

Evaluating Bioenergy Potential of Eastern Redcedar (*Juniperus virginiana* L.) Using a Small Unmanned Aircraft System (sUAS)

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Eastern Redcedar (*Juniperus virginiana* L.)

- Kansas' only native juniper species
- Characterized by rapid growth and reproduction
- Coniferous species which has sharp “scales” instead of leaves
- Evergreen (vs. deciduous)
- Has a native range from northern Florida to Ontario
- Highly invasive



Image courtesy of Kevin P. Price



KSU Howe Property, Blue River Hills
1962

Courtesy KSU Historical
Aerial Photograph Archive



KSU Howe Property, Blue River Hills
2012

Courtesy USDA NAIP Program

Redcedar Uses

- Eastern redcedar is commonly chipped into mulch for use in landscaping and gardening
- Redcedar can be chipped and burned in large boilers to heat buildings
- Biodiesel
- Biochar - soil amendment used to neutralize toxic substances

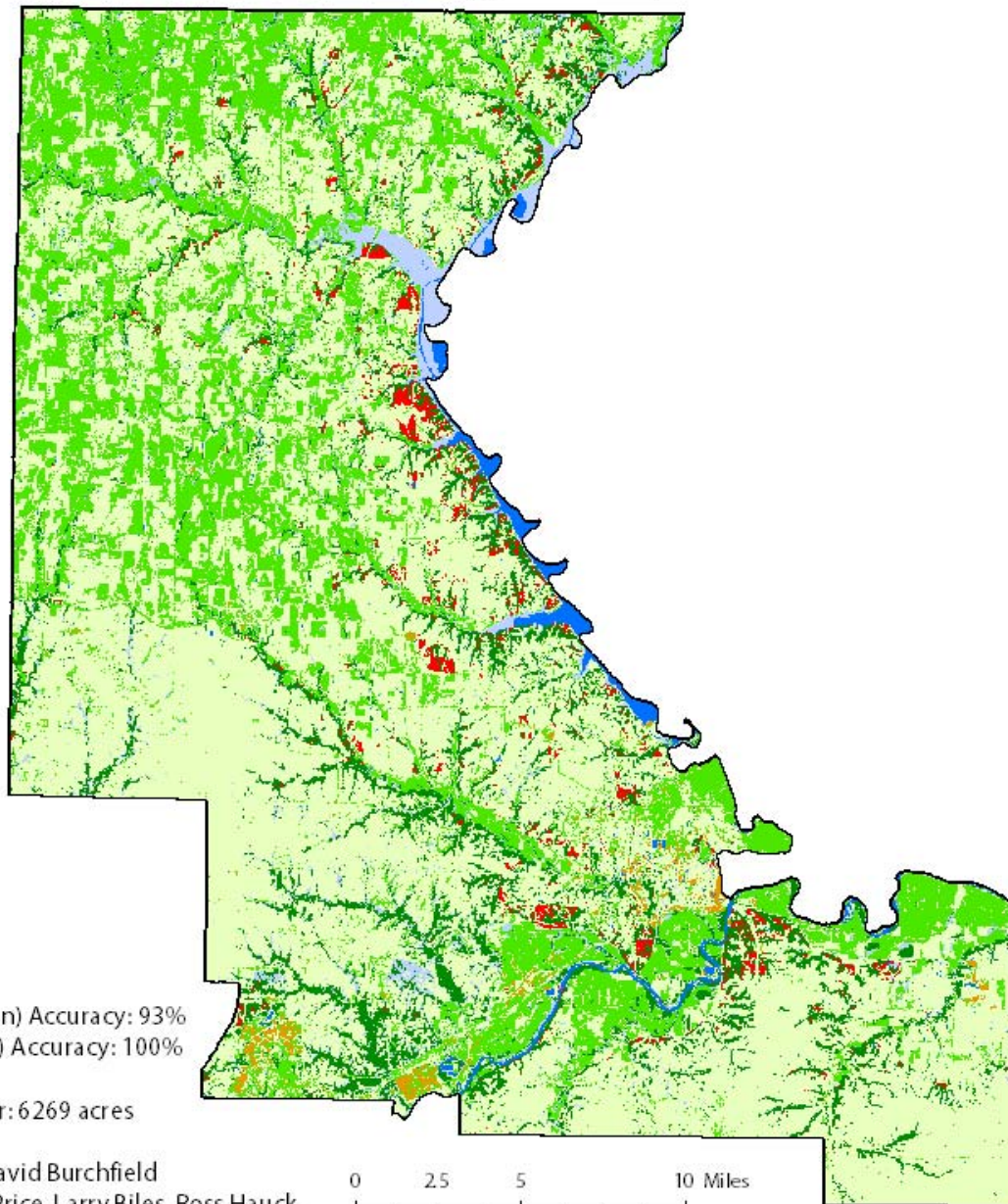


Redcedar mulch near Pratt, Kansas

Since redcedar wood has been shown to be useful and there is a lot of it out there, how can we map redcedar stands and quantify biomass?

