

Medium-term impact of post-fire straw mulching and tree logging debris treatments on soil bacterial community.

¹Pinto, Rayo, ¹Ansola, Gemma, ¹Calvo, Leonor and ²Sáenz de Miera, Luis E.

¹*Dept. of Biodiversity and Environmental Management, Universidad de León (Spain), Campus de Vegazana s/n, 24071 León, Spain*

²*Dept. of Molecular Biology, Universidad de León (Spain), Campus de Vegazana s/n, 24071 León, Spain*

Abstract

Post-fire management treatments, such as mulching and tree logging debris, are employed to mitigate soil degradation and enhance vegetation and soil recovery (Ferreira et al., 2015). These treatments create new conditions in the soil where they are applied, resulting in changes in solar radiation and the introduction of organic matter from straw or wood (Marañón-Jiménez and Castro 2013). Consequently, these changes have implications in soil functionality, and in the soil bacterial community (Lucas-Borja et al. 2020). This research aimed to evaluate the effects of two post-fire treatments in the soil bacterial community composition in the medium term (3 and 4 years after the wildfire).

The study was conducted in Sierra de Cabrera, located in the North-West of Spain, in a large wildfire occurred in the summer 2017. Two months after the wildfire, the regional government implemented straw mulching and tree logging leaving the branches debris in areas severely affected by the fire. Soil samples were collected 3 and 4 years after the fire from treated and untreated burned areas. A total of 40 samples were collected and frozen until DNA extraction and sequencing. Amplicon sequencing of the 16S rRNA gene was performed to study the bacterial community composition in the different treatments and years.

Changes in the soil bacterial community in the medium term were analyzed at high (phylum) and low (genus) taxonomic levels. Both post-fire treatments altered the phyla composition. In straw mulching, only Proteobacteria and Gemmatimonadetes showed significant increase 3 years after treatment, while no significant differences were observed for any phylum 4 years after. Logging plus branches debris treatment displayed significant differences for Actinobacteria (decrease) and Firmicutes (increase) 3 years after treatment. Only Firmicutes maintained significant differences 4 years after treatment but with an abundance decrease with respect to non-treated areas. At the genus level, more differences among treated and non-treated areas were observed over time. However, only the genus *Ralstonia* had a high abundance in the treated areas in both years and treatments.

In conclusion, the results showed that the medium-term effects of straw mulching and logging plus branches debris treatments on the bacterial community composition are greatest at low taxonomic levels, such as the genus level. Notably, the genus *Ralstonia* is a discriminant taxon between treated and untreated areas. In treatment areas, higher abundances of this genus were observed for both treatments, three and four years after the treatments.

Keywords: Soil bacterial community, post-fire management, straw mulching, cut plus lopping.

References

- Ferreira, A. J. D., Alegre, S. P., Coelho, C. O. A., Shakesby, R. A., Páscoa, F. M., Ferreira, C. S. S., Keizer, J. J., & Ritsema, C. (2015). Strategies to prevent forest fires and techniques to reverse degradation processes in burned areas. *CATENA*, 128, 224-237.
<https://doi.org/10.1016/j.catena.2014.09.002>
- Lucas-Borja, M. E., Plaza-Álvarez, P. A., Ortega, R., Miralles, I., González-Romero, J., Sagra, J., Moya, D., Zema, D. A., & de las Heras, J. (2020). Short-term changes in soil functionality after wildfire and straw mulching in a *Pinus halepensis* M. forest. *Forest Ecology and Management*, 457, 117700.
<https://doi.org/10.1016/j.foreco.2019.117700>
- Marañón-Jiménez, S., & Castro, J. (2013). Effect of decomposing post-fire coarse woody debris on soil fertility and nutrient availability in a Mediterranean ecosystem. *Biogeochemistry*, 112(1-3), 519-535.
<https://doi.org/10.1007/S10533-012-9744-X/TABLES/6>

Acknowledgments: This study was financially supported by the Spanish Ministry of Science and Innovation and Next Generation EU funds, in the framework of the FIREMAP (TED2021-130925B-I00) project; and by the Regional Government of Castilla and León in the framework of the WUIFIRECYL (LE005P20) project. Rayo Pinto Prieto was supported by a predoctoral fellowship from the Spanish Ministry of Education (FPU21/ 00309).