

Effects of a simulated drying-rewetting cycle on microbial activity in soils degraded by post-fire erosion

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Photo: RAFAEL MARCHANTE (REUTERS). El País Internacional, June 18th, 2017.

- **Post-fire soil erosion** is an important issue in Mediterranean countries because of its potential large impact on soil carbon stocks and functioning.
- **Addition of mulching** to burnt soils has been proved as an effective measure to reduce post-fire erosion.
- **Could this measure also increase the stability of microbial activity to drought events?** These events are expected to be more frequent in the Mediterranean region with the current climate change projections.

OBJECTIVE: analysing the influence of some post-fire mitigation measurements on the response of soil microbial activity to drying-rewetting events.

METHODS: Two post-fire mitigation field experiments conducted in Portugal (burnt in large fires in 2017)

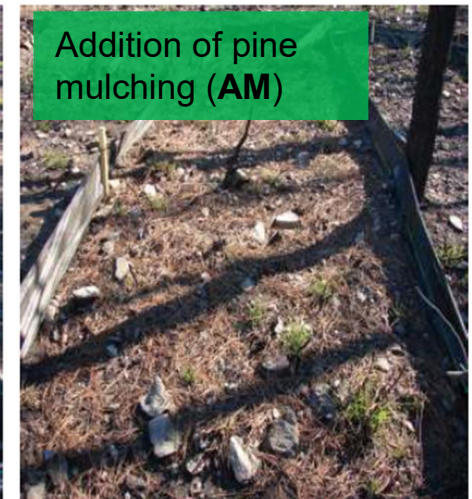
- ❑ Pine Tree Plantation
- ❑ Strawberry Tree Stand



Spontaneous mulching (SpM)



Control (no mulching)



Addition of pine mulching (AM)

Photo: Jan Jacob Keizer

- ❑ Comparison with soils from an adjacent unburnt pine stand

- Sampling involved the organic surface horizon as well as the upper 15 cm of the Ah horizon
- A drying-rewetting experiment was conducted under controlled conditions



Control (no mulching)

Addition of straw mulching (StM)

Photo: Jan Jacob Keizer

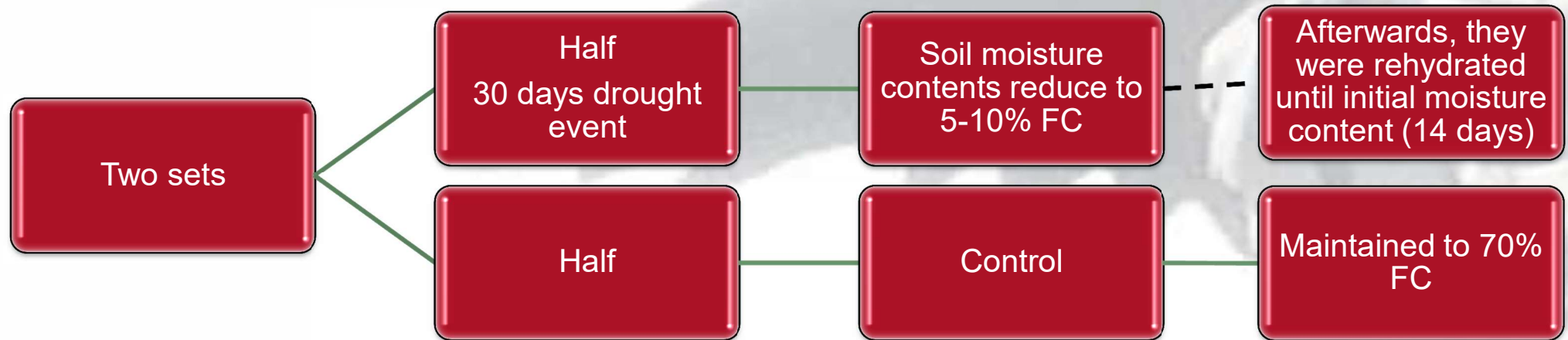
Samples were preincubated 28 days at 25°C and at 70% of field capacity (FC)



Photo: María T. Domínguez



Photo: María T. Domínguez



Soil analysis to evaluate initial differences in microbial activity among treatments, and to monitor the resistance of this activity to the drying event

Soil dehydrogenase activity

Soil β -glucosidase activity

Soil Aminopeptidase activity

Soil Aminopeptidase activity

Soil Phosphatase activity

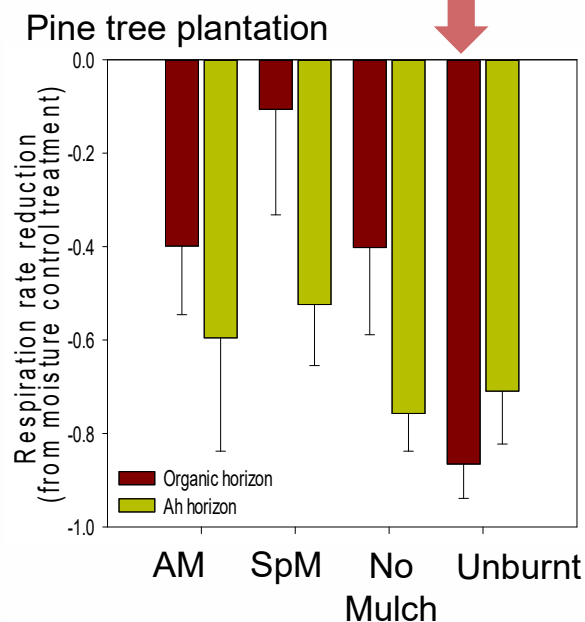
DNA present in soil samples
As a index of microbial biomass

