Supplementary Material and Methods

**Litter incubation procedure**

Two types of tea with distinct qualities were used: green tea (Lipton, Unilever - EAN 87 22700 05552 5) with a high content of cellulose and expected faster decomposition (higher TBIk), and rooibos (Lipton, Unilever - EAN 87 22700 18843 8) with a high content of lignin and expected slower decomposition (lower TBIk) (Keuskamp et al., 2013). The mesh size of 0.25 mm allowed access of microfauna (Setälä et al., 1996). All tea bags were oven-dried at 70 °C for 48 hours and then weighed prior to installation.

**Soil physical-chemical analyses**

Soil pH was determined with a pH meter (1:5 soil:deionized water slurry). Soil organic C content was determined through an extraction with potassium dichromate (K2Cr2O7); the solution was centrifuged and then analyzed by spectrophotometry at 600 nm (Walkley and Black, 1934). Total N and total phosphorous (P) were determined following a Kjeldahl acid digestion with sulfuric acid (H2SO4) and potassium sulfate (K2SO4) as catalysts. The resulting solutions from the digestions were analyzed using a SAN**++** analyzer (Skalar, The Netherlands). Soil inorganic N was extracted adding 0.5 M K2SO4 at a ratio of 1:5, followed by shaking for 1 h at 200 rpm at 20 ºC and then filtered through a 0.45 mm Millipore filter (Jones and Willett, 2006). The inorganic N content was first reduced to NH4+-N with Devarda alloy and its concentration was analyzed via the indophenol blue method using a microplate reader (Sims et al., 1995).

**Soil extracellular enzyme activity measurements**

The fluorescence assays were performed at 364 (±10) nm excitation and 450 (±10) nm emission in a fluorescence microplate reader, while the 2,2'-azino-bis 3-ethylbenzothiazoline-6-sulfonic acid absorption was measured at 420 (± 5) nm.

**Soil microbial analyses**

Soil DNA was extracted from 0.25 g of air-dry soil using the MoBioPowersoil® DNA Isolation Kit (Carlsbad, USA). We performed qPCR reactions in triplicate using 96-well plates on a AB 7300 Real-Time PCR (Life Sciences Technologies, Carlsbad, California, USA). The Bacterial 16S, fungal ITS, AOB and AOA genes were amplified with the Eub 338-Eub 518, ITS 1-5.8S (Evans and Wallenstein, 2012).

**Figure supplementary material**



**FIGURE 1S**: PCA factor loadings for each soil soil extracellular enzyme activity (EEA). Dimension (DIM) 1 accounted for 65% of the variance, DIM 2 accounted for 24%. Soil EEA showed are respectively: Cellobiohydrolase (Cell), Glucosidase (Glus), Glucoronidase (Glur), Xilosidase (Xilo), N-acetyl Glucosaminidase (NaGl), Leucine Aminopeptidase (LeAm), , Phosphatase (Phos).

**Table supplementary material**

**TABLE 1S**: PCA factor loadings for each soil soil extracellular enzyme activity (EEA). Soil EEA showed are respectively: Cellobiohydrolase (Cell), Glucosidase (Glus), Glucoronidase (Glur), Xilosidase (Xilo), N-acetyl Glucosaminidase (NaGl), Leucine Aminopeptidase (LeAm), Phosphatase (Phos).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Enzymes** |  | **Dim 1** |  | **Dim 2** |
| Cell |   | 0.94 |   | 0.18 |
| Glus |   | 0.85 |   | 0.2 |
| Glur |   | 0.97 |   | -0.03 |
| Xilo |   | 0.95 |   | -0.19 |
| NaGL |   | 0.54 |   | 0.77 |
| LeAm |   | 0.82 |   | -0.34 |
| Phos |   | -0.32 |   | 0.86 |
| Variance |   | 65% |   | 22.40% |

