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Nitrogen cycle regulation and associated ecosystem services in the context of climate change: a case study on the potential of agroforestry in Brittany

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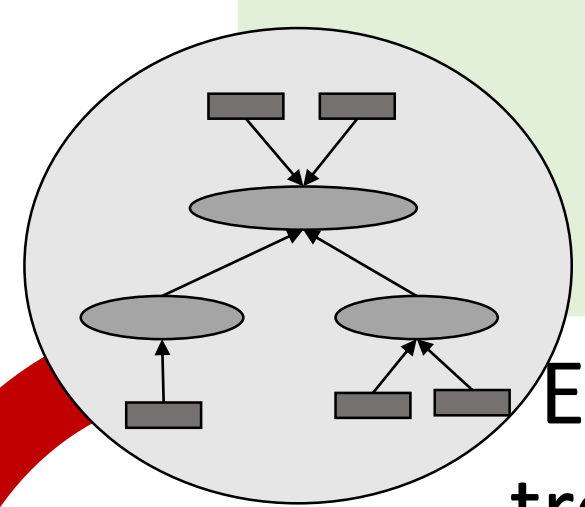
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A PhD linking ecology and agronomy at multiple scales to evaluate the potential of agroforestry systems for nitrogen cycle regulation and the delivery of associated ecosystem services in the context of climate change

1. Ecology at plot scale

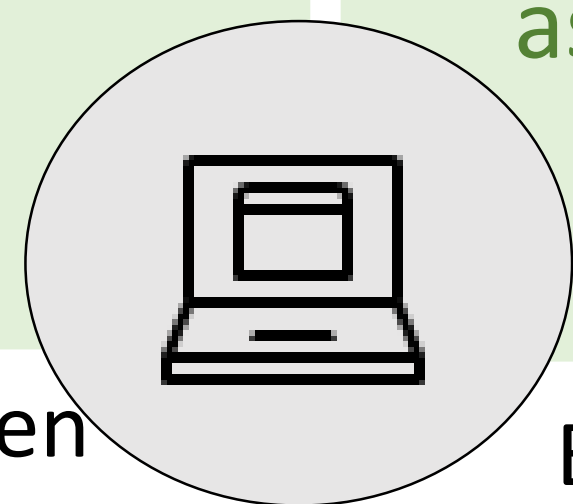
To what extent do trees impact nitrification stability under extreme precipitations events?



Explore the relationship between trees and nitrogen cycle regulation under extreme climate events

2. Agricultural management at plot and farm scales:

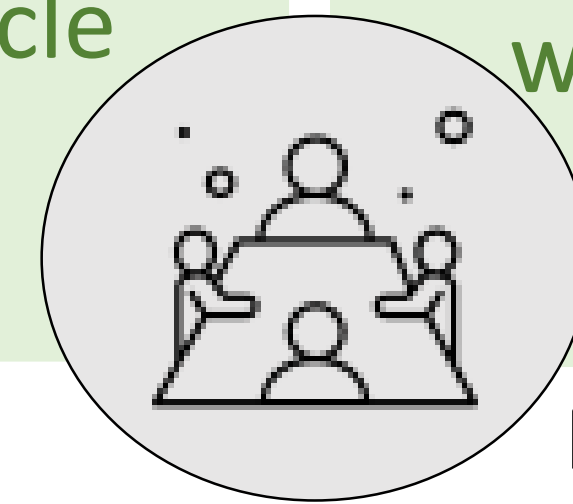
Are agroforestry systems associated with specific nitrogen management practices? Which ecosystem services associated with the nitrogen cycle regulation do they deliver?



Evaluate nitrogen cycle regulation through modeling and associated ecosystem services

3. Agroforestry systems development at territory scale:

Is there room for more agroforestry systems dissemination in Brittany? Which ecosystem services associated with the nitrogen cycle regulation could they provide?

