

Introduction

E1: With added heat trapped in the atmosphere, we're seeing changes to the environment. When plants photosynthesize, they open their stomatal pores to take in CO₂ and release H₂O. This flow of gasses is called stomatal conductance. The release of H₂O is called transpiration. As Earth warms, plants need to conserve more water, but will also lose H₂O faster when they open their stomatal pores.¹ We do not know what to expect from the change in these stressors.

E2: Photochemical reflectance index (PRI) calculates the change in the 532nm wavelength. This is associated with the xanthophyll cycle, which gives information on plant stress.³ Along with this, plants don't open their stomatal pores when they're stressed.¹ This has led to the theory that PRI and transpiration are related.

Objectives

This study aimed to assess:

E1: the relationship of transpiration data between a thermal imagery method and the standard method.

E2: the relationship between transpiration and PRI data.

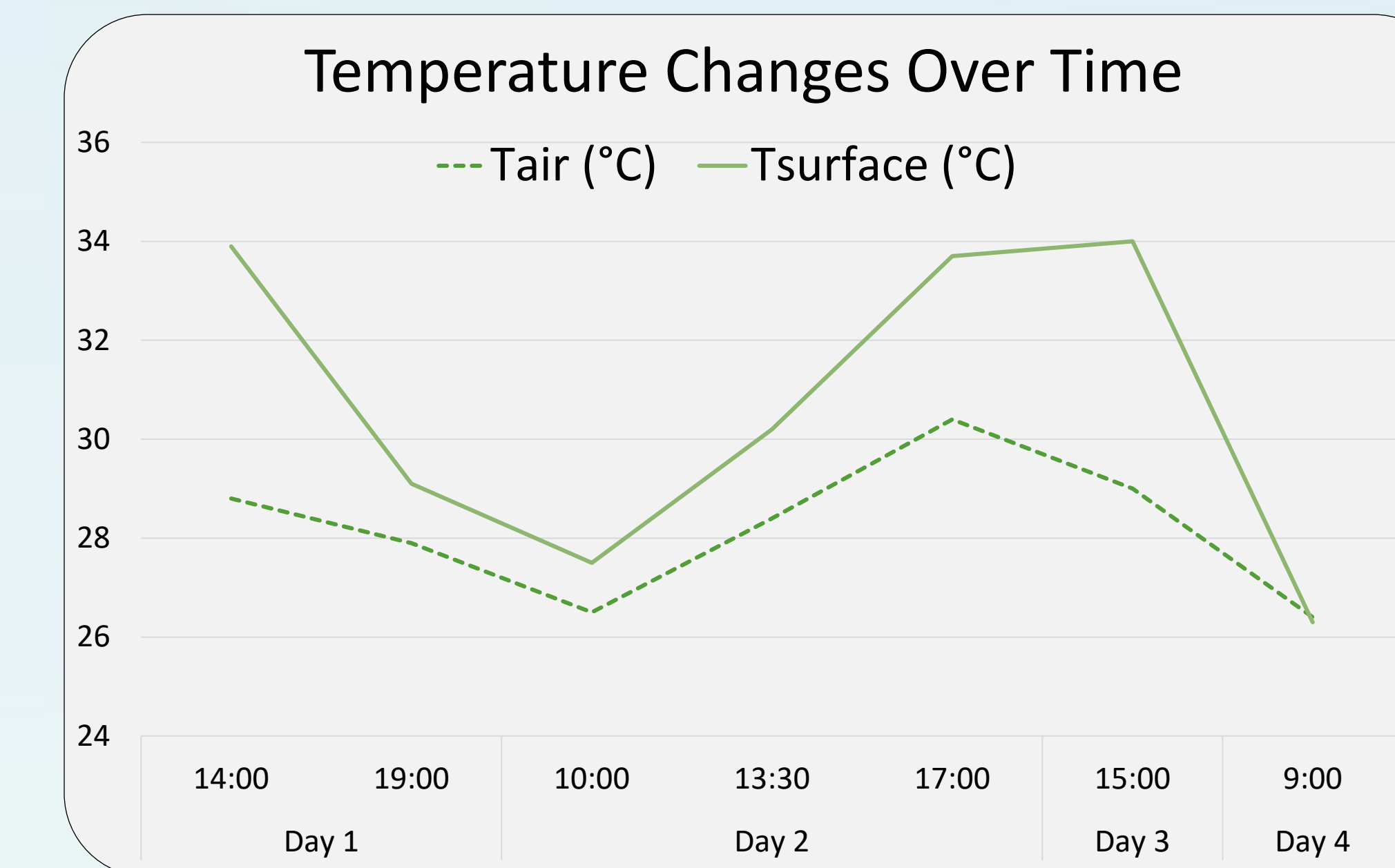
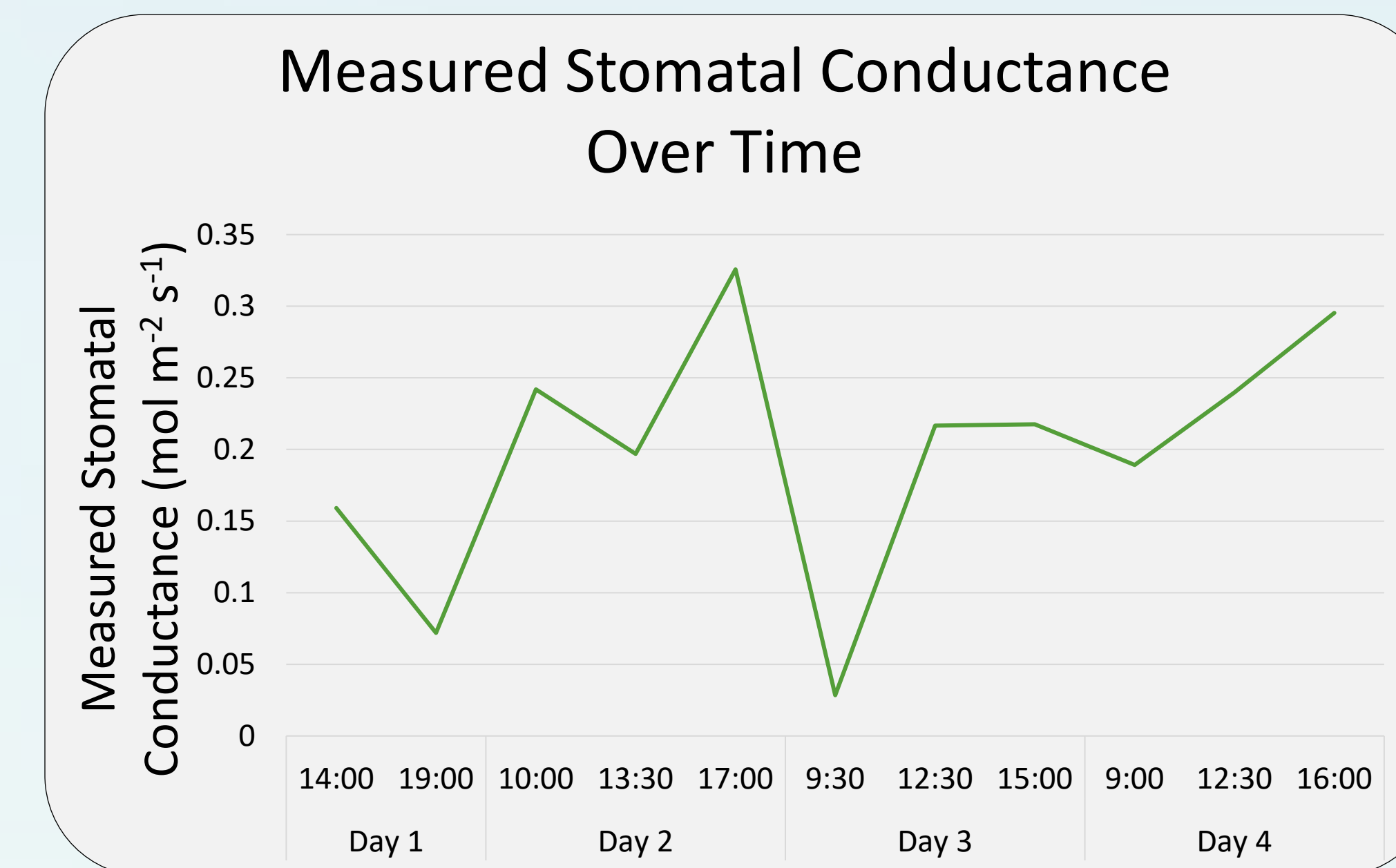
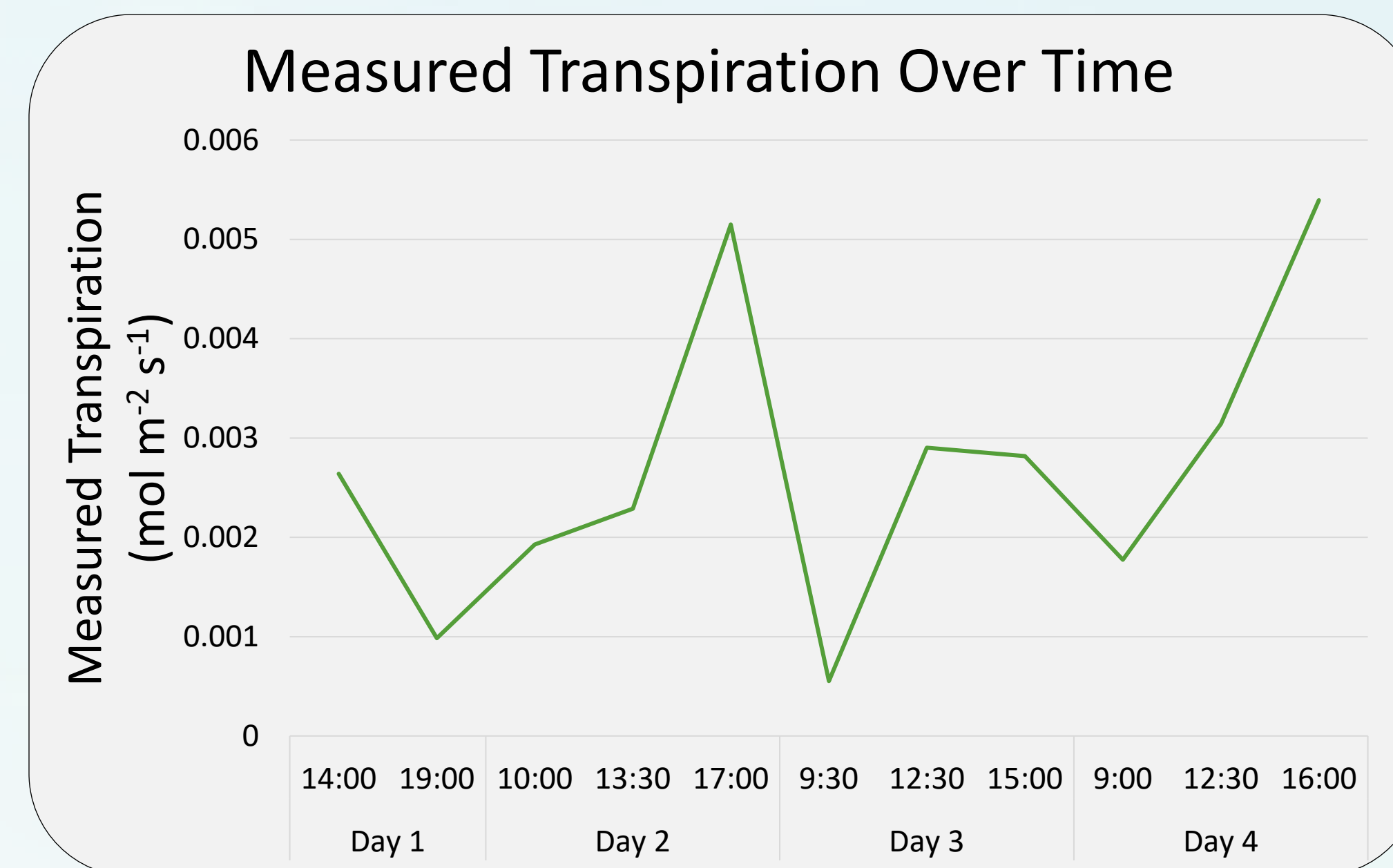
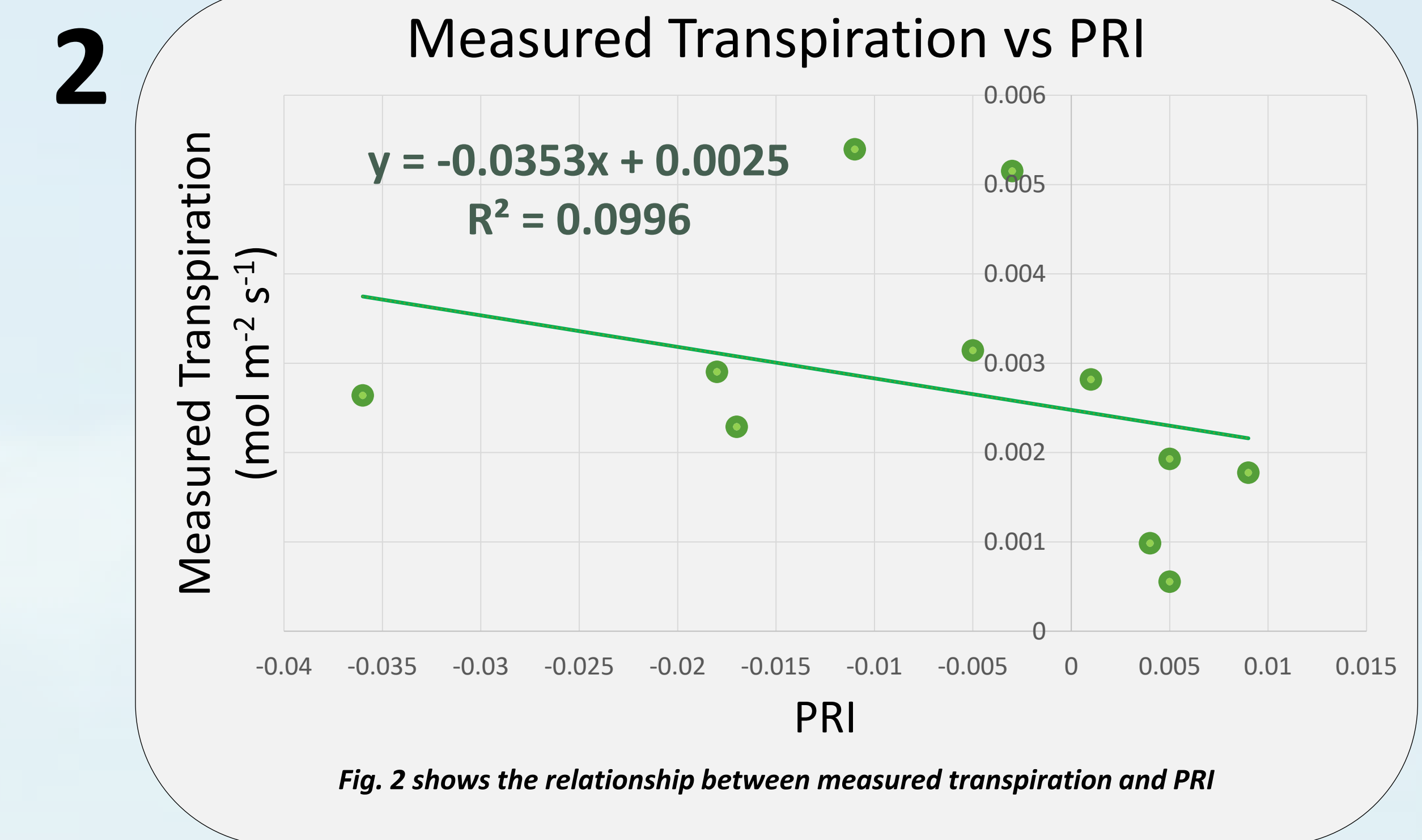
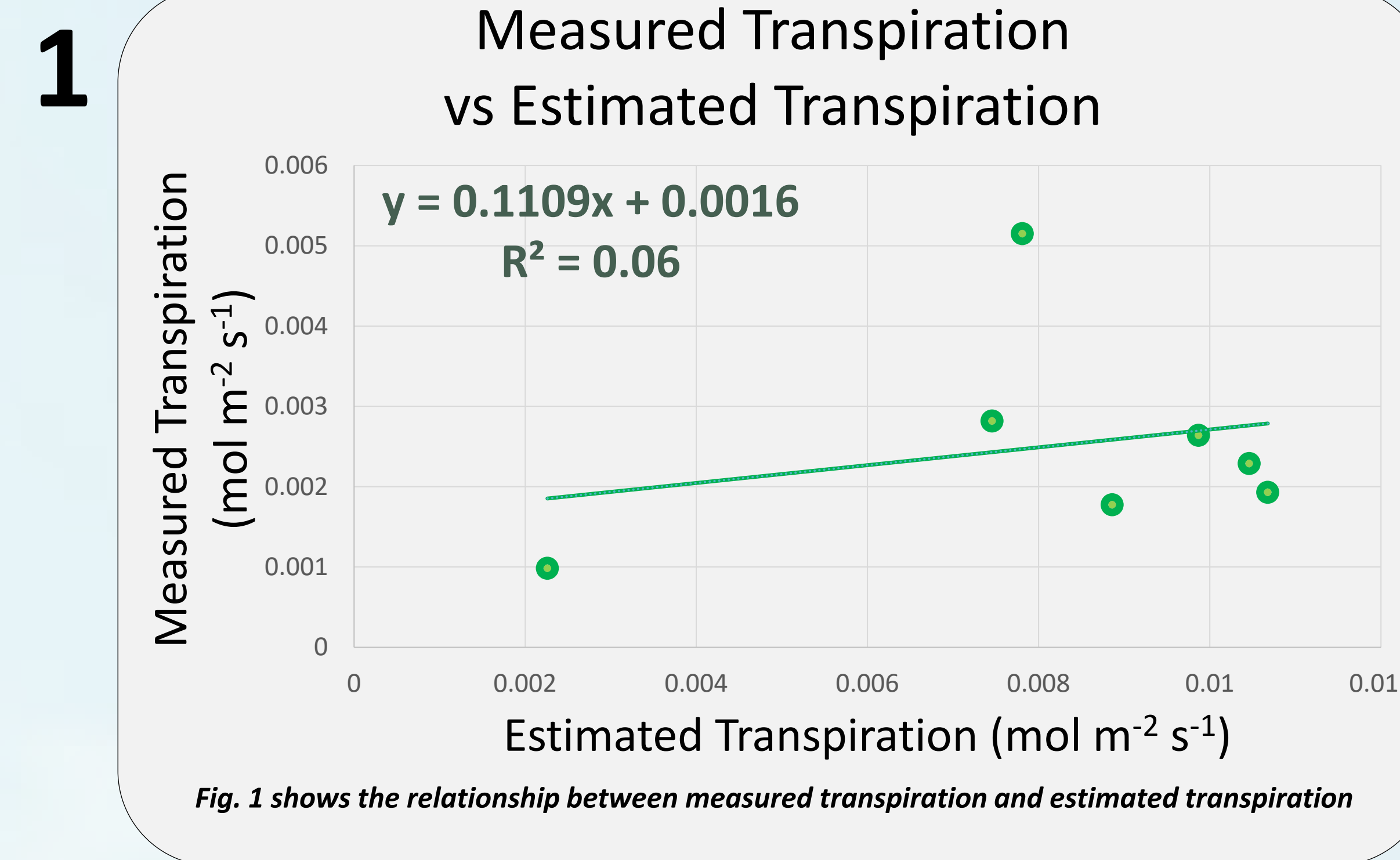
Methods