Multi-date Supervised (SVM) Classification Riley County, Kansas, 2011

-  Agricultural Land
-  Deciduous Forest
-  Rangeland
-  Eastern Redcedar
-  Urban
-  Water
-  Wetland



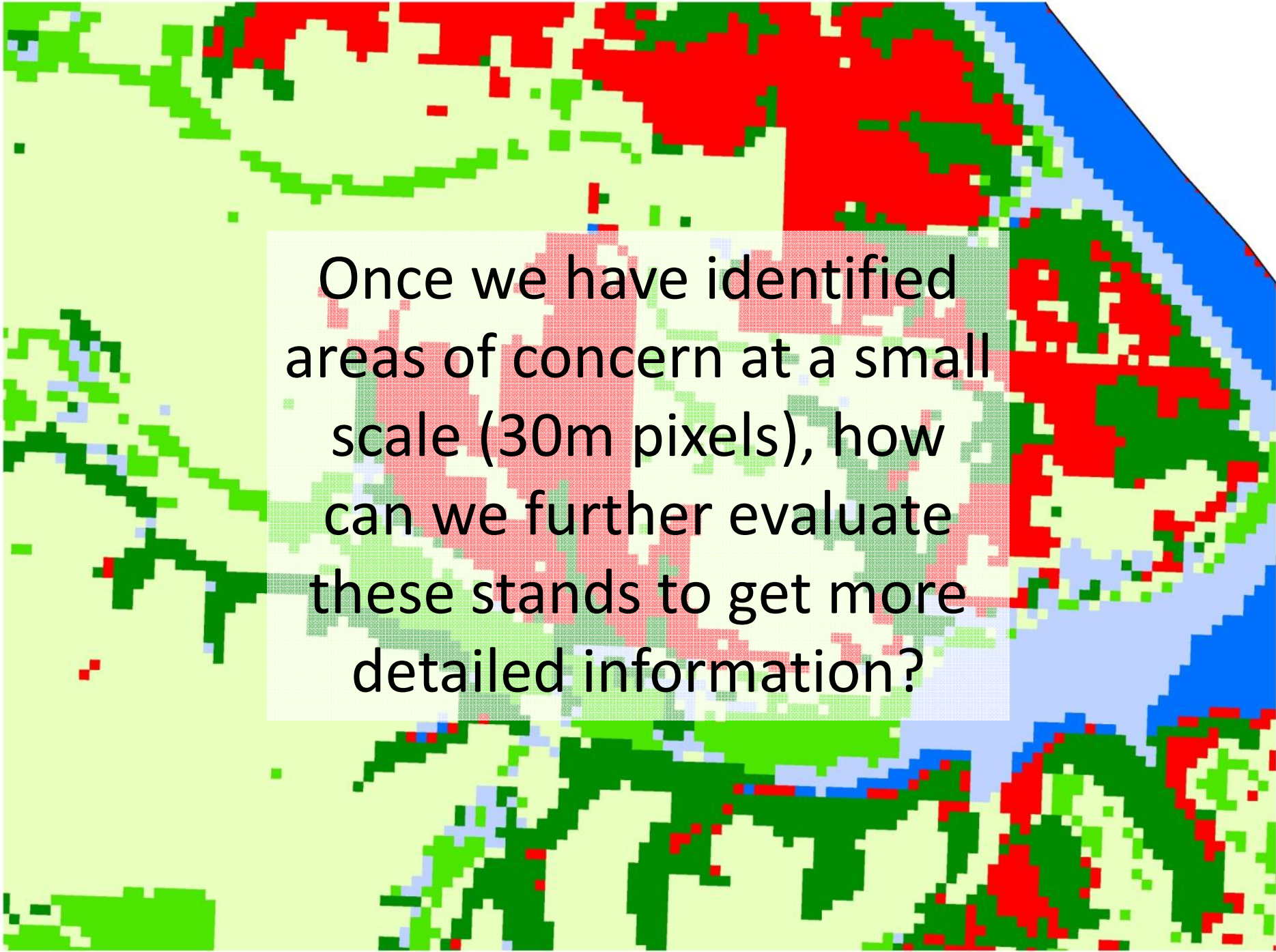
Eastern Redcedar Producer (Omission) Accuracy: 93%
Eastern Redcedar User (Commission) Accuracy: 100%
Overall Classification Accuracy: 81%
Total Area of Eastern Redcedar Cover: 6269 acres

