SMARTSAT
COOPERATIVE RESEARCH CENTRE

What does satellite remote sensing reveal about the paleohydrology and archaeology of the Simpson and Strzelecki Deserts?

Flinders University

Oliver Hatswell[1] and Ian Moffat[1]

The Andy Thomas Space Foundation

Introduction

The expansive scale and inaccessible nature of the Australian Arid Zone provide a significant challenge for cultural heritage management. This area is home to a complex mosaic of stakeholders including petroleum companies, pastoralists, Traditional Owners, and National Parks. Archaeological surveys have not found any site older than ~3,000 years BP in the region, despite the limited climate records of the region suggesting water was available for long periods of the Pleistocene [1]. Did people move into the area only recently, or is the lack of archaeological records due to accessibility difficulties and the complex geomorphology of the region?

Aims

1. Map the location of paleochannels using satellite remote sensing and machine learning.
2. Compare the location of known archaeology sites to the paleochannels.
3. Ground truth the interpreted location and establish the chronology of paleochannels using field mapping, drilling, and geophysics.

Methods

- Various satellite remote sensing approaches include multi-temporal vegetation indices, multispectral, and elevation-based methods.
- Cloud-based large-scale analysis using Google Earth Engine and the Open Data Cube.
- Experiment with machine learning to identify paleochannels.
- Field mapping, core drilling, and geophysics for ground truthing.