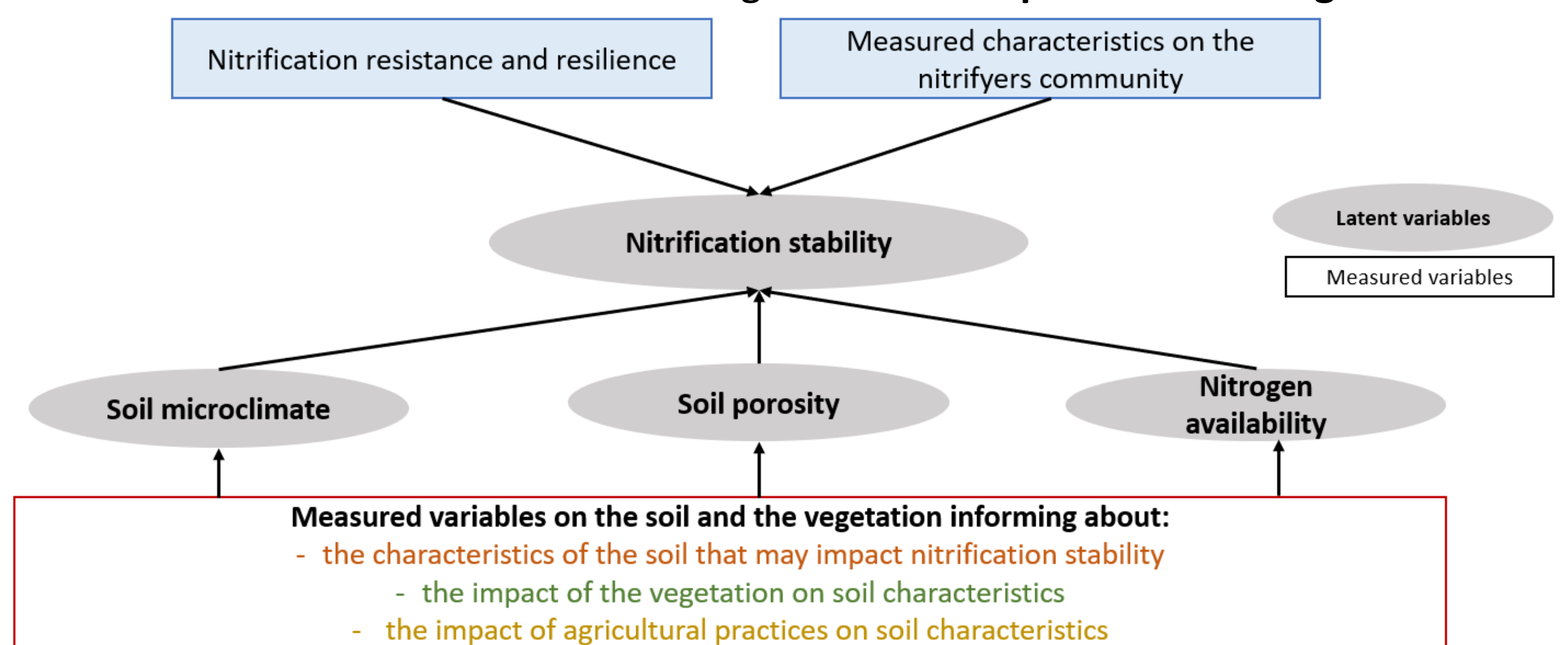


Prospective approach with various stakeholders

Introduction:

- Nitrogen losses are of great concern as they threaten ecosystems. They are expected to increase with the intensification of extreme climate events.¹
- Agroforestry - whereby trees are integrated on a plot with crops and/or livestock - is considered as a lever to address this threat.^{2,3}
- The first part of this PhD aims to explore the potential benefits of trees to improve nitrogen cycle regulation and associated ecosystem services, by taking a focus on the impact of two agroforestry designs on a key process driving the production of reactive nitrogen, the nitrification.

Design of a causal conceptual model to study the impact of trees and agricultural practices on the nitrification through structural equation modeling.