Classification and Cartography by David Burchfield
Contributors: Johnny Bryant, Kevin Price, Larry Biles, Ross Hauck

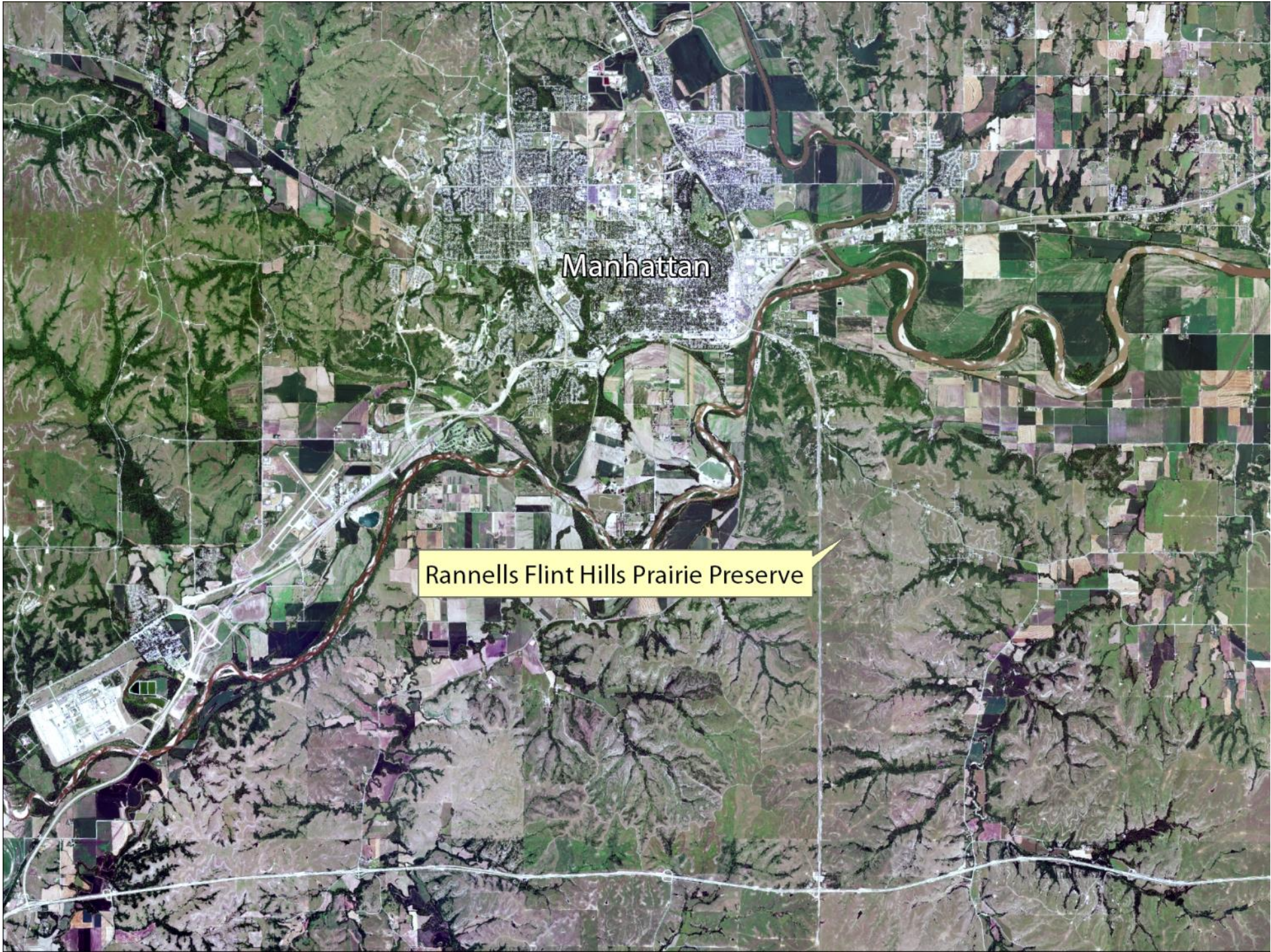


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Once we have identified areas of concern at a small scale (30m pixels), how can we further evaluate these stands to get more detailed information?



