

Sensing Country: Using big data, shared knowledge, and strategic assessment to inform local to regional decision making around feral species impact

Holly Lourie^{1,2}, Helen Murphy², Keller Kopf¹, Olivia Carroll⁴, Justin Perry³, Alex Ernst³, Lewellyn Moulin⁴, Mimal Rangers⁴, Andrew Hoskins³

1. Charles Darwin University, 2. CSIRO, 3. NAILSMA, 4. Mimal Land Management

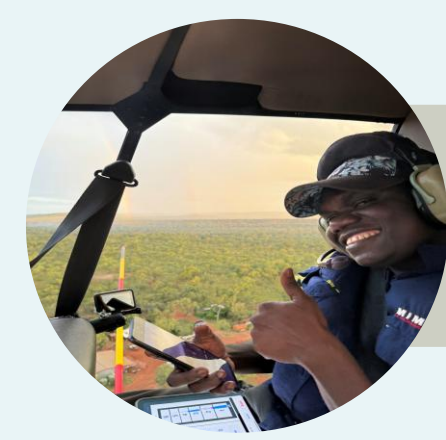
1 Introduction

Feral ungulates (e.g. pigs, cattle, horses, donkeys, buffalo) are key ecological threats in northern Australia's tropical savannahs, driving soil damage, vegetation loss, and wetland degradation. They also impact cultural values by reducing bush-tucker and damaging sacred sites. Impacts are patchy, variable, and poorly mapped across vast, remote regions, limiting coordinated management. Current efforts often rely on site-level data without accounting for broader landscape-scale effects or returns on investment. While this approach is critical to understanding impact at important sites, it is biased towards easily accessible areas, with no representation of the landscape as whole. A contemporary understanding of the distribution and abundance of feral animals is critical if causal links are to be made.

Here we present an integrated framework that combines large-scale abundance and impact data with site-level health and biodiversity assessments to form a cohesive picture of country-wide impacts.

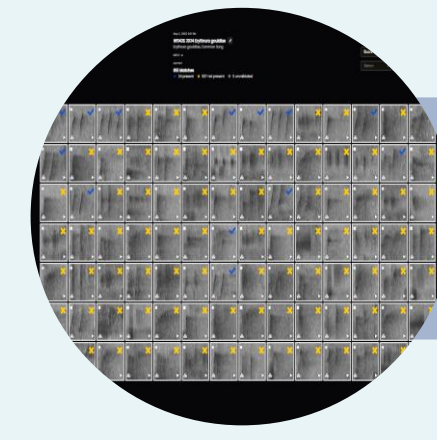
2 Methods

Research methods were carefully co-designed to answer both local and landscape level questions while respecting the unique complexities of place. Inclusivity, adaptability and scalability were key.



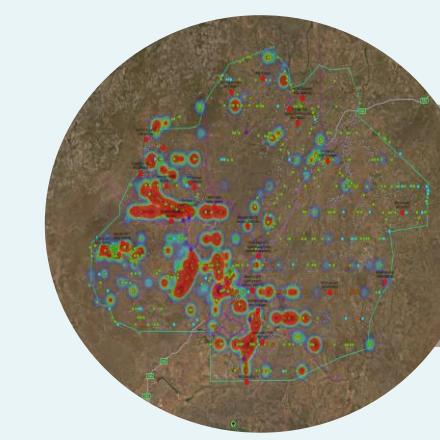
Collection

Aerial feral species surveys (3 yrs) covered 1,360 km across Mimal. **Rapid health assessments** were conducted at 723 waterholes, with **aerial imagery (all sites)** and **multi-parameter water testing (33 sites)** for validation. **TO and Ranger site assessments** added local context at 20 sites. **Acoustic devices (30 sites)** and **eDNA (20 sites)** captured biodiversity status and trends.



