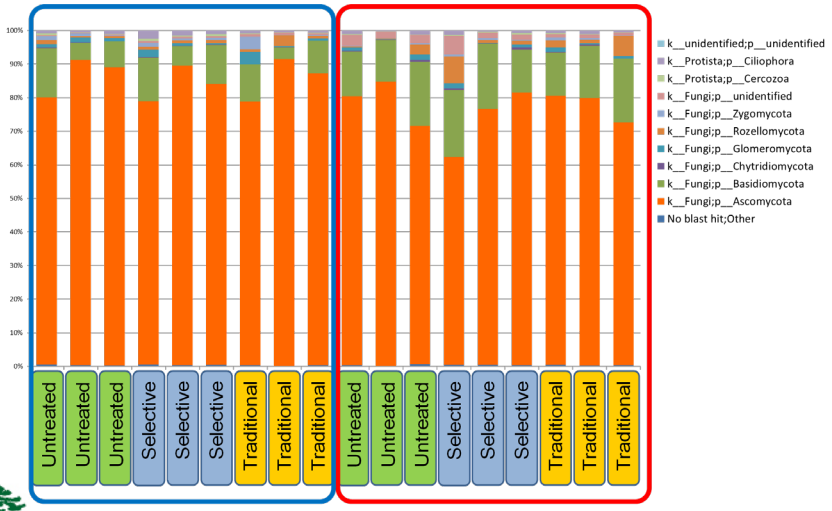
Bacterial diversity (Phyla) - 2015



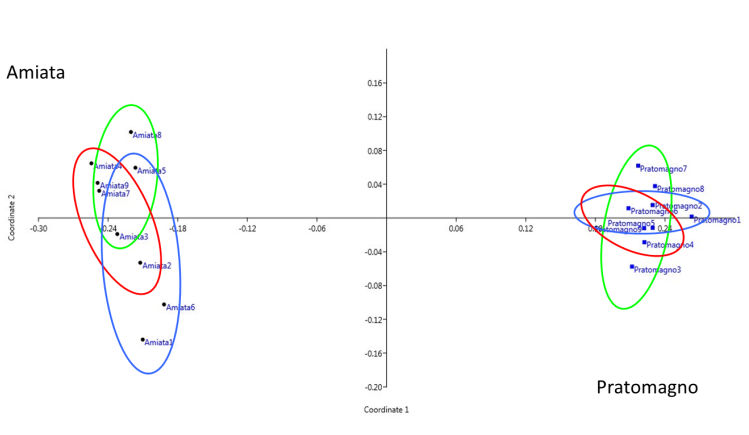
NMDS analysis (genera)



Fungal diversity (Phyla) - 2015



NMDS analysis (genera)



