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Biodiversità delle comunità microbiche della necromassa

Roberta Pastorelli

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

Deadwood → all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil

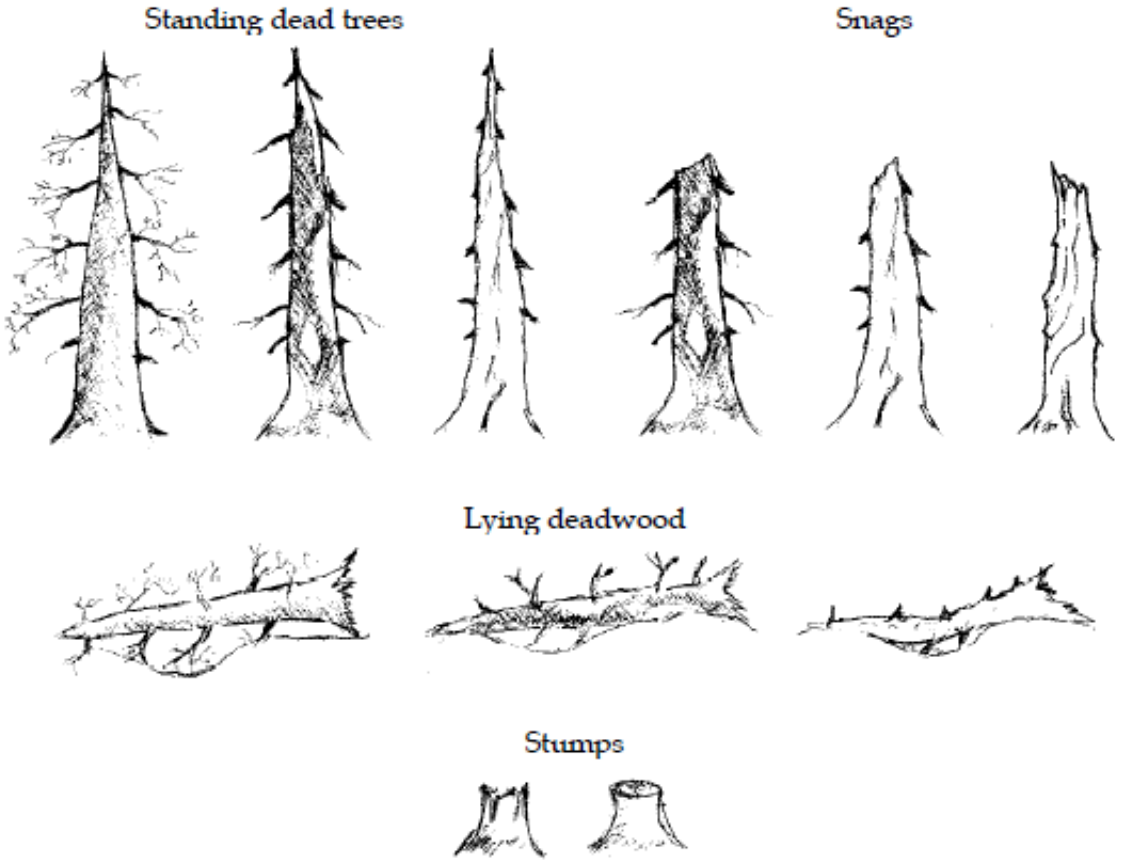
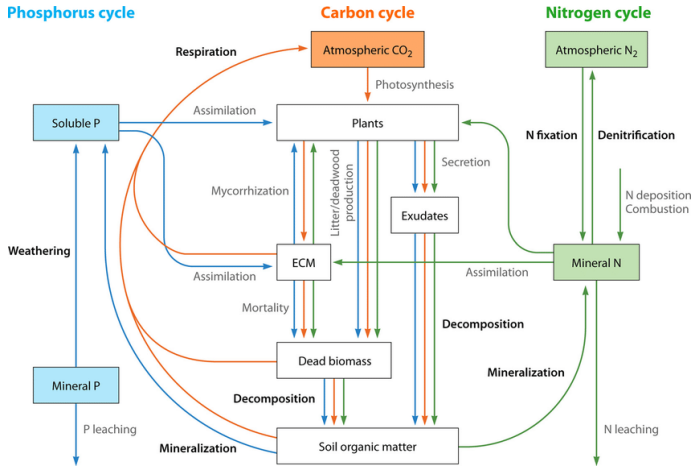
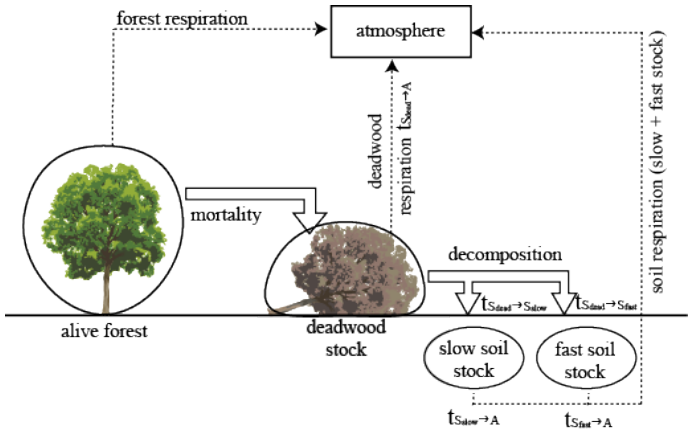


