

NNH18ZDA001N-ECOSTRESS: Merging ECOSTRESS with field data in the highest uncertainty water use efficiency regions in the world

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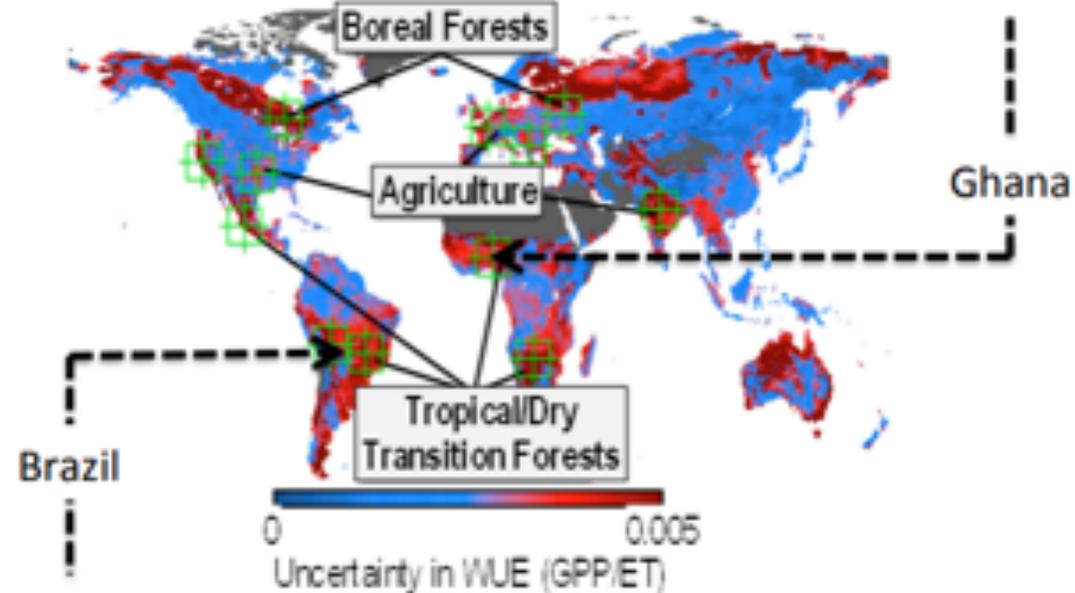