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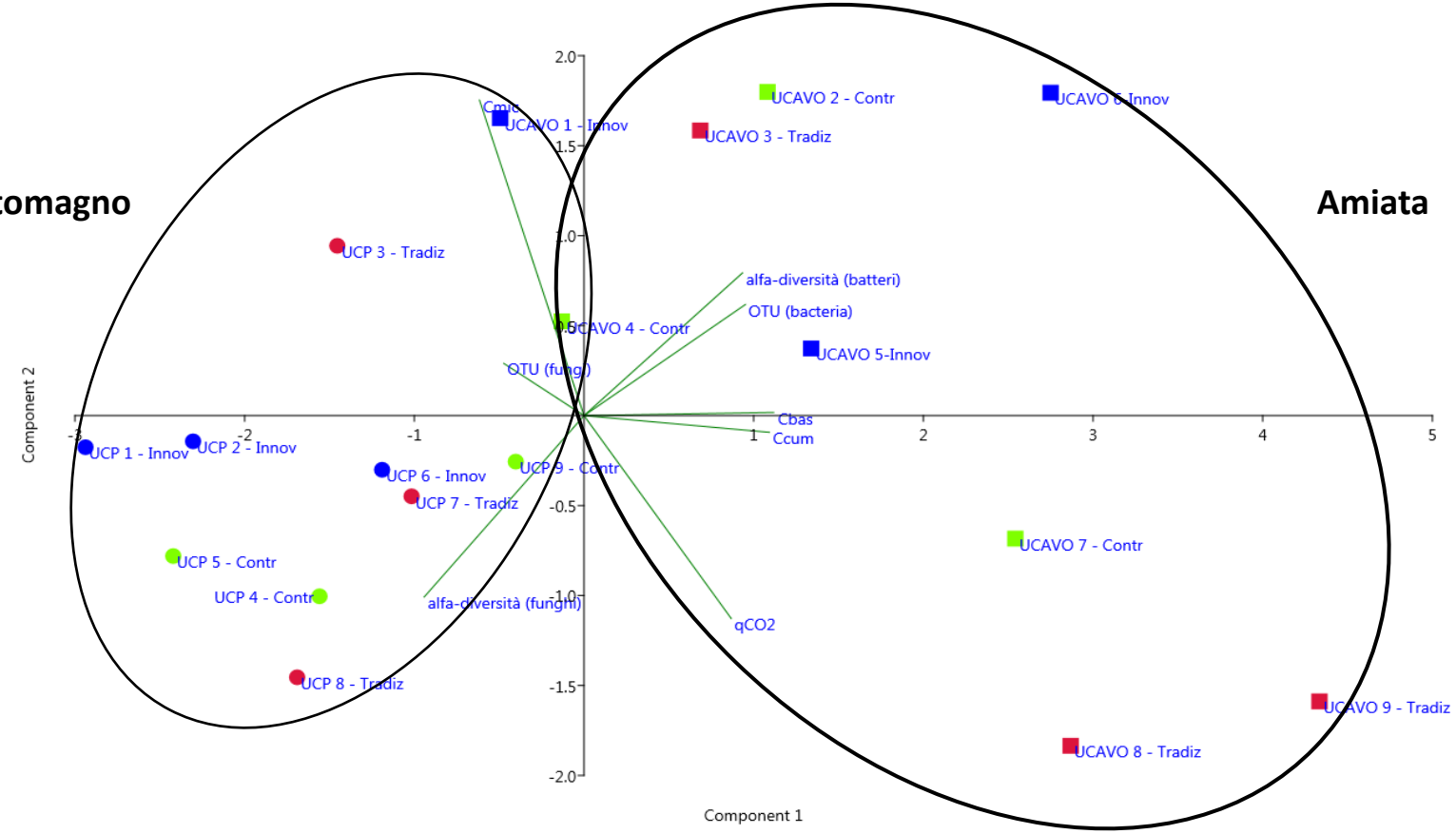
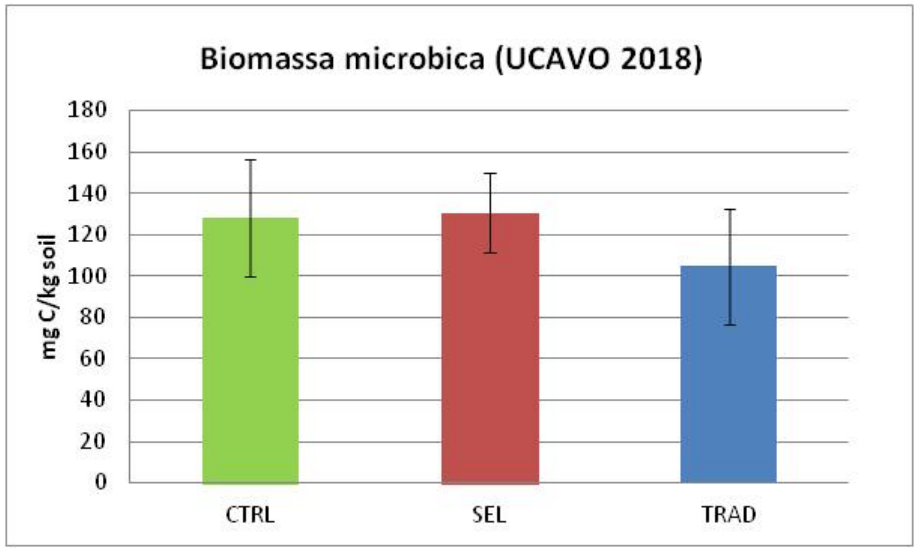
Principal Component Analysis (PCA)

