



Ecological interactions between tree, crop, soil & environment in a silvoarable agroforestry-system in Flanders

Pardon P., Reubens B., Mertens J., Reheul D., Coussement T., Verheyen K.

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Decline in (functional) biodiversity
N leaching
Lowering C-stocks



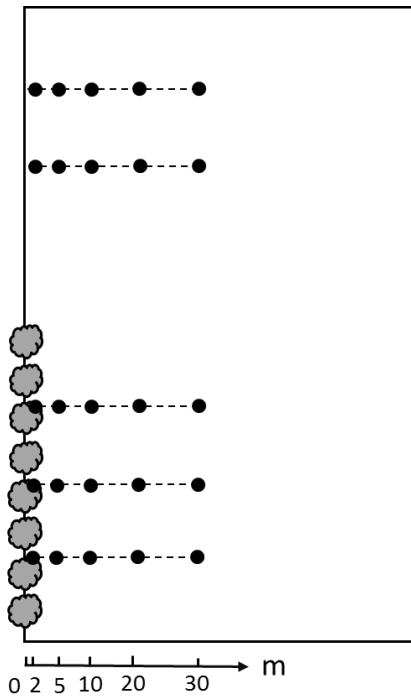
(silvoarable) agroforestry



Soil characteristics
Yield & quality

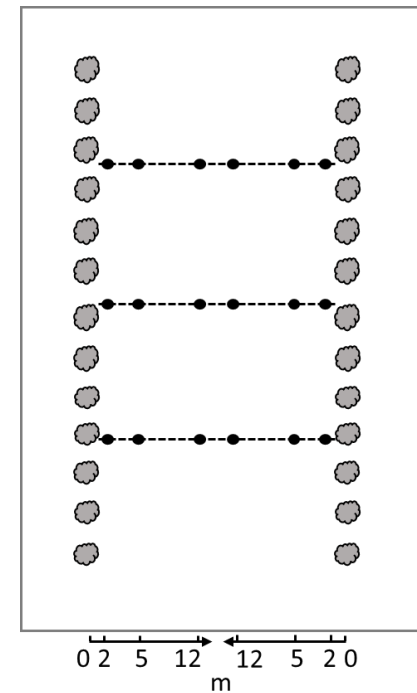
Experimental design

fields partially bordered by a tree row

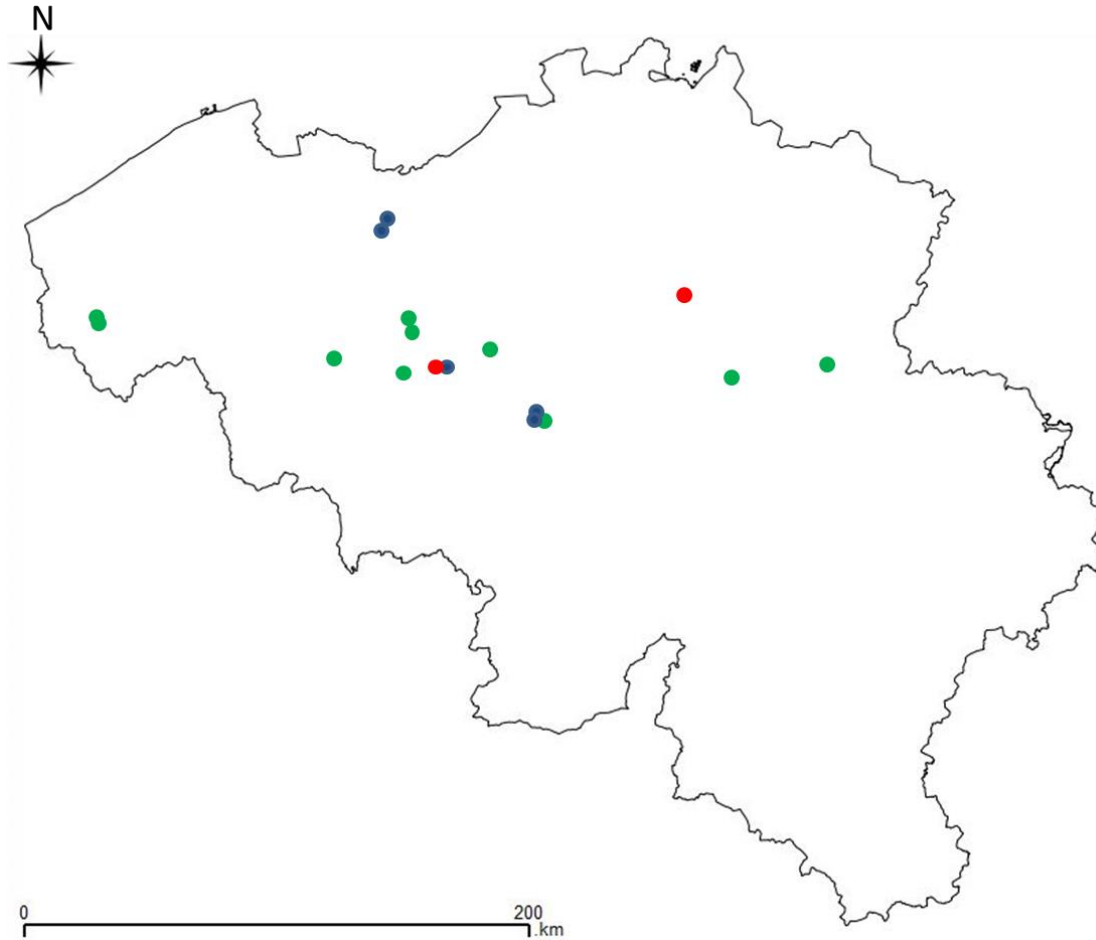