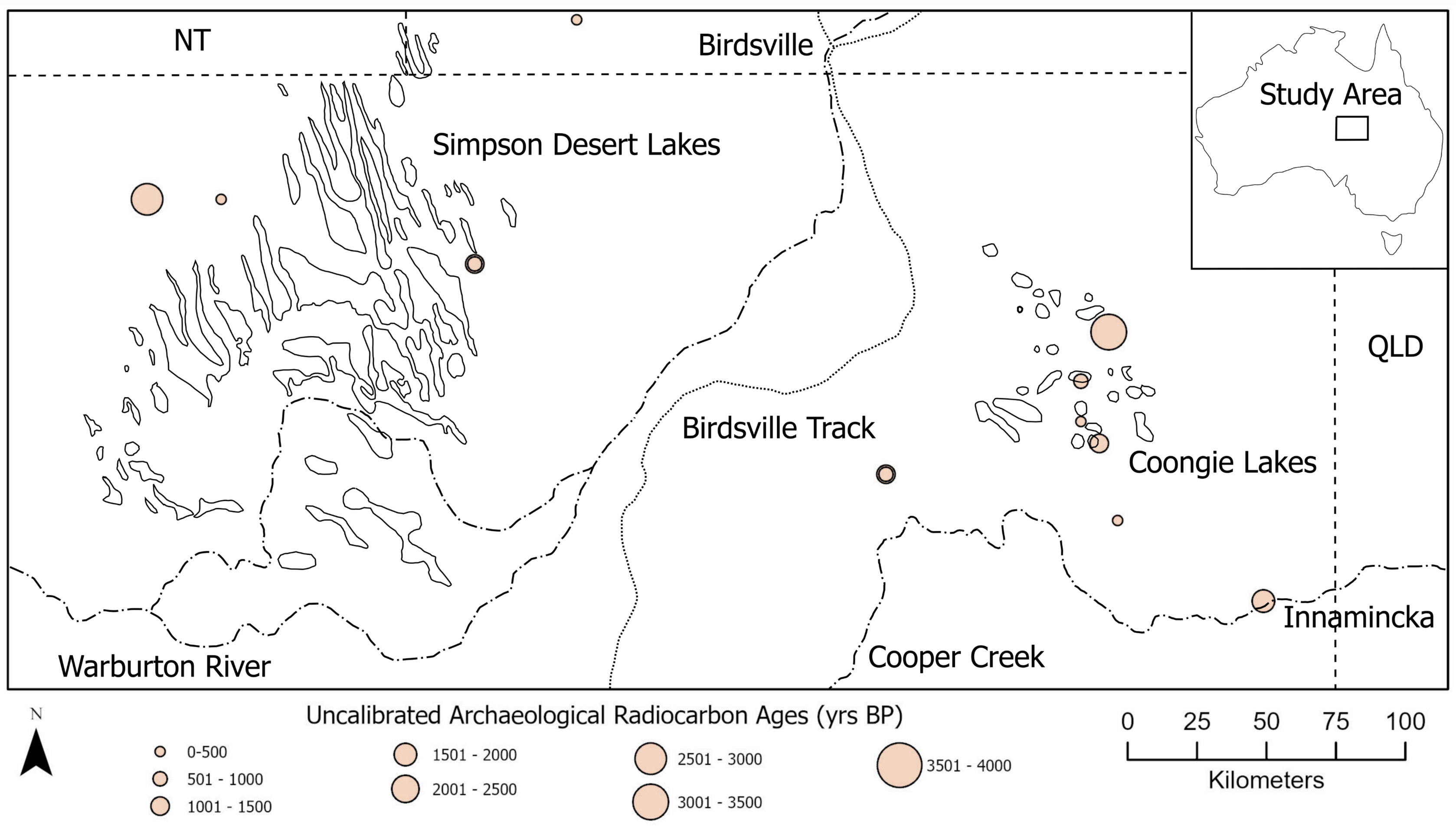

Figure 1: Map of the study area showing radiocarbon ages from previous investigations [2]

Results: Vegetation

The first stage of this project is to identify paleochannels through multi-temporal seasonal variations in vegetation. A code created by Dr Hector Orgeno [3] was amended to change the study area and the defined wet and dry seasons. This code utilises vegetation indices (NDVI, EVI, and NDWI) from Landsat 5 to create various vegetation maps (NDVSI, SMTVI, Seasonal PCP, and Seasonal TCT) for analysis. Below are some examples from the Coongie Lakes region.

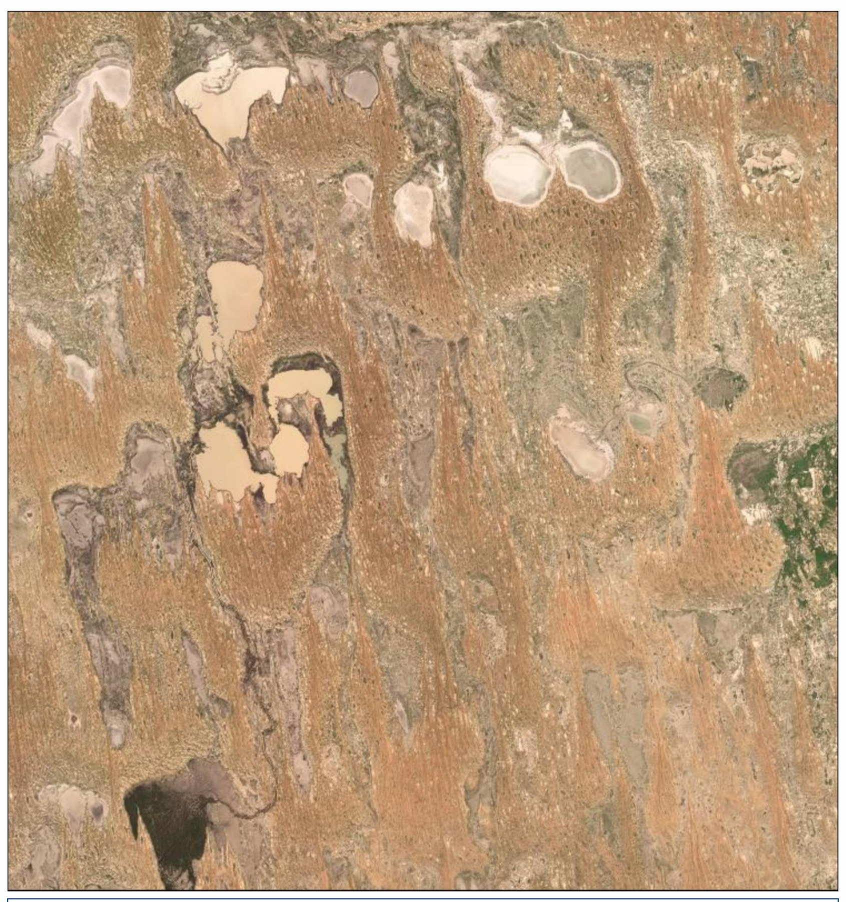

Figure 2: Satellite image of the Coongie Lakes region.