PC	% variance
1	54,8 %
2	17,3 %



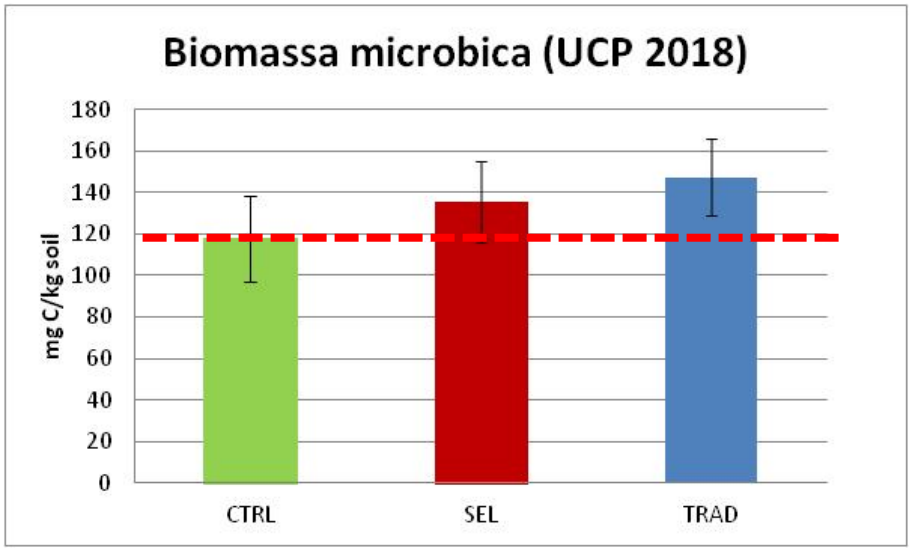
Microbial C biomass (2018)

AMIATA



TRAD soils of the Amiata site showed lower values of microbial biomass compared to CTRL and SEL.

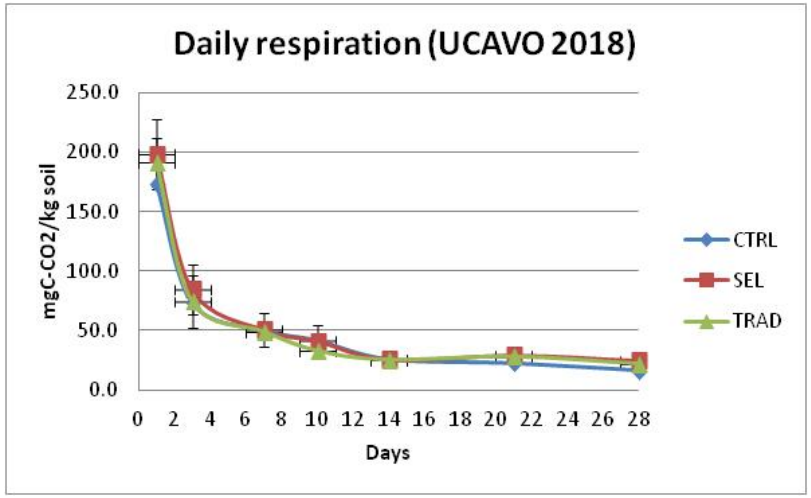
PRATOMAGNO

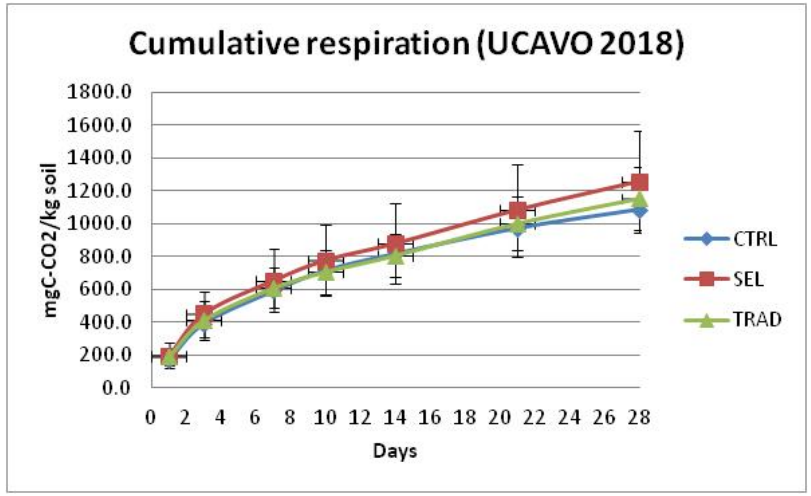


CTRL soils of the Amiata site showed lower values of microbial biomass compared to TRAD and SEL.