- North-South orientation
- Absence of headland
- *Populus x canadensis* or *Juglans regia*
- Different age
- Soil type (loam-sandy loam)

young alley cropping fields



Study sites



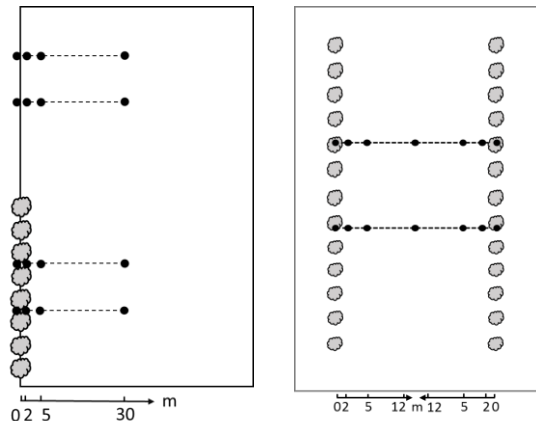
- Young alley cropping (#6)
- *Juglans regia* (#3)
- *Populus x canadensis* (#12)



Functional biodiversity

– Arthropods

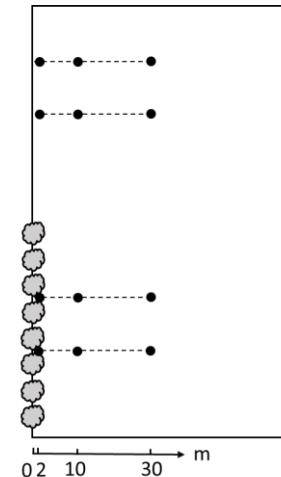
- Carabid beetles, rove beetles, centipedes, millipedes, isopods
- Pitfall trapping:



- 2x 2-weekly collection in June 2015 & subset in 2016

– Earthworms

- 3-step sampling:



