Electrical Resistivity Tomography detection of vegetation water use

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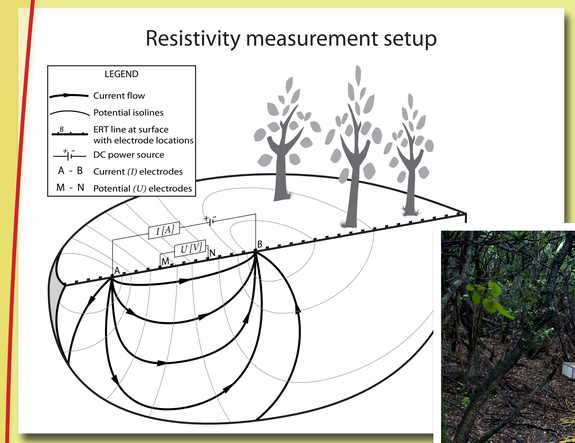
Vegetation growth in Mediterranean ecosystems is greatly dependent on soil moisture storage.

Commonly used methods for soil moisture detection do not provide information at a suitable scale and depth.

We used Electrical Resistivity Tomography (ERT) to detect vegetation water abstraction on shallow soils and rocky substrates at dephts down to 6 meters.



Method: ERT

Electrical Resistivity Tomography is based on the insertion of a controlled direct electrical current (DC) into the ground through electrodes, and measuring the created potential field.

With computer tomography, measurements of many electrode combinations are combined into a spatial resistivity image. We used an array of 28 electrodes at 1 meter spacing, resulting in a maximum investigation depth of 6 meters.

Study area

The study area is part of the 'la Peyne' catchment in Mediterranean France and is covered with secondary natural vegetation. Most common plant types are sclerophyllous and evergreen.

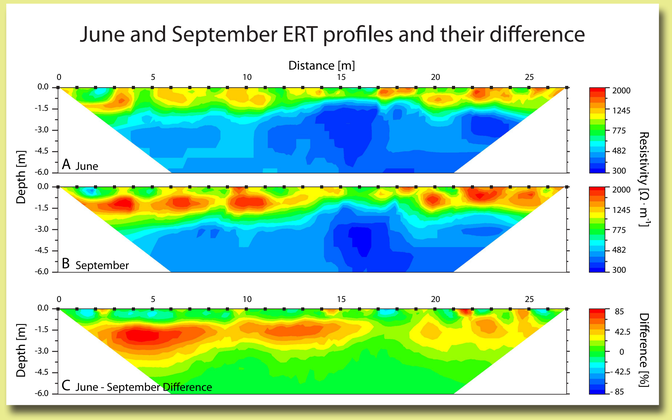
Trees as *Q.ilex* and *A.unedo* are known to have extensive root systems, but the rocky soils prohibit in-situ measurements of rooting depth and water availability.

There are four important types of geology in the area: Flysch, Basalt, Calcareous sandstone and Dolomite.

Time lapse profiles

ERT is sensitive to both hydrology, and differences in density and lithology.

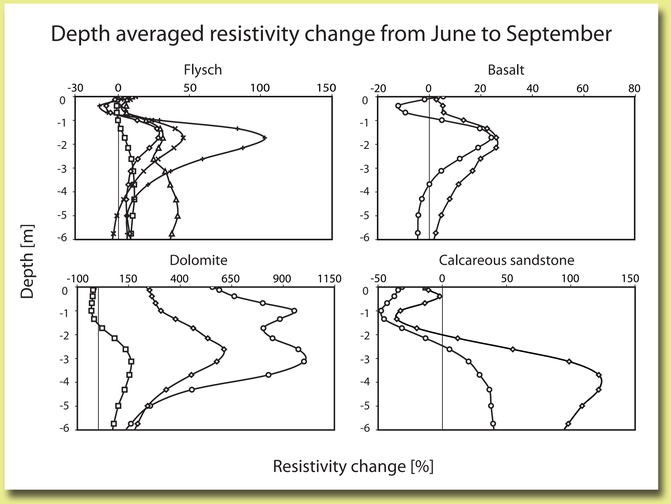
Using ERT profiles taken before and after the dry summer period we separated the stationary lithology from the more dynamical hydrology. With this technique we could accurately determine the depth of vegetation water abstraction.



Geological substrates

We found a strong relation between the geological substrate in the study area and the measured ERT profiles.

Commonly, a three layer profile was visible, with a highly variable top layer, a 3-5 m thick layer with summer water abstraction, and an invariable base. The depth of each layer differed strongly between the geological units.



Conclusion

Using ERT, we show that although soils in the study area are very shallow, tree roots penetrate deeply into the fractured bedrock and abstract water during the summer.

This information is crucial for understanding vegetation development in Mediterranean ecosystems and was inaccessible using any other available method.

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