



HAL
open science

Resilience and resistance of microbial communities against drought events, in a mature agroforestry system in Mediterranean area

Isabelle Bertrand, Esther Guillot

► To cite this version:

Isabelle Bertrand, Esther Guillot. Resilience and resistance of microbial communities against drought events, in a mature agroforestry system in Mediterranean area. Meeting of working Group Medicago sativa, Aug 2016, Montpellier, France. 2016. hal-01603014

HAL Id: hal-01603014

<https://hal.science/hal-01603014v1>

Submitted on 2 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - ShareAlike 4.0 International License

Resilience and resistance of microbial communities against drought events, in a mature agroforestry system in Mediterranean area



Guillot Esther¹, Dufour Lydie², Hinsinger Philippe¹, Bertrand Isabelle¹

1. UMR Eco&Sols, INRA, Montpellier, France

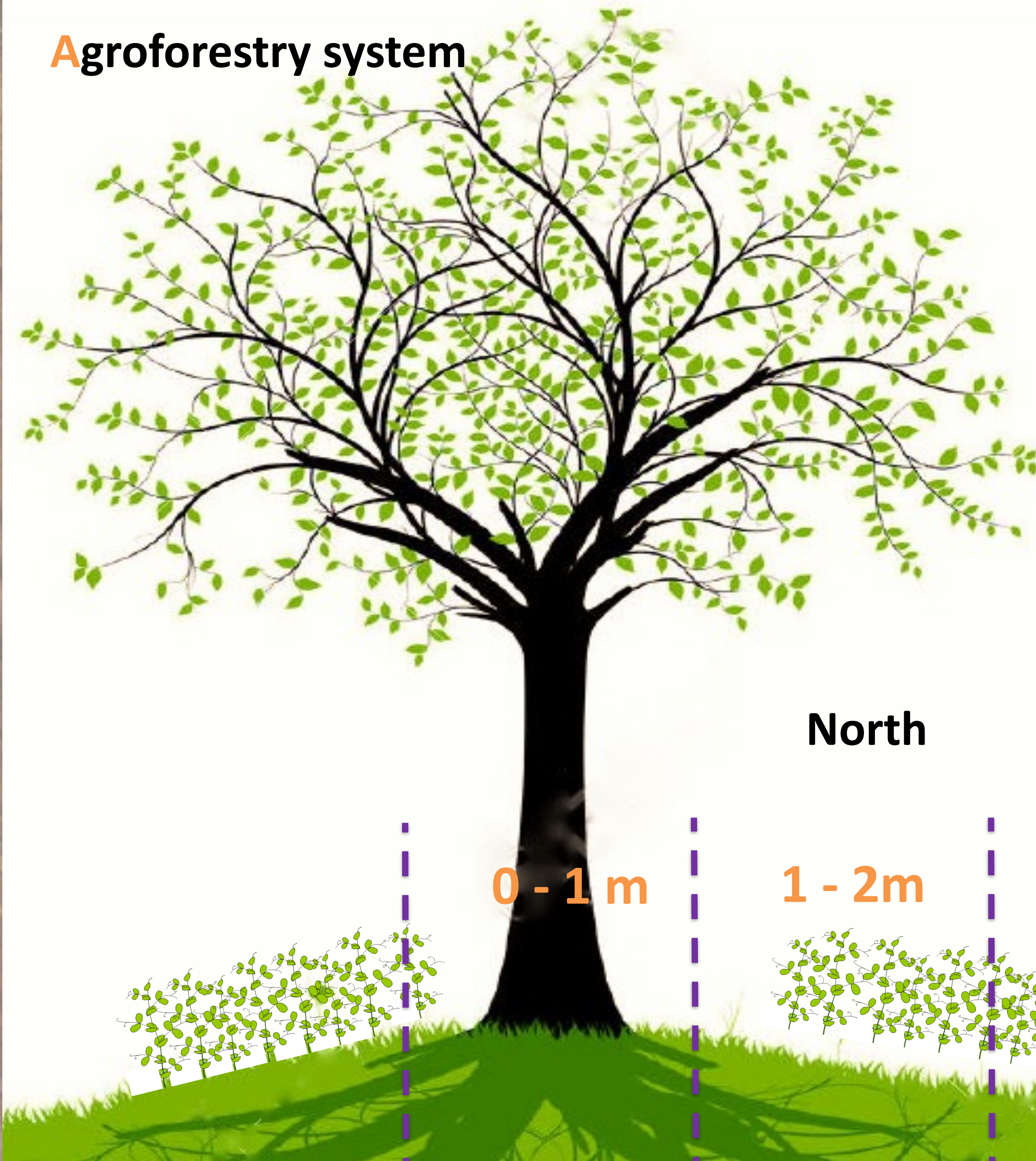
2. UMR System, INRA, Montpellier, France

esther.guillot@gmail.com



- Agroforestry systems are known to limit soil degradation, deeply store carbon and have positive impact on different indicators of soil quality.
- What is the impact of tree-crop associations on resistance and resilience of topsoil microbial communities?
- Our aim is to evaluate the resistance and the resilience of the microbial communities of topsoil along a spatial gradient from the tree line to the center of the intercrop, and in the monocrop treatment.