Fig. 2. Types of aboveground deadwood.

Ecological significance of deadwood:

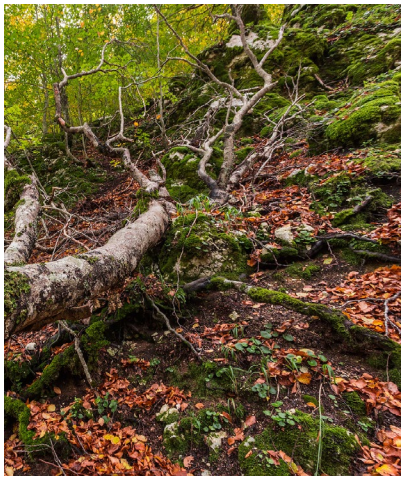
- One of the most significant sources of organic material and mineral elements





- Carbon storage – acting as long term storage (sink) and slowly/fast release (source)

- Fundamental element in the geomorphological and soil hydrological processes:
  - *Retains water, keep moisture and regulates the temperature contributing to micro- and macroclimates*
  - *Limits the risk of soil erosion and stabilize litter on steep slopes*
  - *Riparian ecosystems – stabilize stream ecosystems by retaining sediment*

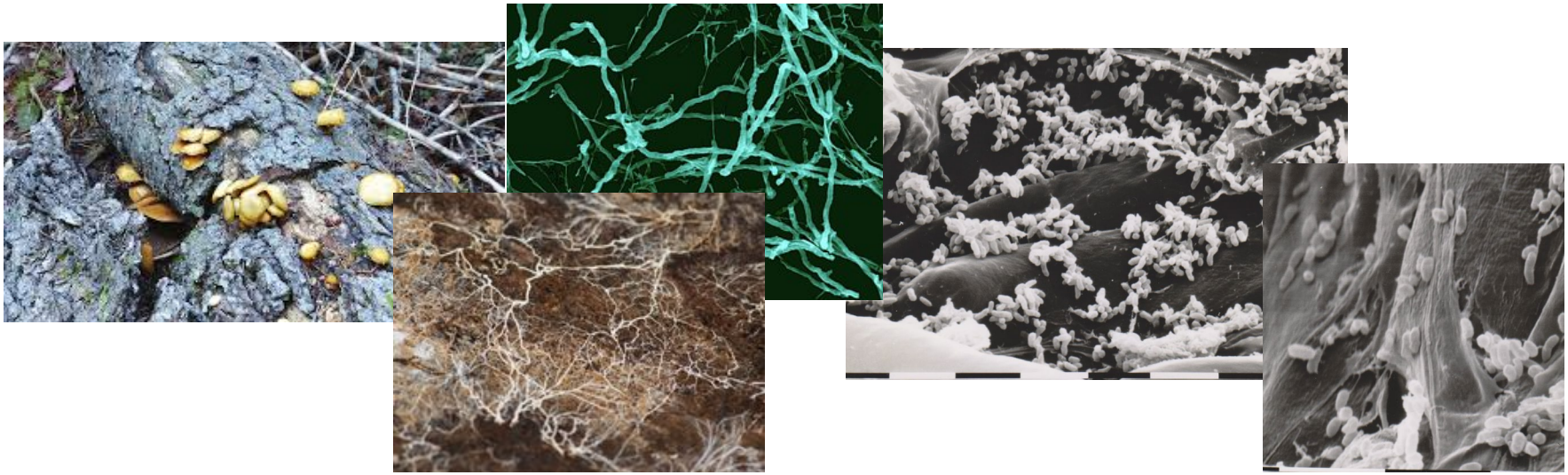


➢ fundamental component of forest biodiversity

A large part of organisms are dependant on decaying wood for **nutrients** and **habitat**: vertebrate, invertebrate, birds, briophyte, microorganisms

- Maintaining biodiversity (plants and animals)
- Increases species richness (number of species) and diversity
- Natural rigeneration – starting from moss, ferns and herbes

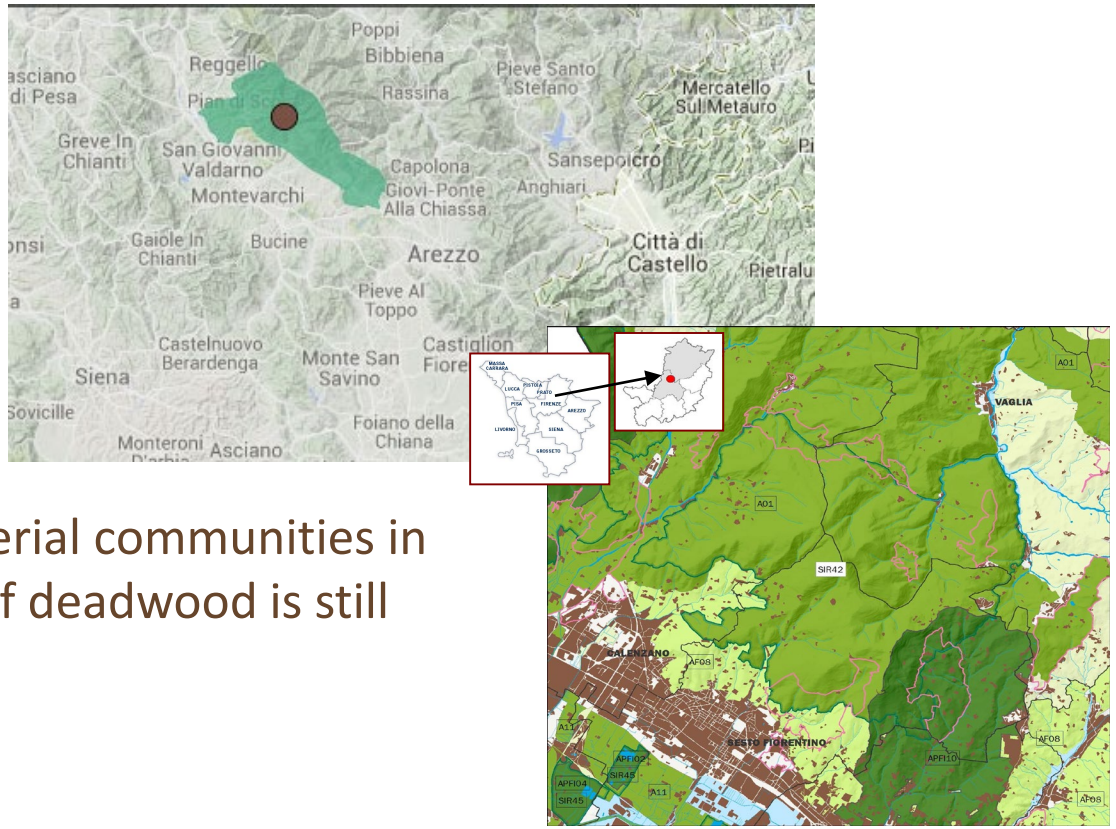
Saproxylic fungi and wood-inhabiting bacteria are particularly important in consideration of their role in wood decomposition and, consequently, in nutrient and carbon cycling.



