

Ecohydrology of CAM plants: environmental co-benefits for agroecosystems



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May 7, 2020

Photosynthesis and water use efficiency



Agave,
prickly pear



Sugarcane,
sorghum,
corn



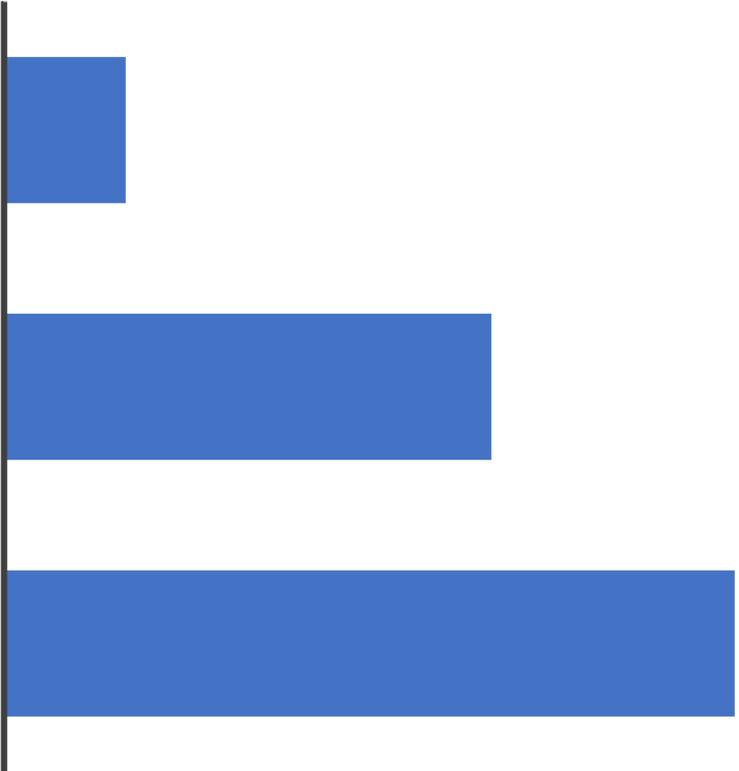
Wheat,
rice

