Agroforestry in temperate regions: where does the water go?

A case study with ERT in a corn field bordered by poplar trees.

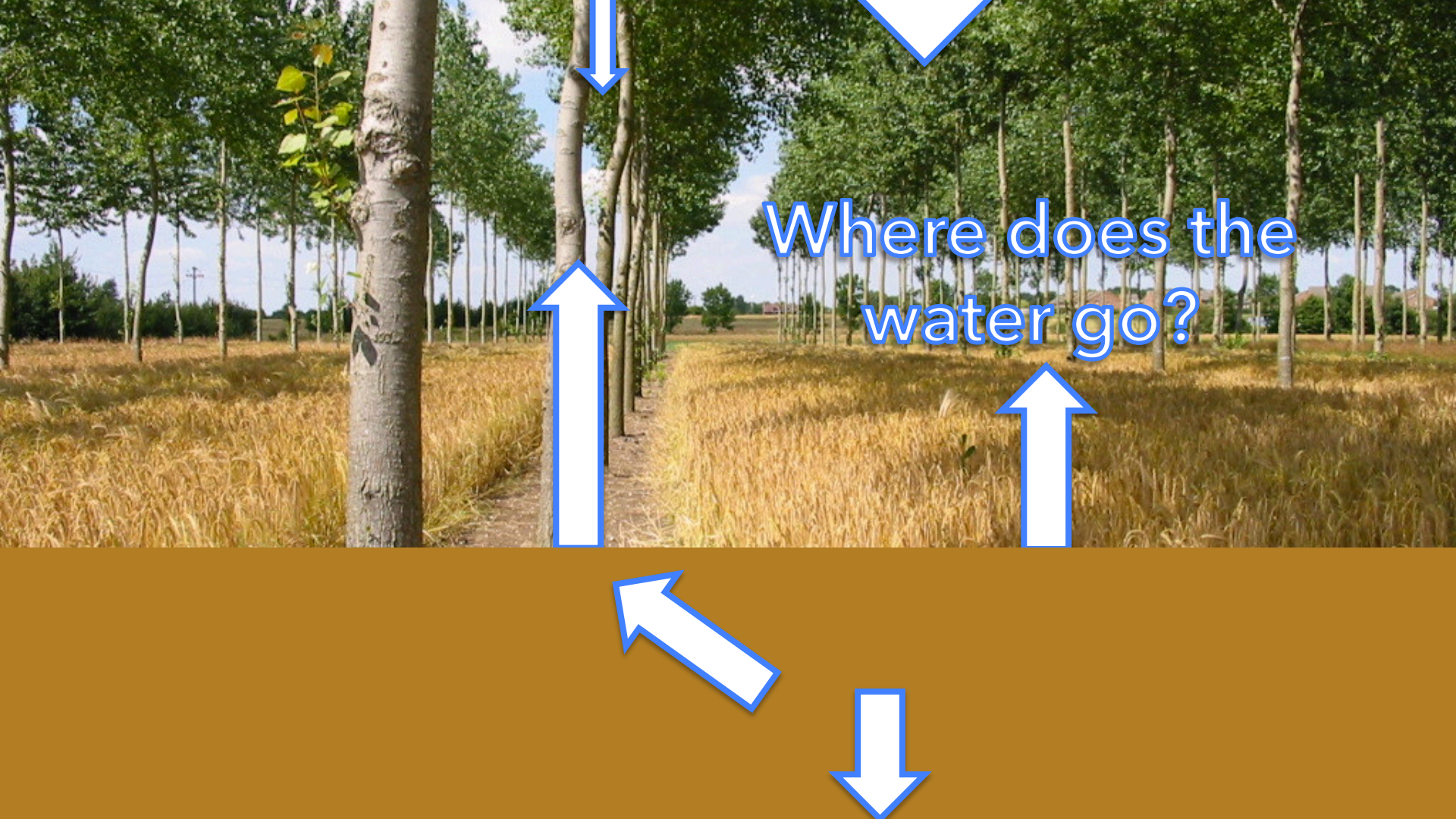
S. Maloteau[1], T. Coussement[2], P. Pardon[3], S. Artru[1], M. Javaux[4], *S. Garré*[1]