Part 1 - *Validate WUE and canopy temperature in Brazil and Ghana*

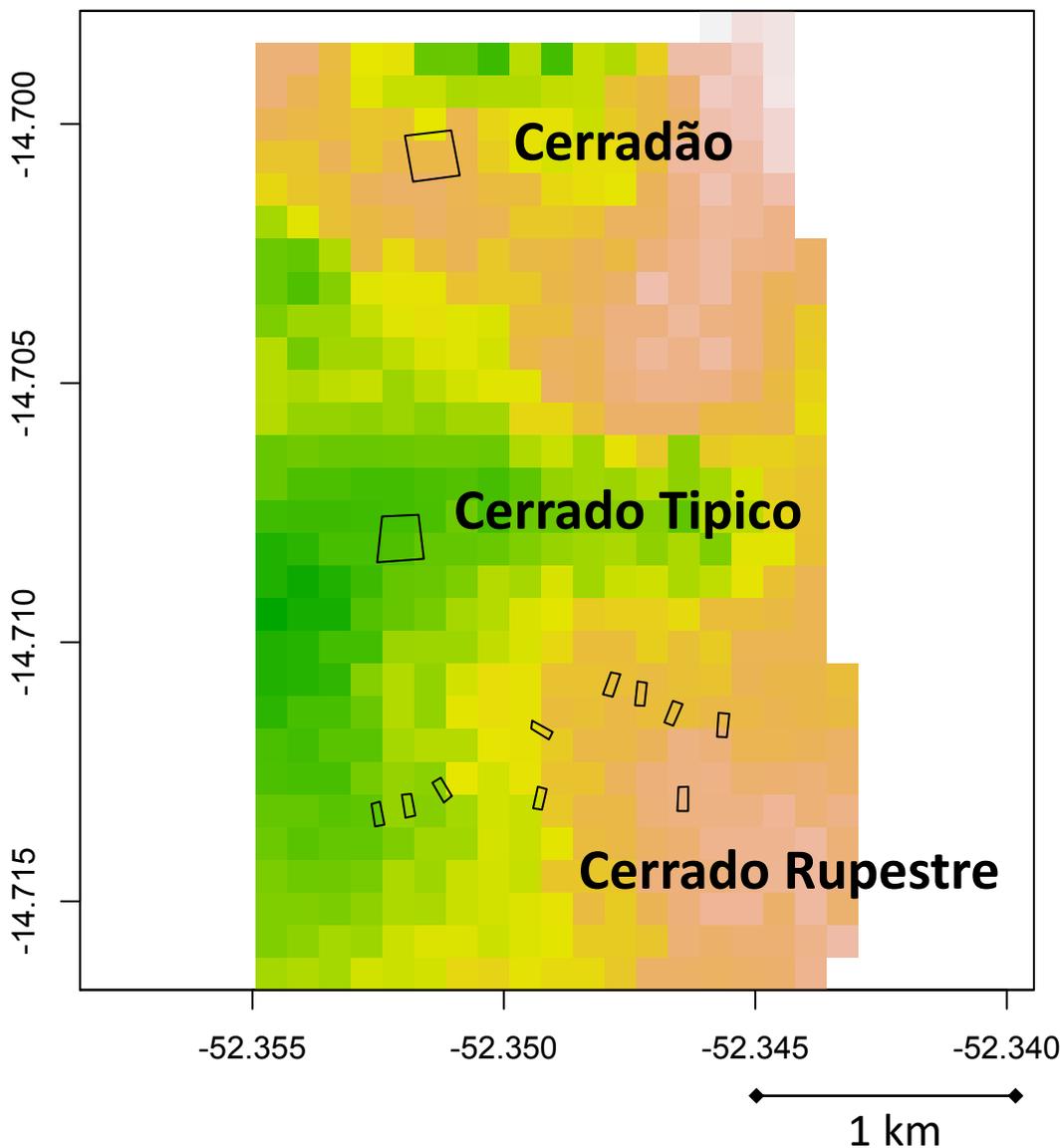


Relevant Leaf Trait Measurements

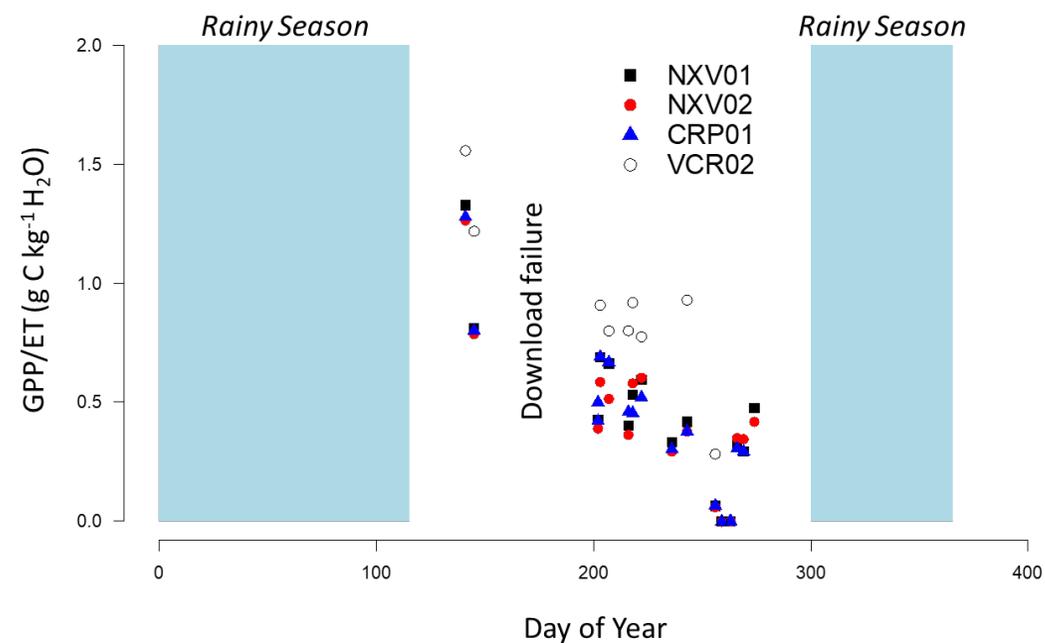
Tissue Samples (Macronutrients/Isotopes)
Thickness and Dry Matter Content
Specific Leaf Area
Visible-Near Infrared Reflectance
Stomatal Conductance
Photosynthesis (Saturated/Maximum)
 V_{cmax} and J_{max}
Transpiration
Leaf Area - Sapwood Ratio
Venation Patterns
Turgor Loss Point



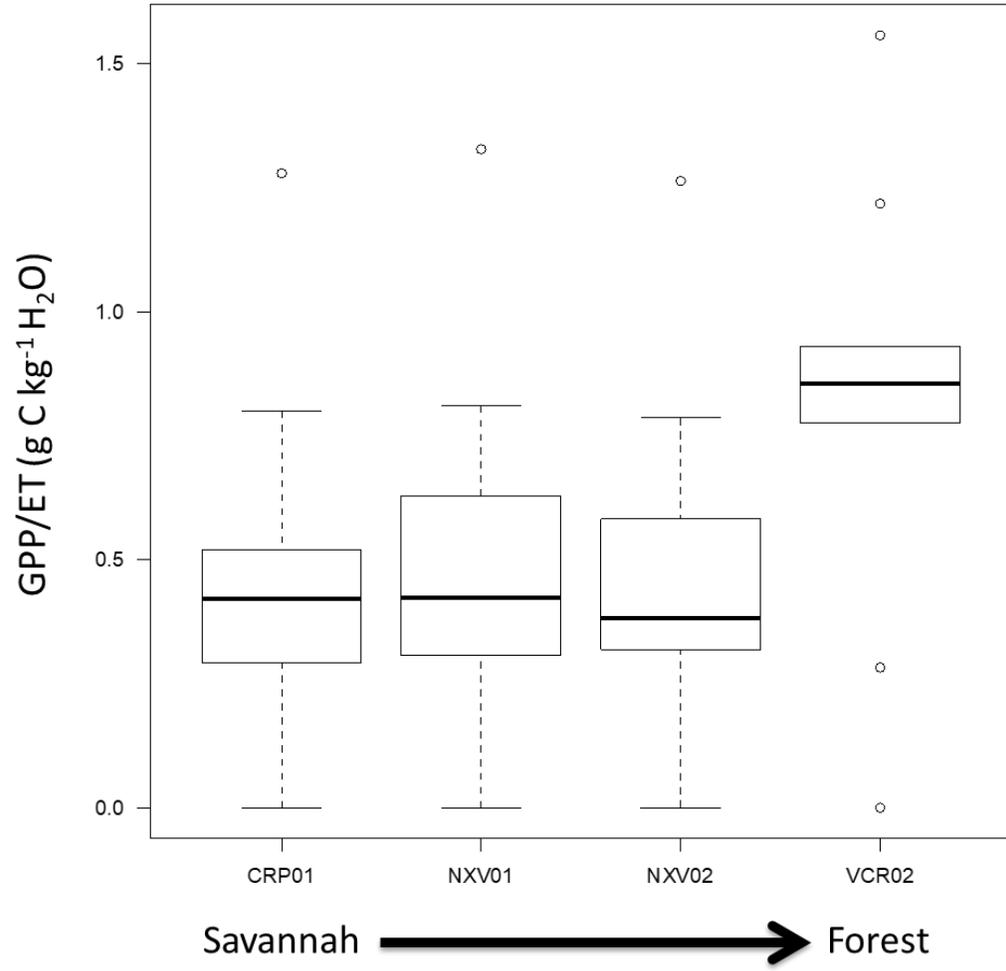
Part 1.1 Validate WUE in tropical forests



