



## **Pastoralist piloted drone monitoring – drones as a tool not a toy**

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### **Abstract**

Landscape management is at the heart of what pastoralists do. Ultimately the viability and sustainability of pastoral businesses is based on how their landscape functions and responds to rainfall. Core to the concept of improving landscape function in a rainfall limited climate – Rainfall Use Efficiency. Management strategies that improve Rainfall Use Efficiency such as regenerative grazing and erosion control techniques can be implemented on any property but need to be done so in a targeted and informed way. The challenge in achieving good landscape management comes not only in knowing what to do but more importantly when to do it. This is particularly challenging given the variable climatic conditions and diverse landscape types experienced in the Pilbara.

Emerging Ag Technologies are providing tools and data that make managing the variability easier. Drone technology is a rapidly growing industry and is becoming increasingly accessible. Drones present an opportunity to gather information about your landscape in a repeatable, reliable and efficient way, and to use that information to make informed decisions about your landscape management.

With funding from the Southwest WA Drought Resilience and Innovation Adoption Hub, Contour Consulting has developed a new tool that is pastoralist-friendly and allows for more informed pasture assessment and calibration of your stocking decisions. The process is end-to-end, from establishing monitoring sites through to follow-up support, and is tailored to your property.

The tool provides quantitative pasture and landscape condition data through repeatable assessments that will give land managers direction and confidence to make proactive grazing management decisions. It also creates a database of evidence that could be used in documenting improved management as part of a carbon or natural capital project.

### **Introduction**

Australian Rangelands span an impressive area of 6,300,000 km<sup>2</sup> area and represent a diverse array of vegetation types. Despite this diversification, they function as a cohesive natural ecosystem which is primarily utilised for grazing livestock (Wilson, 1988). Australian Rangelands are incredibly vast, requiring

modern solutions for precision agriculture to monitor these areas effectively. Tracking the large-scale ecosystem changes is mandatory for the better landscape and livestock management. To monitor these areas, tools like drones play a crucial in the livestock production and management.

Drones have been proven to offer numerous advantages from the last 10 years as a part of precision agriculture (Zuo, 2021). The information gathered can assist the pastoralist to make quick decisions about whether to intervene to guarantee the best possible output at the end of the season. Digital, thermal, and multispectral cameras are the most often utilized types of cameras, and they are crucial in giving the necessary information on vegetation and livestock conditions (Aquilani, 2022).

Unmanned Aerial Vehicle (UAV) technology was used along with in person site assessments to develop a digital library of different sites on the Yerilla Station in the Goldfields region of Western Australia, to accelerate the process of decision-making regarding stocking numbers and pasture utilisation. On-ground photos, cattle condition assessments and remote sensing technology were integrated for better pasture management across different seasons. This Project was joint venture between Contour Consulting and the Southwest Drought Hub WA.

### Methodology

Eight monitoring sites, each with 3 to 4 subsites (Figure 1), were selected for drone monitoring at Yerilla Station, 150 km northwest of Kalgoorlie Boulder in the goldfields region of Western Australia. Sites were selected using a combination of geospatial desktop analysis and in consultation with the station manager. Detailed information about the land system, pasture type, current pasture condition, occurrence of erosion and its extent/type, and important indicator species i.e. increaser and decreaser species were recorded during an initial on-ground visit to each of the sites. Rainfall data is being recorded by installing rain gauges on each of the sites. Subsites were selected in areas that had a higher probability of responsiveness to the changing seasonal conditions and management. Observations were made about the grazing extent, palatable species, micro-habitat areas and recruitment rate of desirable species. This data forms the basis for the land manager to be able to interpret and identify pasture condition changes through reassessment.

