



# Spatial patterns of argan-tree influence on soil quality of intertree areas in open woodlands in South Morocco

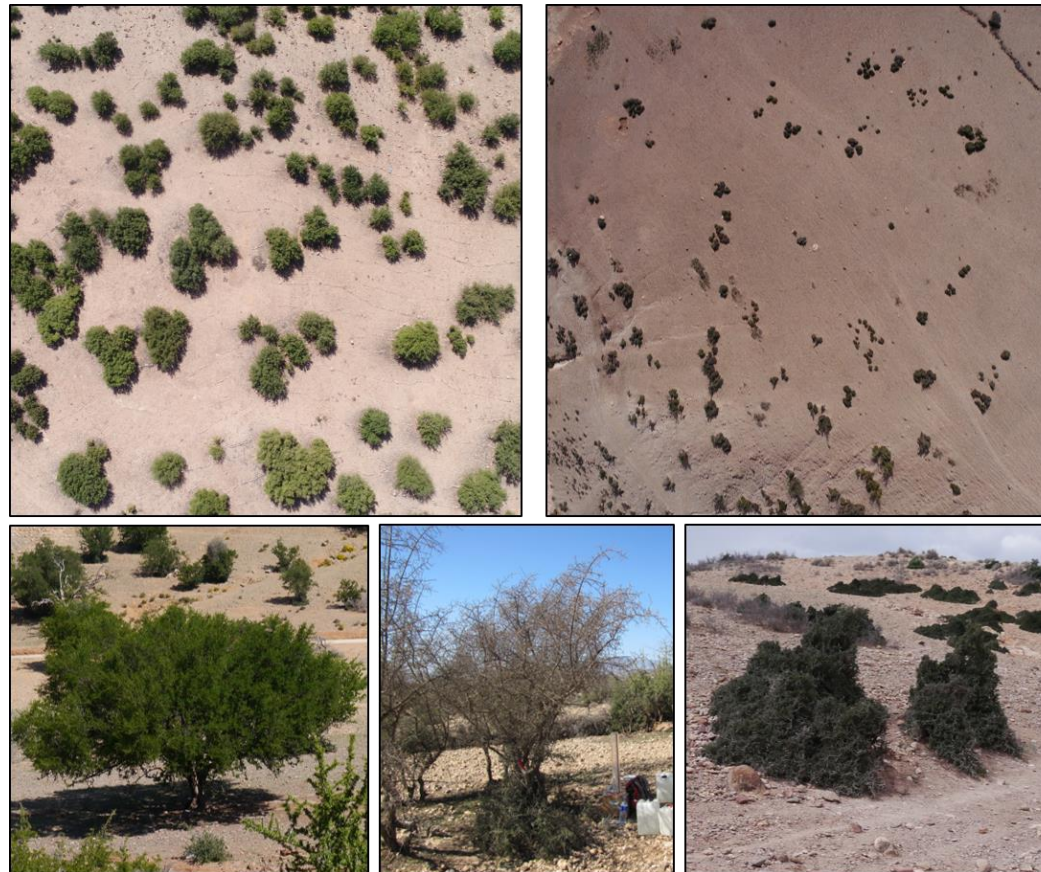
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The argan woodlands in South Morocco have been heavily degraded due to overbrowsing and overgrazing by goats, sheep and camels as well as intensification and expansion of agriculture.

Canopy-covered areas (tree areas) decrease while areas without vegetation cover between the argan trees (intertree areas) increase and are at higher risk of further degradation.