1st Results – GPP/ET Time Course Among Sites

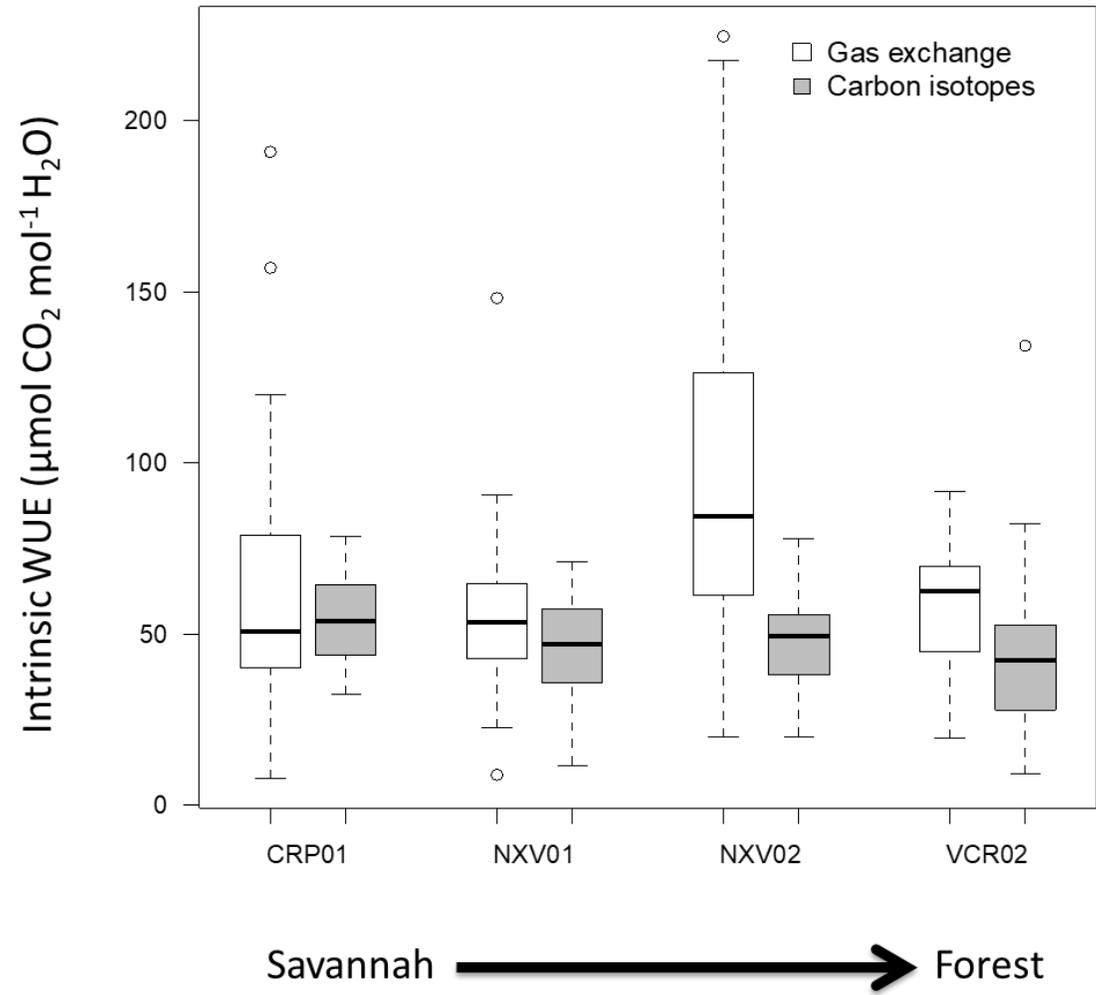


ECOSTRESS GPP/ET



1st Results – iWUE from Gas Exchange vs. Isotope

Next Step: Convert all WUE to g_1 to make it comparable per Medlyn et al. (2007)



C-13 Leaf Isotopes = WUE



Part 1.2 Validate canopy temperatures in tropical forests

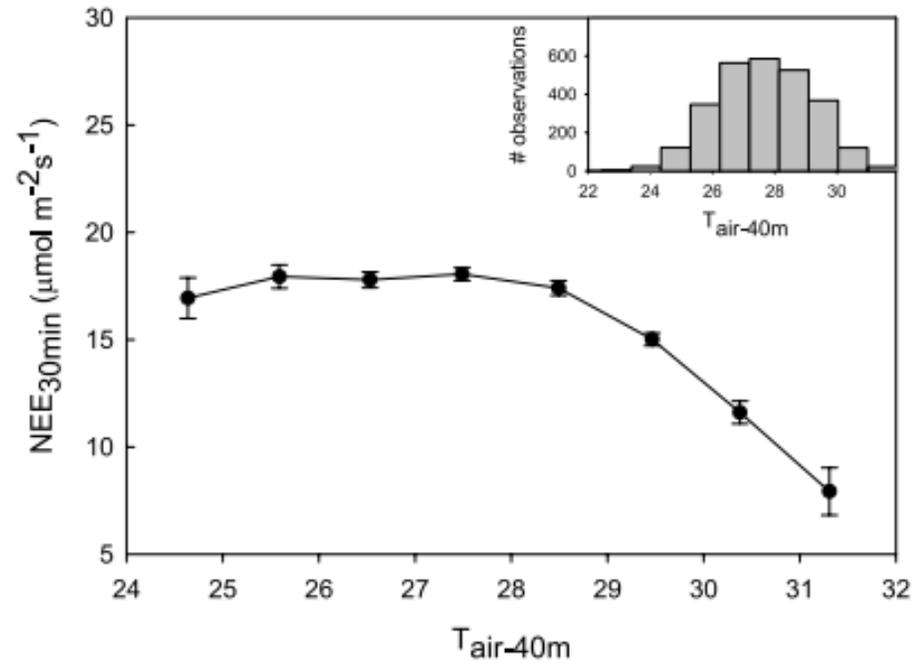
- Are tropical forests near a high temperature threshold?
- Do leaf traits determine canopy temperatures?



