Soil biodiversity in artificial black pine stands one year after selective silvicultural treatments

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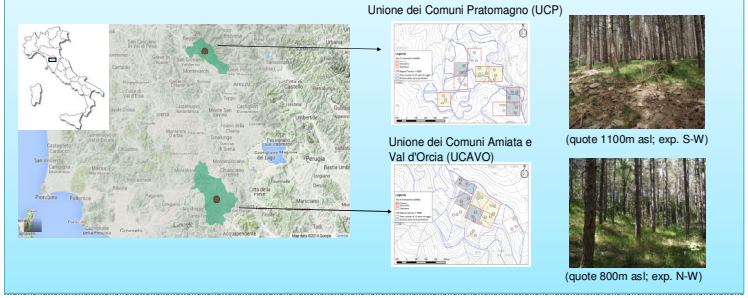
INTRODUCTION

From the end of the eighteenth century up to the mid-1900s, black pine plantations were established throughout the Apennines' range in Italy, to improve forest soil quality. The main aim of this reafforestation was to re-establish the pine as a first cover, pioneer species. A series of thinning activities were therefore planned by foresters when these plantations were designed.

EXPERIMENTAL AREAS

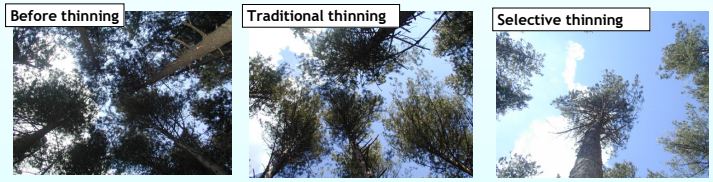
The pilot areas (9 plots each) are two: Pratomagno (18ha) e Val d'Orcia (18ha):



CONCRETE ACTIONS

The innovative thinning is conceptually based on the identification of the dominant plants and the removing of the plants around. This approach provides the following results:
Enhance the pine succession and Increase the economic value of the product

- Enhance the pine dendrometric stability
- Reduce the canopy cover and enhances the rate of light, water and temperature at the soil level.



Macroarthropodes (Coleoptera)

Preliminary results appeared in the Pratomagno individuals belonging to the tribe Nebriini and Pterostichini well represented by genera *Nebria* and *Percus*, respectively. The tribe of Notiophilini with the kind Notiophilus, also appears in the Amiata area. These data need to be confirmed.


Genus *Percus*


Genus *Nebria*

AIM OF THE WORK

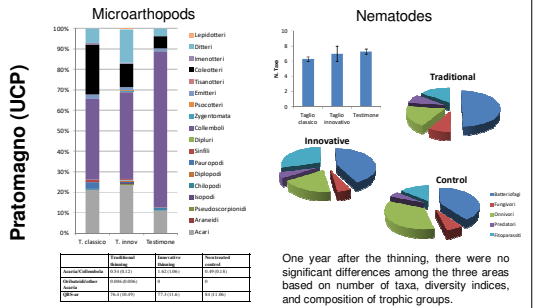
The project Selpibiolife (LIFE13 BIO/IT/000282) (www.selpibio.eu) has the main objective to demonstrate the potential of an innovative silvicultural treatment to enhance soil biodiversity under black pine stands. The monitoring survey involved different biotic levels: microorganisms, mesofauna, nematodes and macrofauna (Coleoptera). Here we present the results observed 1 year after the treatments.

