

# UAVs in Multi-disciplinary Agricultural Research and Outreach: Cutting-edge Technology for Real-World Water Challenges MESA & DELTA COUNTIES

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## PROJECT INTRODUCTION

- This project occurred at the Western Colorado Research Center (WCRC), Fruita, CO in Mesa County.
- The project emphasizes seamlessly integrating drone imagery to offer farmers semi-real-time insights into crop health, water utilization, and pest pressure.



Figure 1. Before and during flight images of the DJI Matrice 350 RTK drone.

- The UAV technology develops innovative management strategies that allow producers to optimize production, reduce costs, and protect the environment.
- Unmanned aerial vehicles (UAVs) or drones as seen in Figure 1 offer improved ET prediction by providing high-resolution imagery of the Earth's surface.
- However, the impossibility of covering extensive areas in the same flight mission due to battery limitations restrict flight time.

## INTERNSHIP GOALS & OBJECTIVES

**Goals;**  
To develop an understanding of drone technology to support researchers and extension professionals in addressing pressing challenges in Western Colorado, encompassing crop production enhancement, sustainable agriculture, climate resilience, and conservative and efficient water resource use.

- Objectives;**
- Analyze, download, and process multi-spectral images of the drone flights of the study area captured by the DJI M350 RTK drone with an Altum-PT Micasense camera into detailed 3D models and orthomosaics.
  - Analyze reflectance values of 7 bands and Normalized Difference Vegetation Index (NDVI) of orthomosaic images by importing them to ArcGIS or QGIS software.
  - Produce a clean document of MicaSense Altum processing workflow (including Reflectance Calibration) making this document available to the interested public.

## WHAT YOU LEARNED

- I gained valuable experience in processing multispectral drone imagery using Agisoft Metashape professional image stitching software. Through this process, I developed a strong understanding of photogrammetry, image processing techniques, and the application of multispectral data in environmental research.
- This internship provided me with practical skills in data analysis, software proficiency in Agisoft Metashape, and Loggernet, and an appreciation for the role of remote sensing in ecological monitoring.
- I learned data collection techniques using field instrumentation for collecting information on assessing crop water consumptive use, crop stress patterns, and other signature issues relating to precision farming with innovative technology.