- September-October 2015



Sampling litter layer:
40cm x 40cm



Soil-extraction: 2 x 3,2l +
24 gr mustard powder

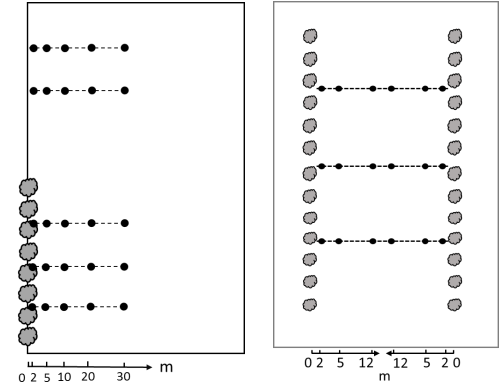


Soil sampling and sorting:
20cm x 20cm x 20cm

Yield & quality

– Tree

- Dimensions
- Annual growth (tree coring)
- Vitality



– Crop

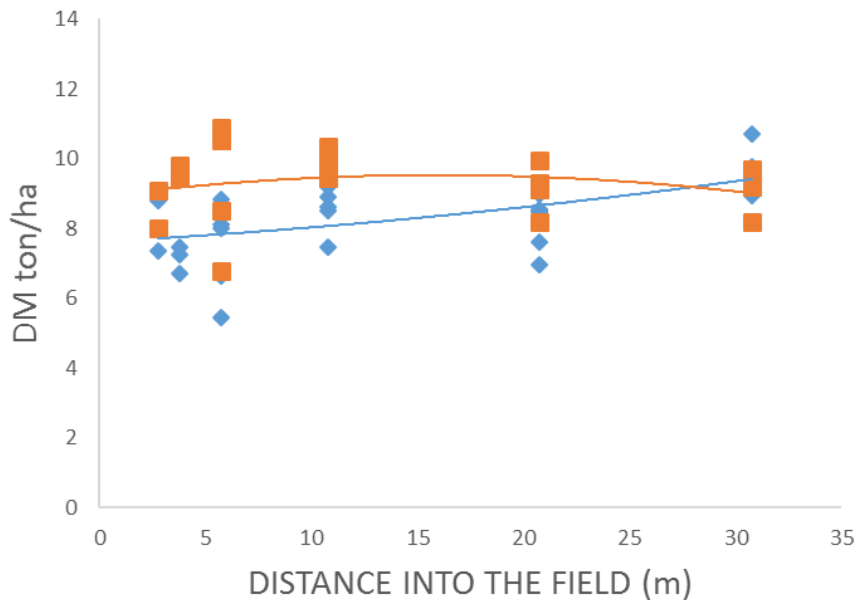
- Ton dry matter/ha
- Quality -> 2015:
 - **Maize (silage)**: % dm, protein and starch content, OM digestibility
 - **Winter wheat/barley**: protein content, % dm, TGW
 - **Grass**: % dm, protein content, crude fibre, crude ash, OM digestibility