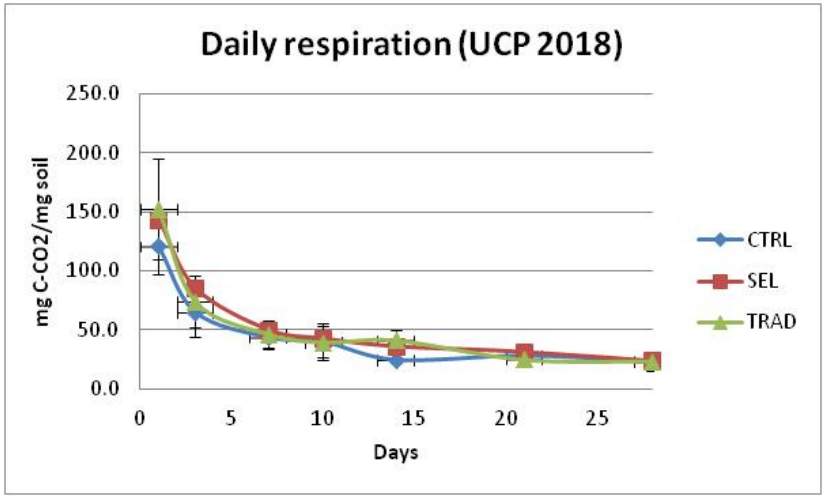
Microbial respiration (2018)

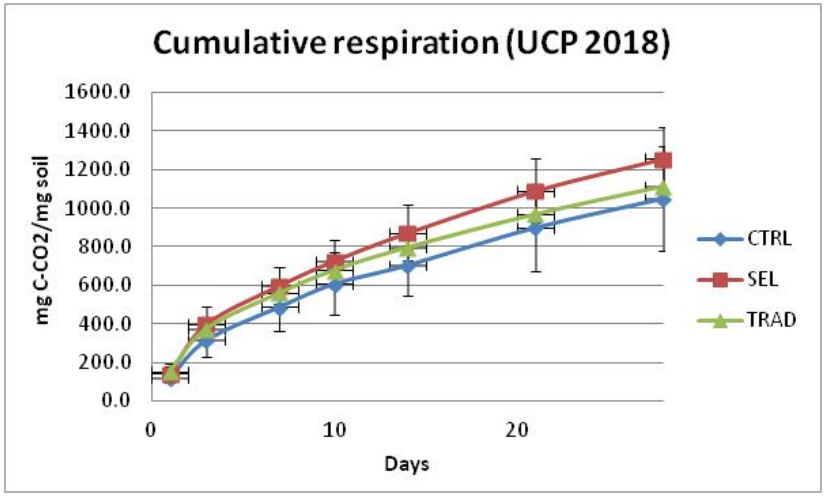
AMIATA





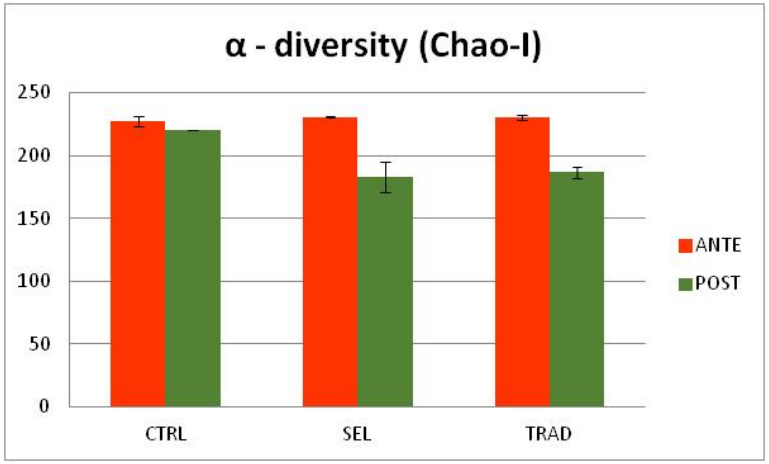
PRATOMAGNO



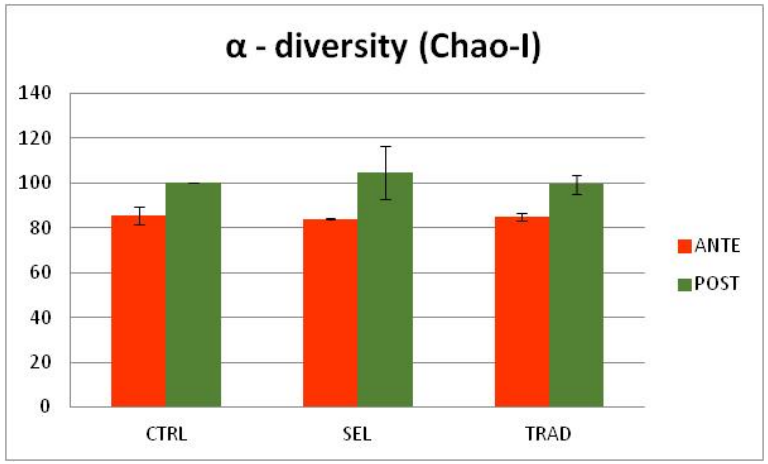


Microbial diversity - Amiata (2015-2018)