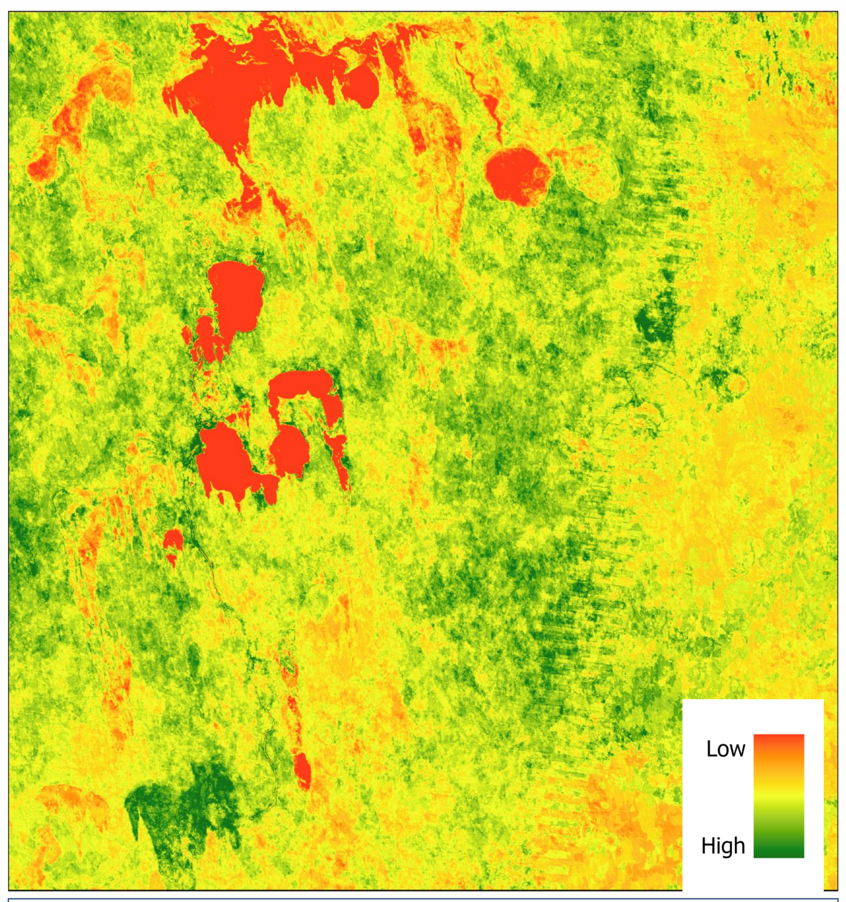

Figure 3: NDVSI map of the Coongie Lakes region showing the seasonal variation of vegetation from 1984–2013.