Gembloux Agro-Bio Tech

EGU2017-6399E

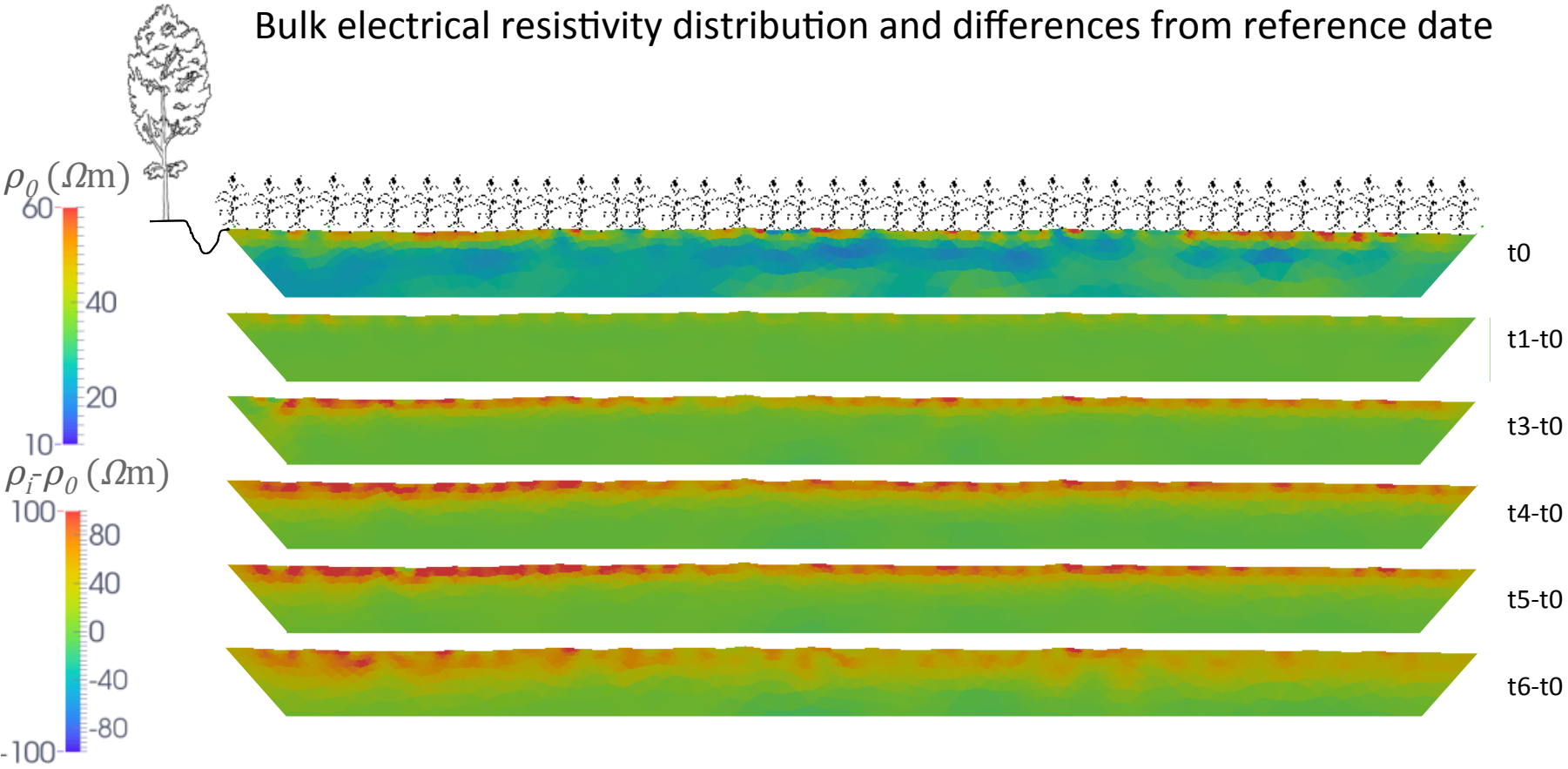
2-MIN MADNESS

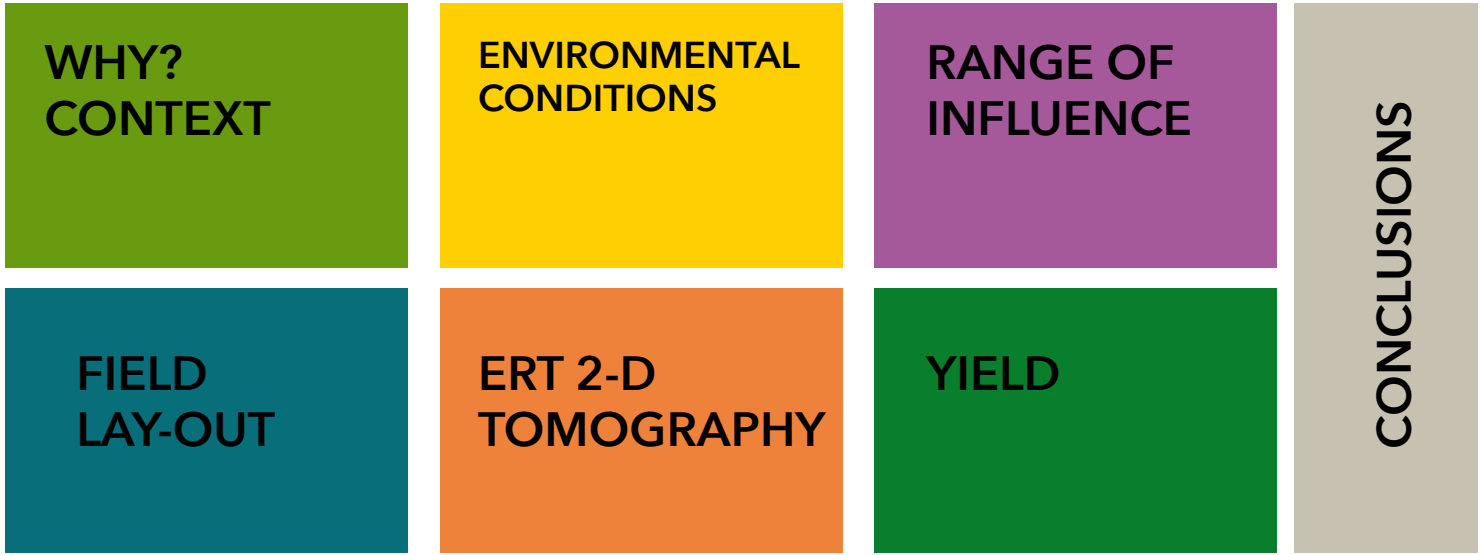
© Agroforestry Research Trust


Where does the water go?

The use of electrical resistivity tomography to asses the impact of trees on crop water uptake and soil water dynamics

Bulk electrical resistivity distribution and differences from reference date





PICO PRESENTATION | HOME

Context

Agroforestry in Flanders

www.agroforestryvlaanderen.be

- Impact on soil characteristics and crop performance
  - Competition for water, light, nutrients ?
  - Effect of micro-climate near the trees ?
- But … lack of ‘mature’ agroforestry fields in Flanders