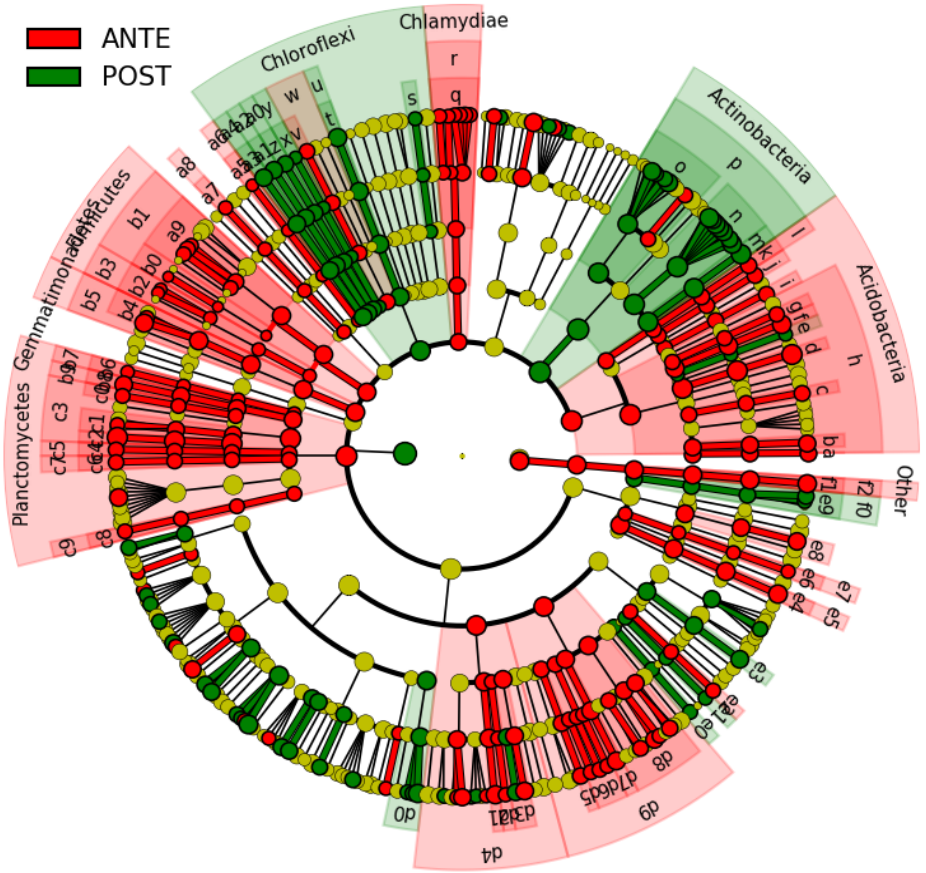
Bacteria



Fungi



NO THINNING (CONTROL)