Measured stomatal conductance and transpiration was taken by a high-end field measuring device (LI-COR 6800). Measured PRI data was taken by a Spectral Reflectance Sensor. Estimated stomatal conductance and transpiration was taken by a thermal imaging method (FLIR Duo Pro R Thermal Camera and ATMOS41 Weather Station). Estimated stomatal conductance and transpiration was calculated based on equations from Bonan (2016).²

$$R_n = S \downarrow - S \uparrow + L \downarrow - L \uparrow = \lambda E + H + G$$

This was the main equation used to calculate the estimated transpiration.

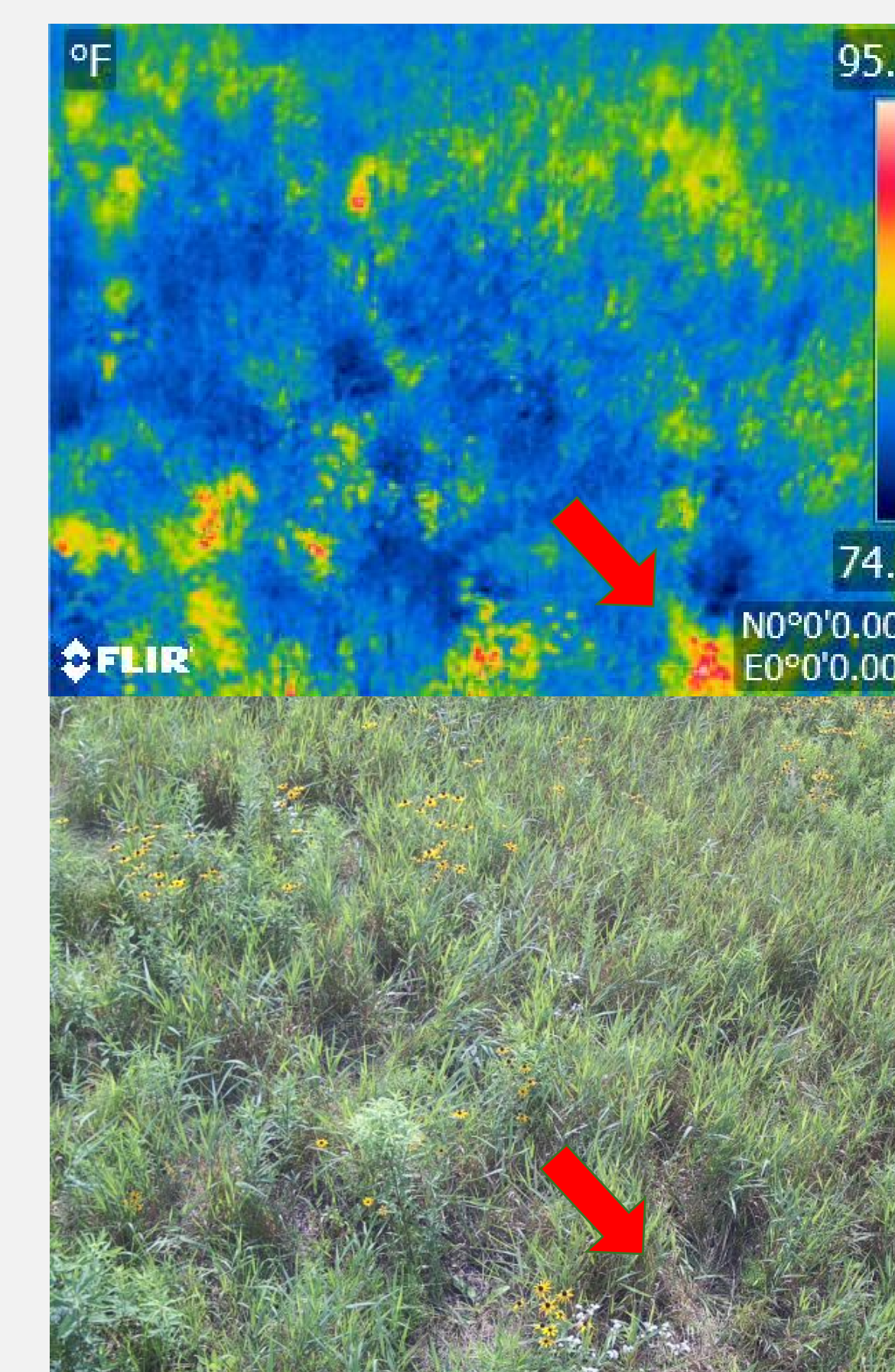
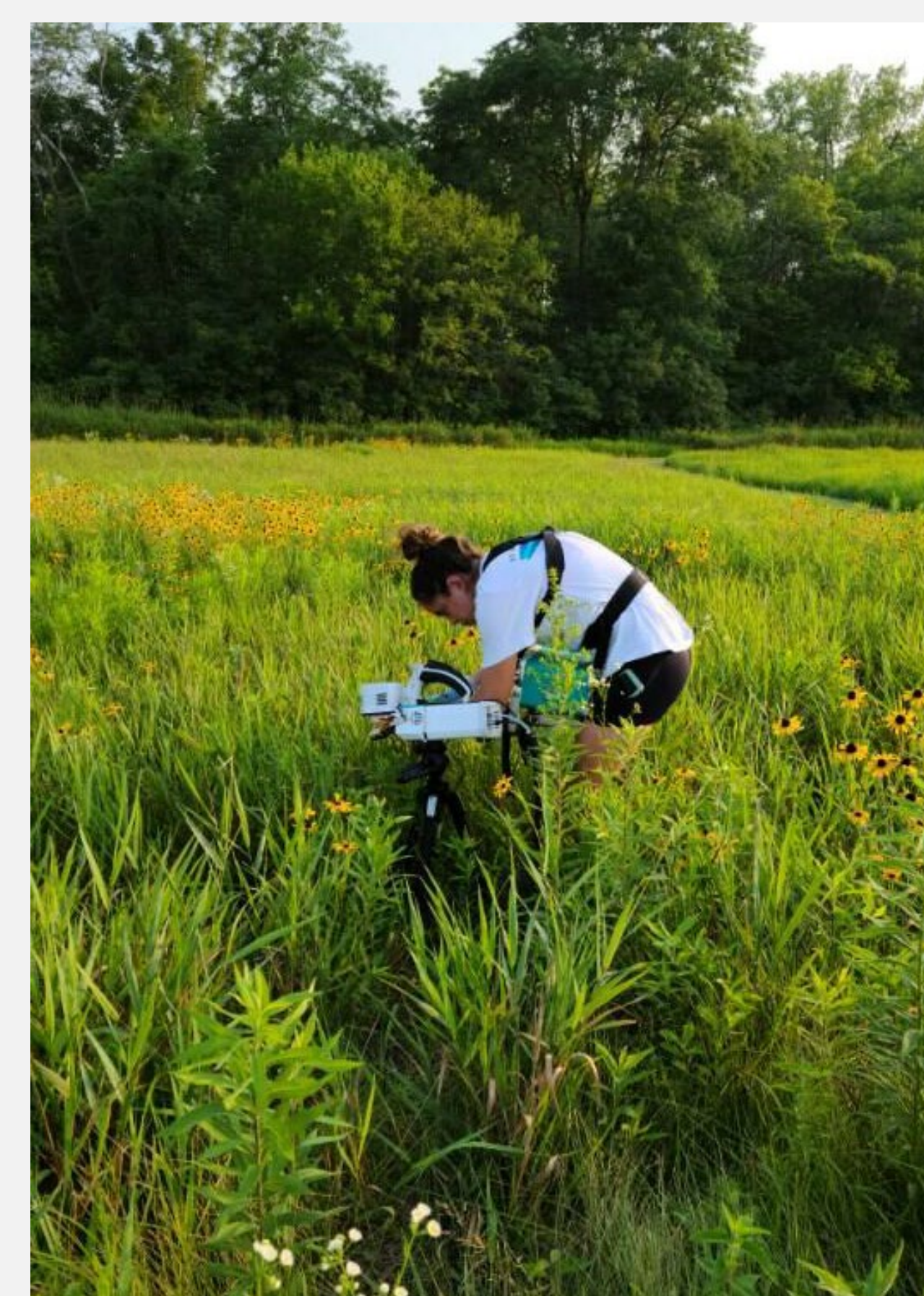
Results



Discussion

Given the opportunity to do this project again, I would revise these mathematical models based on this pilot study. Among these assumptions, incorporating ground heat flux may be one of the more significant changes to consider. This heat flux was negated in computations, although as shown below in the thermal image, it seems to be impactful.

If new models are more accurate, this will be a less expensive and more convenient way to collect stomatal conductance and transpiration data, which will also allow data of a canopy instead of a single plant.



Acknowledgements

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References

- ¹ Campbell, G. S., & Norman, J. M. (1998). *Introduction to environmental biophysics* (2nd ed.). New York: Springer.
- ² Bonan, G. (2016). *Ecological Climatology: Concepts and Applications* (3rd ed.). Cambridge: Cambridge University Press.
- ³ Campbell, G.S., et al. "NDVI and PRI – The Researcher's Complete Guide." Meter Environment.