Pioneer are fungal species that starting from degradation of polysaccharides and biopolymers (cellulose, hemicelluloses and lignin) modify the deadwood logs both chemically and structurally, and generates new habitats and food resources for other species.
Bacteria have a limited ability to decompose polymeric ligninocelluloles and fungal decay activity weakens ligning barriers and release easily degradable oligomers, providing oppurtunities for bacterial access and growth.

The aim of present work is study the possible relationship between the decomposition state of the dead pine wood (*Pinus nigra* Arnold ssp. Nigra) and the composition and activity of resident microbial communities (fungi, bacteria, actinobacteria)

Many studyes focus on the decomposition rate for several tree species and on saproxylic fungal community.



Conversely, the diversity of bacterial communities in relation of amount and quality of deadwood is still little explored.

Samples collection

1. *Recently dead* –presence of branches and bark

2. *Weakly decayed* – loss of branches and bark

3. *Medium decayed* – trace of bark, no twigs

4. *Very decayed* – no bark, loss of shape

5. *Almost decomposed* – only woody debris

4 samples for each decay class

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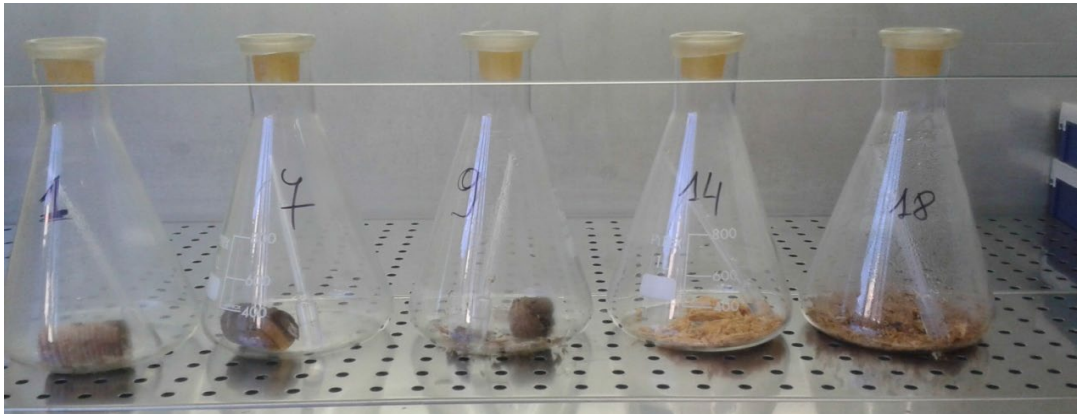
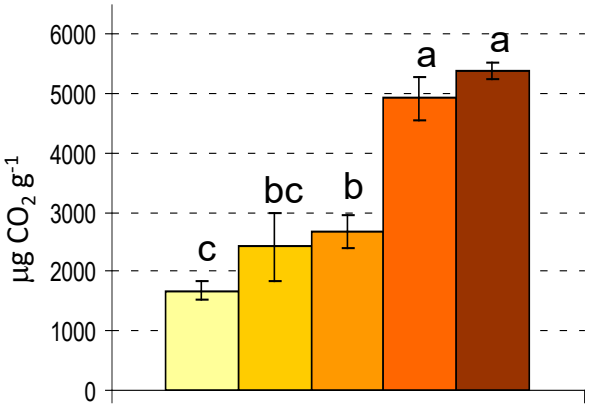
The potential decomposition rate of deadwood was assessed by measuring the CO_2 production in a closed system by means of gas chromatography

