



HAL
open science

Agroforestry: Can trees change aggregate stability?

Yogan Monnier, Jean-Luc Maeght, Yves Le Bissonnais, Catherine Roumet,
Alexia Stokes

► **To cite this version:**

Yogan Monnier, Jean-Luc Maeght, Yves Le Bissonnais, Catherine Roumet, Alexia Stokes. Agroforestry: Can trees change aggregate stability?. *Climate Smart Agriculture* 2015, Mar 2015, Montpellier, France. 2015. hal-02793200

HAL Id: hal-02793200

<https://hal.inrae.fr/hal-02793200>

Submitted on 5 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.

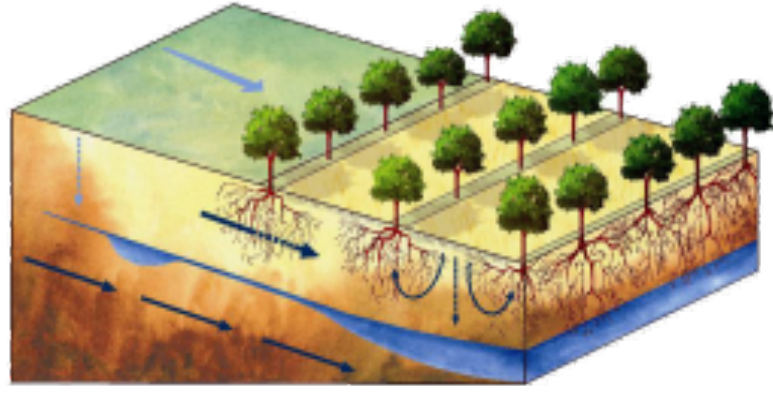
Agroforestry: Can trees change aggregate stability?



Y. Monnier¹, J.L. Maeght^{2,1}, Y. Lebissonais³, C. Roumet⁴, A. Stokes¹

1. INRA, UMR AMAP, Bld de la Lironde, 34298, Montpellier cedex 5, France / 2. IRD, UMR IIEES-Paris, Paris, France / 3. INRA, UMR LISAH, 2 Place Pierre Viala, F-34060, Montpellier, France / 4. C.N.R.S., UMR CEFÉ, 1919 route de Mende, 34293, Montpellier Cedex 5, France

Why?



Soil erosion in farmlands is a major cause of water quality degradation and reduced crops production potential throughout the European countries.

Soil erodibility = the ability of soils to resist erosion, assessed by measuring soil aggregate stability (Le Bissonais 1996).

Soil aggregate stability can be positively correlated to soil organic matter content, roots presence and soil biota (Graf and Frei 2013, Pérès et al. 2013).

