SOUTHERN NSW Innovation Hub
SUSTAINABLE AGRICULTURE, LANDSCAPES AND COMMUNITIES

CASE STUDY: RECOGNISING THE ONSET OF DROUGHT

Western NSW pastoralists are using technology to set decision-making trigger points that improve drought preparedness

The **Managing Rangelands for Drought Resilience** project was a collaborative cross-Hub project that demonstrated and built pastoralists' confidence in applying new digital tools and management systems in their businesses. The national project was led by the Northern Hub (Northern Western Australia and Northern Territory Drought Resilience Adoption and Innovation Hub) and involved the Hubs for Southern NSW, Southern Queensland and Northern NSW, South West Western Australia, and Tropical North Queensland.

The Southern NSW Drought Resilience Adoption and Innovation Hub's Managing Rangelands for Drought Resilience project focused on working with pastoralists from Western NSW to test and demonstrate how satellite-based mapping technology can predict ground cover changes up to six months ahead of drought.

Pastoralists Bill and Pip Ryan worked with Dr John Leys of Wind Erosion Consulting to review and assess whether the freely available satellite vegetation cover data from the GEOGLAM Rangeland and Pasture Productivity (RaPP) mapping tool could be used to set an on-farm trigger point to prepare for drought.

A workshop for Western NSW pastoralists at Booligal in December 2023 gathered insights and feedback on how pastoralists use technology and digital tools to monitor and manage rangelands, including the RaPP mapping tool. The workshop was organised by Southern NSW Innovation Hub in collaboration with the NSW Farmers' Association.

Image: *Sheep grazing saltbush, Hay Plains, Western NSW (credit Southern NSW Innovation Hub)*

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Part 1: Assessing satellite tools with the Ryans

Bill and Pip Ryan sustainably manage their 130,000-hectare properties near Oxley in the Western Riverina using a combination of experience, technology and knowledge sharing with other land managers. They receive an annual rainfall of about 300mm and being resilient to drought is essential to their business in a semi-arid environment based on perennial saltbush.

The Ryans continually monitor stock condition, ground cover, species type and rainfall to protect their vegetation. Key decision time for the business is August-September which is the end of the winter growing season.

The Managing Rangelands for Drought Resilience project worked with the Ryans to assess if the satellite vegetation cover data freely available via the RaPP mapping tool, could be used to set a trigger point for drought preparation. The aim was to use levels of vegetation cover observed in winter to predict if cover would be low in the following summer.

"Our business is based on managing the land, the animals and the welfare of the people, all within an ethical framework. Vegetation is the core of our production. Protecting perennial saltbush, vegetation and soils, especially during drought, is fundamental to our sustainability."

Bill and Pip Ryan, Pastoralists, Curragh Station, Oxley NSW

Image: *Pip and Bill Ryan (credit Southern NSW Innovation Hub)*

On-farm trigger points

Analysis of previous seasons and conditions at the Ryans' properties showed that if vegetation cover was less than 55% in August, then the following summer would bring vegetation cover of less than 40%. This rule held for six out of seven (86%) of instances over the past 22 years. The Ryans implement different management options for the farm depending on the vegetation cover and stock condition at the end of August.

Satellite vegetation cover values correlated with the Ryans' management actions over the last seven years to 2023 with results as follows:

- **Business as usual (BAU).** Adjust stock numbers according to the pasture available, but no supplementary feeding is required. BAU occurred in 2017, 2021, 2022 and 2023 when August cover levels were above 55%.
- **Supplementary feeding in the paddock.** Pasture quality and or availability is less than desired for the stocking rate. This occurred in 2017 when August's total cover levels were above 55%, but the availability and quality were low for the desired stocking rate. This lower quality and availability in 2017 were related to the green cover shown in Figure 1, where only three months in 2017 were above 30% green. Again, in 2020, total cover was above 55%, but only four months above 30% green, but not above 40%, as in 2017.
- **Stock containment and paddock feeding for a few months.** Pasture quality and availability are low, like in 2019 when the cover was < 55%. but the green proportion of the pasture was the worst green cover in 22 years, with a maximum of 11% green in the growing season. Animals were contained for three months and returned to the paddock with supplementary feeding.
- **Stock containment and feeding until seasonal conditions change.** This occurs when the growing season fails for two years. This happened in August 2019 when the cover was <55% and the previous 31 months had 28 months with < 20% green growth (Figure 1). The lack of green growth resulted in a rapid drop in cover to below 40% in summer 2019-20 (Figure 1).