**TABLE 2S:** Results of the Spearman's rho tests between the pH and the soil extracellular enzyme activity (EEA) in El Regajal (Spain, n=24), Capo Caccia BS (Italy, n=8), Capo Caccia UC (Italy, n=8) and Arrábida (Portugal, n=9). Capo Caccia BS and Capo Caccia UC indicate bare soil and under canopy microsites. Statistical differences are highlighted in bold. The rho value (ρ) and the level of significance (p value) are shown for each correlation. Soil EEA showed are respectively: Cellobiohydrolase (Cell), Glucosidase (Glus), Glucoronidase (Glur), Xilosidase (Xilo), N-acetyl Glucosaminidase (NaGl), Leucine Aminopeptidase (LeAm), Phosphatase (Phos), first axes of PCA analysis (EEA\_PCA1).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | **El Regajal** |   | **Capo Caccia BS** |   | **Capo Caccia UC** |   | **Arrábida** |  |
|  | ρ | p- value |  | ρ | p- value |  | ρ | p- value |  | ρ | p- value |   |
| **pH vs.** |   |   |   |   |   |   |   |   |   |   |   |   |
| Cell | 0.05 | 0.41 |   | 0.01 | 0.49 |   | 0.38 | 0.35 |   | 0.59 | 0.09 |   |
| Glus | -0.20 | 0.18 |   | -0.09 | 0.41 |   | 0.52 | 0.19 |   | 0.25 | 0.52 |   |
| Glur | 0.33 | 0.06 |   | 0.12 | 0.39 |   | -0.02 | 0.96 |   | -0.35 | 0.35 |   |
| Xilo | **0.45** | **<0.05** |   | 0.08 | 0.42 |   | 0.15 | 0.72 |   | 0.03 | 0.94 |   |
| NaGL | -0.18 | 0.21 |   | -0.09 | 0.42 |   | 0.32 | 0.44 |   | 0.18 | 0.65 |   |
| LeAm | **-0.65** | **<0.01** |   | -0.18 | 0.34 |   | -0.03 | 0.95 |   | -0.28 | 0.46 |   |
| Phos | **-0.67** | **<0.01** |   | -0.08 | 0.43 |   | 0.25 | 0.55 |   | 0.17 | 0.66 |   |
| EEA\_PCA1 | 0.25 | 0.12 |   | -0.11 | 0.40 |   | 0.36 | 0.38 |   | 0.12 | 0.77 |   |

**References**

Evans, S. E., and Wallenstein, M. D. (2012). Soil microbial community response to drying and rewetting stress: Does historical precipitation regime matter? *Biogeochemistry* 109, 101–116. doi:10.1007/s10533-011-9638-3.

Jones, D. L., and Willett, V. B. (2006). Experimental evaluation of methods to quantify dissolved organic nitrogen (DON) and dissolved organic carbon (DOC) in soil. *Soil Biol. Biochem.* 38, 991–999. doi:10.1016/j.soilbio.2005.08.012.

Keuskamp, J. A., Dingemans, B. J. J., Lehtinen, T., Sarneel, J. M., and Hefting, M. M. (2013). Tea Bag Index: a novel approach to collect uniform decomposition data across ecosystems. *Methods Ecol. Evol.* 4, 1070–1075. doi:10.1111/2041-210X.12097.

Setälä, H., Marshall, V. G., and Trofymow, J. A. (1996). Influence of body size of soil fauna on litter decomposition and 15N uptake by poplar in a pot trial. *Soil Biol. Biochem.* 28, 1661–1675. doi:10.1016/S0038-0717(96)00252-0.

Sims, G. K., Ellsworth, T. R., and Mulvaney, R. L. (1995). Microscale determination of inorganic nitrogen in water and soil extracts. *Commun. Soil Sci. Plant Anal.* 26, 303–316. doi:10.1080/00103629509369298.

Walkley, A., and Black, I. A. (1934). An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. *Soil Sci.* 37, 29–38. doi:10.1097/00010694-193401000-00003.