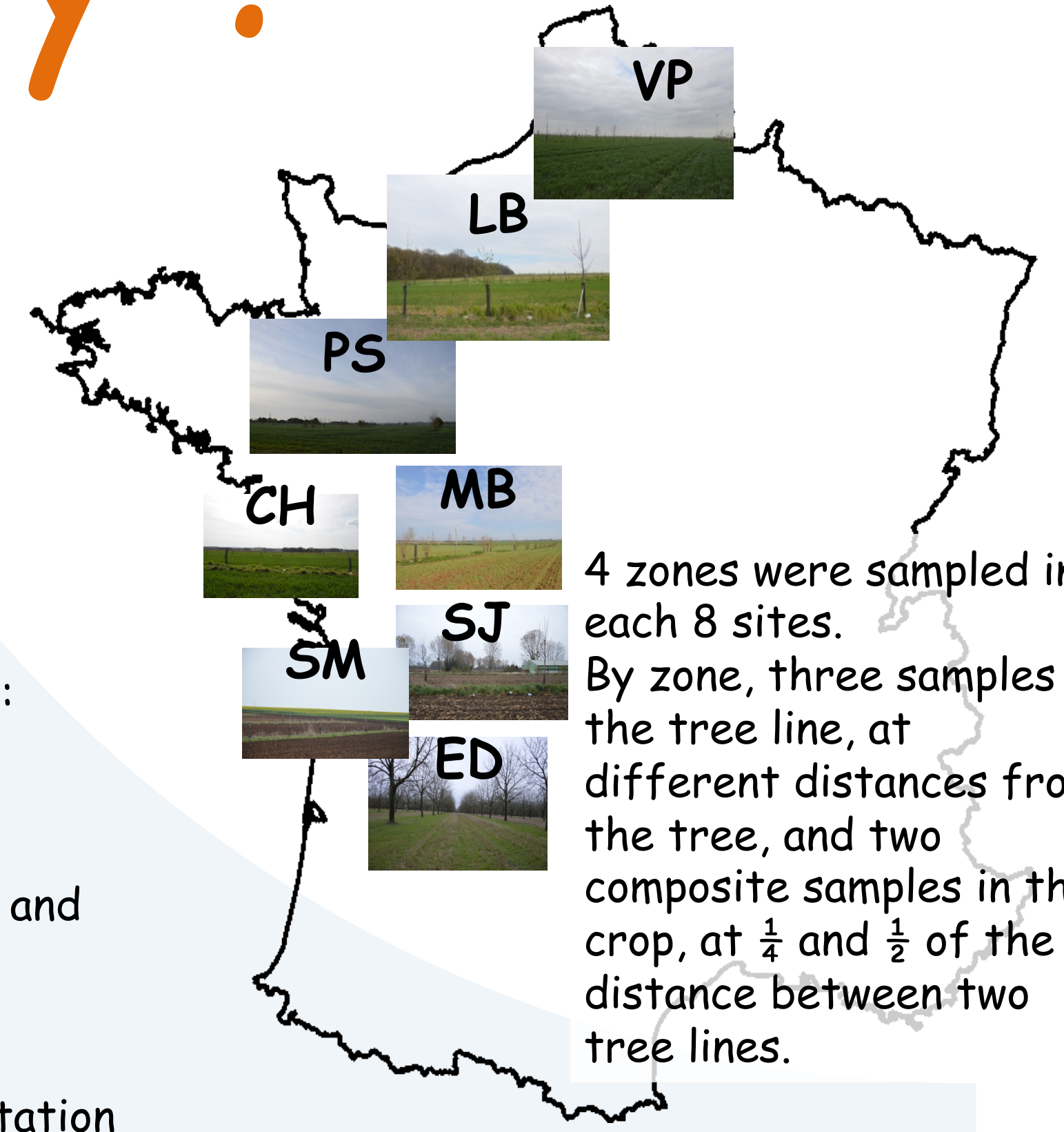
In agroforests, if the role of tree lines as physical barriers to runoffs is easily understanding, processes involving rooting systems and soil erodibility are still unknown.



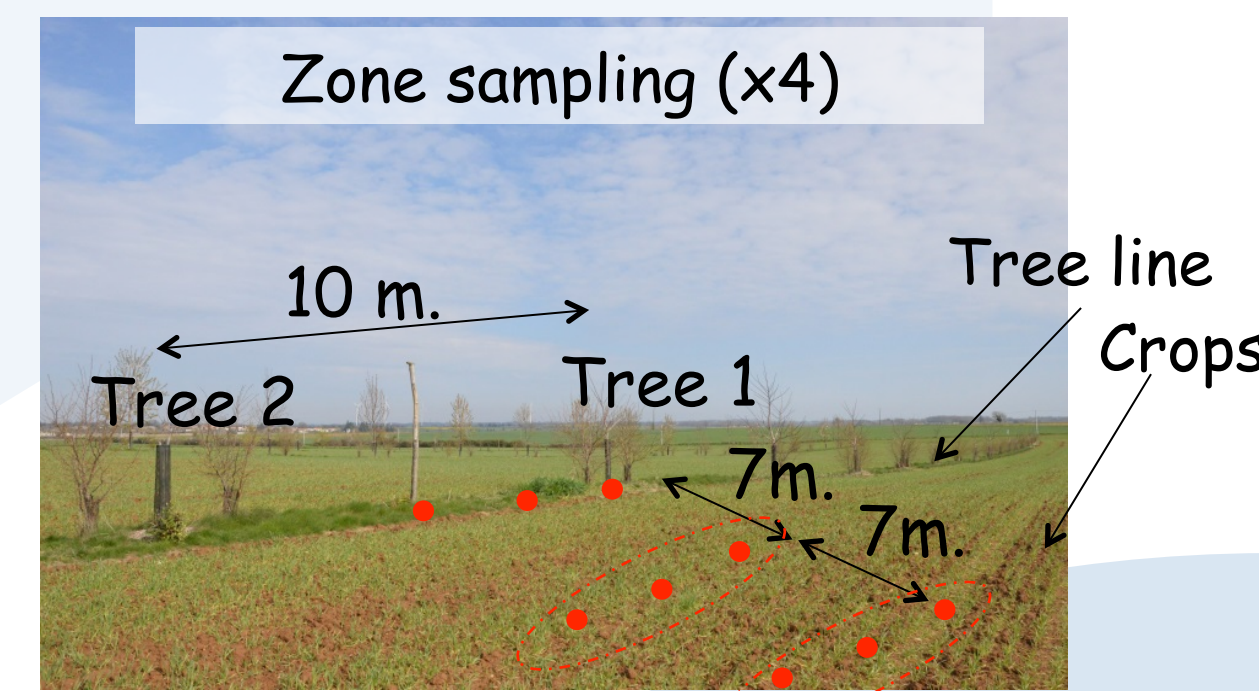
How?