Materials and Methods

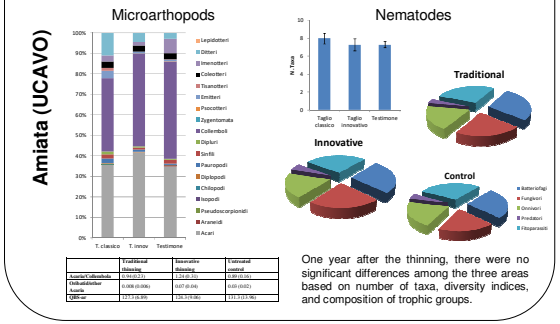
Soil samples were collected separately from the two areas in May 2015. For each area 9 plots (1ha) were delimited. 3 samples were randomly sampled from each plot and then mixed to form one composite sample (0 to 15 cm layer) for nematodes. Moreover, a sample of soil was collected from each point by means of a special corer devoted to the microarthropods sampling (a 10 cm cube). 16S rRNA (region V3-V4) and ITS amplicon sequencing (Illumina) was used to assess soil bacterial diversity whereas soil respiration and biomass (not shown) to assess microbial activity. Nematodes were isolated from 100 ml of each soil sample using a modified Baermann funnel method, after through mixing. Microarthropods were extracted using Berlese-Tullgren funnels whereas pitfall-traps were used to collect coleoptera. Animals, nematodes and arthropods, were identified, counted and classified into different taxa at family and order levels, respectively.

RESULTS

Microarthropods and nematodes



One year after the thinning, there were no significant differences among the three areas based on number of taxa, diversity indices, and composition of trophic groups.



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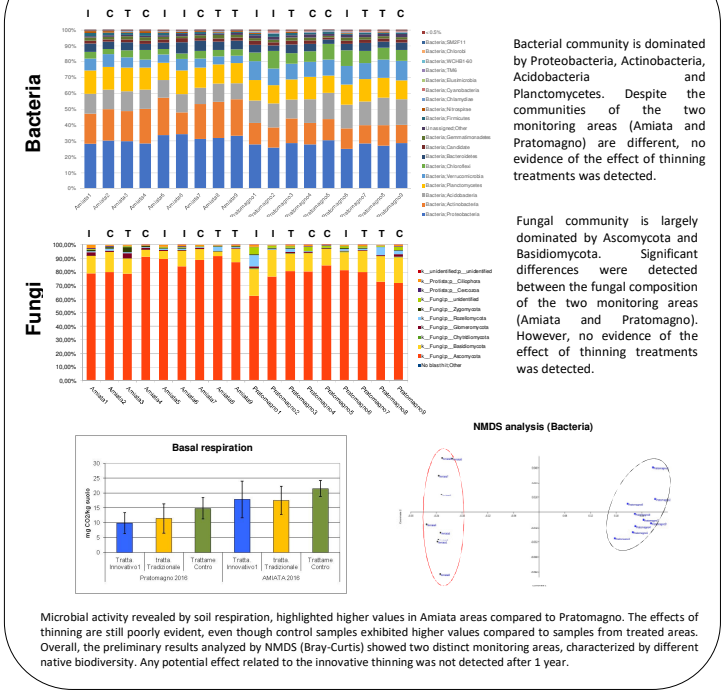
Microbial communities



Bacterial community is dominated by Proteobacteria, Actinobacteria, Acidobacteria and Planctomycetes. Despite the communities of the two monitoring areas (Amiata and Pratomagno) are different, no evidence of the effect of thinning treatments was detected.

Fungal community is largely dominated by Ascomycota and Basidiomycota. Significant differences were detected between the fungal composition of the two monitoring areas (Amiata and Pratomagno). However, no evidence of the effect of thinning treatments was detected.

Microbial activity revealed by soil respiration, highlighted higher values in Amiata areas compared to Pratomagno. The effects of thinning are still poorly evident, even though control samples exhibited higher values compared to samples from treated areas. Overall, the preliminary results analyzed by NMDS (Bray-Curtis) showed two distinct monitoring areas, characterized by different native biodiversity. Any potential effect related to the innovative thinning was not detected after 1 year.

CONCLUSIONS

The overall native soil biodiversity resulted to be higher in the Amiata (UCAVO) area than in Pratomagno (UCP). This result is likely due to the different climatic conditions of the two areas. Neither Amiata and Pratomagno areas showed any significant effect of treatments on the overall soil biodiversity after 1 year from the thinning, confirming that more time is required to modify the ground biota. A significant enhance of biodiversity after thinning is expected over the next 2 years.

European Geosciences Union General Assembly 2017
Vienna | Austria | 23-28 April 2017