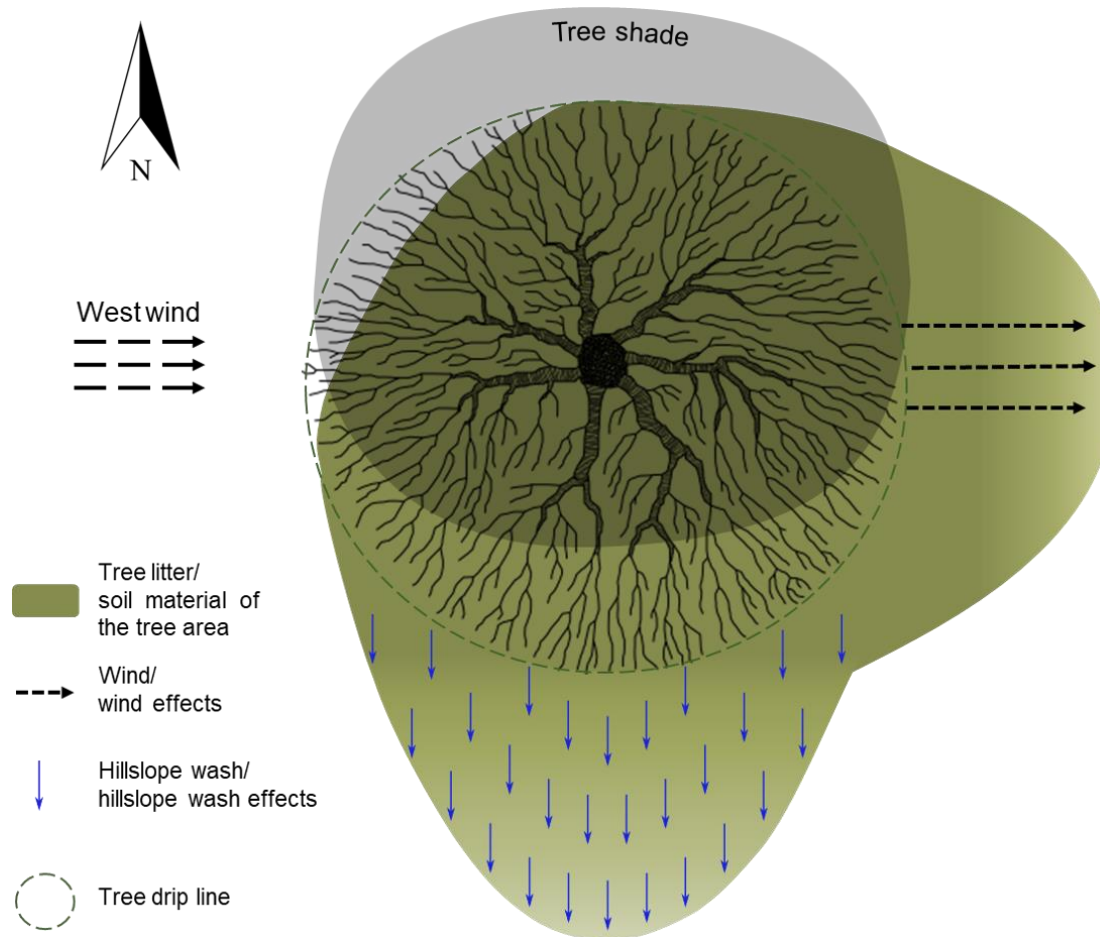
Difference in tree densities of undisturbed and heavily degraded sites (both images taken from 120 m height)