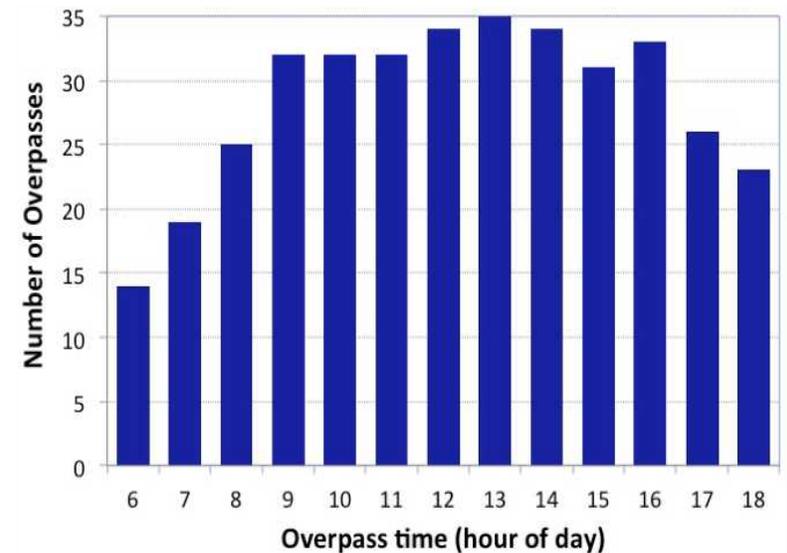
O-18 Leaf Isotopes = Canopy Temperature

$$\Delta^{18}\text{O}_{es} = \varepsilon^* + \varepsilon^k (\Delta^{18}\text{O}_v - \varepsilon^k) \frac{e_a}{e_i}$$