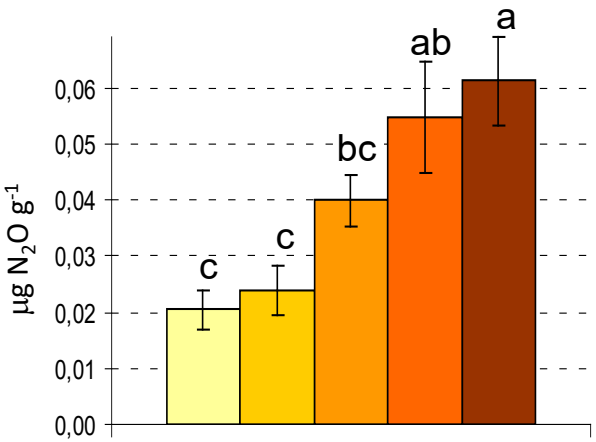


With this technique at the same time the potential output of methane (CH_4) and nitrous oxide (N_2O) was also measured, assessing the potential involvement of deadwood in greenhouse gas (GHG) production

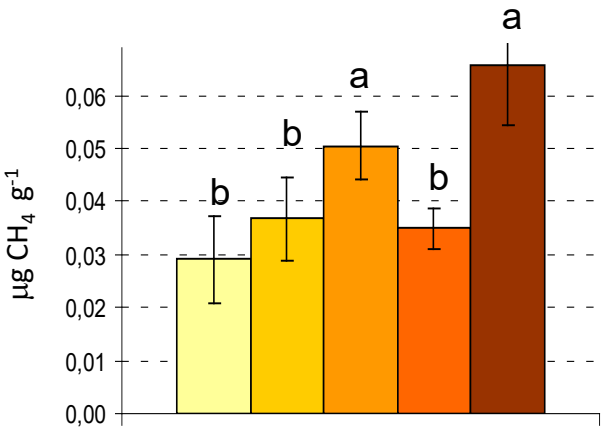
GHGs production increased along with decay classes



CO_2 max



N_2O max



CH_4 max

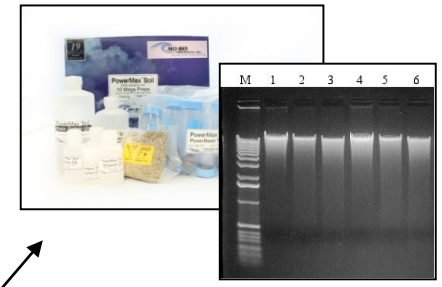
- ✓ the large flux of CO_2 from deadwood highlighted its role as a C source
- ✓ deadwood might also act as sources of N_2O and CH_4

Microbial community structure

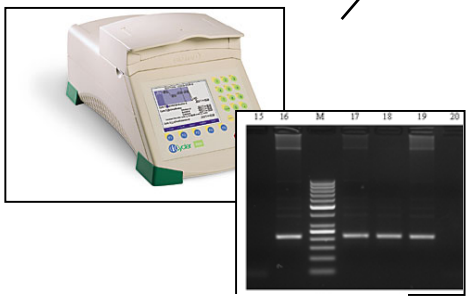
The composition of decomposer microbial communities (fungi, bacteria and actinobacteria) was assessed by using PCR-DGGE fingerprinting.

sawdust

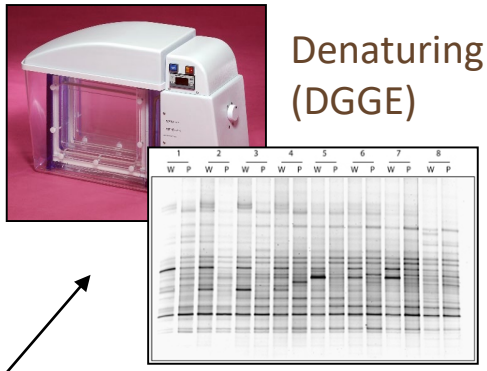
DNA extraction



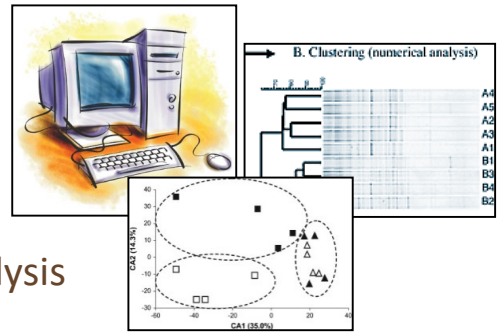
PCR amplification



Denaturing Gradient Gel Electrophoresis (DGGE)