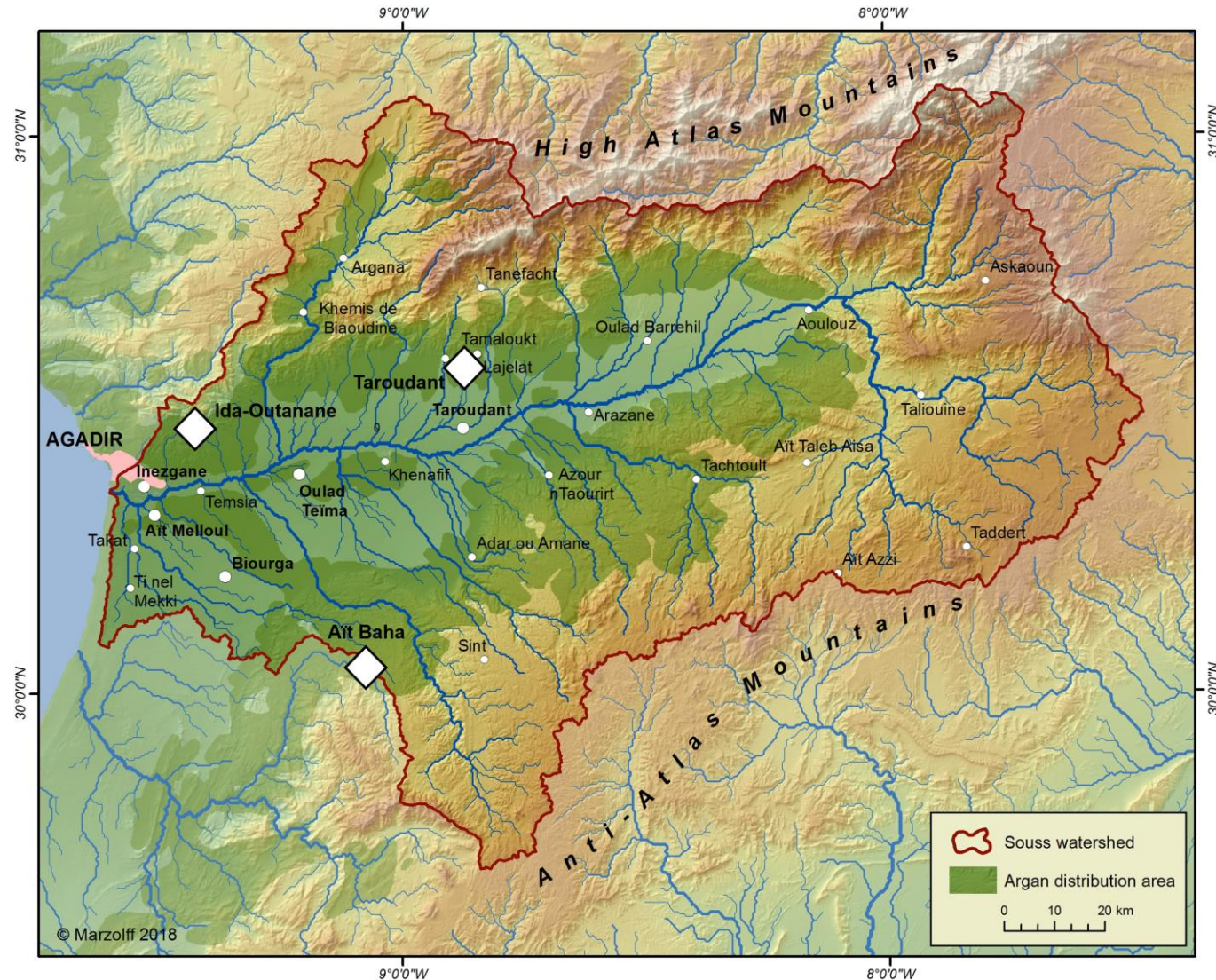
0 12.5 25 m

Degradation of tree architecture (Kirchhoff et al 2019).



Hypothetically, the argan-tree influences the intertree area to the east (due to wind drift), downslope (due to slope wash) and to the north (due to shade in the midday sun → higher soil moisture).