PHOTOSYNTHETIC
TYPE

CAM

C4

C3



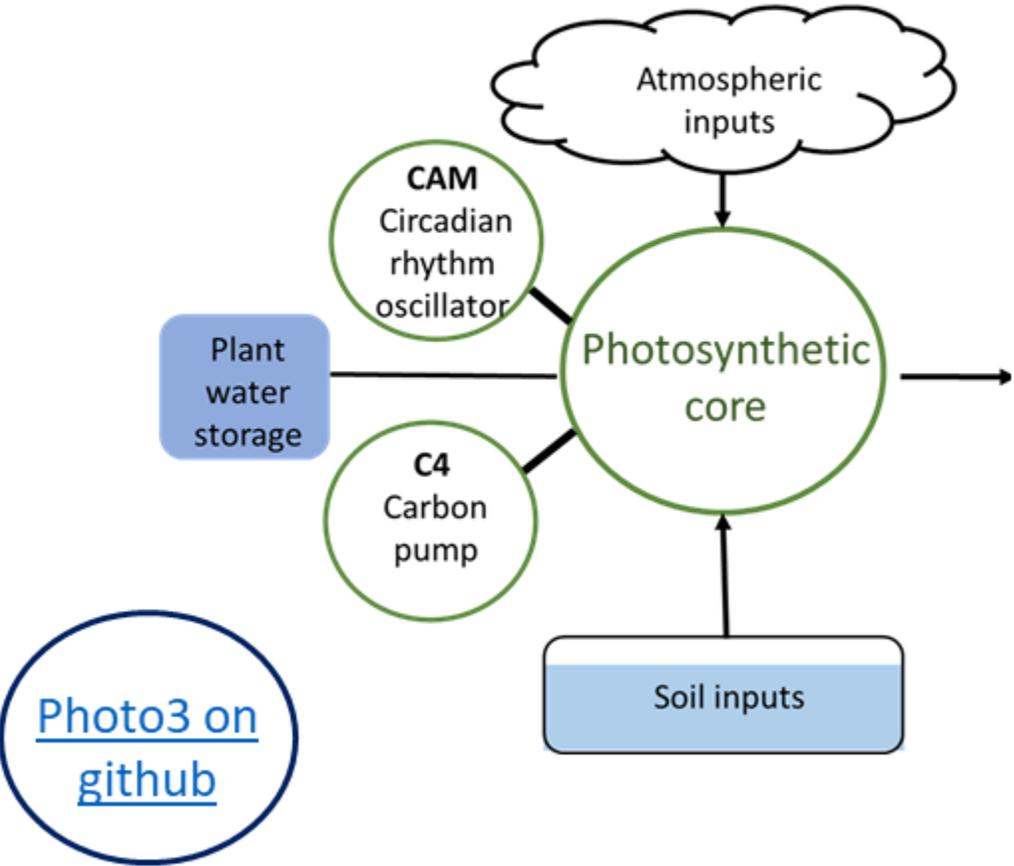
WATER USE PER UNIT C



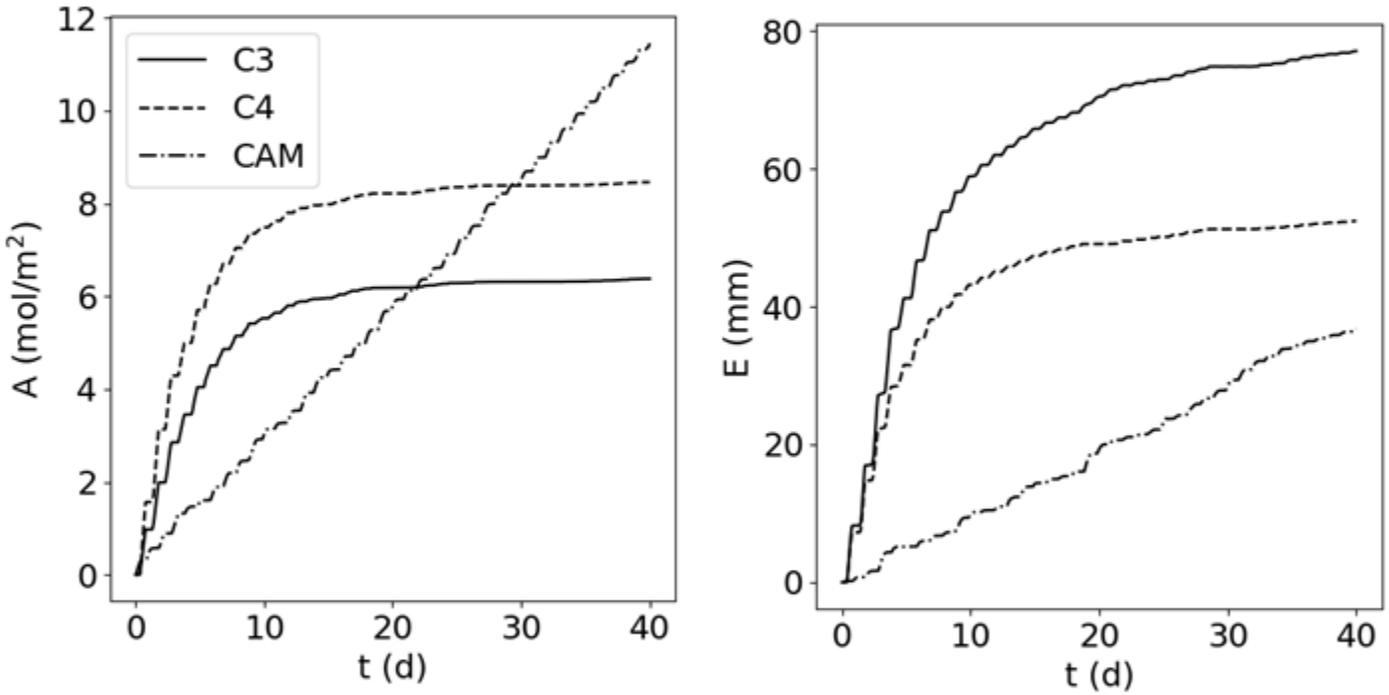
For an analogy and description of the pathways, see Hartzell et al. (2018) PLOS ONE 13(6), [e0198044](https://doi.org/10.1371/journal.pone.0198044).