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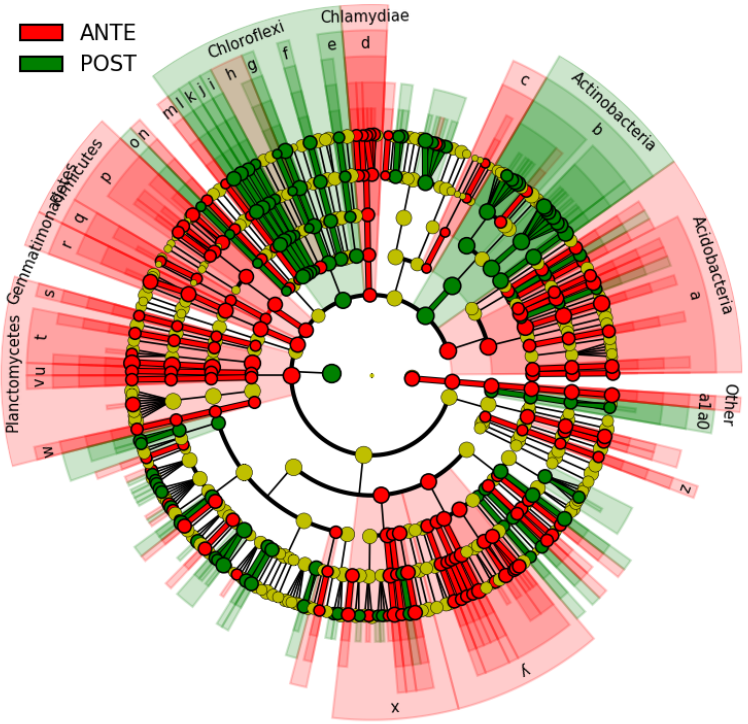
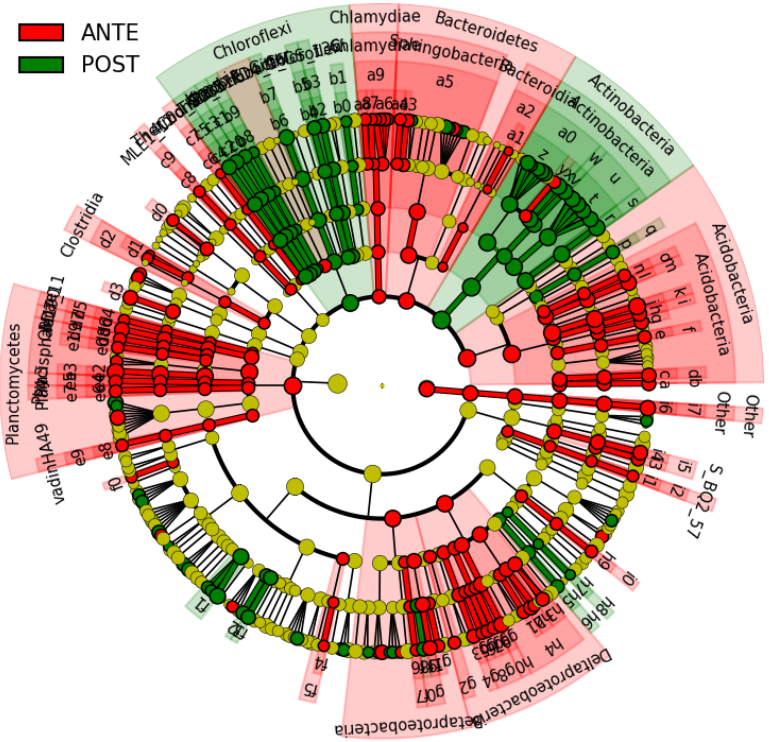
Microbial diversity - Amiata (2015-2018)

TRADITIONAL



SELECTIVE



In Amiata Planctomycetes and Acidobacteria significantly decreased in 2018 (-35% and -44%, respectively), whereas Actinobacteria (copiotrophs) increased of about 50% in all the plots.

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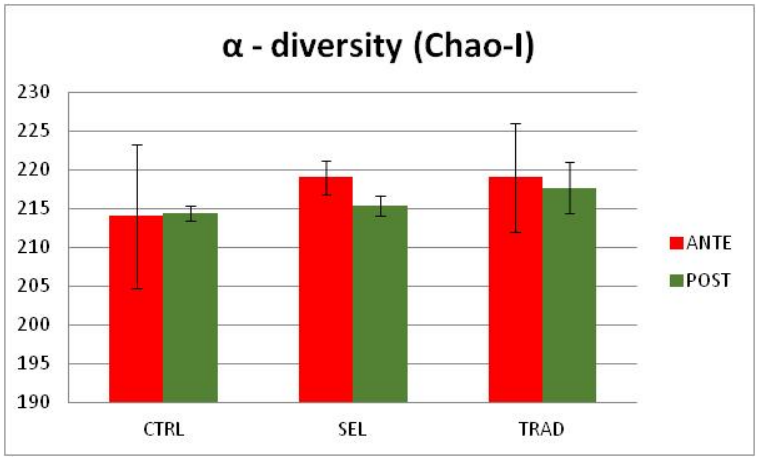
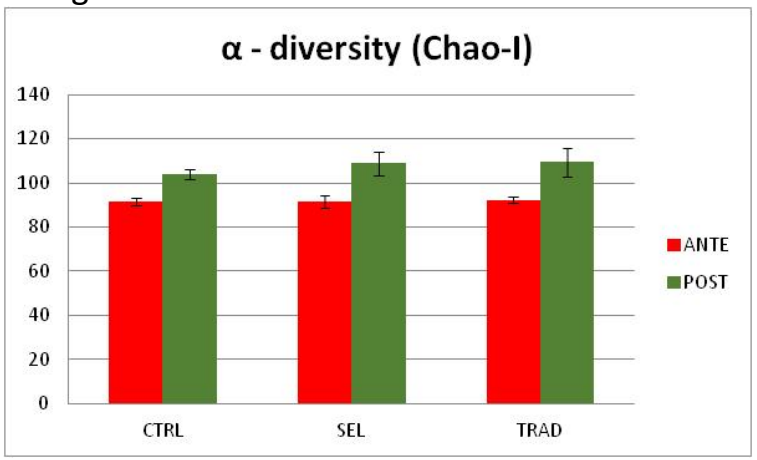
Microbial diversity – Pratomagno (2015-2018)