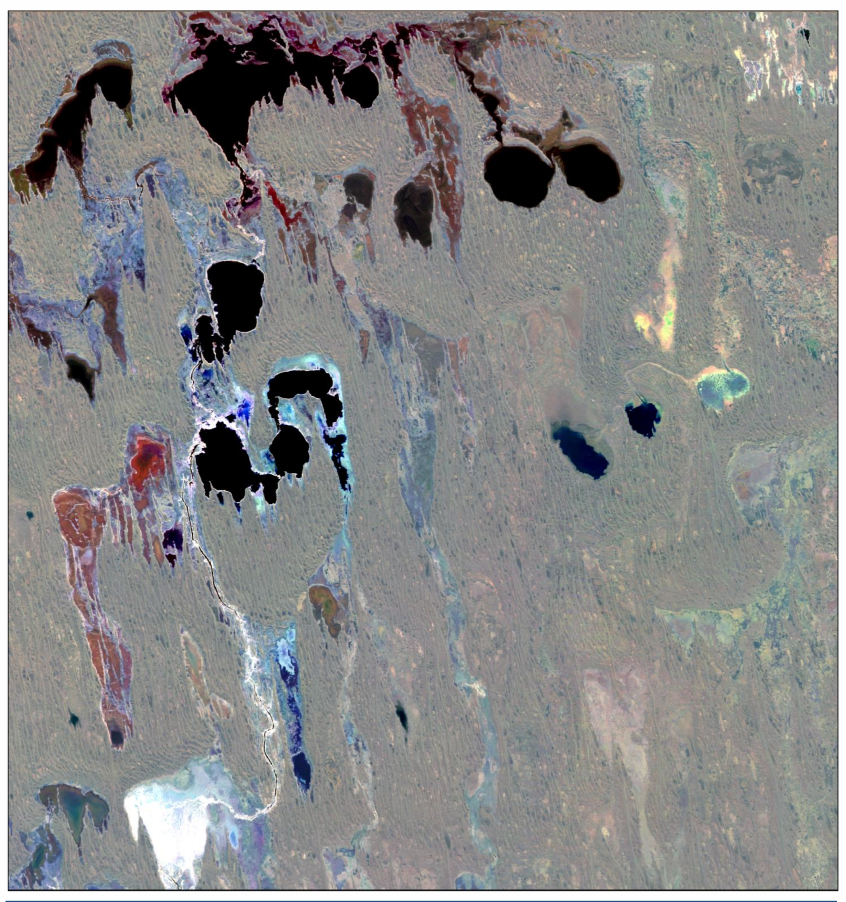

Figure 4: SMTVI map of the Coongie Lakes region using EVI averages from the wet seasons (May to Oct) of 1984–2012.

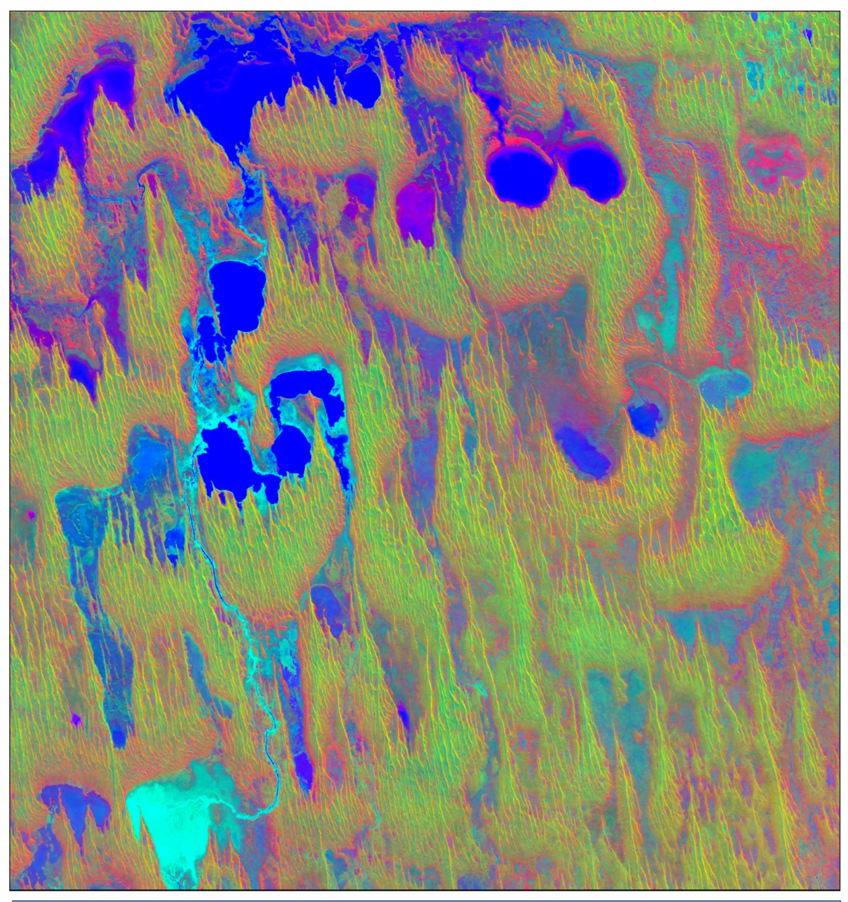

Figure 5: TCT map of the Coongie Lakes region calculated using the mean of images from the wet seasons (May to Oct) of 1984–2013.

References

[1] Hughes et al. (2017) *Quaternary Science Reviews* 163: 72-83.

[2] Williams et al. (2014) *Internet Archaeology* 36.

[3] Orengo and Petrie (2017) *Remote Sensing* 9(7):735.

[1]Archaeology, College of Humanities, Arts and Social Sciences, Flinders University

Australian Government
Department of Industry, Science and Resources
Cooperative Research Centres Program