N-mineralization rates

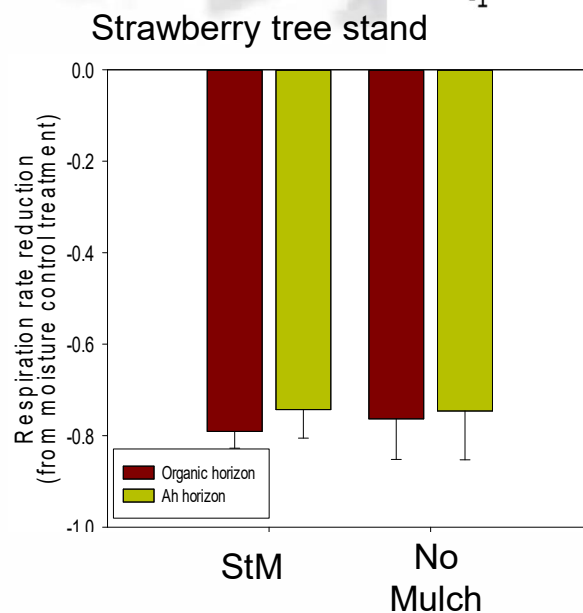
Soil respiration rates (IRGA)

MAIN RESULTS

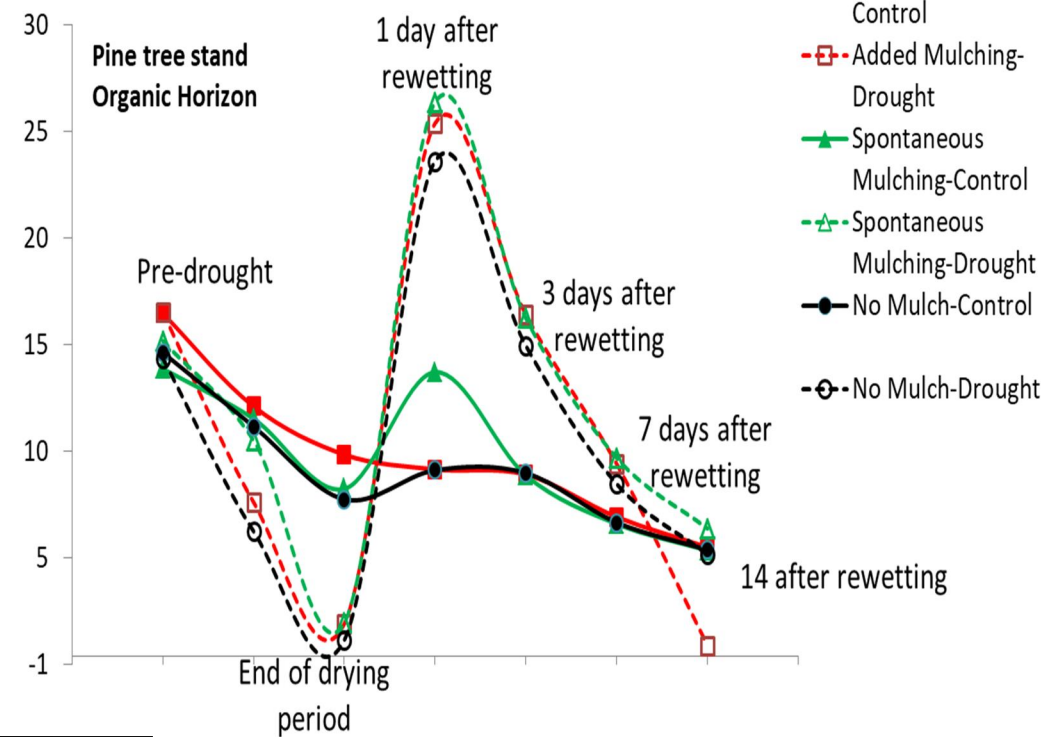
- Most of microbial variables discriminated well between burnt and unburnt soils (reduced activity in the burnt soils)
- Similar response to the drying-rewetting event between mulched and unmulched soils
- Greater resistance to drought (lower reduction in respiration rates at the end of the drying period) in the organic soils from the Pine tree stand (greatest levels of organic matter)



AM: Added mulching; SpM: Spontaneous mulching; StM: straw mulching



Respiration Rate ($\mu\text{g C-CO}_2/\text{g/day}$)



CONCLUSIONS

- ✓ Forest fire still affected soil microbial activity almost two years after the fire event
- ✓ Post-fire management (addition of mulching) did not confer more resistance of soil to drying events (but have additional benefits, mainly control of soil erosion...)
- ✓ When comparing across soils, the highest resistance to drought was found in the soils with higher organic matter content

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