Computer Analysis



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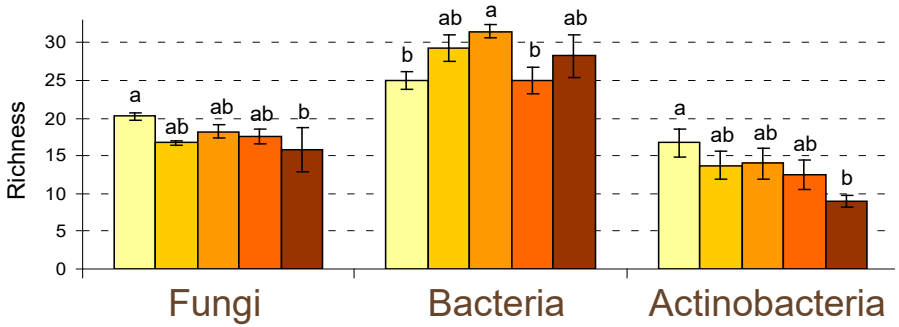
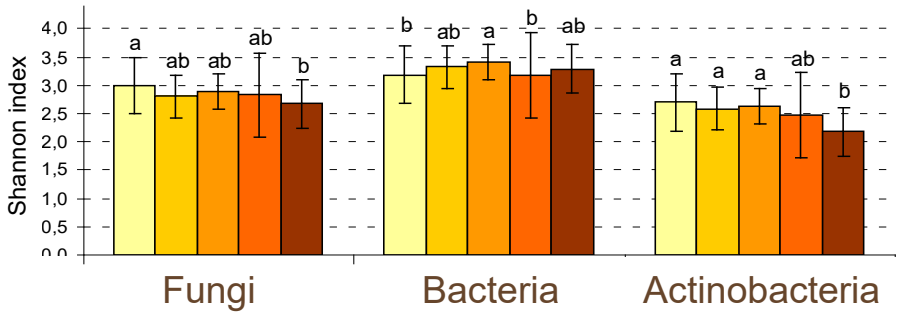
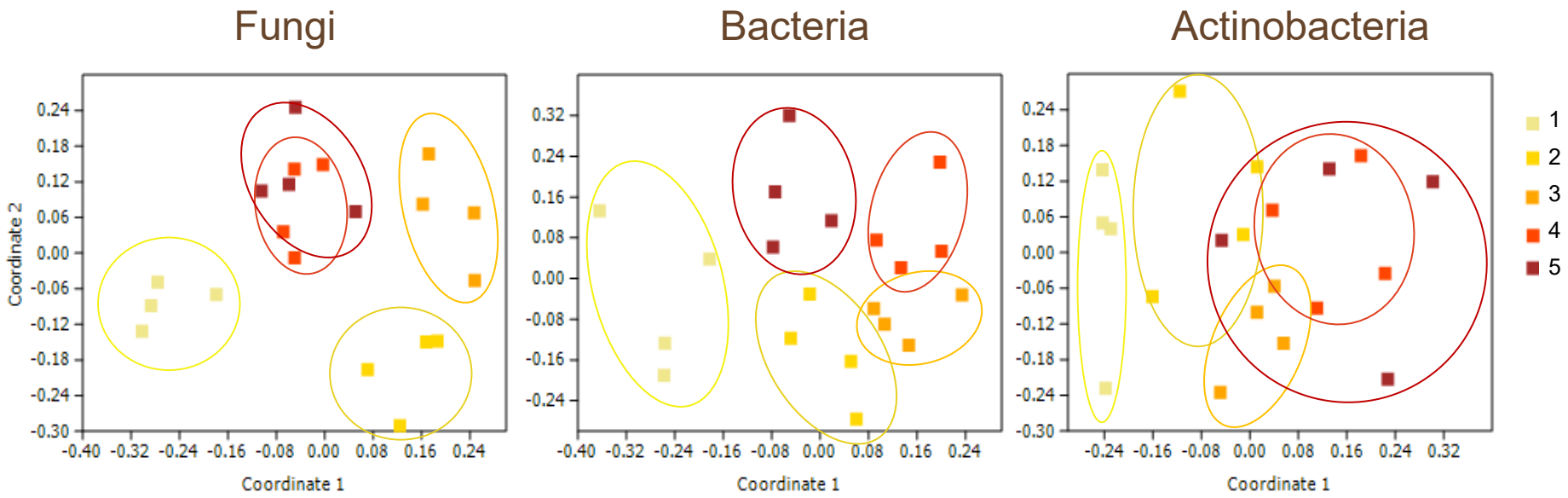
Monte Morello