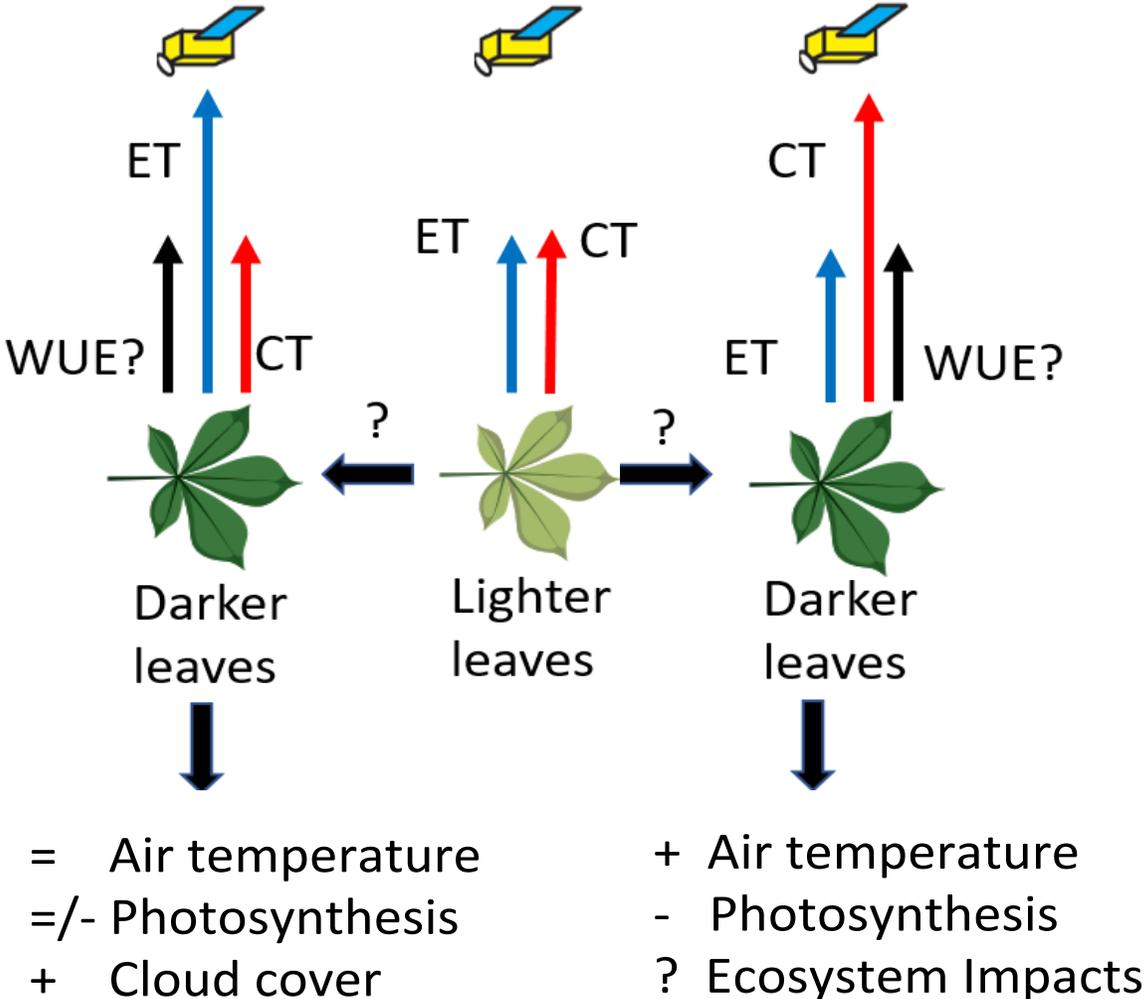
See lightning talk by Jenna Keany



Doughty and Goulden 2008

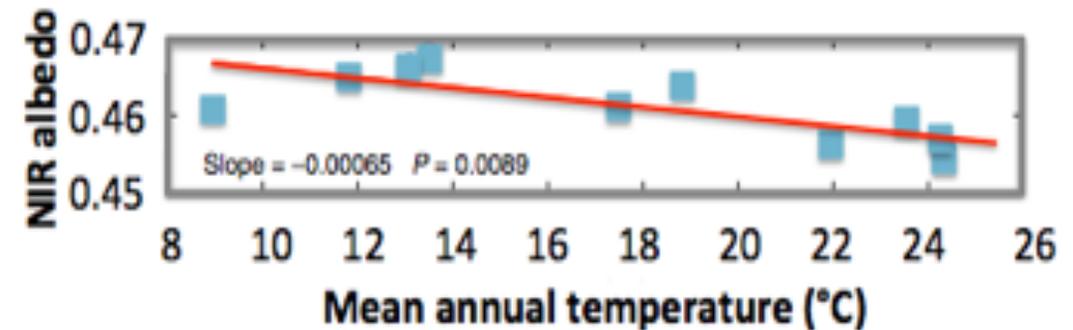
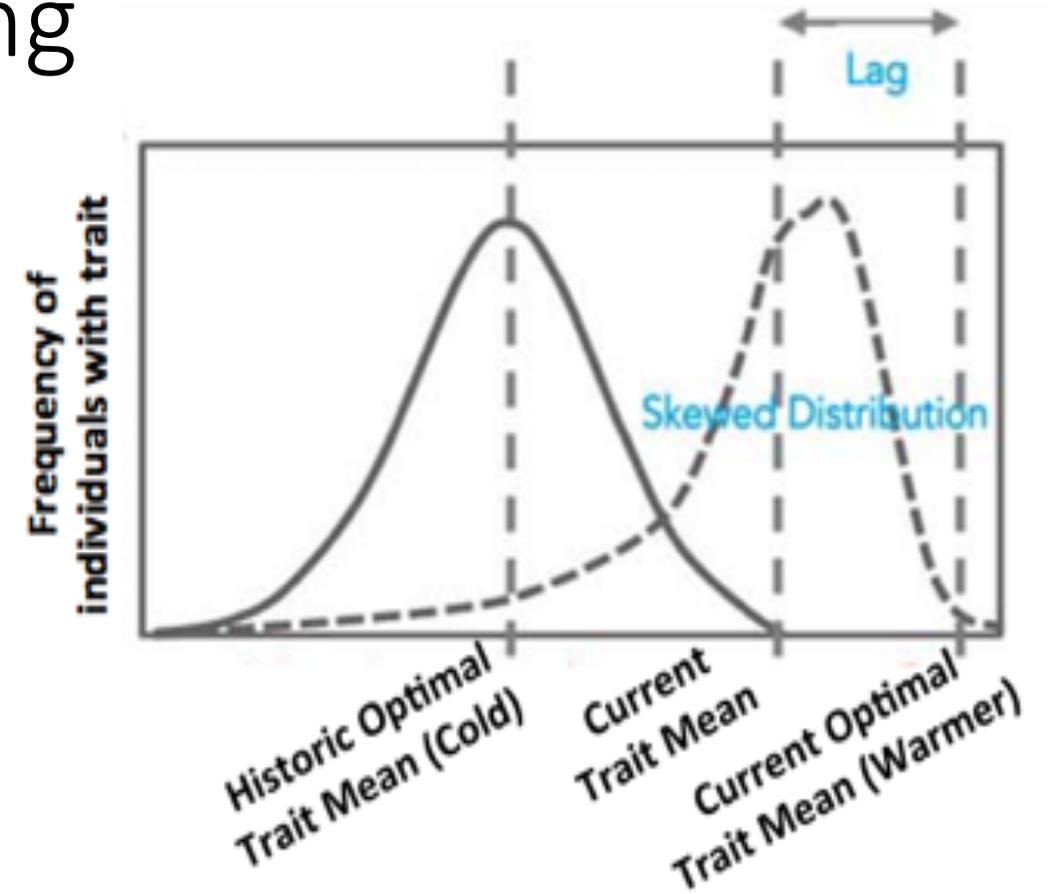


Part 2 – Will a decrease in leaf or canopy albedo increase evaporation or canopy temperature?