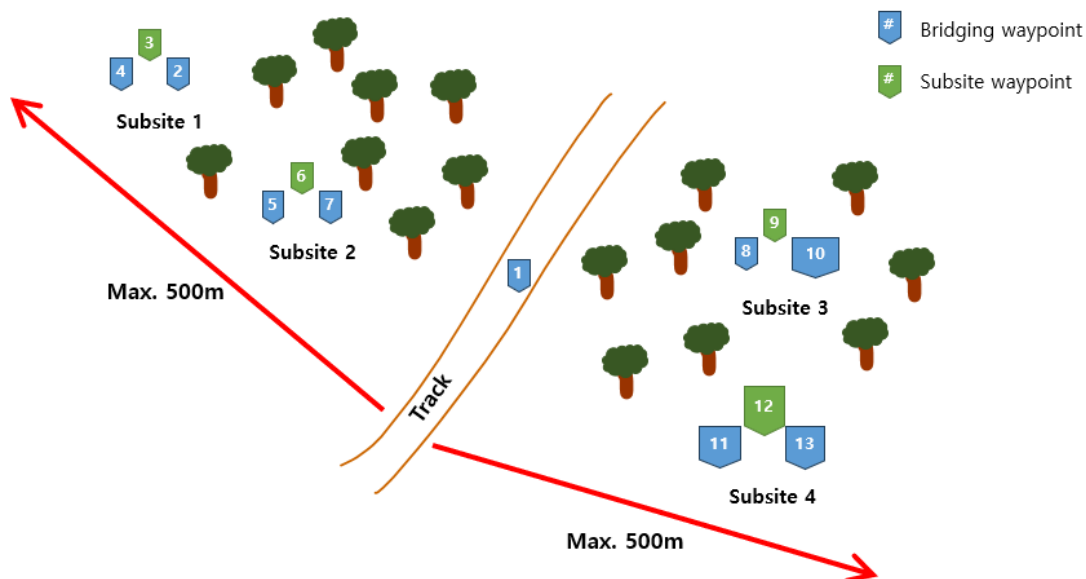


Figure 1: Setting up the monitoring site along with 4 different subsites

Autonomous flight waypoints were setup to capture an RGB photo of each subsite using the off-shelf drone technology and a drone programming app 'Litchi for DJI Drones' (Figure 2). Photos are taken at or above the canopy height to allow for monitoring of understorey species. Birdseye photos can be used to assess ground cover in grassland sites.

At Yerilla, photos of each subsite were captured monthly in a repeatable manner to build up a library for monitoring the growth of the palatable species, changes in the pasture and indicator species for grazing management decisions. A 'rolling rainfall to stocking rate' spreadsheet was developed to assist the station manager in monitoring rainfall and current stocking rates. Using the station's median rainfall data, this tool compares the current stocking rate to the suggested rate (Figure 3). This tracker offers useful information for making well-informed stocking decisions, such as whether to move stock into or out of an area based on pasture conditions and recent rainfall when paired with monthly photos. An assessment sheet is used as go-to-go record keeper for all the observations and action during assessment or re-assessment of a monitoring site. Information about desirable/undesirable species, rain gauge reading, temperature and any adjustment made to the stocking numbers are recorded to keep all the crucial details in check for better site evaluation process.



Figure 2: Flight path simulation of a monitoring site in the Litchi app for DJI drones.

## Results

Using drones as a part of modern precision agriculture has made the process of decision-making more efficient and faster. Reassessment of sites takes approximately 8-10 minutes. The data collected through the monitoring system supports land managers to proactively manage grazing across their property. During dry seasons, feed requirements for stock can be budgeted with the assistance of drones as a part of pre-planning. To prevent overgrazing, the Yerilla station manager now employs this technology with confidence

for prompt livestock movement. This economical approach has the potential to be widely used. In addition to helping the cattle industry achieve high welfare outcomes and production targets, it offers to improve rangeland conditions over the long term and manage rangelands for drought resistance. Pastoralists from all around WA, including those from the Pilbara, Kimberley, and Goldfields-Nullarbor regions, have expressed their interest in learning more about the package.