Manhattan

Rannells Flint Hills Prairie Preserve

Ritewing Zephyr II
LDP LLC – modified Canon Powershot S100 NDVI Camera
GoPro HD Hero3 Video Camera
Ardupilot Mega 2.5 Autopilot



Image courtesy Joel Prince

GoPro Video

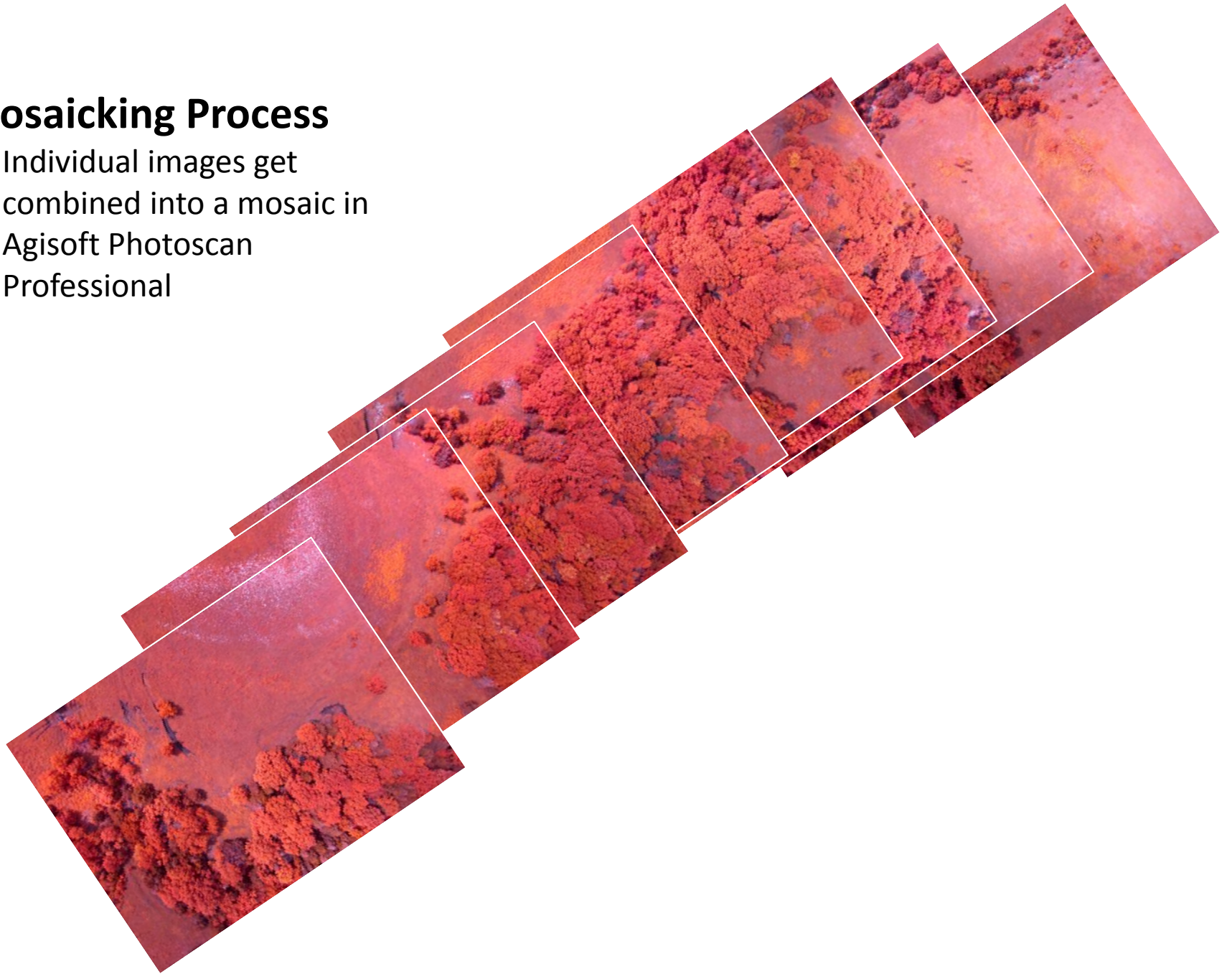


Very poor light conditions!