Crop yield: first results

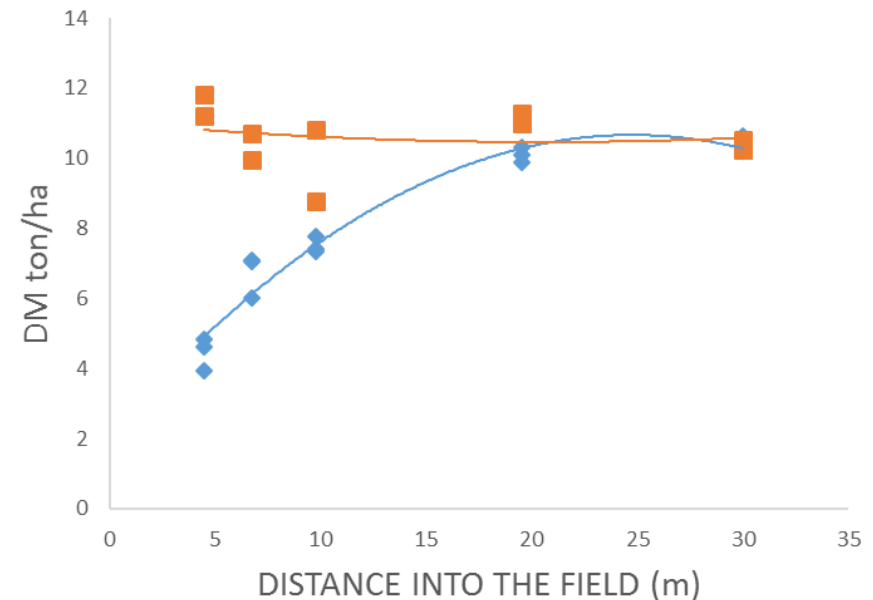
POPULUS X CANADENSIS + WINTER BARLEY

◆ tree row ■ control



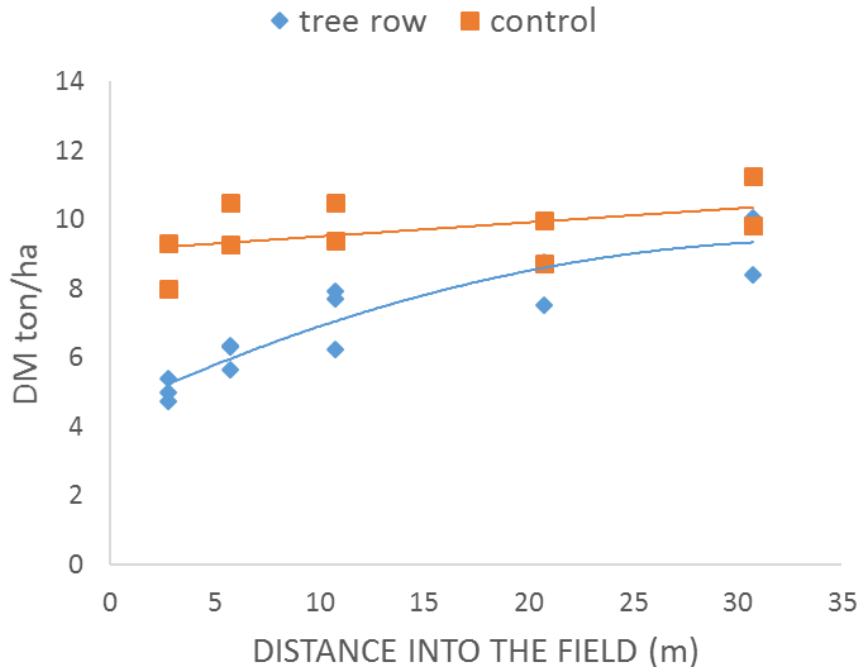
POPULUS X CANADENSIS + FORAGE MAIZE

◆ tree row ■ control

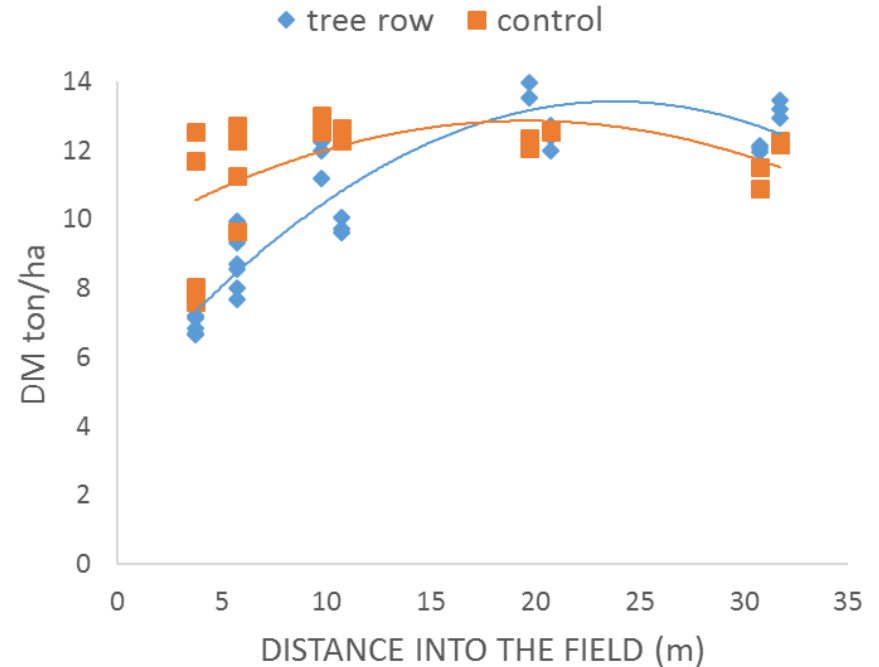


Crop yield: first results

POPULUS X CANADENSIS + WINTER WHEAT

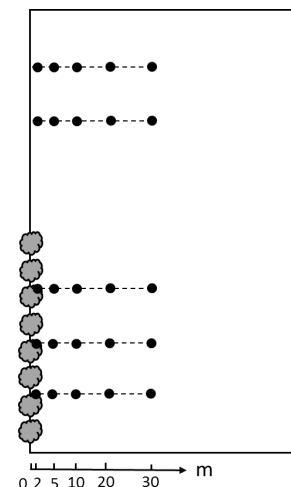
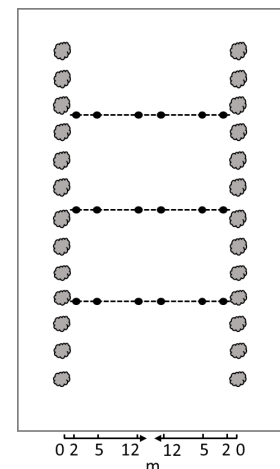