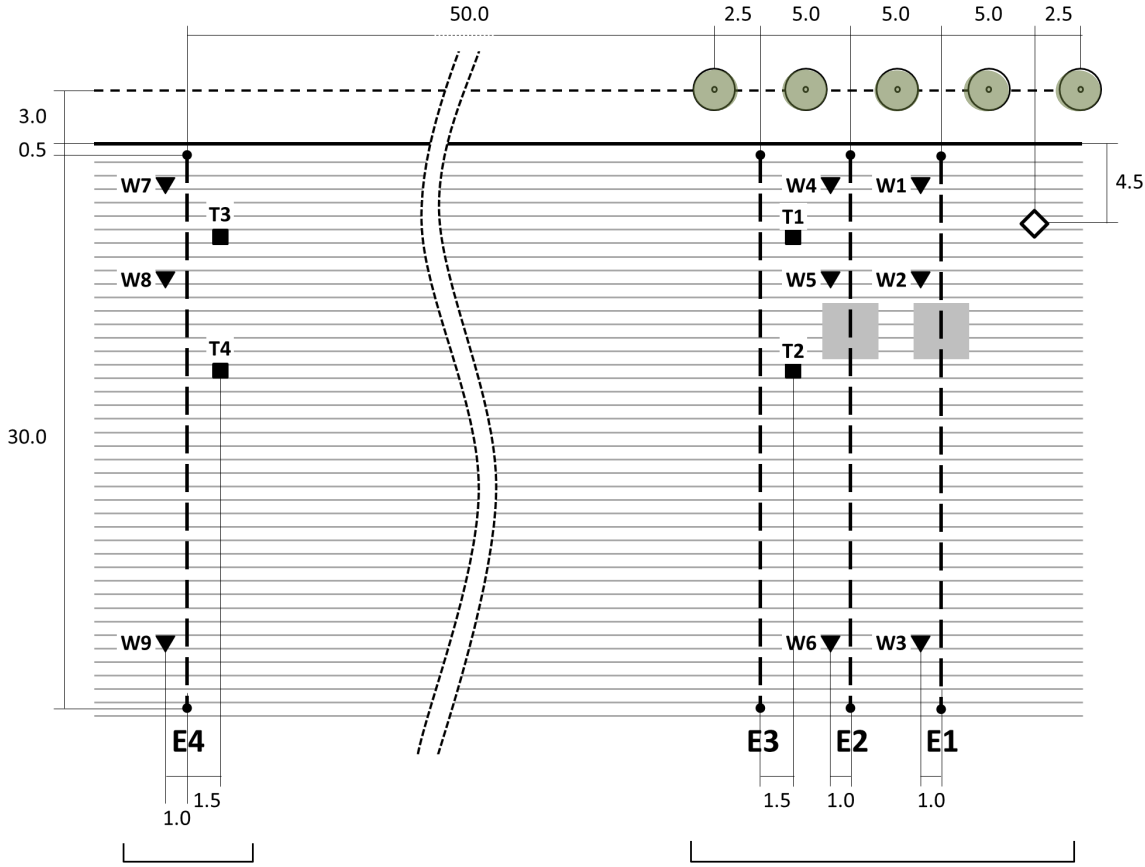
➔ research on fields where trees closely border the field

Field lay-out

- Soil temperature sensor **(T)** at 10 cm depth
- Watermark sensors **(W)** at 15 cm depth and samples for pF curves at same depth
- Weather station
- ERT transect **(E)** (30m long, 61 electrodes)