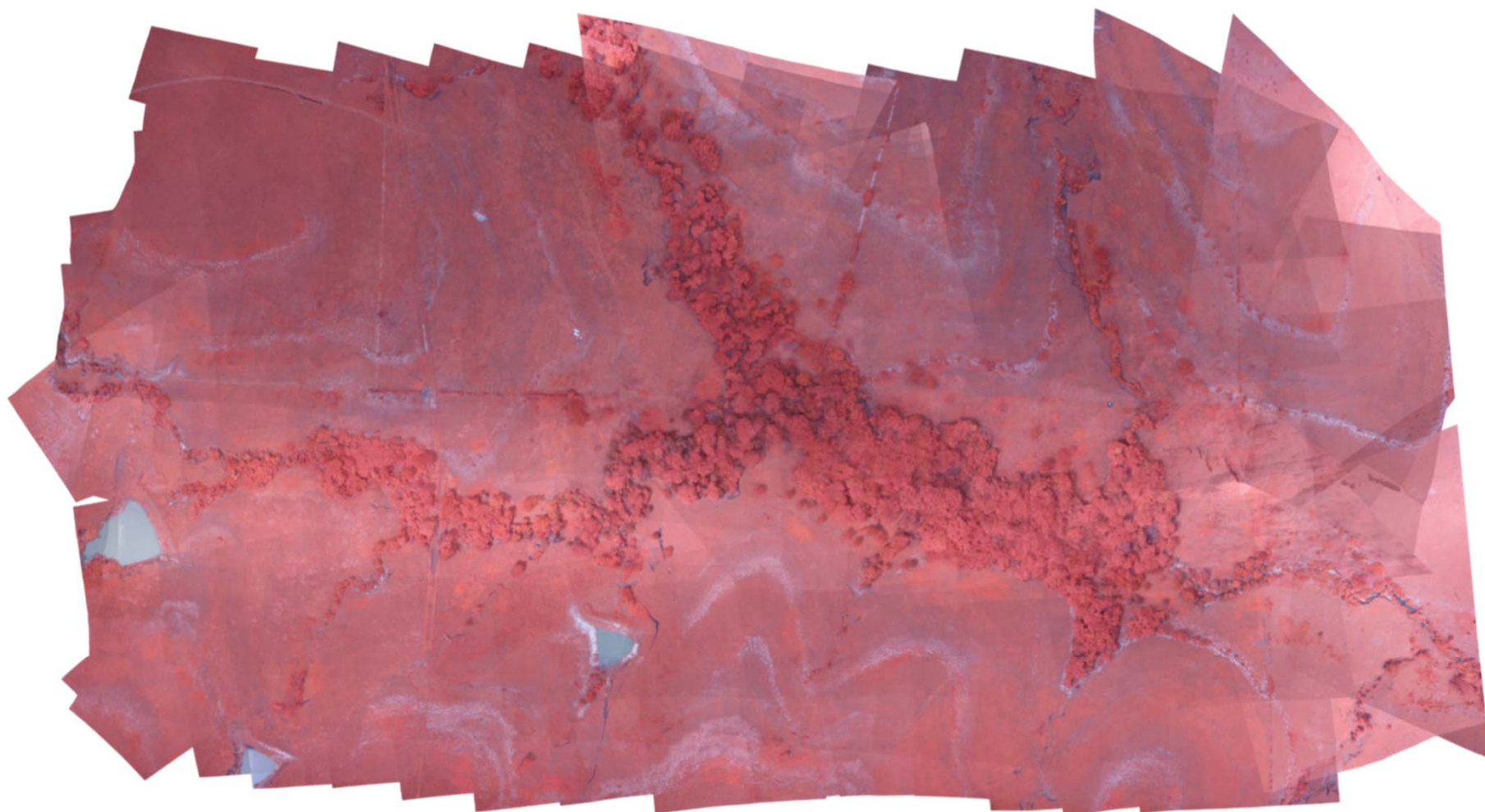
Image courtesy Joel Prince

Mosaicking Process