JUGLANS REGIA + WINTER WHEAT



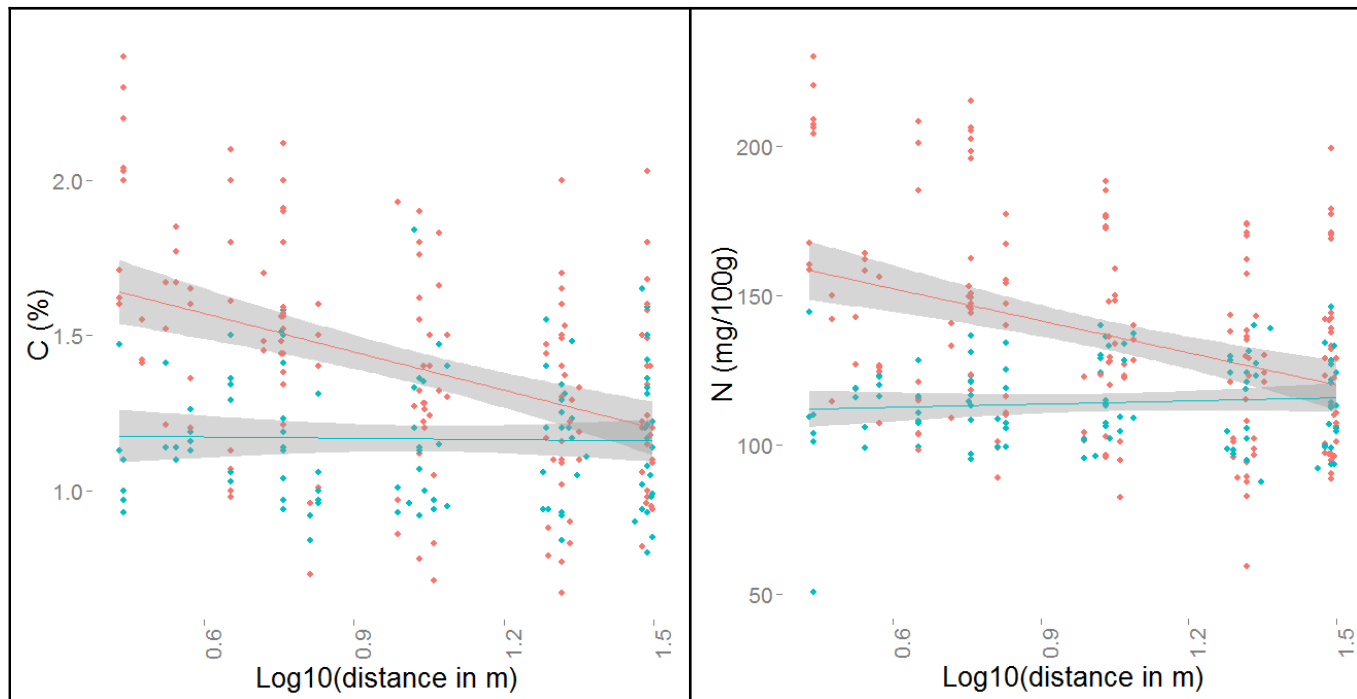
Soil characteristics and N-leaching

- Soil characteristics
 - C%, N, K, Mg, Na, Ca, pH-KCl
 - upper soil layer (0-23 cm) of harvest plots (1.5m x 6.5m)
 - dec 2015- jan 2016
- Mineral N
 - Subset of 6 fields with *Populus x canadensis*
 - 0-30cm ; 30-60cm ; 60-90cm
 - Late winter, summer, fall
 - 2015 – 2016 – late winter 2017
 - Soil moisture content (5 measurements)