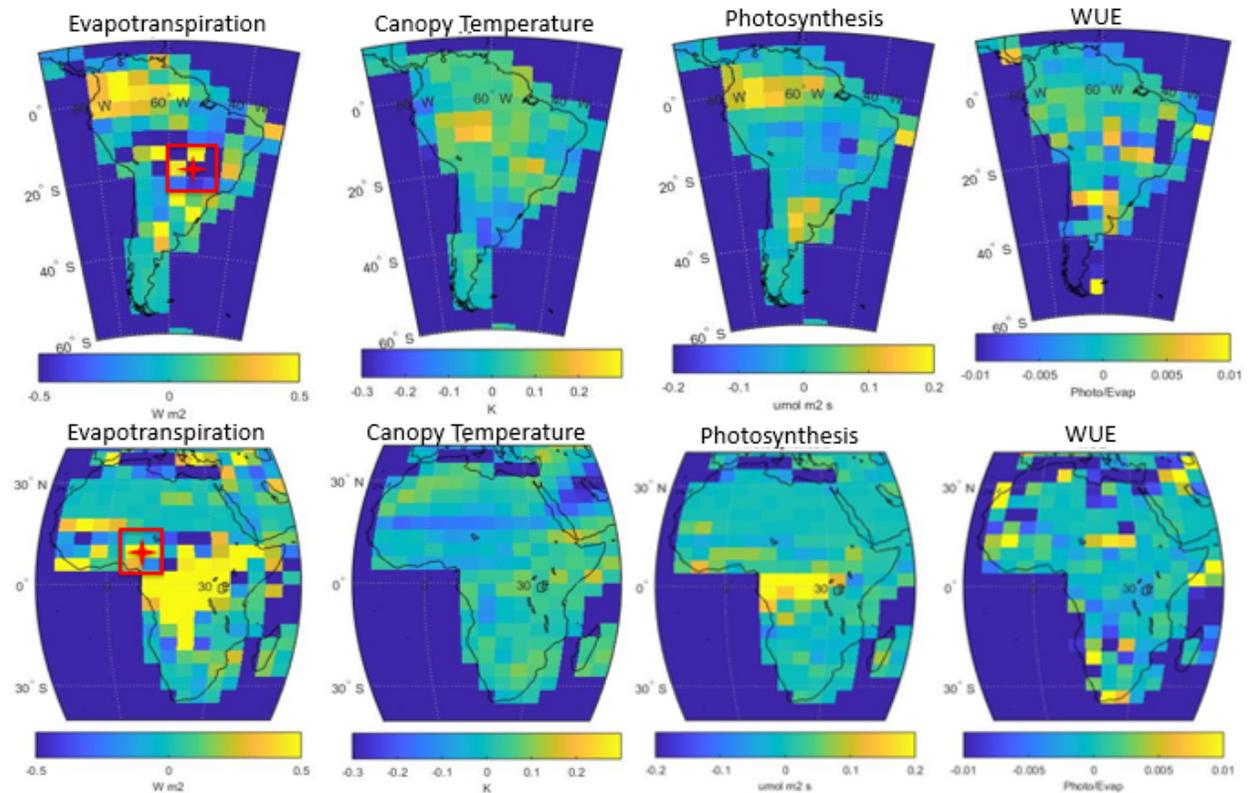
Leaf traits like LMA are changing in response to climate change

- LMA is tightly correlated to leaf reflectance properties.
- We predict in a warmer world, leaf NIR albedo will decrease (tropical leaves will darken).



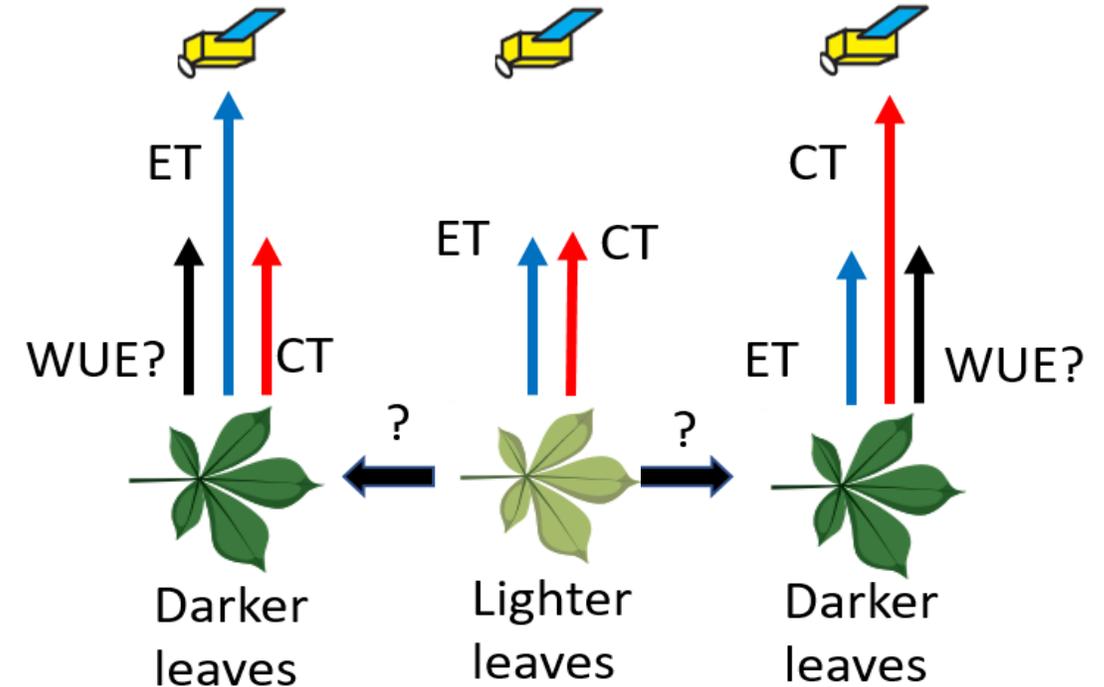
Climate simulations currently predict that as albedo decreases evapotranspiration (ET) will increase

- More ET leads to more bright clouds and no net change in planetary albedo
- However, if, in contrast, canopy temperature increases we could have a drastically different future
- Empirically, we do not know how albedo impacts ET and canopy temperature in the tropics



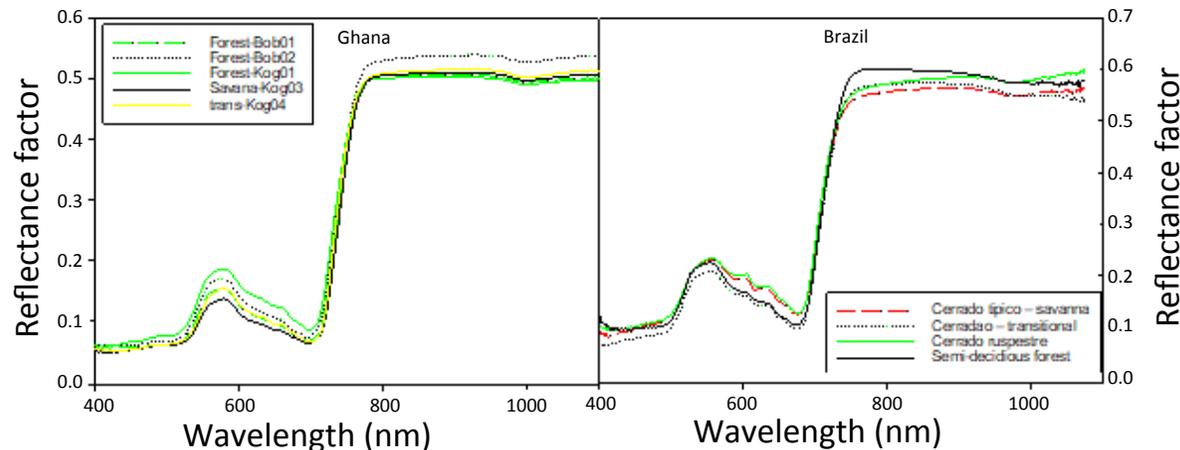
Use Ecostress + leaf trait data to understand how changes to canopy albedo will impact Bowen ratio

- How does leaf-level albedo affect plant water use with respect to ET and WUE?
- What are the plot-level effects of contrasting albedo, but similar forest characteristics, on canopy temperature and ET measured by ECOSTRESS?