For each sample we measured :

- soil aggregate stability (Le Bissonais, 1996)
- microbial metabolic activity and diversity (microresp @)
- root biomass and root trait diversity
- characteristics of the vegetation structure and soil properties.



4 zones were sampled in each 8 sites. By zone, three samples in the tree line, at different distances from the tree, and two composite samples in the crop, at $\frac{1}{4}$ and $\frac{1}{2}$ of the distance between two tree lines.



Objectives

- Do the presence of a tree line improve soil aggregate stability?
- What are the mechanisms underlying?

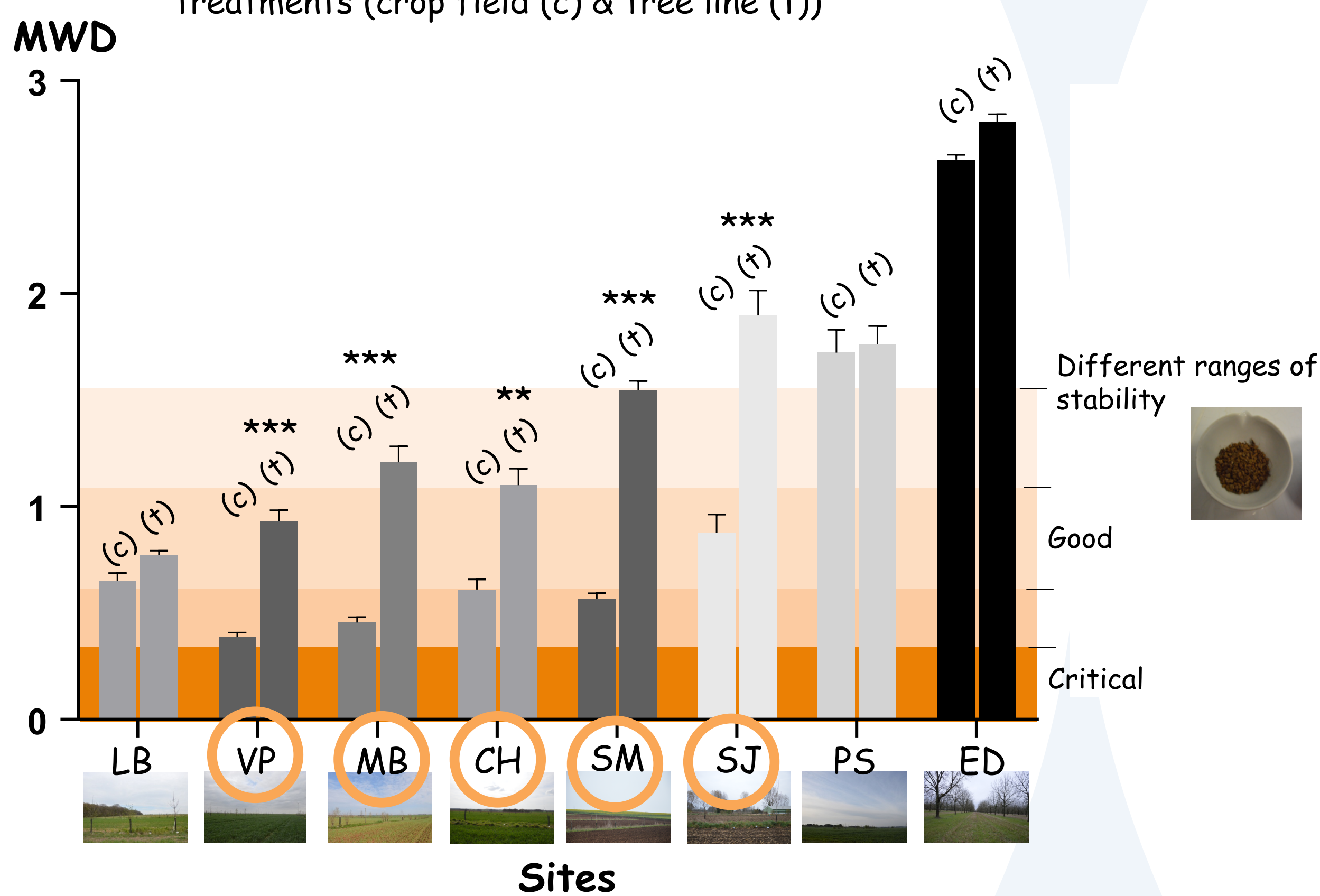
Are there effects of the tree line on soil aggregate stability?