Soil characteristics: first results

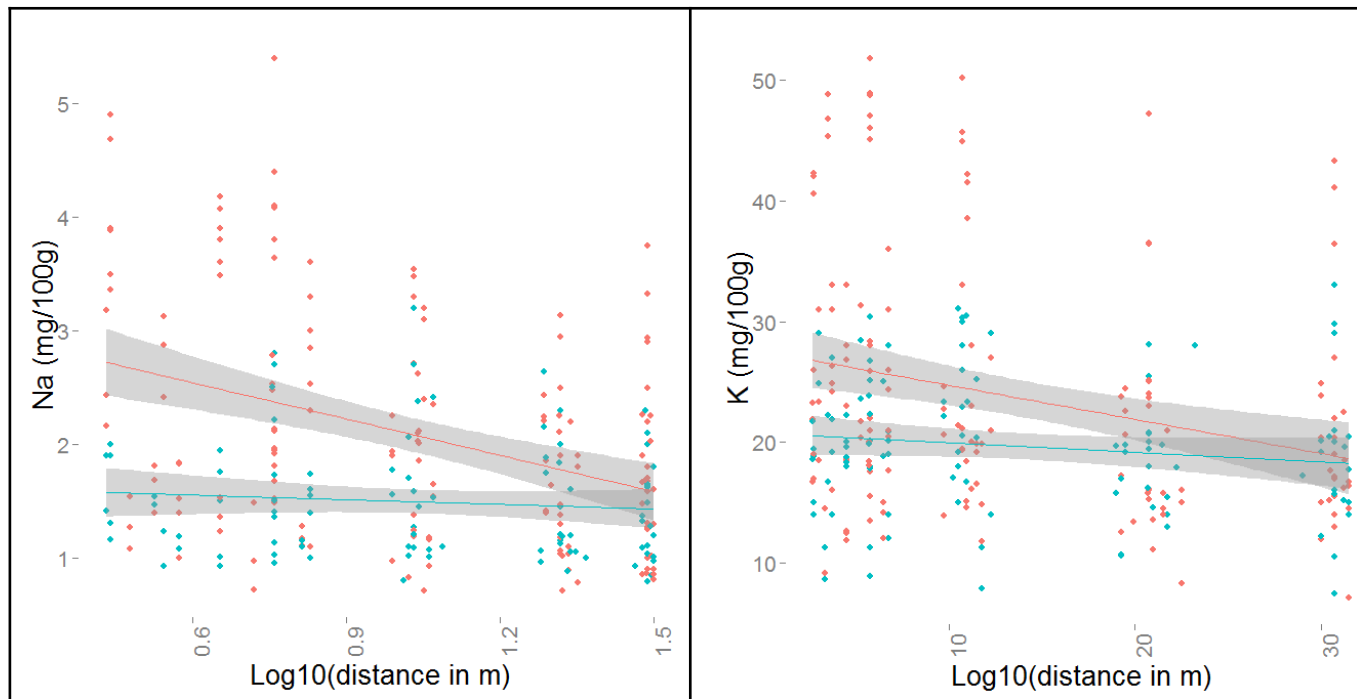
	Linear mixed model: fixed effects		
	distance	T+/T-	interaction
C (%)	p<0.0001	p<0.0001	p<0.0001
N (mg/100g dm)	p<0.0001	p<0.0001	p<0.0001
C:N	p=0.0405	p=0.9716	p=0.8553
Na (mg/100g dm)	p<0.0001	p<0.0001	p<0.0001
K (mg/100g dm)	p<0.0001	p=0.0004	p=0.0001



Red: tree row
 Blue: control
 Grey shading shows 95% confidence interval.