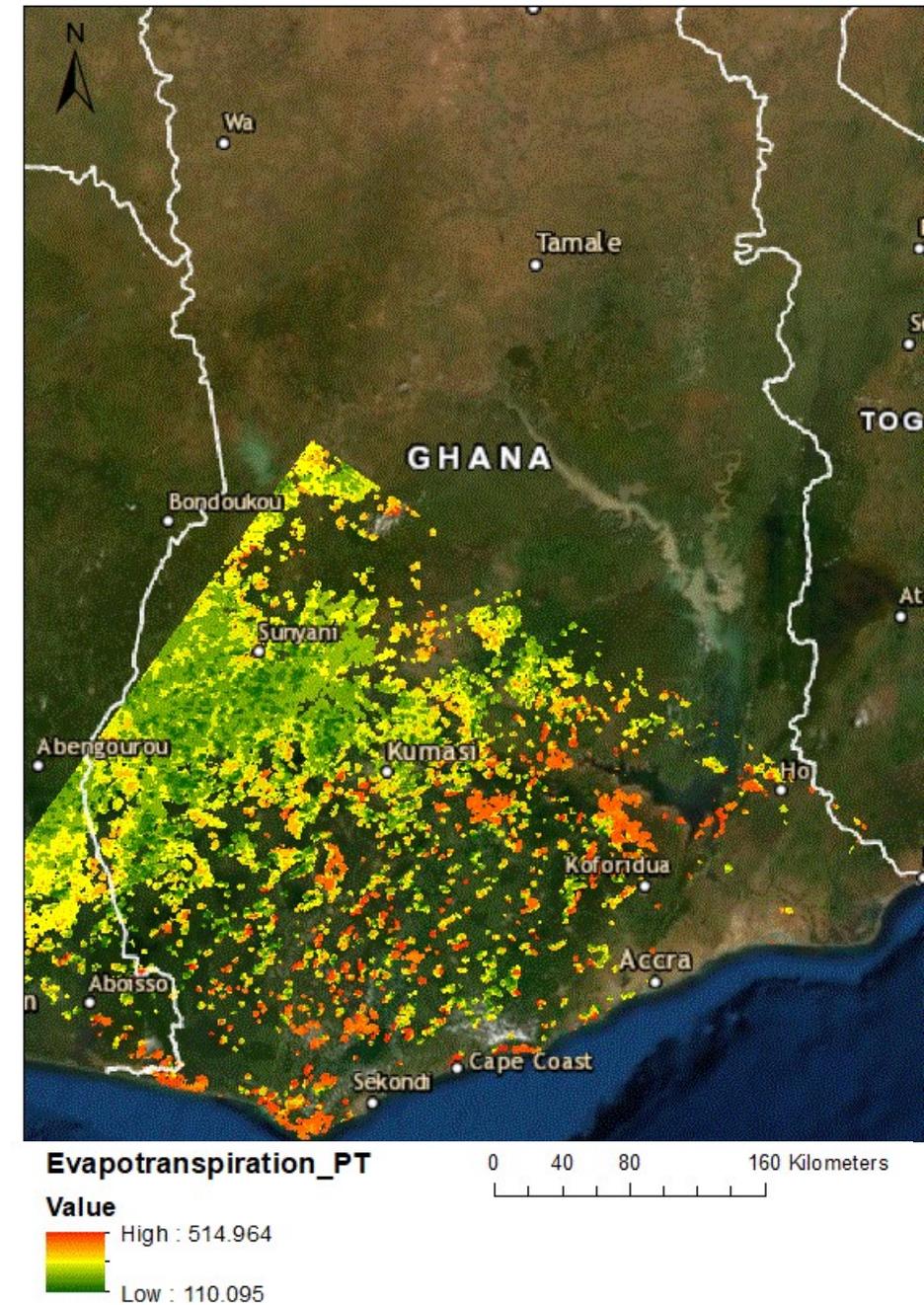
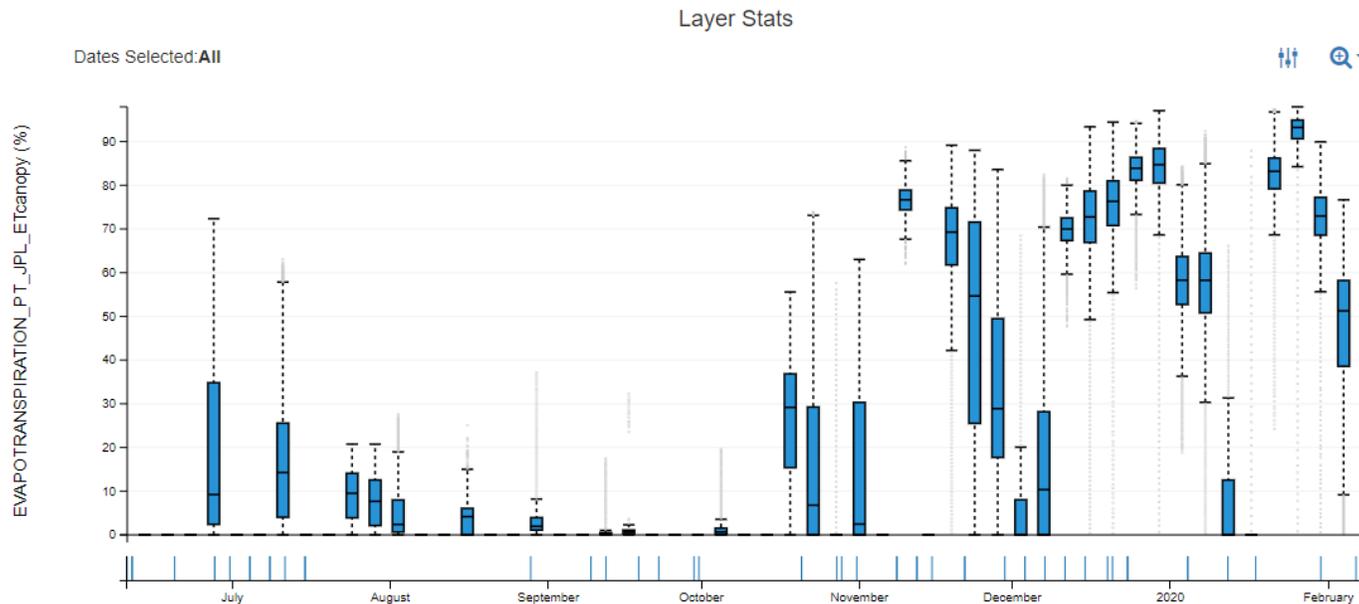