Field-work to collect data on soil and vegetation characteristics according to two agroforestry designs (alley-cropping agroforestry and hedgerows) and for three distances from the trees

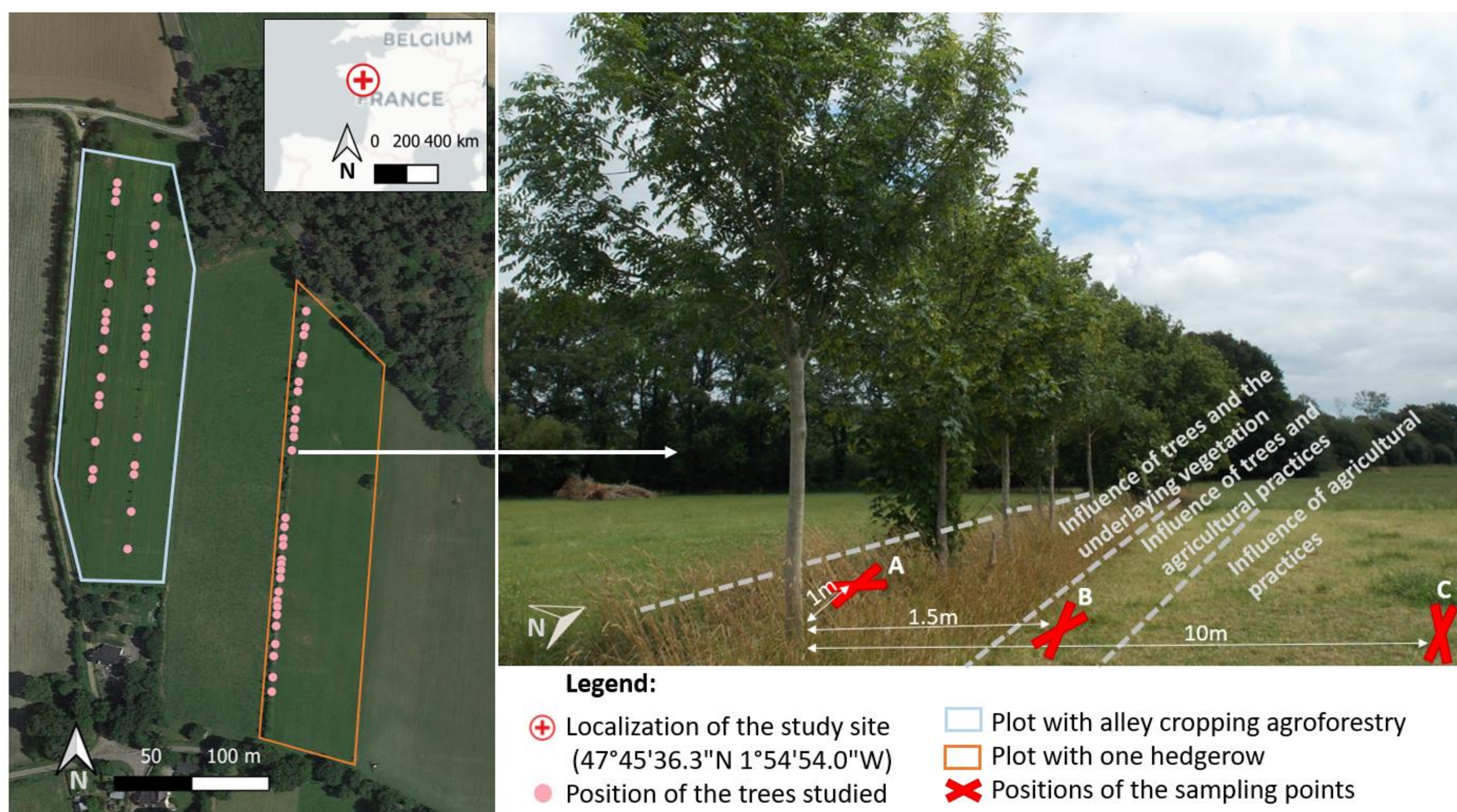
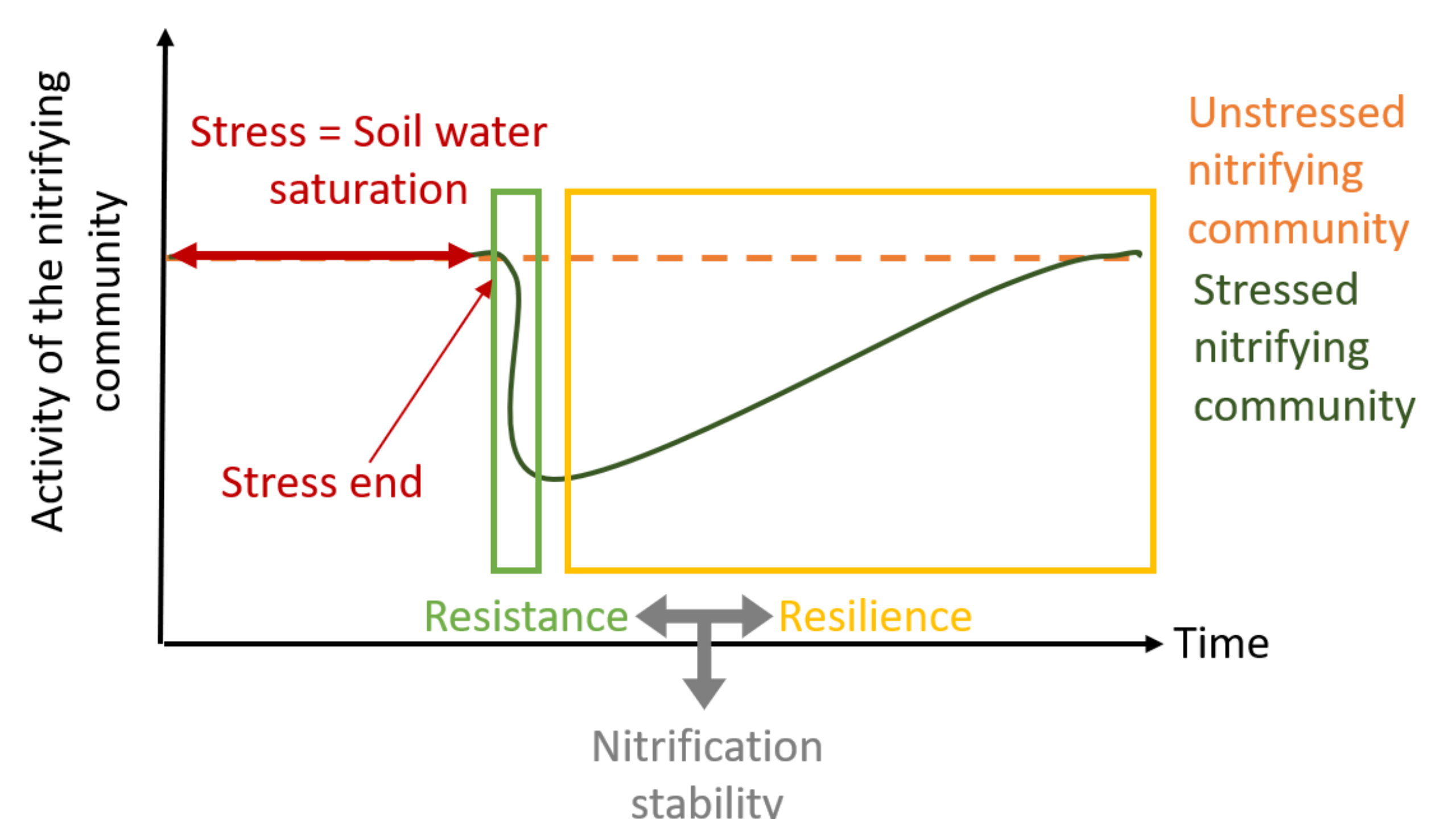


Figure 2: Experimental design for in-field measurement according to two factor: (i) the agroforestry design and (ii) the distance to the tree row.

Lab-work to collect data on the nitrification stability, i.e. the biological response of nitrifying microbial communities to a disturbance, here to extreme precipitation events



Keep in touch !

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- ¹Greaver, T.L., C.M. Clark, J.E. Compton, D. Vallano, A.F. Talhelm, C.P. Weaver, L.E. Band, et al. « Key ecological responses to nitrogen are altered by climate change | Nature Climate Change ». *Nature Climate Change* 6 (2016): 836-43. <https://doi.org/10.1038/nclimate3088>.
- ²Caubel, Virginie. « Influence de la Haie de ceinture de fond de vallée sur les transferts d'eau et de nitrate ». Ecole nationale supérieure agronomique de Rennes, 2001.
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