- Poplar tree
- Ditch
- Corn row
- Yield plot

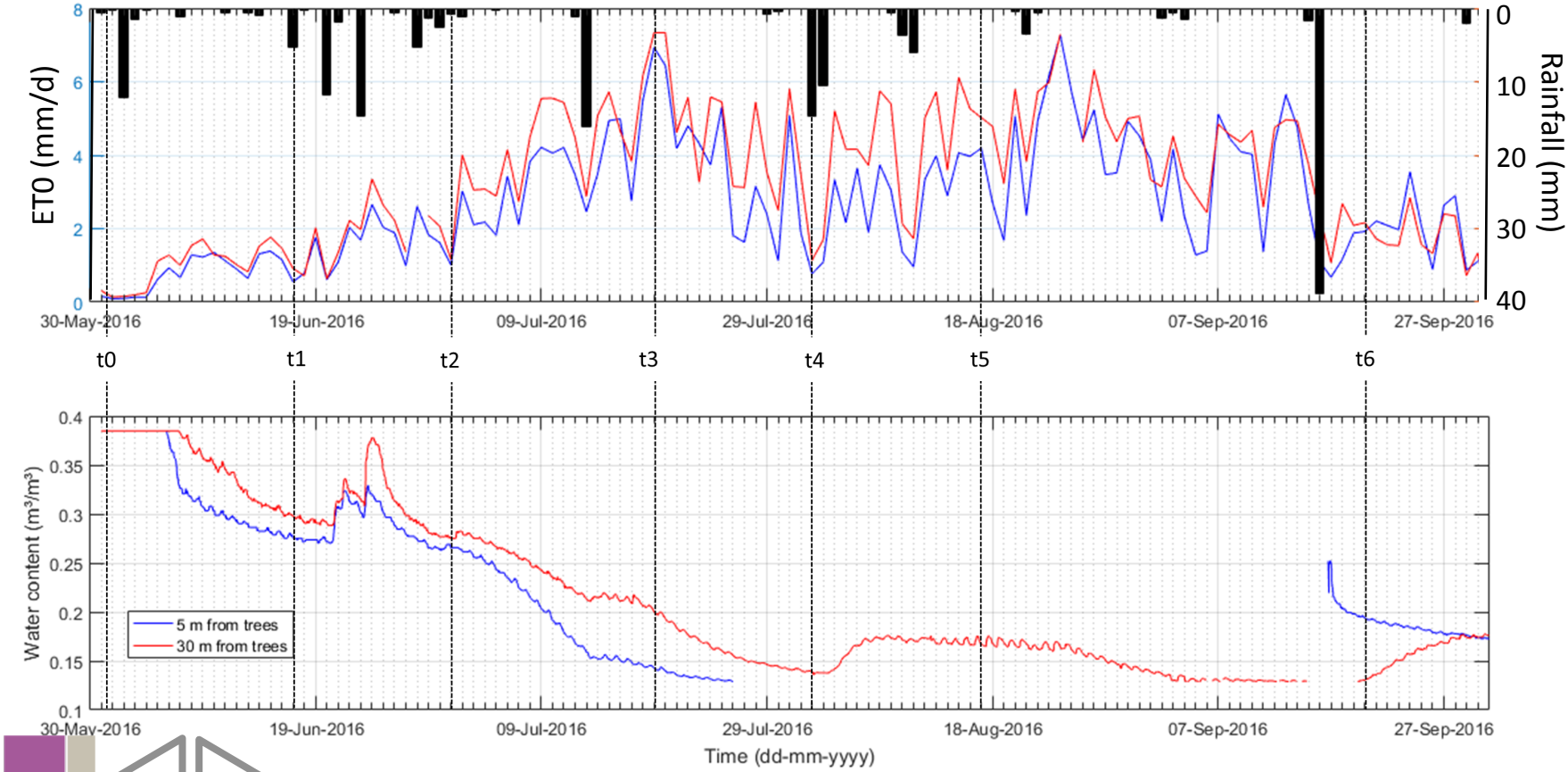
All dimensions are in meter.