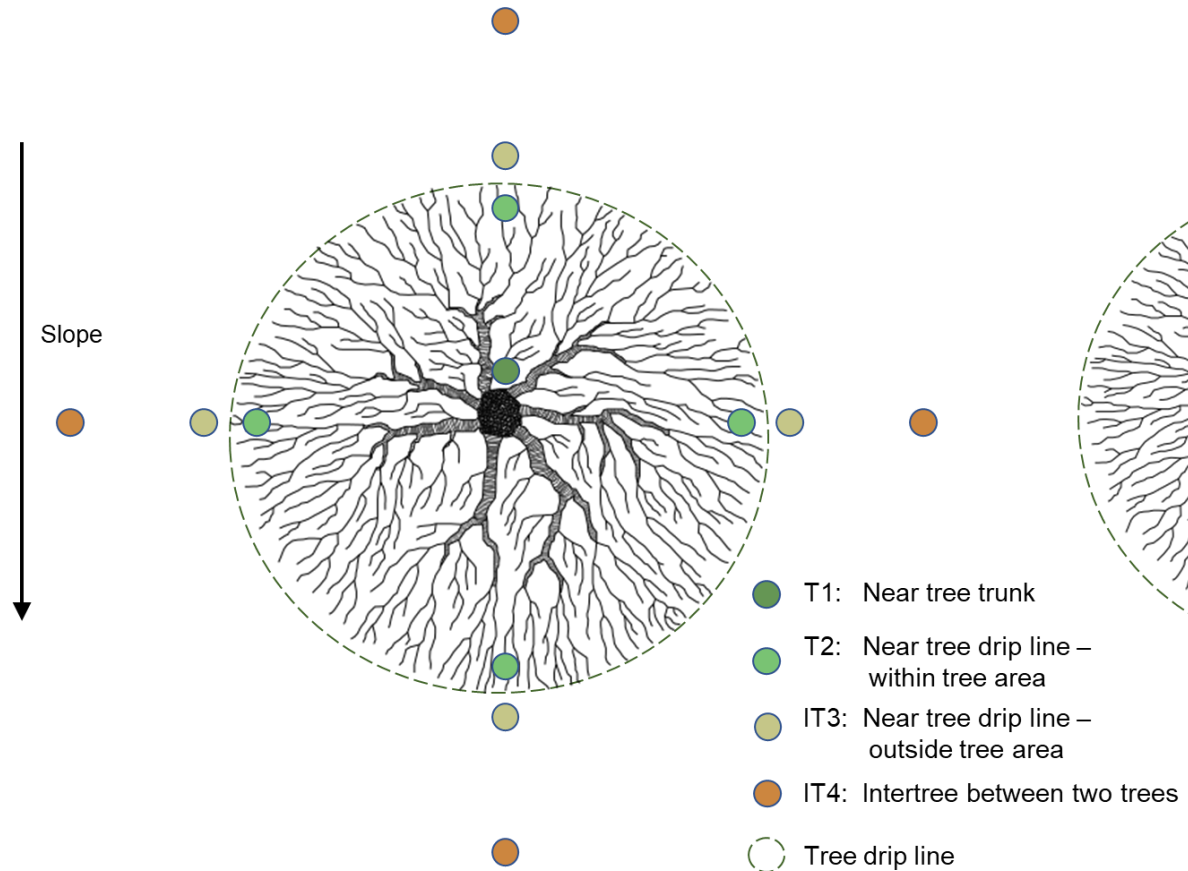


## 3 study areas in the Souss region

- Ait Baha:
  - Anti-Atlas
  - maritime climate
- Ida-Outanane
  - High Atlas
  - maritime climate
- Taroudant
  - High Atlas
  - continental climate



385 soil samples were taken in four directions from the tree area (near the tree trunk) to the intertree area (midpoint between two trees).



Samples were analysed for the parameters soil moisture, pH, electrical conductivity (EC), percolation stability (PS), nitrogen content (N), content of soil organic carbon ( $C_{org}$ ) and C/N ratio.