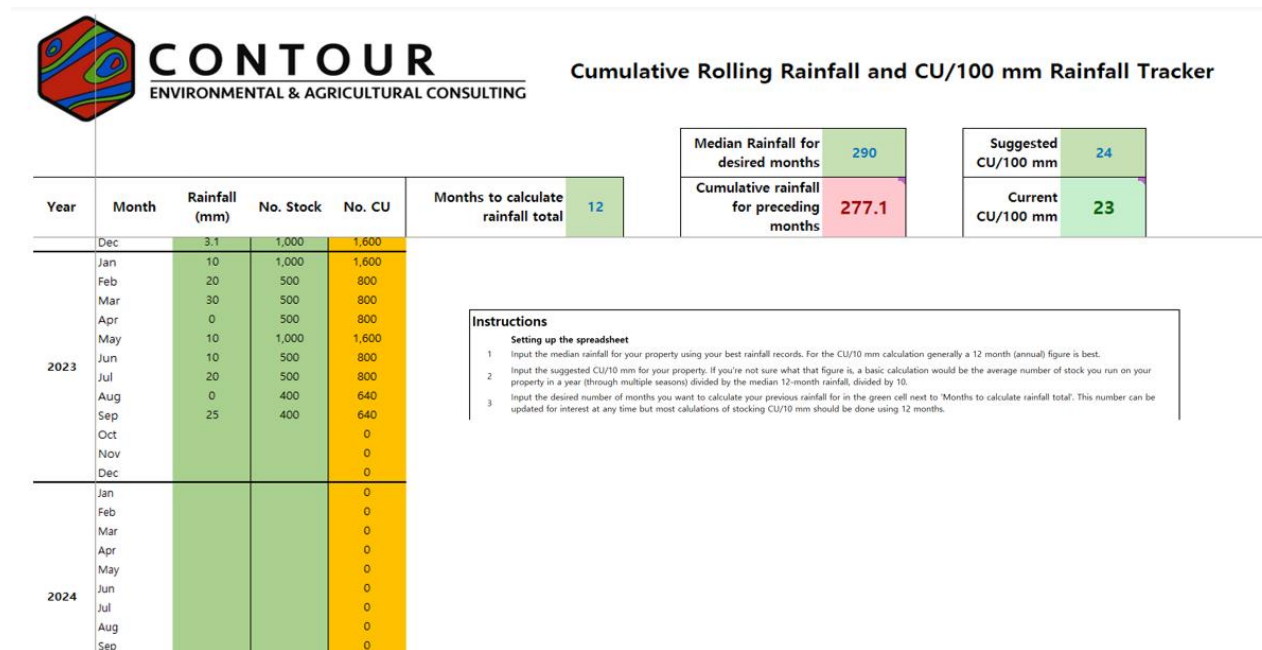


Figure 3: Cumulative Rolling Rainfall and Cattle Units/100 mm rainfall tracker

### Conclusion

In conclusion, drones have revolutionized the precision agriculture methods and the way pastoralists manage their stock. UAVs assist pastoralists by keeping track of their livestock, monitoring the land's condition and identifying potential threats with a bird's eye view. The use of aerial imagery technology may help managers to not only increase productivity, but also enhance sustainability in the pastoral industry. The data-driven decisions have improved time management, which is a crucial factor for pastoralists. This modern precision agriculture tool can help to mitigate the risk associated with droughts or harsh weather conditions, ensuring the longevity of the rangeland operations and better management of the livestock. Ultimately, the adoption of UAVs represent an analytical thinking approach that aligns with the future of Australian Rangelands, making the way for a more productive pastoral sector.

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## References

- Aquilani C (2022). Animal. Precision Livestock Farming technologies in pasture-based livestock systems, 16(1).
- Wilson A (1988). Vegetation Attributes and Their Application to the management of Australian rangelands. In A. Wilson, & K. C. Noble, *Handbook of Vegetation Science* (Vol. 16, pp. 253-294). Dordrecht: Springer.
- Wong K (2006). UAVs Over Australia Capabilities and Opportunities. *21th International Council of the Aeronautical Sciences Conference (ICAS 98)*, (pp. 13-18). Melbourne, Victoria, Australia.
- Zuo A (2021). Flying over the farm: understanding drone adoption by Australian irrigators. *Precision Agriculture: An International Journal on Advances in Precision*, 22, 1973-1991.