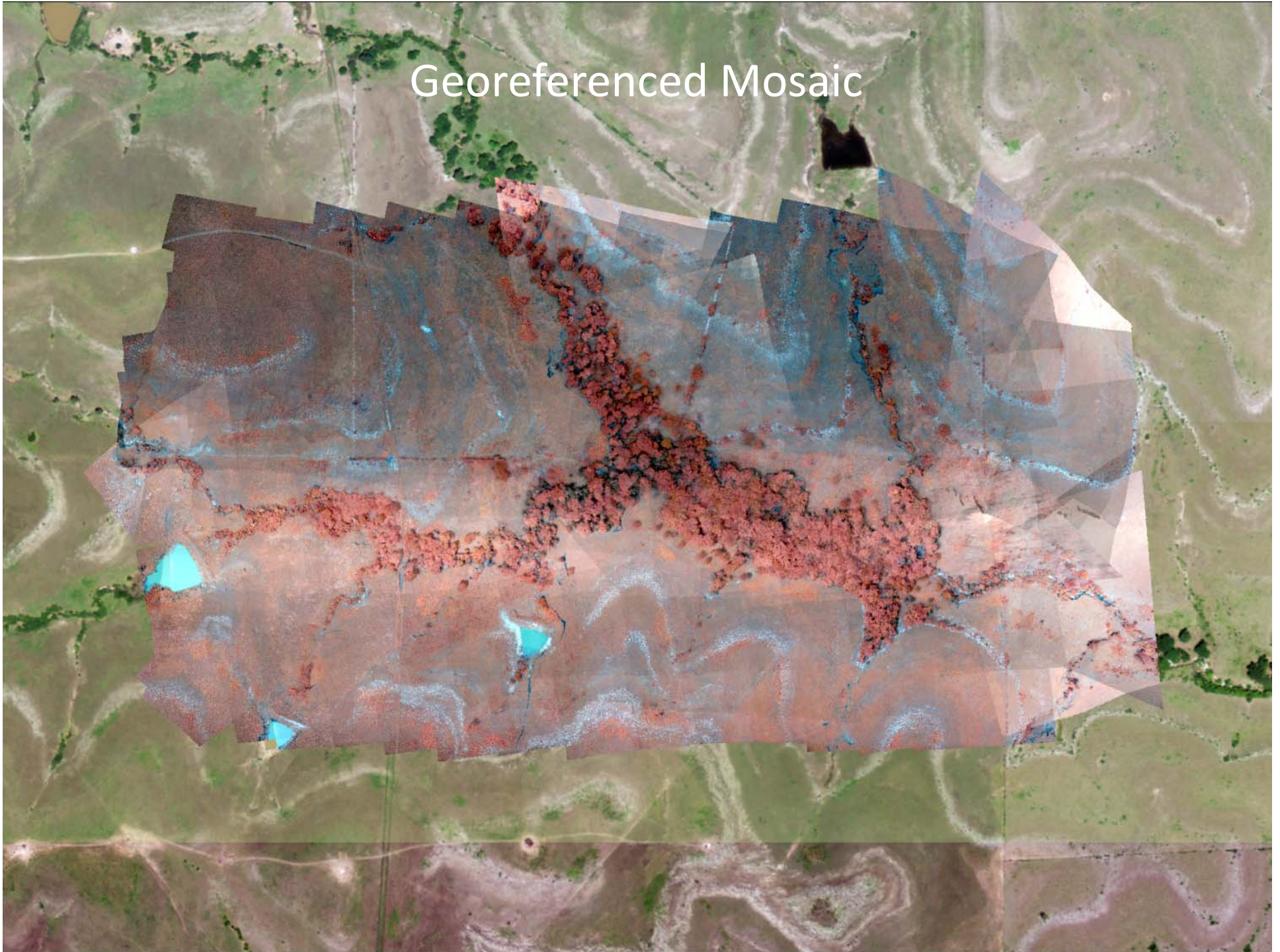
- Individual images get combined into a mosaic in Agisoft Photoscan Professional