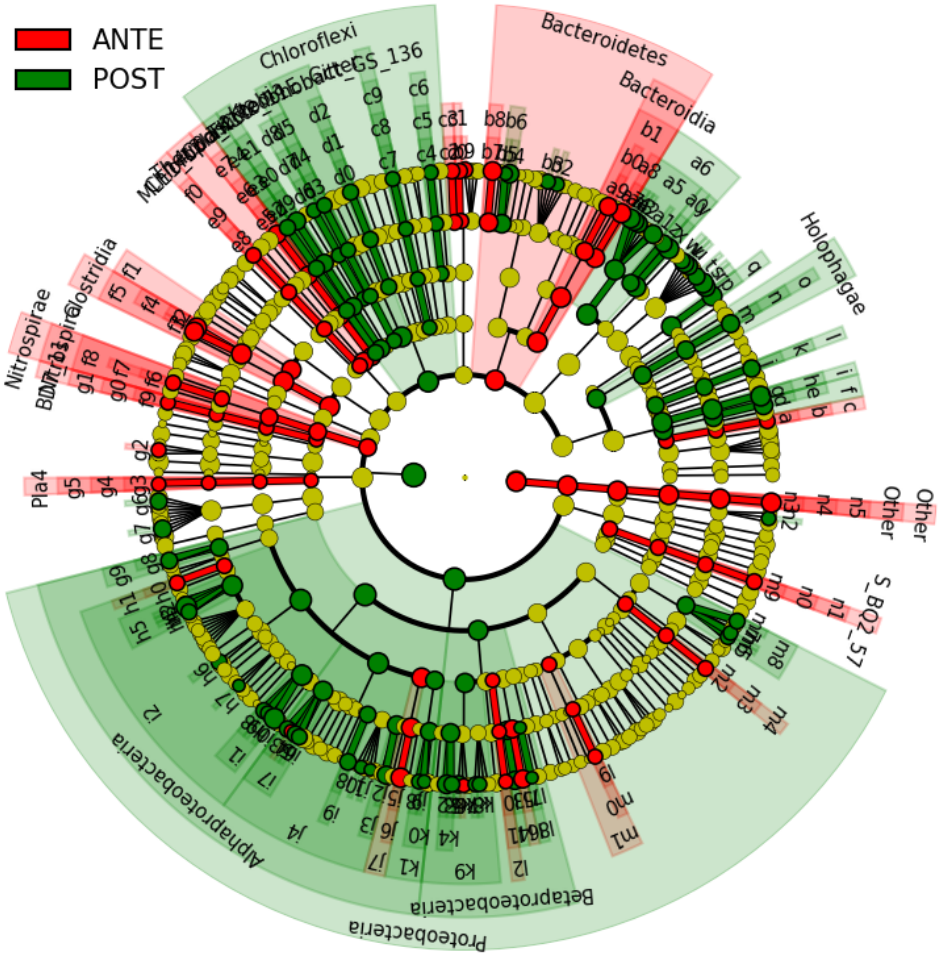
Bacteria



Fungi



NO THINNING (CONTROL)



