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Evapotranspiration components of pine (Pinus brutia) trees in a Mediterranean ecosystem

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One of the most deterministic aspects of water consumption in Mediterranean ecosystems is evapotranspiration, which accounts for returning a large fraction of precipitation into the atmosphere.
Pine trees as an indigenous species play an important role in the soil water balance in these ecosystems.
The main objective of this study is to simulate the contribution of evapotranspiration components of pine
(Pinus brutia) in the water balance. The research includes a comprehensive sensitivity analysis and model
calibration. The field study is located in Athalassa Forest Park in Cyprus. The 10-ha field is covered by a
combination of seasonal vegetation and indigenous trees and shrubs, with a 5 to 6-m planting distance.
The site is relatively flat with a mean slope of 4% and an average annual rainfall of 315 mm.
Pine tree evapotranspiration components were modeled using a one-dimensional NOAH-MP land surface
model (one grid cell). Due to incomplete knowledge about the extent of the tree roots (root zone area),
we modeled the grid cell in three different scenarios according to tree density (the distance between
trunks, 5-6 m), tree canopy area (7.5 m2 on average), and leaf area index (LAI = 2.5 on average) to represent our field study in the model. We analyzed the sensitivity of all modeled water balance components, namely, evapotranspiration (evaporation from bare soil, transpiration, and evaporation
from the canopy), runoff (surface and subsurface runoff), soil moisture change of the soil column to all
related soil and vegetation input parameters, using a local sensitivity analysis. We also examined the
impact of the number of soil layers with roots, different soil layers thicknesses, and the slope of the area
on the model outputs (water balance components). The results showed that NOAH-MP is capable

of
representing a semi-arid Mediterranean ecosystem.

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