The richness and and evenness of bacterial bands in DGGE profiles resulted higher than those in fungal and actinobacterial DGGE profiles



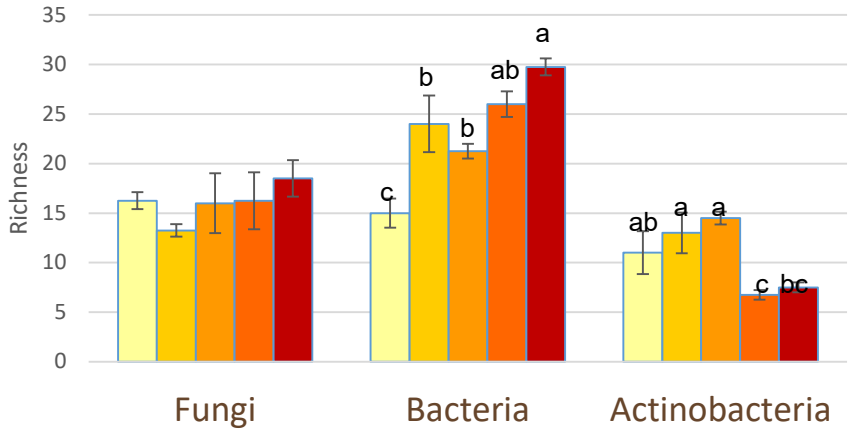


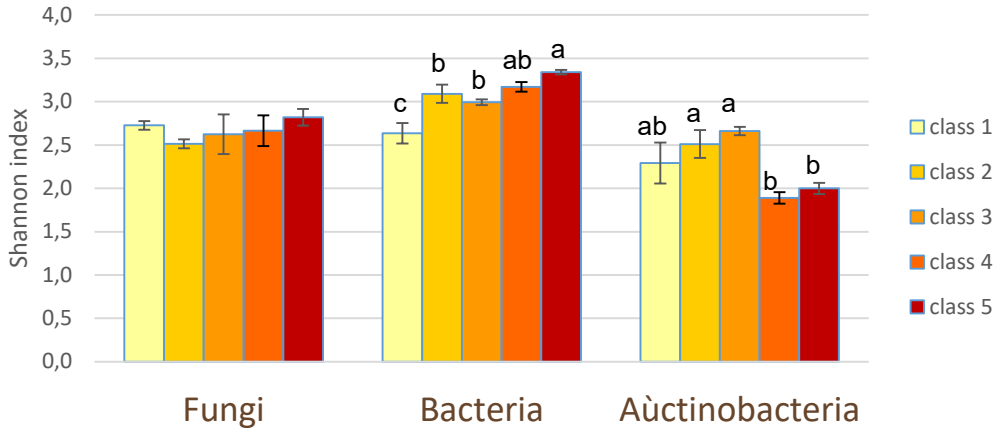
Fungi and actinobacteria possess potentially a more important role in the early colonization and decomposition of deadwood logs leaving the way for bacteria in the middle stages of decomposition.