= Air temperature
 =/- Photosynthesis
 + Cloud cover

+ Air temperature
 - Photosynthesis
 ? Ecosystem Impacts

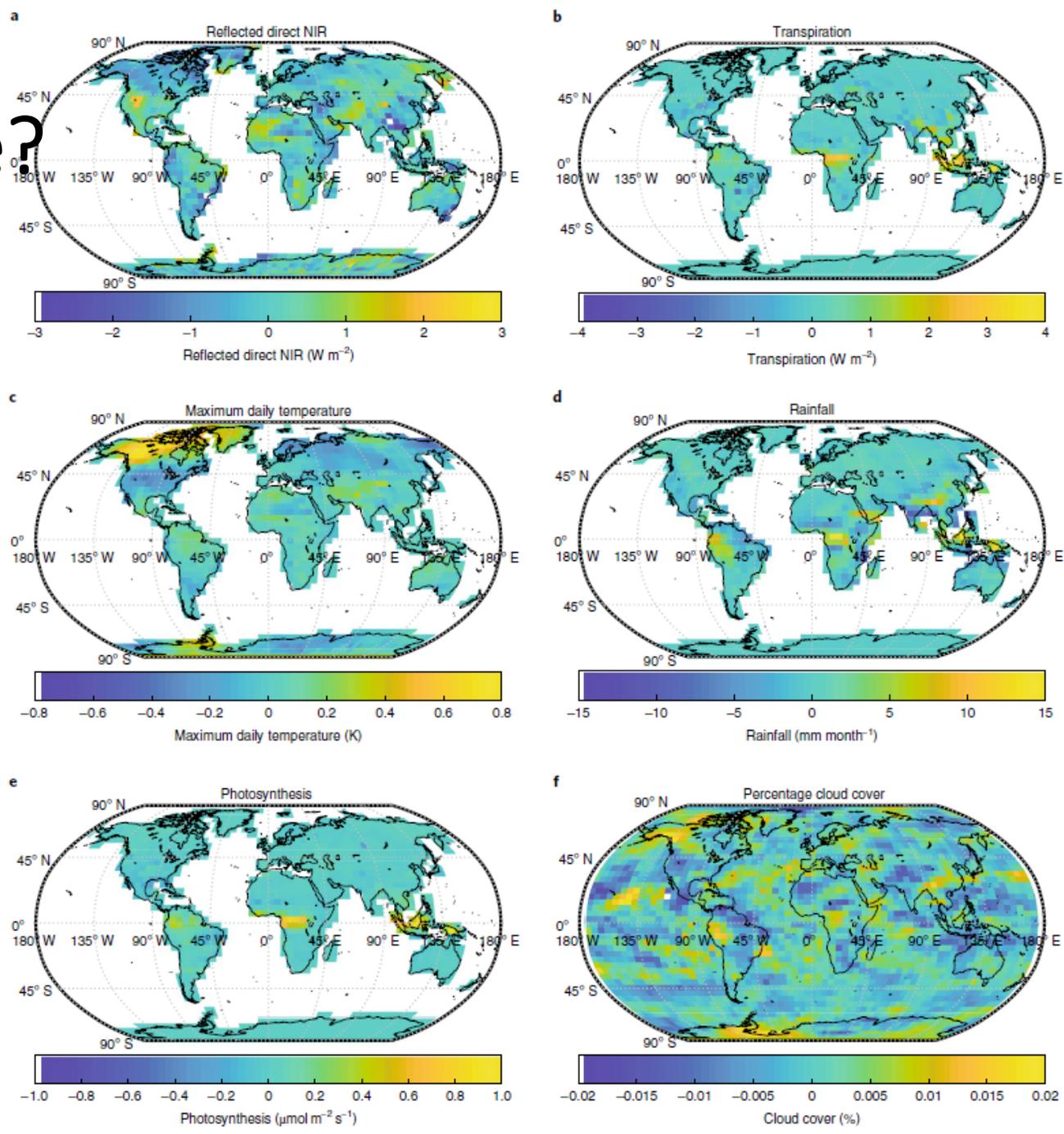


Compare albedo to ECOSTRESS canopy temperature and ET for all Ghana and Brazil.



How will darker tropical leaves impact global climate?

- We will rerun our ESM simulations parametrized by our continental scale ECOSTRESS data
- We will better understand how potential future albedo changes will impact global climate



Questions?

We acknowledge support for our project (NNH18ZDA001N) from NASA