Aggregate stability (Mean Weight Diameter, MWD) in different sites and different treatments (crop field (c) & tree line (t))

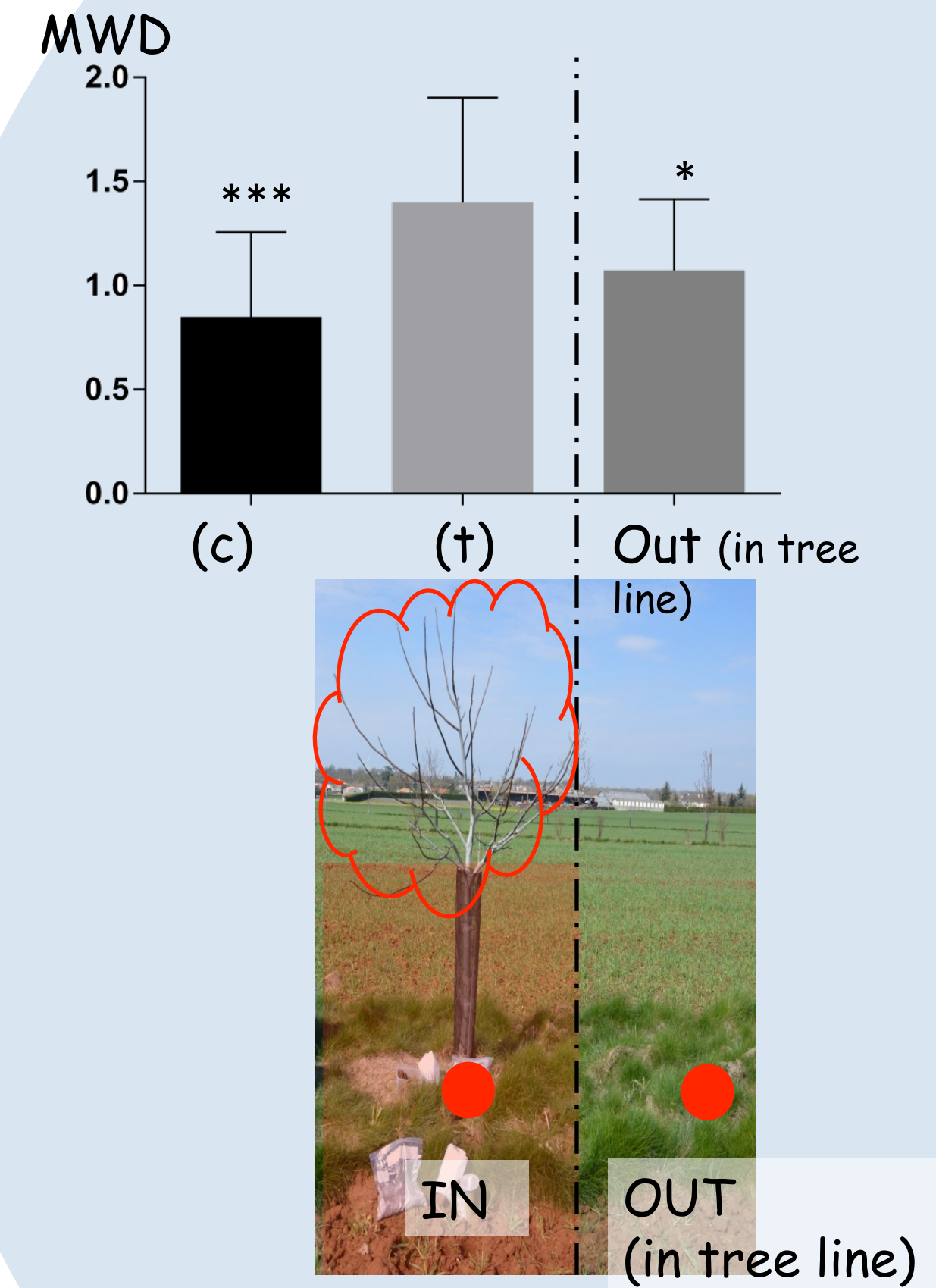


Higher soil aggregate stability in 5 sites => increment from critical to good levels of stability