Modeling the impact of water stress on C3, C4, and CAM

Photo3 model



Comparing C3, C4, and CAM in drydown



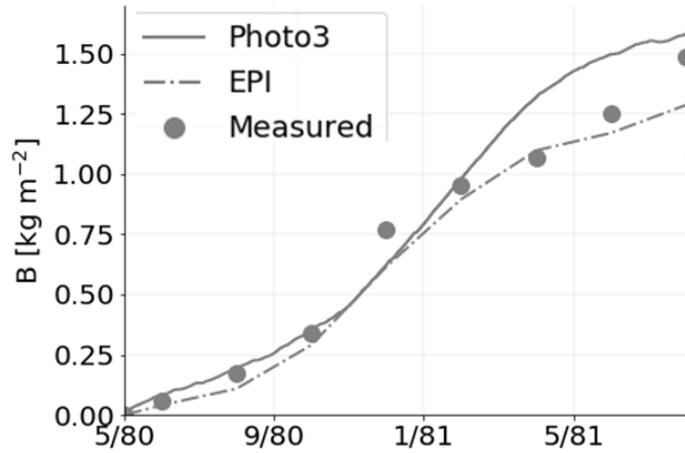
$$A_c = A_{\phi, c_m, T_l}(\phi, c_m, T_l) \times f_{\psi_l}(\psi_l)$$

Calvin cycle carbon demand Farquhar model Water stress function

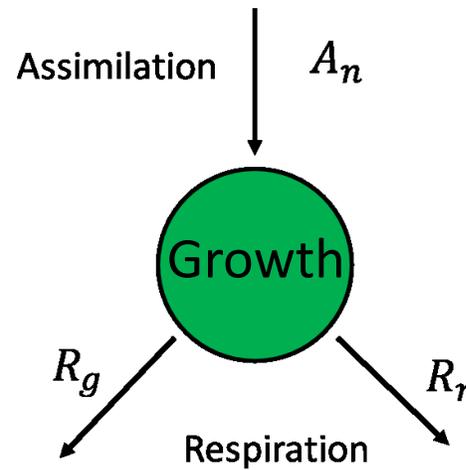
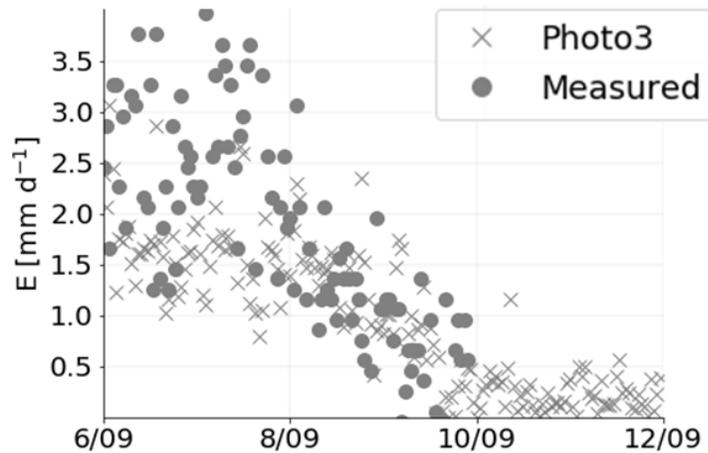
Hartzell et al. (2018) *Ecological Modelling*, 384, [10.1016/j.ecolmodel.2018.06.012](https://doi.org/10.1016/j.ecolmodel.2018.06.012).

CAM productivity and water use in the field

Productivity
(Til Til, Chile)



Transpiration
(Sicily, Italy)



$$\frac{dB}{dt} = A_n - R_r - R_g$$



Productivity: discrepancy between Photo3 and EPI models



O. ficus-indica

Environmental co-benefits for agroecosystems

CAM crops perform consistently. Under low annual rainfall and/or high hydroclimatic variability they can...

- increase agricultural productivity and provide social benefits
- benefit soil nutrient levels and erosion control
- provide carbon sequestration in soils and biomass which surpasses that of traditional methods