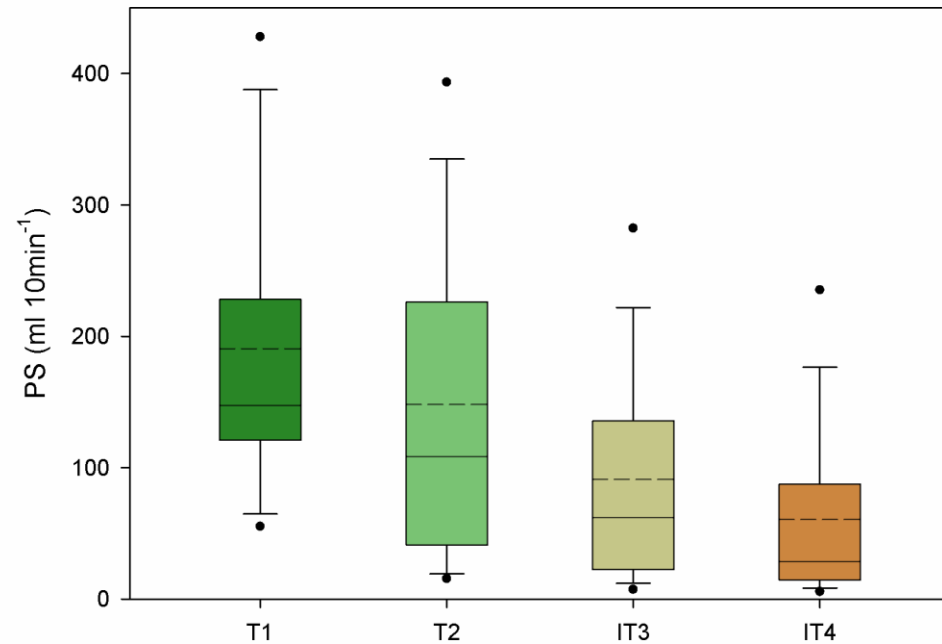
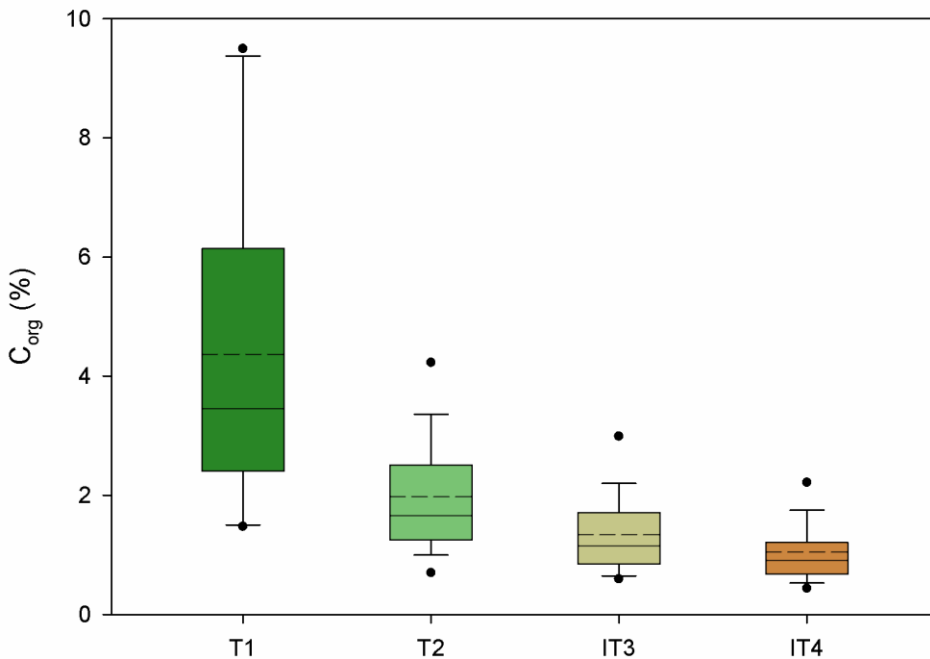