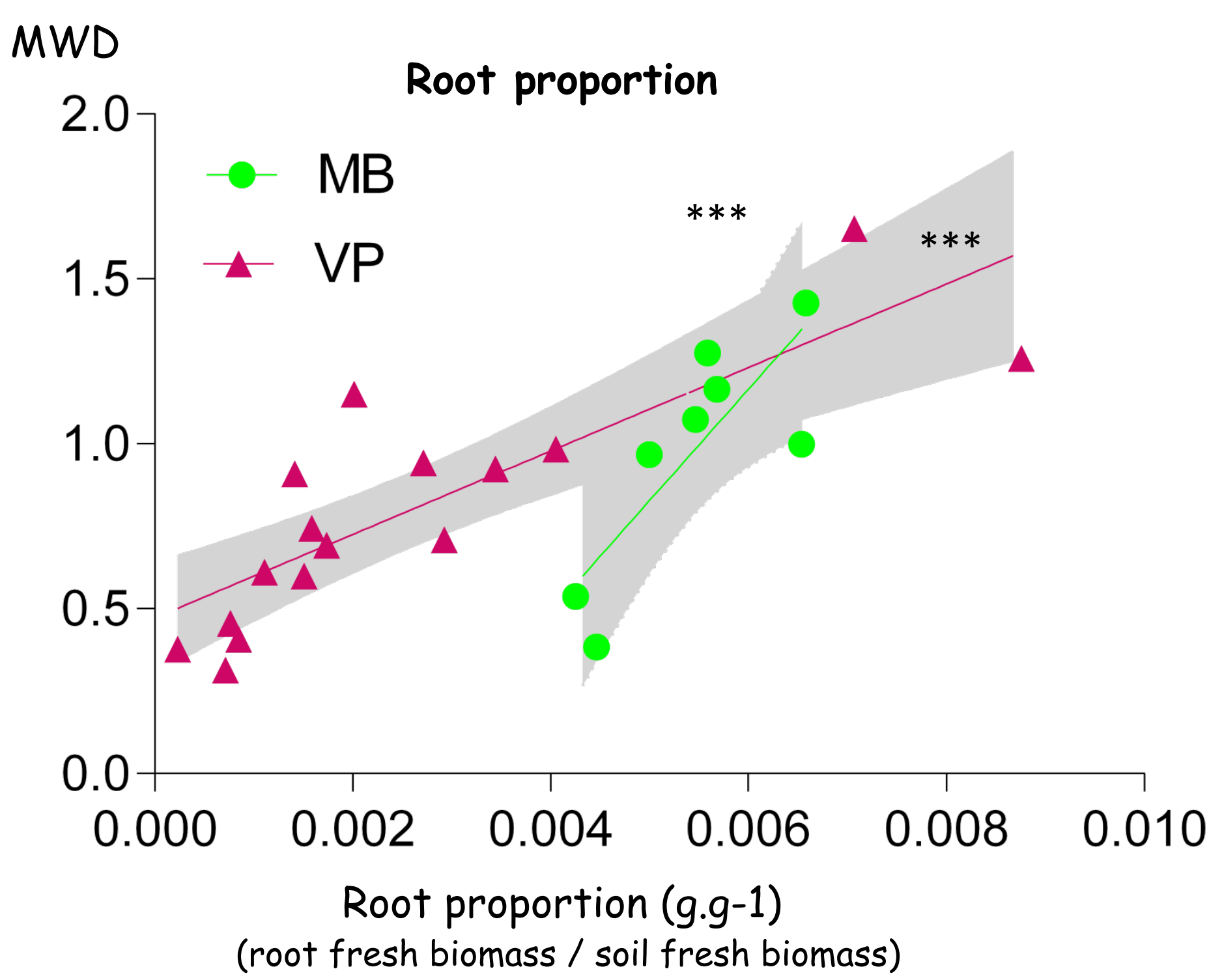
No difference between soil aggregate stability in tree-line and crops field in 3 sites (ED, LB & PS)