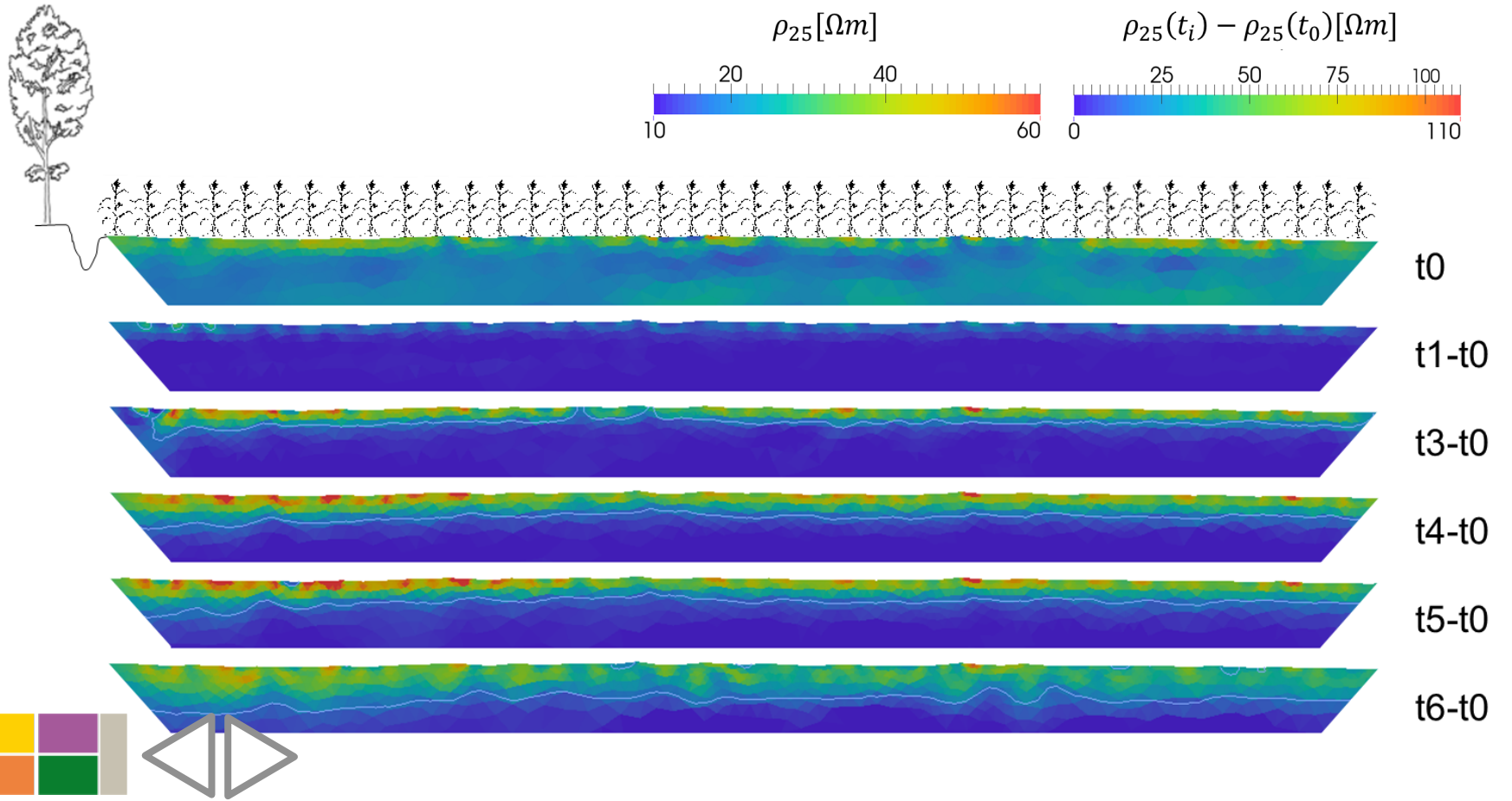
Reference zone (RZ)

Tree-bordered zone (TZ)