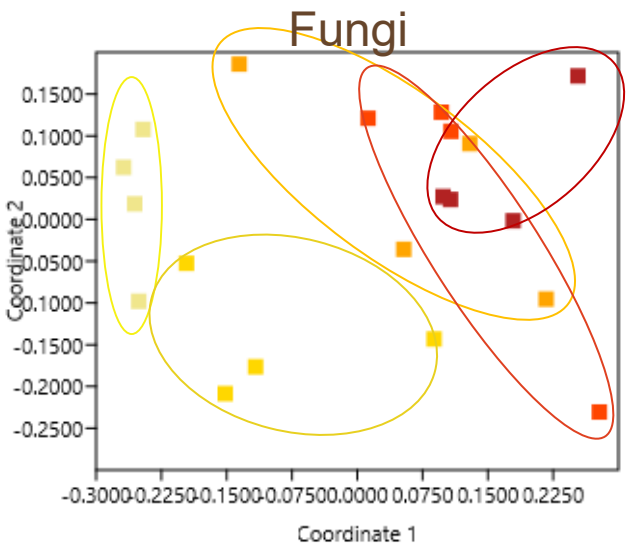


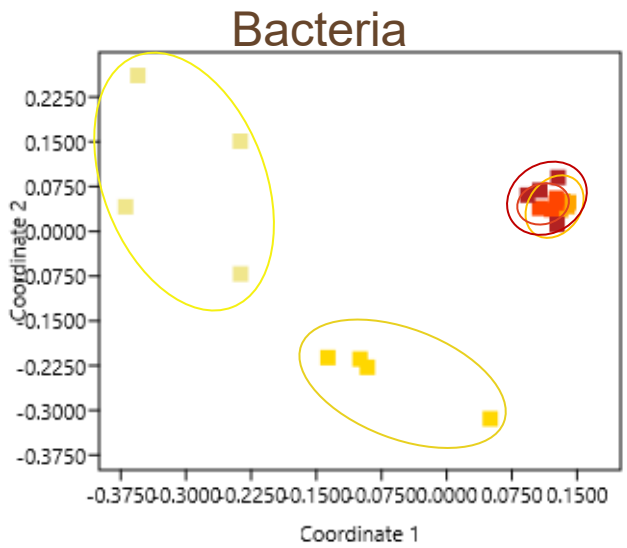
- ✓ Wood decomposition implies a successional pathway of different microbial taxa
- ✓ Class 1 is remarkably separated from those of middle and late decay classes
- ✓ Actinobacteria are less influenced by environmental changes during decomposition

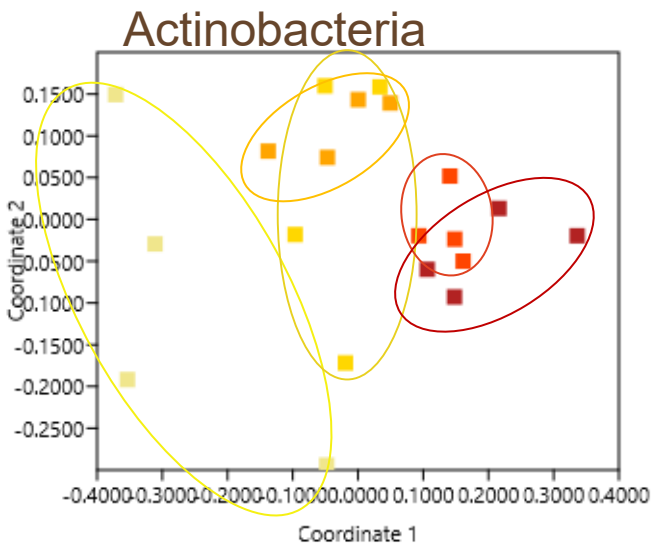
Pratomagno











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In conclusion……

- Deadwood potentially may act as **source** of GHGs (CO_2, N_2O and CH_4), increasing as decomposition progress
- The microbial community structure differ both at **species** and **abundance** level, depending on the rate of decay

Changes in environmental conditions likely due to changes in substrate availability during wood decomposition may have strong impacts on fungal and bacterial community compositions, whereas slight effects were found for actinobacteria that revealed low species diversity within the intermediate and later stages of deadwood decay. Thus, as wood decomposition progresses, the microbial species are replaced by those more suited to the new substrates or that survive via competitiveness.

GRAZIE PER L'ATTENZIONE!