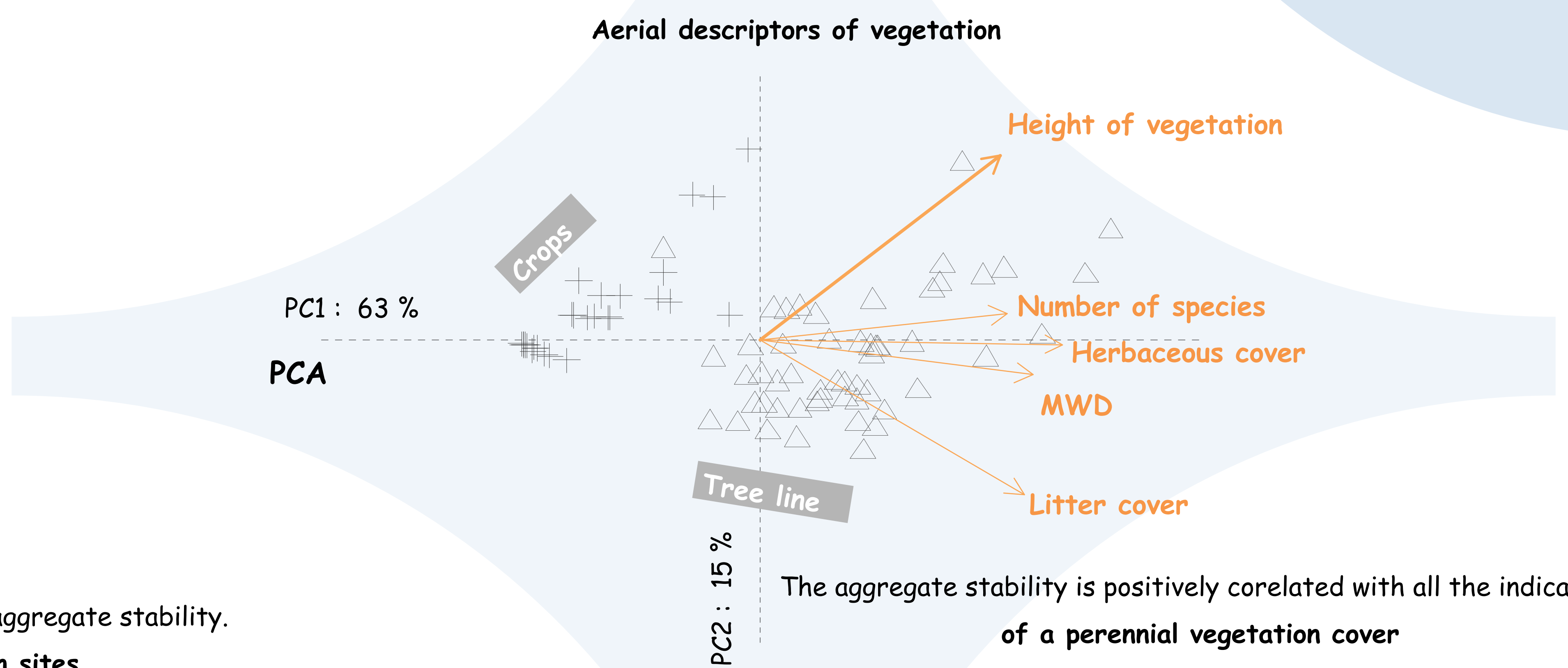
Crown presence (MB)



What factors drive the soil aggregate stability?



The root proportion in the soil is positively linked with the aggregate stability. The strength of the relationship differ between sites



Then... what next?

- Most of sites are too young to reveal a distance effect to the line => new sampling design with hedges
- Next analysis to better explain our results : Soil organic matter content / Root morphological traits / Microbial activity & metabolic diversity



- From mature hedges
- Progressive sampling from 0 to 9 m.
- Several depths: from 0 to 2.10 m.

1. Graf F, Frei M, (2013) Soil aggregate stability related to soil density, root length and mycorrhiza using site-specific *Alnus incana* and *Melanogaster variegatus* s.l. *Ecol. Eng.* 57: 314-323.
2. Le Bissonais Y, (1996) Aggregate stability and assessment of soil crustability and erodibility: I. Theory and methodology. *European Journal of Soil Science*, 47: 425-437
3. Pérès G, Cluzeau D, Menasseri S, Soussana JF, Bessler H, et al. (2013) Mechanisms linking plant community properties to soil aggregate stability in an experimental grassland plant diversity gradient. *Plant Soil* 373: 285-299.