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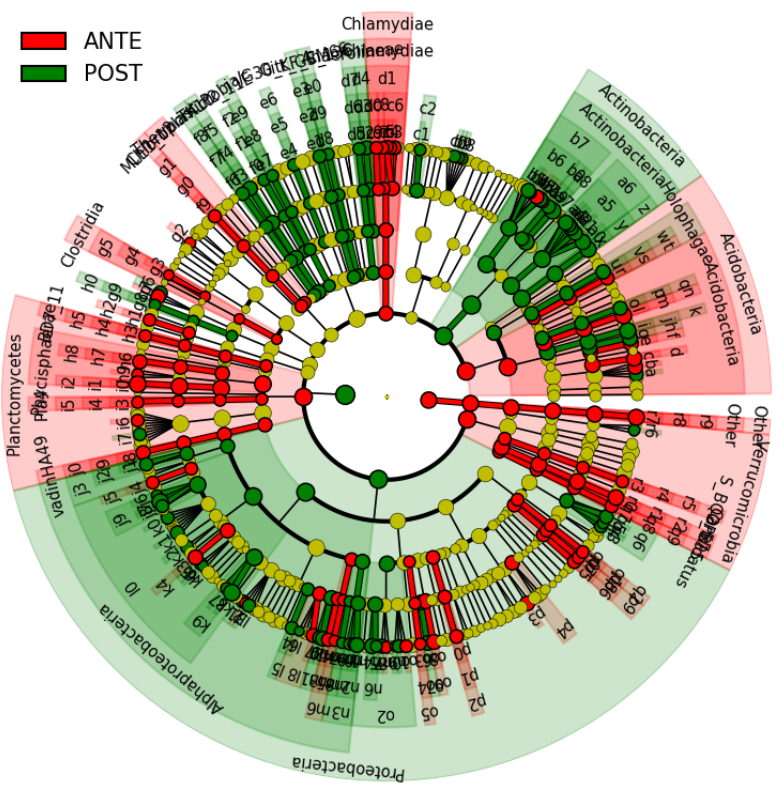
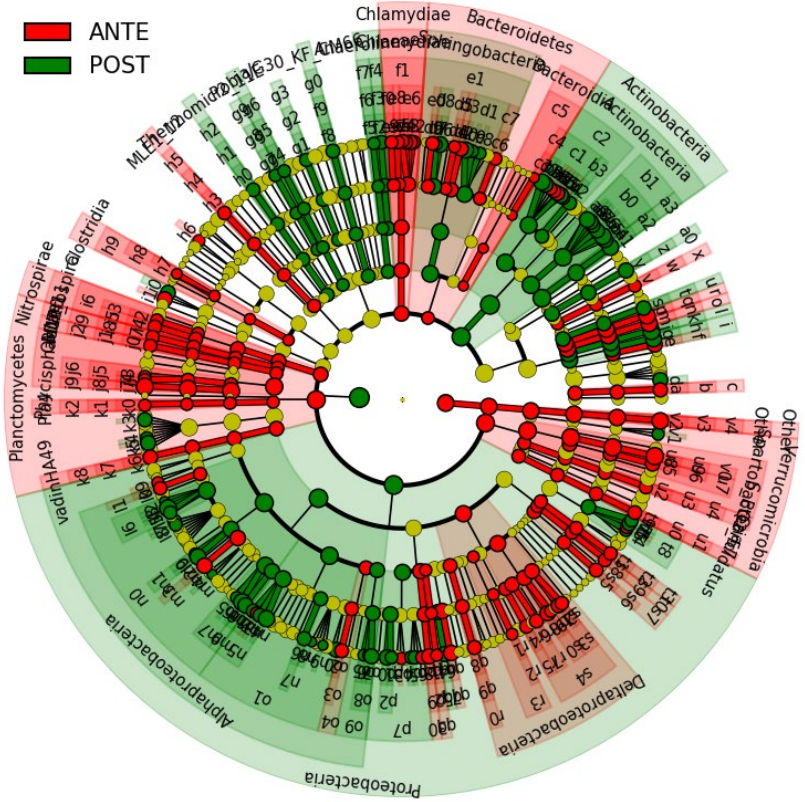
TRADITIONAL



SELECTIVE



Verrucomicrobia (oligotrophs) strongly decreased in SEL (-22%) and TRAD (-10%) plots, whereas increased in control samples (not statistically significant). It suggests an increase of nutrients in soil after thinning, specially after SEL.

CONCLUSIONS

1) Amiata and Pratomagno host different native soil microbial communities
2) In general, after 3 years bacterial diversity decreased wherease fungal diversity increased, regardless the silvicultural treatments
3) Amiata soils did not exhibit any significant difference in terms of microbial biomass and diversity after the silvicultural treatments. However, a higher microbial respiration was observed in SEL.
4) Pratomagno revealed a higher microbial biomass and respiration values after thinning (mostly SEL). Moreover, the decrease of Verrucomicrobia and the increase of Acidobacteria indicate an increase of nutrients and fertility of soil after thinning, specially after SEL.
5) The overall results seem to indicate that selective thinning might support soil microbial diversity and its functions. However, in order to collect more consistent data the dynamics of the microbial community structure should be monitored over a longer period (>3 years)

Thank you