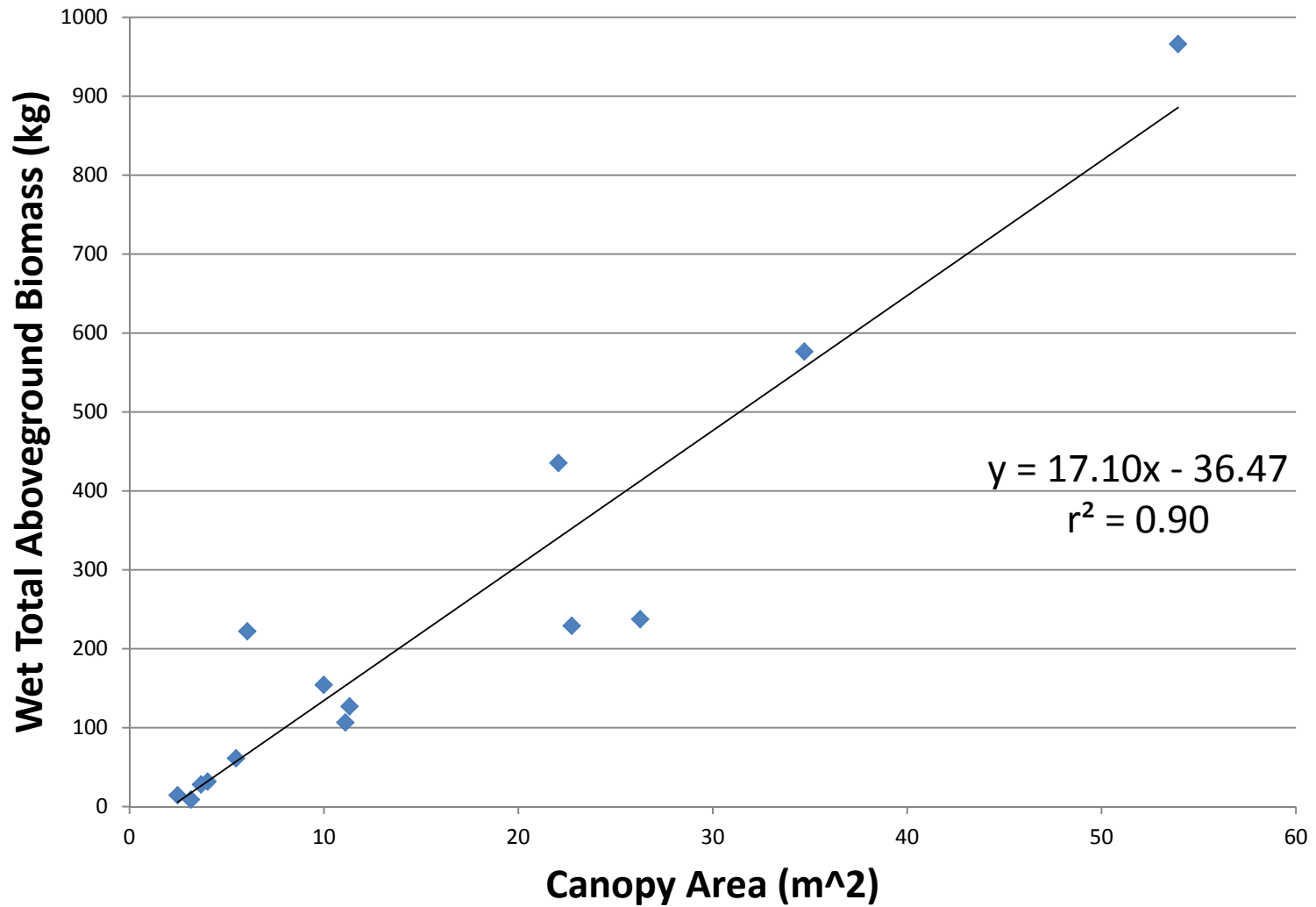
Mosaic Result



Georeferenced Mosaic



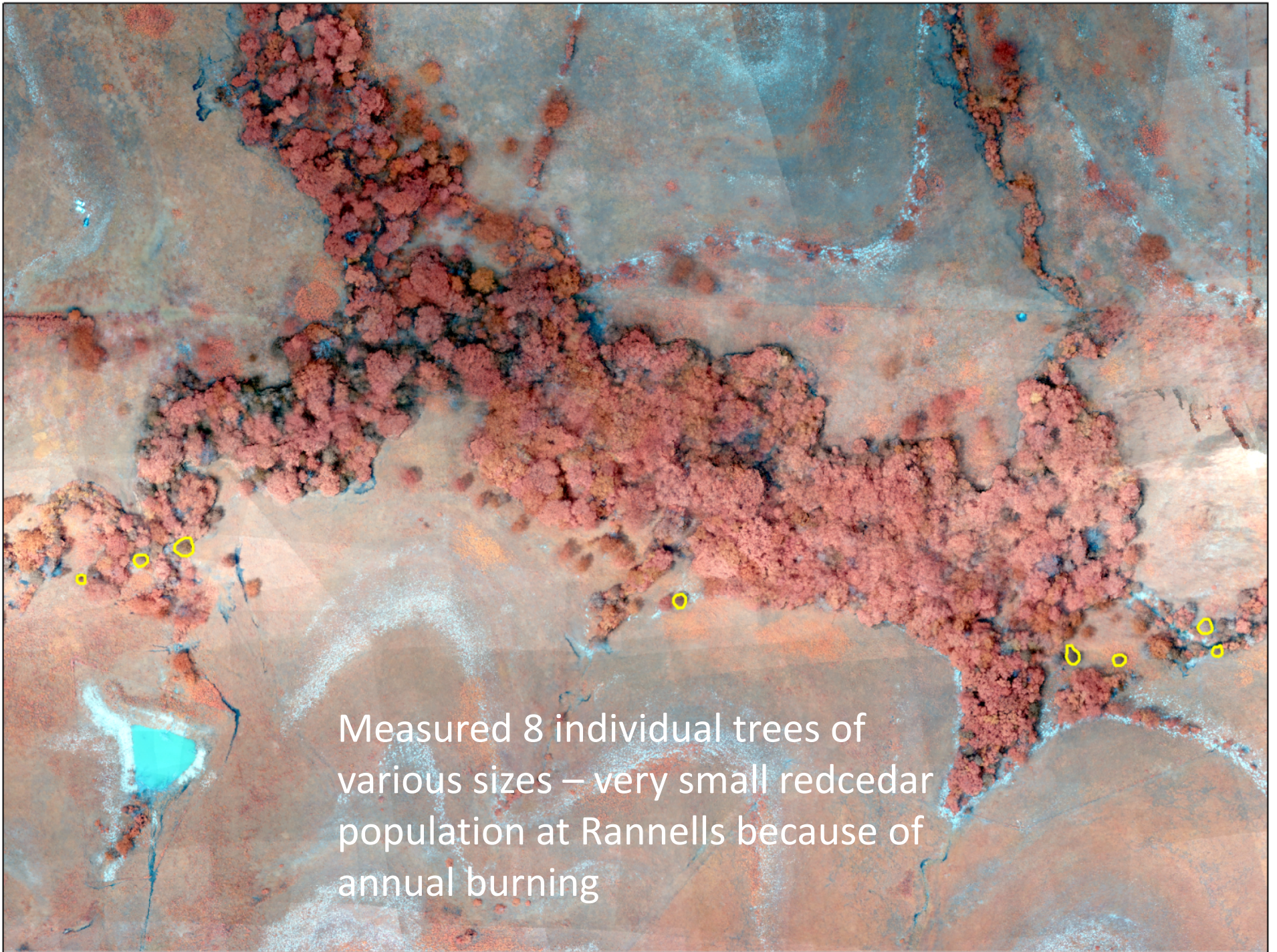
Eastern Redcedar Canopy Area versus Biomass



Some data from Strauss, *et al.* (2011)



(<1 inch pixel size)



Measured 8 individual trees of various sizes – very small redcedar population at Rannells because of annual burning

Using regression equation to predict biomass of each tree

$$\textit{Total aboveground biomass} = 17.10(\textit{canopy area}) - 36.47$$

Example:

$$\begin{aligned}\textit{Total aboveground biomass} &= 17.10(73.6 \text{ m}^2) - 36.47 \\ &= 1222 \text{ kg}\end{aligned}$$

Future Work/Lessons Learned

- Repeat in area with higher number of isolated redcedar of various sizes
- Fly on a bright, sunny day rather than in variable light conditions to improve mosaic quality



The image features a collage of several overlapping, rectangular pieces of metal that have been heavily corroded with rust. The rust is a prominent reddish-brown color, forming irregular patterns and streaks across the darker, metallic surfaces. The metal pieces are layered, creating a sense of depth and texture. In the center of the collage, the word "Questions?" is written in a clean, white, sans-serif font. The background is a plain, light color, which makes the rusted metal and the text stand out.

Questions?