## MAPS PRODUCED

### Grand Valley, WCRC, Fruita, CO

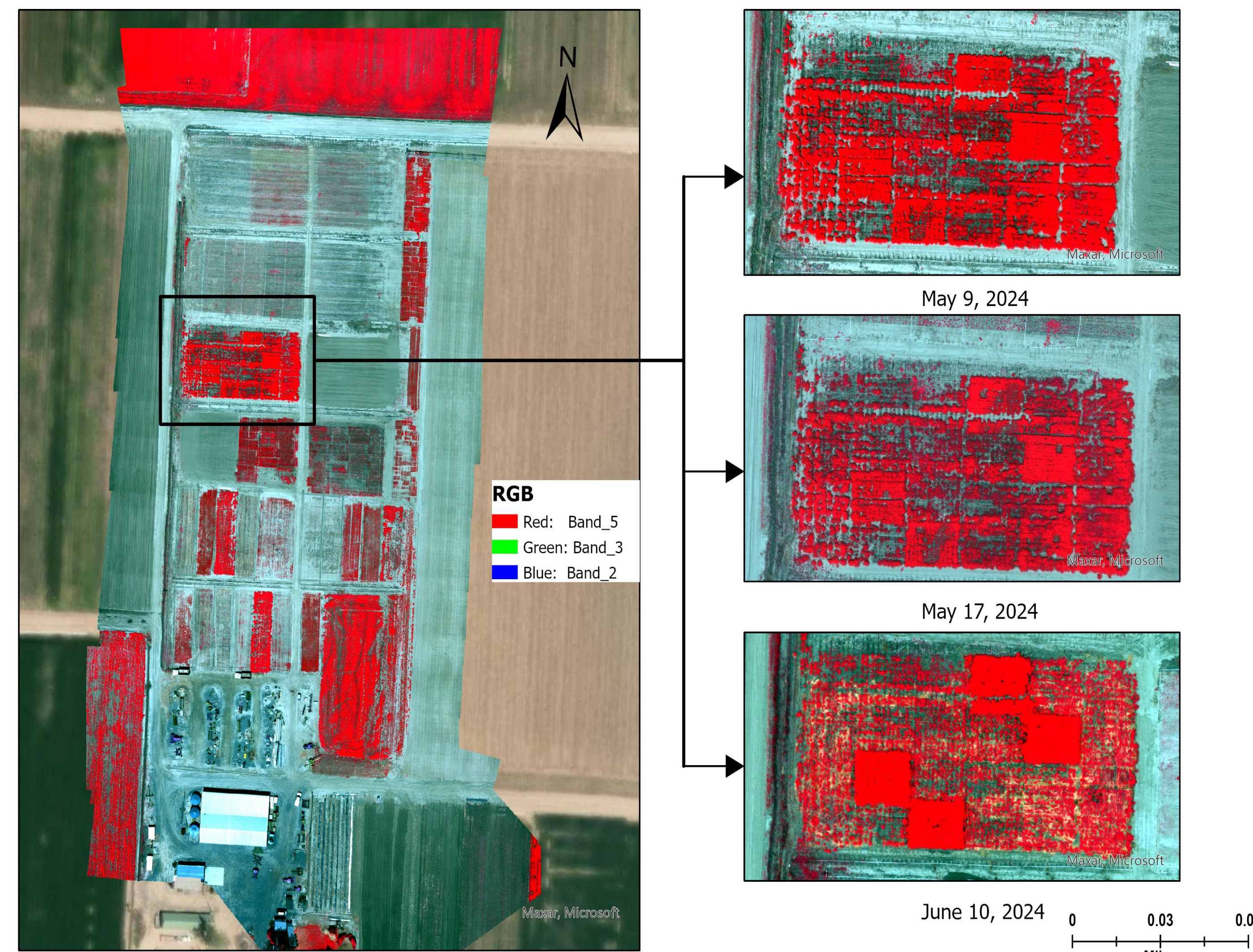


Figure 2. (Above): This map shows color infrared (CIR) images distinguishing between vegetation, land, and urban covers from Orthomosaic image of the Grand Valley WCRC. This information was processed for 30m x 30m fields captured with DJI Matrice 350 RTK imagery. The spatial resolution for this map is 5 cm.

## WHAT YOU LEARNED (CONT'D)

- I have learned how to configure and use the CROPSCAN, Inc. Multispectral Radiometer (MSR) to collect surface reflectance (GNDmV), IRR (IRRadiance-thermal), and five bandwidth wavelengths data which will be a baseline for the data collected using the Unmanned Aerial System (drone).
- I have learned how to program Infrared Radiometer (IRT) and Normalized Difference Vegetation Index (NDVI) sensors on dataloggers which are being used to collect thermal and NDVI data at the Fruita, Banner, and Olathe sites.
- I experienced working with a diverse group of stakeholders (Delta County ranchers and producers, Mesa County farmers and producers, The Land Institute, American Rivers, Trout Unlimited, and The Nature Conservancy), all of whom are interested in adopting novel farming techniques in the Upper Colorado River Basin and will leverage on this experience to develop comprehensive and inclusive solutions to the multifaceted challenges faced by water systems worldwide.
- I learned to explore my personal strengths and unique contribution to the Western Colorado Research Center team through the Clifton Strengths Assessment and Workshop held on June 27, 2024. I learned that my greatest strength is executing and people with dominant executing themes make things happen and are consistent.

