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Deadwood decay across an elevational gradient in a burnt Mediterranean pine reforestation

[1]Reyes-Martín, Marino Pedro, [2]Juan-Ovejero, Raquel, [1]B. Leverkus, Alexandro and [1]Castro, Jorge

[1]*Departamento de Ecología, Universidad de Granada, 18071 Granada, Spain*
[2]*Centre for Functional Ecology, Department of Life Sciences, University of Coimbra. 3000-456 Coimbra, Portugal*

Abstract

Dead wood remaining after wildfires is an important source of nutrients that are released during decomposition. The study of the decomposition rates is relevant to understand the role of burnt wood as a driver of soil fertility and to plan management activities in the burnt area. However, post-fire wood decomposition rates are still poorly understood, particularly in Mediterranean-type ecosystems. In this study, four plots were established after the 2005 Lanjarón fire (Sierra Nevada Protected Area, southeast Spain) across an elevation gradient (1477, 1750, 2053 and 2317 m a.s.l.). At each plot, standardized samples of logs of 75 cm length and variable diameters were left on the ground for long-term monitoring. The baseline for the initial wood density and nutrient content (C, N, and P) was established, and subsequently, a subsample of 30-50 logs per plot were collected at various intervals for analysis (after 2, 4, 8, 10 and 15 y for wood decomposition and after 2, 4 and 15 y for nutrient content). After 15 y, the logs had lost an overall 55% of their density. The greatest density loss occurred during the final 5 y of the study. Contrary to studies in other climates, large-diameter logs decomposed faster than small-diameter logs, which might have resulted from a higher moisture content in larger logs. During the study, across all the plots, there was a reduction in C concentration of between 4.92% and 8.39%, whereas P concentration increased between 4.41% to 76.62% and C/N ratio increased between 10.85% and 86.75%. N content decreased by 1.42% – 35.90% in three plots and increased by 12.49% in another plot. Hence, nutrient composition of the logs after 15 y differed sharply from the initial concentrations, but there was no clear altitudinal pattern to these differences in concentrations. Burned wood decomposition and nutrient dynamics can vary considerably depending on the specific conditions of each ecosystem and the interaction of various environmental factors, such as humidity and temperature. Our results provide one of the longest time series of wood decomposition in Mediterranean ecosystems, thereby contributing to improve our understanding of burned wood decomposition processes and forest regeneration and restoration.

Keywords: density loss, carbon, nitrogen, phosphorus, decomposition