Soil characteristics: first results

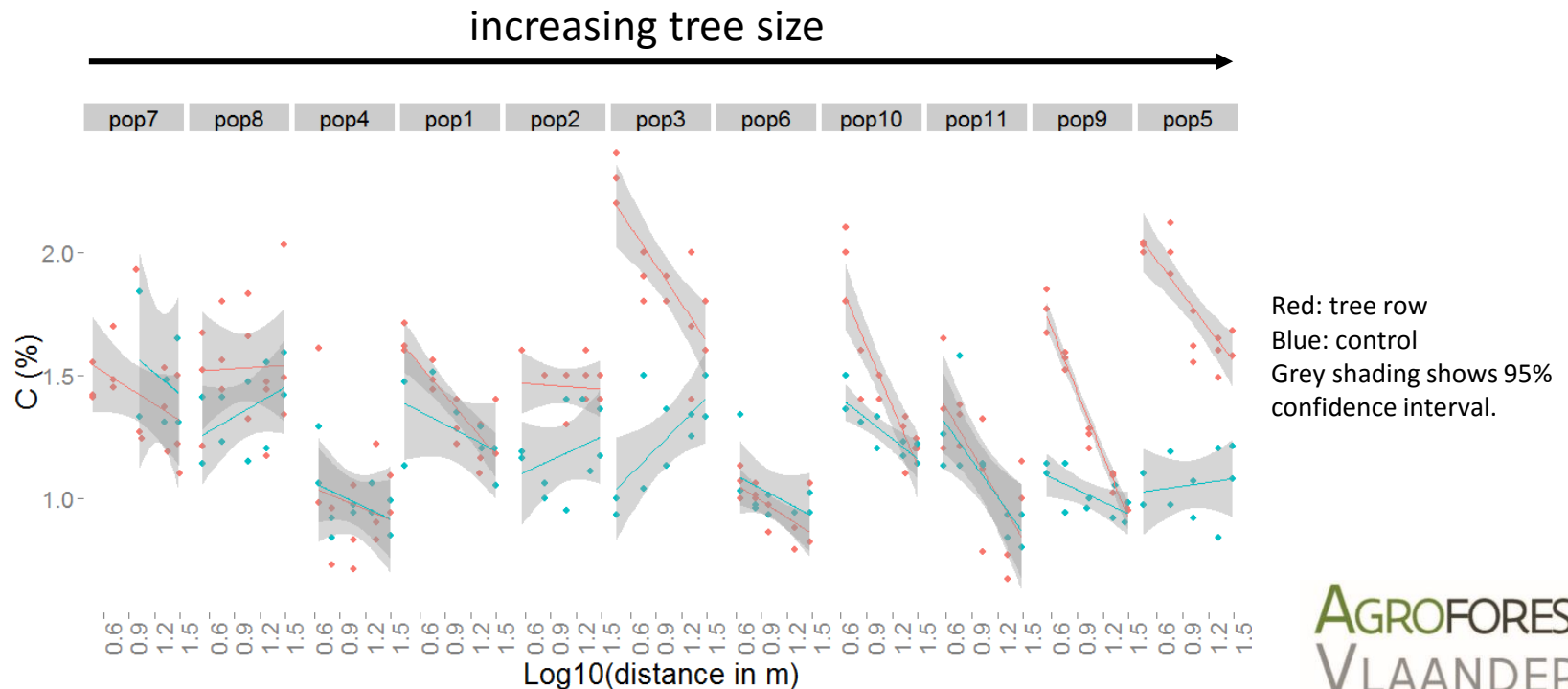
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Soil characteristics: first results

	r_s intercept		r_s slope	
	r_s	p-value	r_s	p-value
C (%)	0.61	p=0.0519	-0.56	p=0.0759
N (mg/100g dm)	0.64	p=0.0404	-0.74	p=0.0134
C:N	-0.38	p=0.2484	0.26	p=0.4512
Na (mg/100g dm)	0.76	p=0.0105	-0.66	p=0.0309
K (mg/100g dm)	0.77	p=0.0081	-0.80	p=0.0052



Preliminary conclusions:

- Tree rows significantly influence soil C%, N, Na and K concentration
- This effect is:
 - distance-dependent
 - positively correlated with tree-size
- Lower crop yield was noted nearby tree rows, magnitude of this effect appears to be related to crop type and possibly also to tree species.

Outlook:

- Tree row potential for augmenting functional biodiversity (decomposers and natural pest controlling species)
- Tree row impact on soil mineral N content (plant-availability and N-leaching)

Thank you for your attention

paul.pardon@ugent.be

www.agroforestryvlaanderen.be

info@agroforestryvlaanderen.be

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