Agroforestry system



Experimental design

- Restinclières experimental site, 15 km north of Montpellier, France. Association of 21 year-old walnut trees (*Juglans regia x nigra*) and wheat/barley/pea crop rotation.
- 5 replicates of agroforestry spot : a 13-m transect, 6.5m on north face of the tree divided in 4 sampling intervals of the topsoil (0-15cm) :
zone 1 : 0-1m , zone 2 : 1-2m, zone 3 : 2-4m, zone 4 : 4-6.5m
- 5 replicates of monocrop control
- Microcosms incubation :
 - Control treatment : 60% WHC, 25°C, dark atmosphere
 - Water stress treatment : <5% WHC, 25°C, dark atmosphere



Figure 1 : Map of France

Carbon mineralisation

- Carbon mineralisation was measured each week during the incubation, and twice a week during the resilience stage
- Resistance and resilience index were calculated as described by Orwin and Wardle (2004), based on C mineralisation.



Figure 2 : Photograph of the incubation system , Montpellier Ecotron



Figure 3 :

Average cumulated C mineralisation during 29 days of incubation. Each graph represents different distances from the tree and is a comparison between control and water stress treatments.

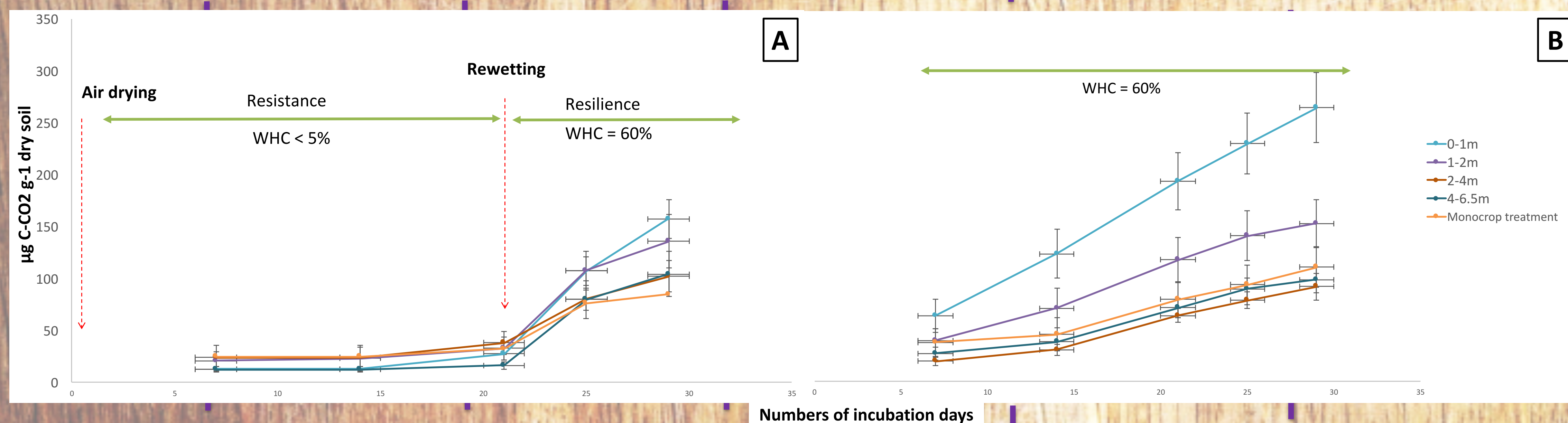


Figure 4 :

Average cumulated C mineralisation during 29 days of incubation. A represents the water stress treatment and B the control treatment.

	Day	Distance				
		0-1m	1-2m	2-4m	4-6.5m	Monocrop treatment
Rate day ⁻¹ µg C-CO ₂ g ⁻¹ dry soil	Day 21 : Resistance	1.315 ^a	1.579 ^a	1.823 ^a	0.780 ^a	1.543 ^a
	Day 29 : Resilience	18.556 ^a	14.670 ^{ab}	9.125 ^b	12.579 ^{ab}	7.503 ^{ab}
Index	Day 21 : Resistance	0.0758 ^a	0.147 ^a	0.373 ^a	0.122 ^a	0.357 ^a
	Day 29 : Resilience	0.216 ^{ab}	0.607 ^a	0.219 ^{ab}	0.477 ^{ab}	-0.064 ^b

Table 1 :

Daily rate of C mineralisation at the end of the stress (Resistance) and 7 days after rewetting (Resilience) and indices of resistance and resilience based on cumulated C mineralisation. Data are mean, n=5, letters indicate significant differences (P<0.05)

- Stronger cumulated C mineralisation occurring close to the tree, decreasing with increasing distance from tree.
- Our data show difference in microbial resilience along the spatial gradient, but not difference in resistance.
- Microbial communities seem to be more sensitive to water stress and rewetting close to the tree than in the monocrop treatment.

References :

• Orwin, K.H., Wardle, D.A., 2004. New indices for quantifying the resistance and resilience of soil biota to exogenous disturbances. *Soil Biology and Biochemistry* 36, 1907-1912