## MAPS PRODUCED (CONT'D)

### Grand Valley, WCRC, Fruita, CO

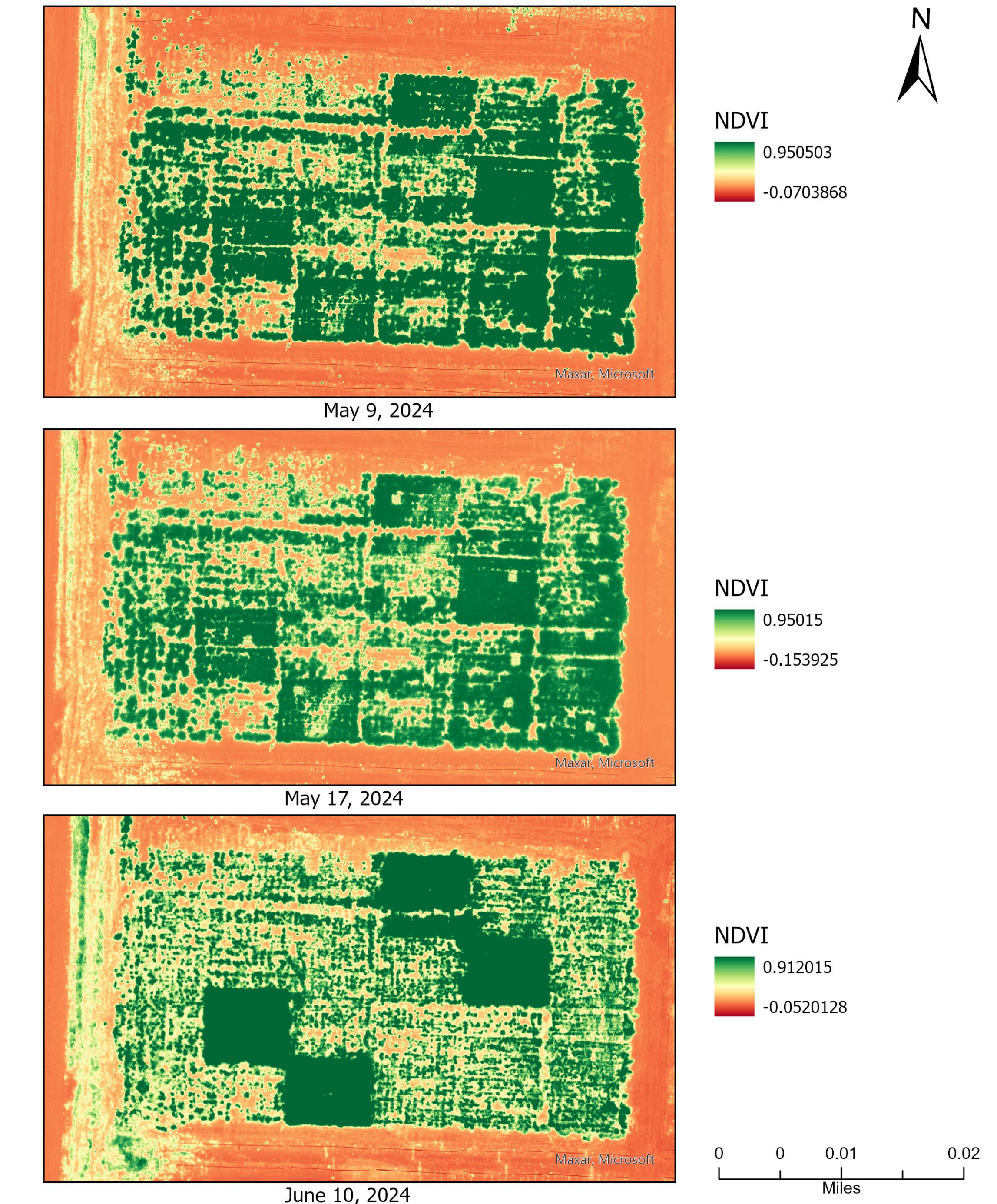


Figure 3. (Above): This map presents NDVI calculated from Orthomosaic images of the Grand Valley WCRC field. Red and orange pixels represent areas with no vegetation. Yellow pixels represent areas with low to moderate vegetation. Green pixels represent areas with high vegetation density, vigor, and relative biomass.

## PROJECT APPLICATION TO MY EDUCATION

- This internship is relevant to my education due to its research-based nature. It forms part of my PhD research work where unmanned aerial systems and remote sensing techniques are required to map actual crop water use or evapotranspiration in Colorado effectively.
- As I aspire to create a world where we women in Ghana and less privileged societies do not have one thing holding us back due to our gender, this internship's commitment to diversity, equity, and inclusion, provided an opportunity to assess and enhance practices through a DEI lens.

## NEXT STEPS

- I hope to perform QA/QC of all the raw data collected from the field for later publication in fact sheets, technical reports, or publications.
- Engage the CSU community as well as the Western Colorado Extension units in drone training, data processing, and research.