Translation

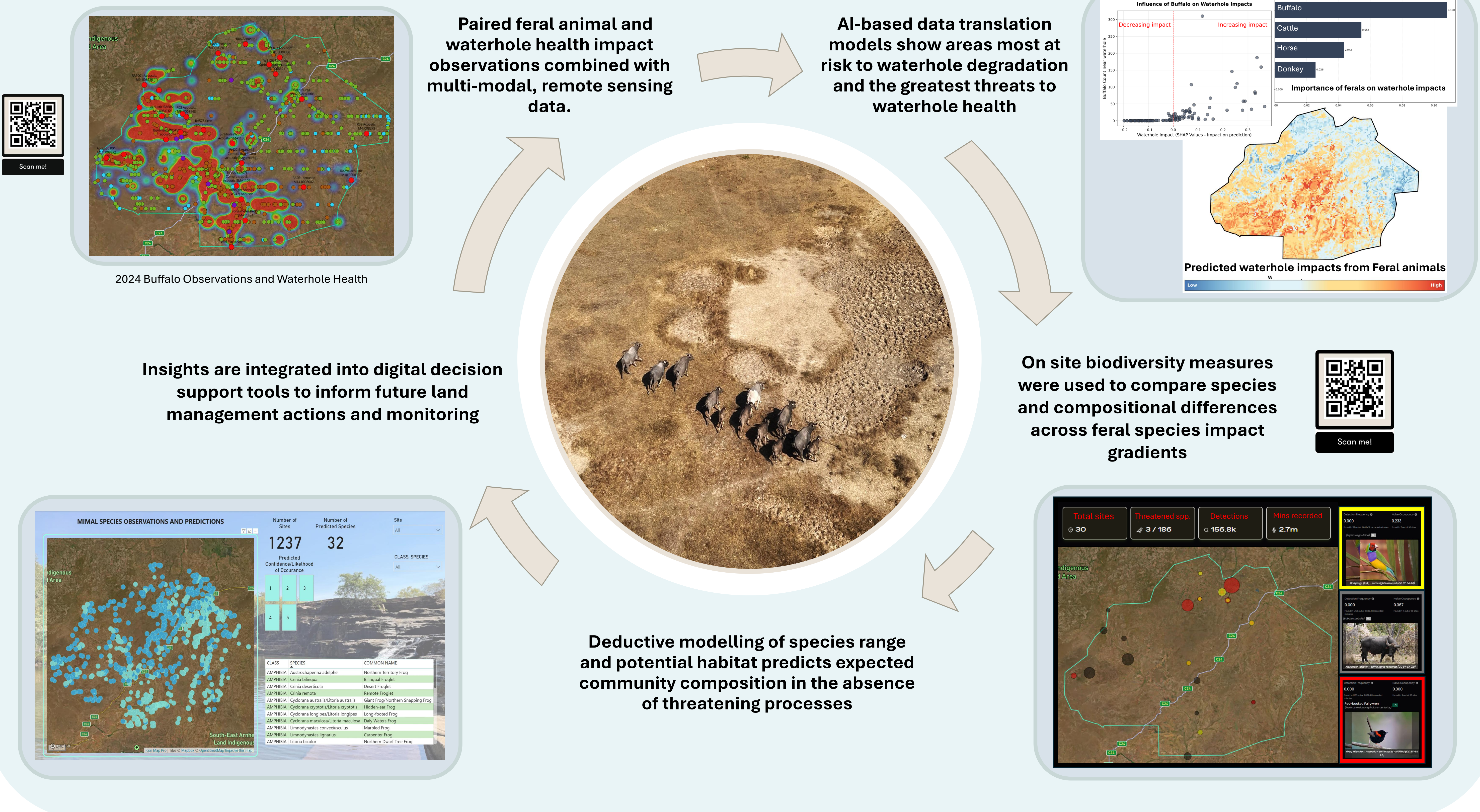
Aerial surveys mapped feral species distribution and abundance. **AI** analysed 2.7 million minutes of acoustic data to measure biodiversity across feral species density gradients. **eDNA** captured non-vocal species, while **rapid waterhole assessments** identified impact hotspots. **Deductive models** were then used to compare expected vs. observed species diversity.



Visualisation

Interactive maps and digital dashboards integrate all data to highlight feral animal impact and biodiversity hotspots across the entire landscape, guiding targeted actions and tracking outcomes against expected biodiversity indicators. **Powerful visualization tools** allow for complex datasets to be communicated to all stakeholders

3 Results



4 Discussion & Conclusion

This integrated approach shows that **buffalo are the primary drivers of wetland degradation in Mimal**, with most impacts linked to their thermoregulatory wallowing behaviour. While all feral ungulates affected waterhole health to some degree, buffalo had the strongest and most consistent influence. Aerial imagery (not shown here) was collected alongside field data and will be used to further validate these findings.

Analysis of multi-modal datasets also identified **promising indicator species**: birds like **wrens and finches** were noticeably less common in heavily impacted areas, suggesting their potential as sensitive ecological indicators.

The relatively low impact of feral pigs in Mimal appears counterintuitive but is likely due to competitive exclusion by buffalo. In regions without buffalo (e.g. Cape York Peninsula), feral pigs are expected to play a much more significant role in wetland degradation.

Taking a big-picture view of feral animal impacts reveals patterns and priorities that site-level data alone can't — enabling smarter, more strategic management that supports the values and aspirations of people looking after Country.

5 Next Steps

- Test scalability by applying the approach to datasets from Cape York Peninsula.
- Evaluate and refine AI tools (developed with QUT) for detecting waterholes and assessing their condition across Northern Australia.
- Complete data visualisation and translation tools to return actionable insights to land managers.
- Analyse large-scale aerial imagery to better attribute impacts to specific behaviours (e.g. wallowing, grazing, drinking).