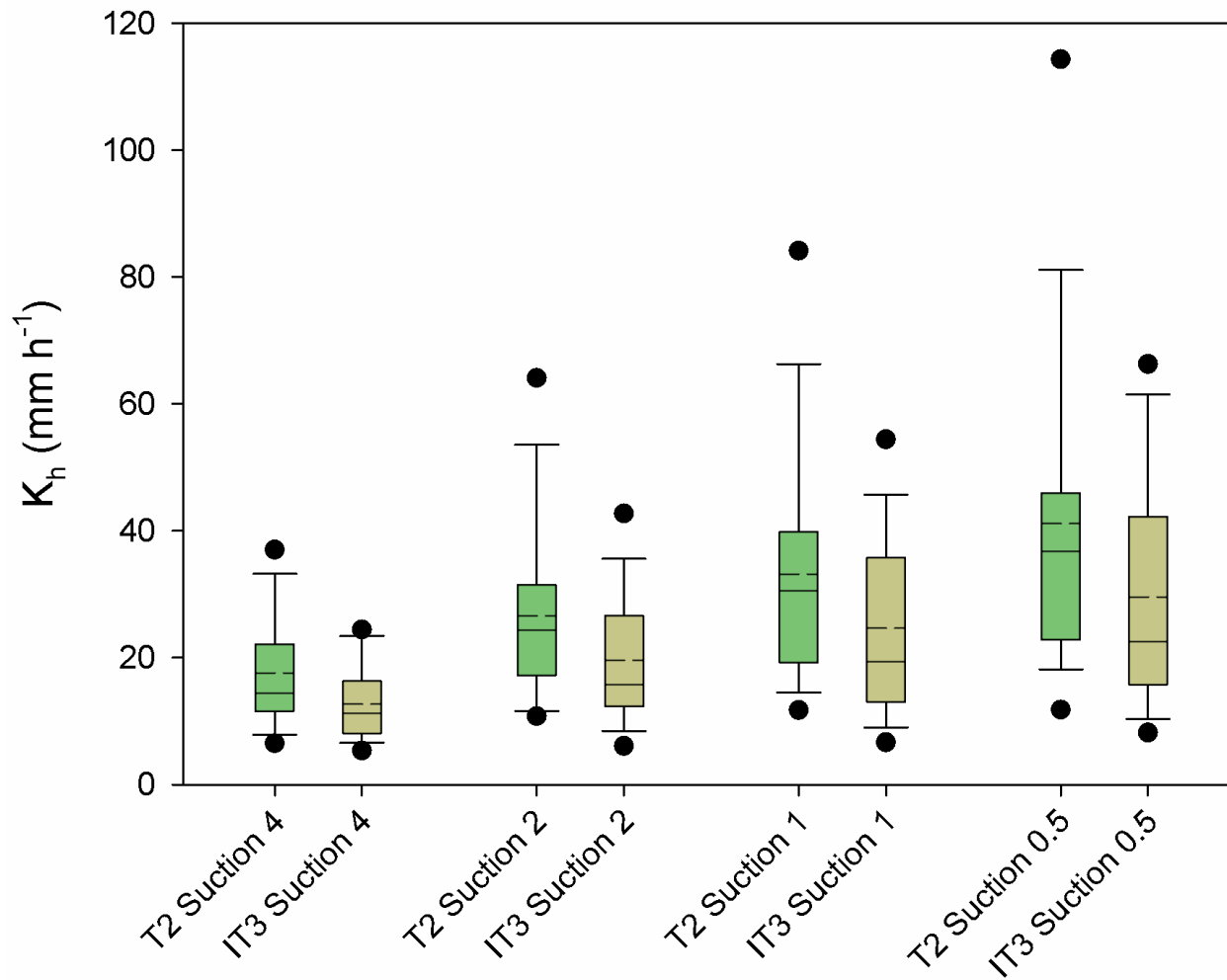
74 tension-disc infiltrometer experiments were performed overall for 19 out of 30 test sites at the T2 (near tree drip line, within tree area) and IT3 (near tree drip line, outside tree area) sampling locations to measure the unsaturated hydraulic conductivity ( $K_h$ ).





Exemplary results for content of soil organic carbon and percolation stability show a decrease of values from the trunk and along the tree drip line to the intertree area.





