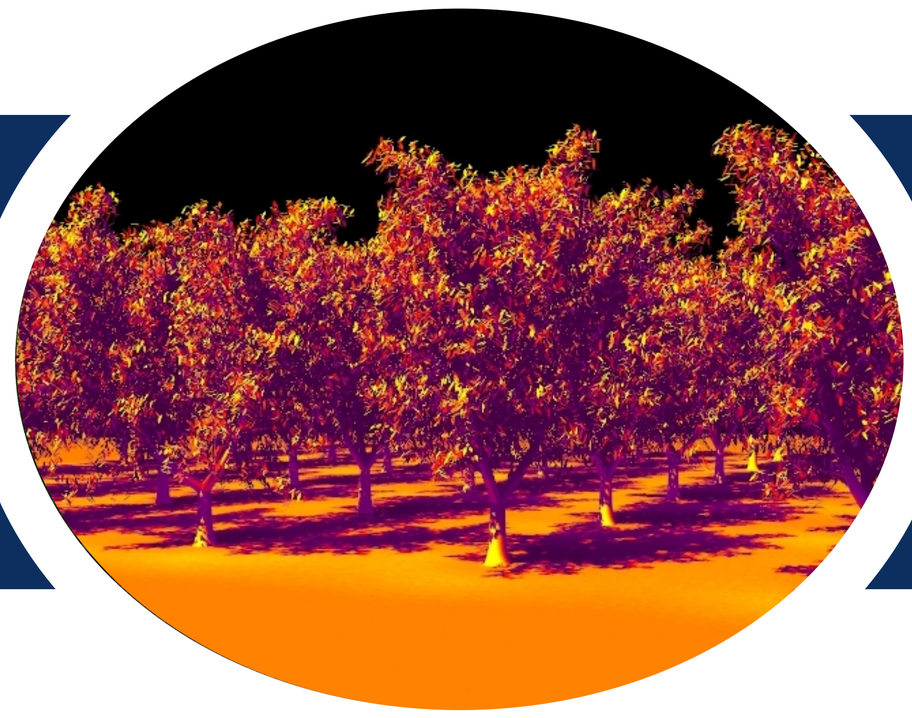
Assessment of Almond Water Status using Inexpensive Thermal Imagery

Funding provided by ABC project:
17-HORT31-Bailey (Year 1)



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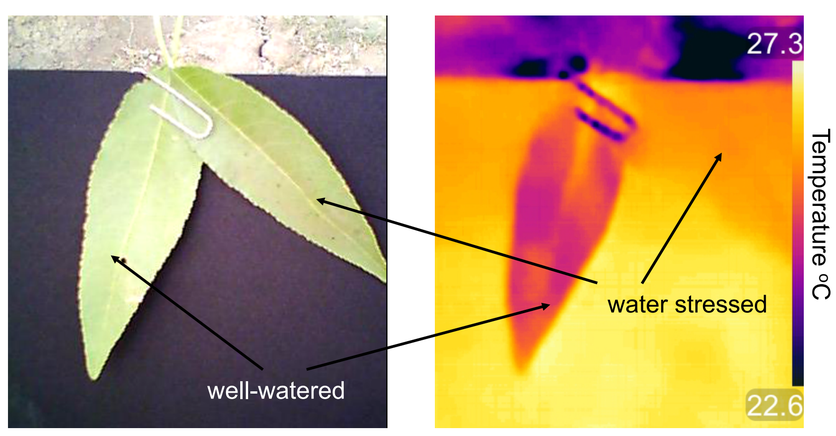
Aims and Objectives:

The ultimate outcome and benefit to the almond industry of this project will be the development of a smartphone application ("app") that can be used to quickly evaluate tree water status, and help guide irrigation decisions. The measurements will not require any sensors or sensor networks to be installed, other than a thermal camera smartphone attachment that can be purchased for <$400. Specific objectives of this project are listed below:

1. Develop a model for evapotranspiration inversion from thermographic imagery
2. Collect validation data for model calibration and testing
3. Develop a smartphone application for distribution

Basic Premise:

Leaf stomata close in response to decreases in the amount of available water, which as a result causes leaf temperature to rise. Thermal imagery can be used to measure the spatial variability in these temperature changes for individual leaves or canopies.



Current Limitations:

Although the idea of measuring plant water needs using thermal imagery has been around for several decades, several substantial constraints have limited its use by growers:

- Cost: A typical thermal camera costs tens of thousands of dollars.
- Speed: Normally, proprietary software is needed to process the thermal images, which then needs to be exported to a different file format to be processed into water stress values. This is a complicated work-flow that growers are unlikely to use.
- Image Analysis: A thermal image takes three-dimensional information and collapses it to a two-dimensional image, making it difficult to interpret pixel values.

Solutions:

Lowering Cost

The FLIR One Pro is a low-cost thermal camera that attaches to your smartphone. It has surprisingly impressive performance considering its cost.

	Flir One Pro
Cost	$399
Resolution	160x120
Spectral Range	8-14 µm
Operating System	iOS or Android

Real-Time Processing

FLIR offers a software developer kit (SDK) for the FLIR One thermal camera, which allows for rapid development of thermal camera based apps for iOS or Android devices.

FLIR CERTIFIED DEVELOPER

Google play
Available on the App Store

Thermal Image Analysis

Detailed, three-dimensional models will be used to simulate the images that the thermal camera collects in order to better interpret the thermographic data.