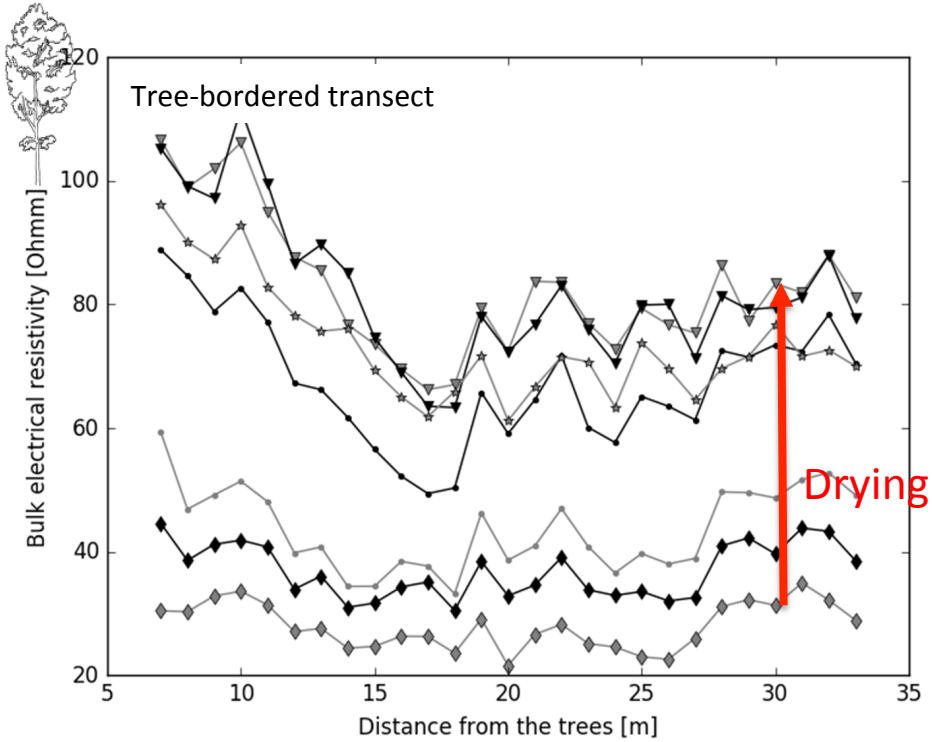
Environmental conditions

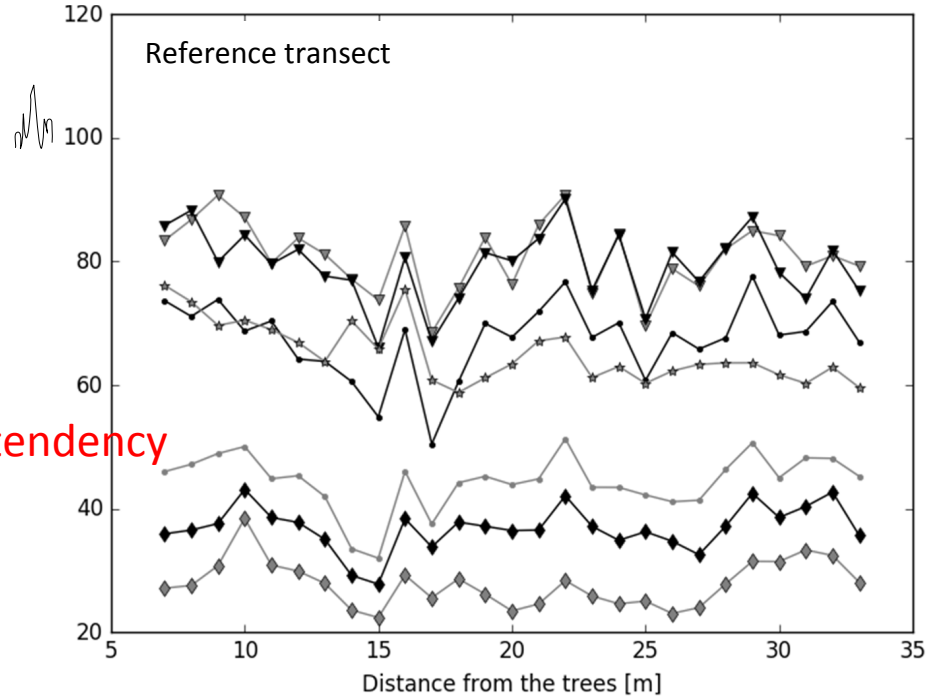


ERT 2-D tomography



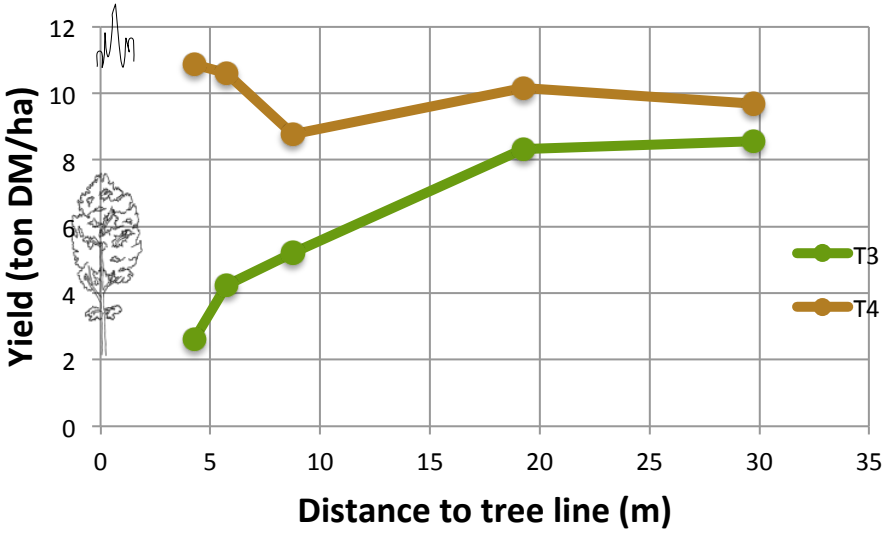
Range of influence

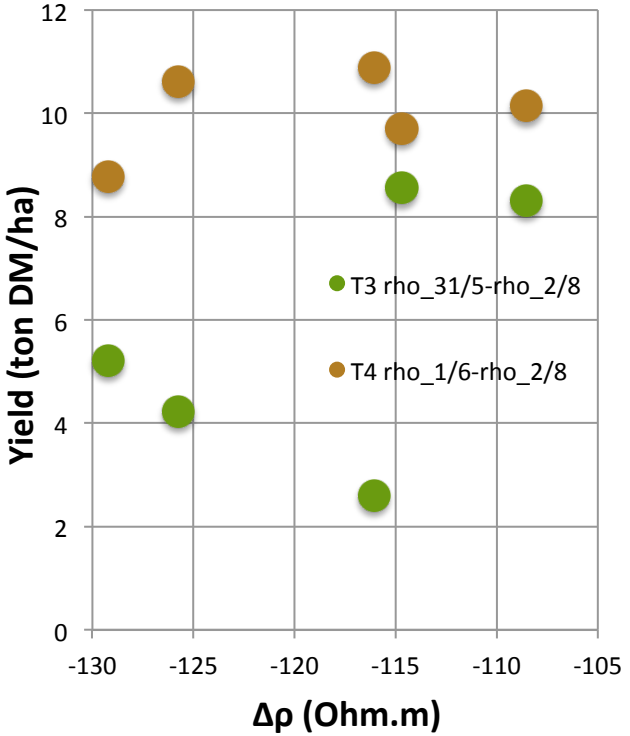




t0 t1 t2 t3 t4 t5 t6

Crop yield


Yield (ton DM/ha)
Distance to tree line (m)
T3
T4


Yield (ton DM/ha)
Δρ (Ohm.m)
T3 rho_31/5-rho_2/8
T4 rho_1/6-rho_2/8

Conclusions and perspectives

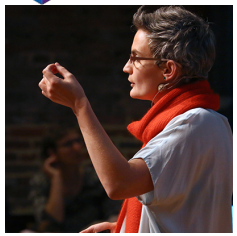
CONCLUSIONS

- ERT is an interesting **tool to assess the spatio-temporal dynamics of soil moisture** due to soil-plant interactions
- There are **differences between tree-bordered and no-tree transects** in terms of soil water dynamics
- In this case-study and in this particular growing season, a **distance of influence of maximum 15 m** can be observed during the driest soil conditions
- There is a clear yield decline close to the trees. As also suggested by the distance of influence graphs, there is only a correlation between yield decline and increased resistivity differences for the point within the first 15 m from the trees.

PERSPECTIVES

- The measurements will be repeated for at least one more year to observe variability due to climate.

Contact: Sarah.Garre@ulg.ac.be



Sarah Garré is a professor at the University of Liège in Belgium. She is specialised in the used of geophysical techniques to study soil-plant interactions.

Paul Pardon is doing his PhD in the framework of the project Agroforestry in Vlaanderen at ILVO and University of Ghent in Belgium. He quantifies the impact of trees on crop performance, biodiversity, …

Tom Coussement is working at the Soil Service of Belgium. As a partner in the Agroforestry in Vlaanderen project, they contribute by performing soil analyses and monitoring.

Sophie Maloteau acquired and partly analysed the measurements shown in this presentation when she worked at the University of Liège. She is not active in academics anymore at the moment.

Sidonie Artru is finishing her PhD thesis on the effects of competition for light due to dynamic shade on crop performance at the University of Liège.

Mathieu Javaux is a professor at the Université Catholique de Louvain in Belgium. He is an expert in modelling and measuring soil-plant interactions.