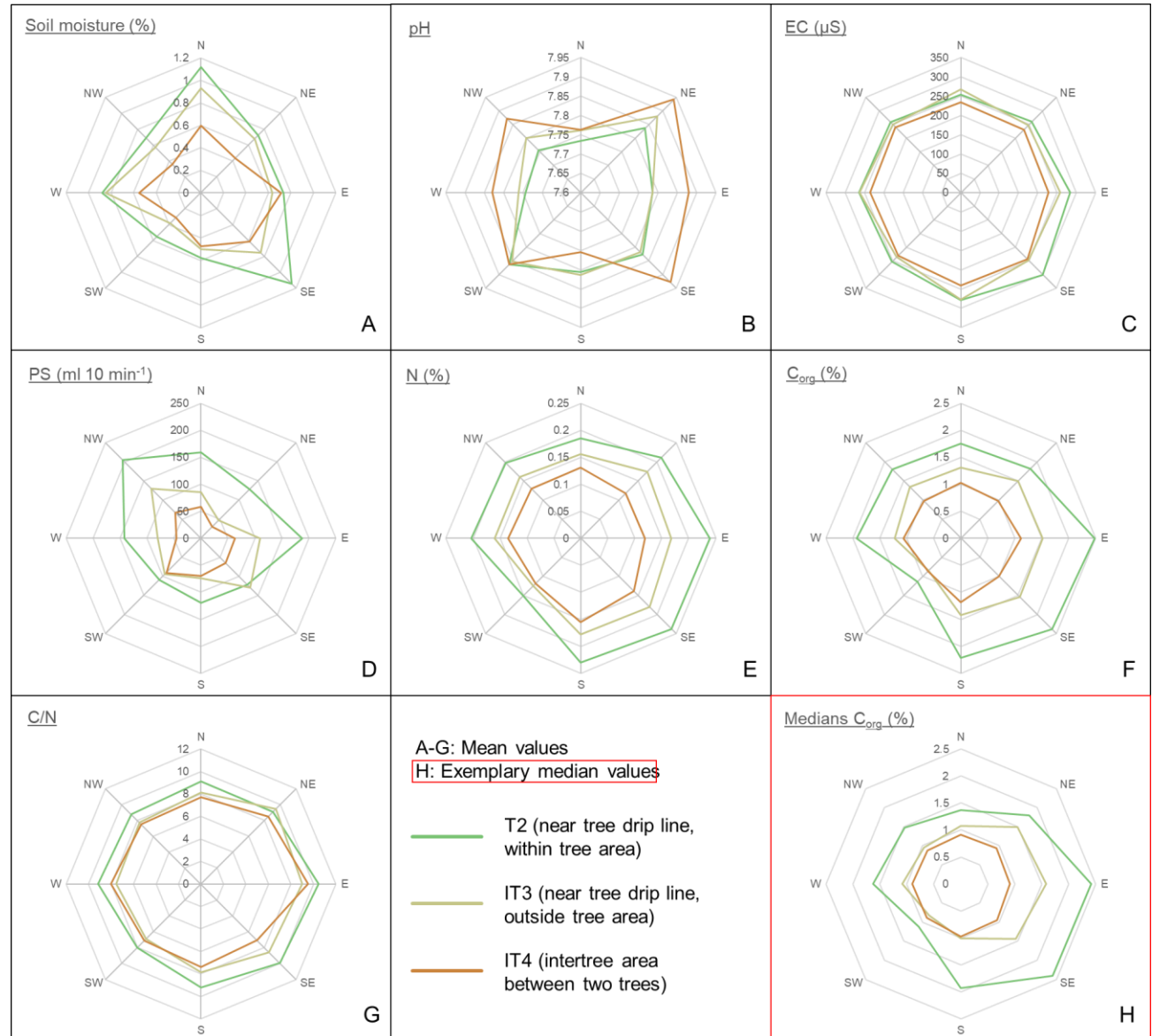
Results of the tension-disc infiltrometer experiments show higher unsaturated hydraulic conductivities under the crown than outside the crown although ~1 m apart.

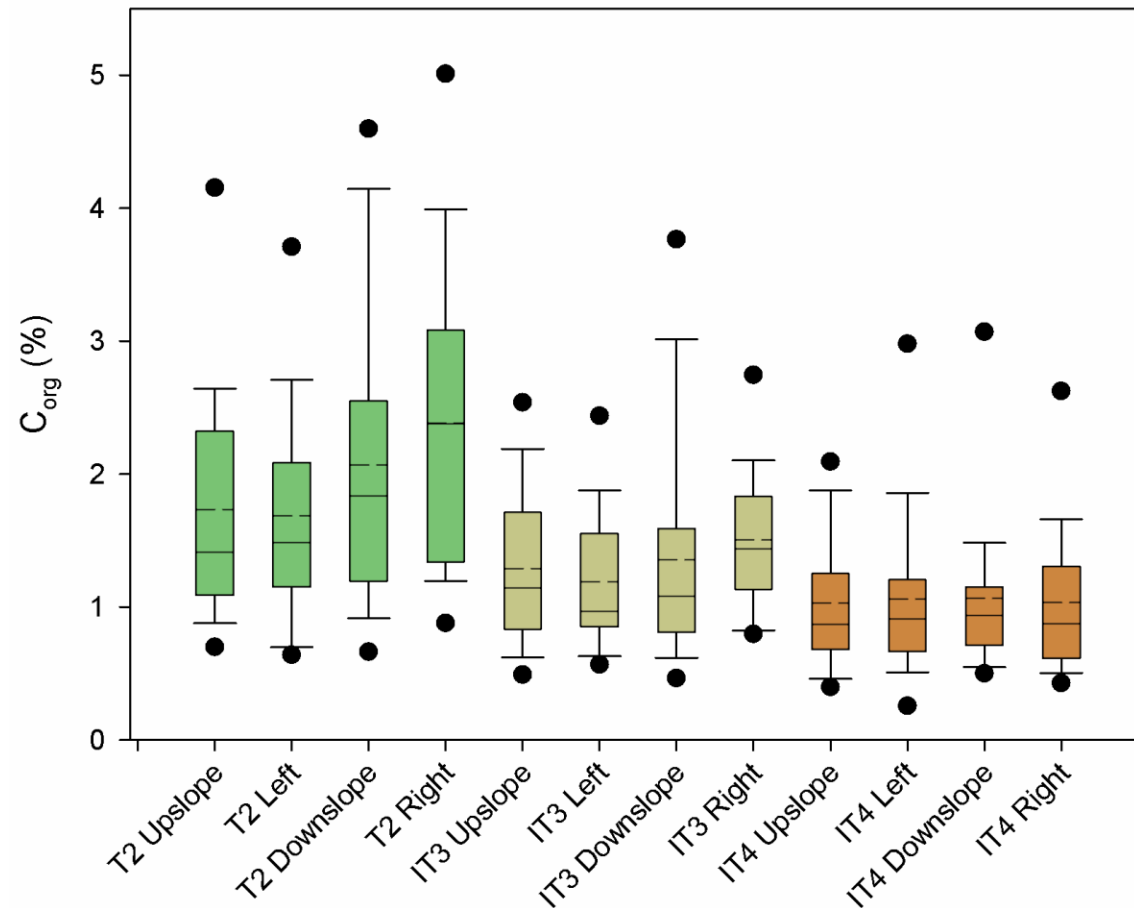


Directions of influence for the studied parameters.

Soil moisture shows highest values for T2 and IT3 in the North

Corg & N show highest values for T2 & IT3 to the East and South





Reorganisation of the data to show positions on the slope around the sampled trees: Upslope, left from the tree (view from downslope), downslope, right from the tree (view from downslope). Upslope = N in 19 out of 30 cases; Left = West in 16 out of 30 cases; downslope = South in 15 out of 30 cases, Right = East in 16 out of 30 cases.



## Conclusions

The influence of the argan tree is mostly limited to its tree area. The highest values for all parameters are found near the trunk.

The tree influences the T2, IT3 and IT4 sampling locations in specific directions:

- mostly to the east or downslope due to the translocation of litter or soil particles
- to the north with higher soil moisture values due to shade in the midday sun

Argan trees vary in size, degradation and genetic variety, which could be possible factors for litter production or protection of the soil and thus increase or decrease influence of the tree on the intertree areas.

For reforestation measures young sprouts should be planted close to trees in northern or eastern directions (higher soil moisture/higher Corg/N-content).