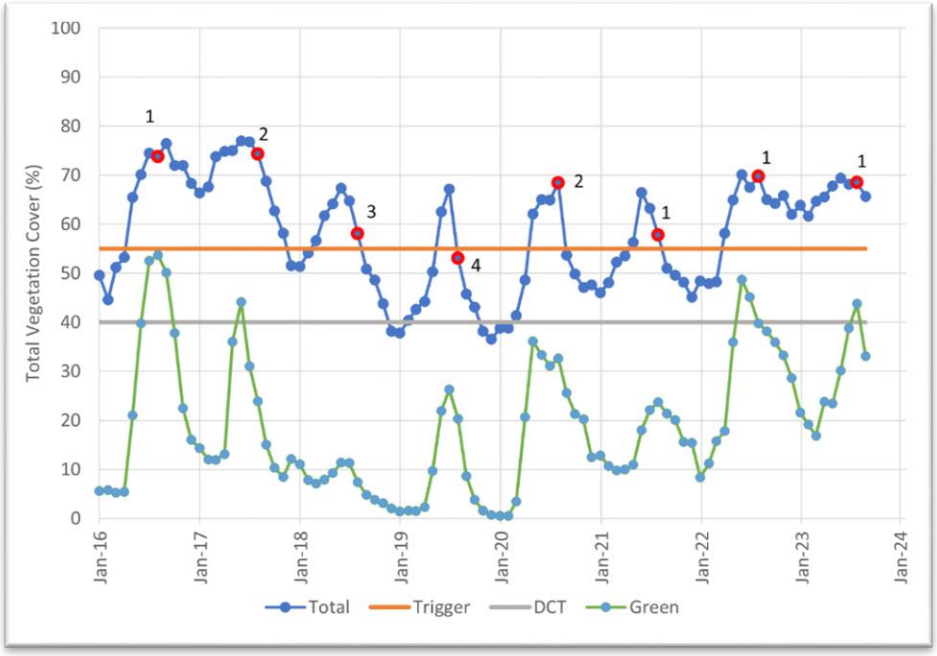


Figure 1: *RaPP time series for Curragh and management action taken post-August*

Management principles underpinned by data

Experience, technology and discussions with other land managers are key factors in the sustainable management of the Ryans' properties and in reducing the impact of drought. One of the key characteristics of their business is the focus on environmental and economic sustainability goals. To achieve these, they apply the following management principles.

- **Achievable**: All management options must be achievable and within the business resources.
- **With family**: Enjoying the business with family involvement is essential.

- **Healthy vegetation**: The aim is to have good ground cover and improve vegetation condition. Cover may not be optimal in drought, but the objective is to keep the saltbush in good condition. The Ryans do this in line with NSW Local Land Services (LLS) Riverina (2013) photo standards for saltbush condition (Figure 2). For example, on their property Curragh they aim for "excellent" condition and the intention is not to go below "good" condition (Figure 2).
- **Flexible:** Living in a dry climate with variable rainfall means being flexible and continually adjusting management according to the season.
- **Regular review**: The pasture and stock must be continually reviewed to prepare for drought. Having a plan where different management options have been tested and costed helps reduce management stress. For example, working out the costs of paddock feeding and containment feeding should be worked out before the decision is made.
- **Decision points**: Have trigger points and a specific time each year for making decisions about feeding, selling stock and setting the new stocking rates for the property. Most importantly, stick to the plan.

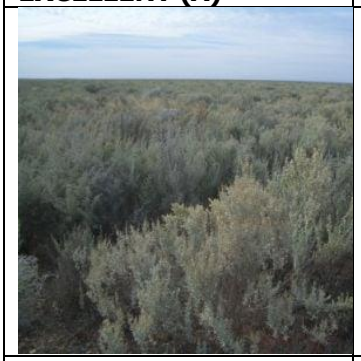
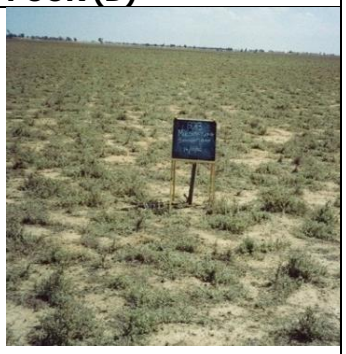
EXCELLENT (A)	**GOOD (B)**	**FAIR (C)**	**POOR (D)**
			
Diversity of annual and perennial palatable plants dominated by bladder saltbush of varying ages and with regeneration (mix of ages).Shrub spacing 1 to 1. I.e. if shrubs are 1 m tall, their spacing is 1 m apart. Some black bluebush, thorny saltbush, medics, creeping saltbush and a range of grasses. Good overall cover, including litter and lichen, and plant density is high.	Less diversity and increase in less palatable plants i.e. black bluebush. Shrubs are more sparse, with shrub spacing 2 to 5 times shrub height. There is more evidence of bare areas in between, indicating fewer forbs and grasses. Some lichen and litter cover.	Reduced cover of bladder saltbush, very sparse, shrub spacing 6 to 12 times shrub height significant bare areas. Minimal forbs and grasses between shrubs.	Dominance of annual and ephemeral species with relatively low palatability. No regeneration of saltbush, and if they exist, are degenerate. Isolated small shrubs, if any at all.
Highly productive and resilient.	Fluctuating productivity, less resilient but still high in good seasons.	Productive in good seasons.	Impaired productivity, very seasonally dependent, low or non-existent productivity in dry seasons.
No erosion evident.	Very minor erosion.	Soil disturbance in bare areas, soil exposed to erosion.	Severe erosion and high susceptibility of soils to erosion in all seasons.

Figure 2: *Saltbush Plains – Bladder saltbush dominant. Above are photo examples of bladder-dominant and black bluebush-dominant saltbush plains in different conditions (excellent - poor). Modified version of Meat & Livestock Australia photo standard example photo standard example.*

On-farm technology use

The Ryans use a range of technology to help with farm management. The technology improves labour efficiency and safety and supports livestock management, stock movement, stocking rates, and animal treatment records. It underpins their reporting for ethical production on-farm and assists with operational functions including:

- Rainfall and water tank monitoring.
- Helping workers navigate the property, i.e., with maps on their phones.
- Logging maintenance issues and updating stock management records in the paddock.
- Reliable communications to improve work health and safety and enable staff to remain connected across the remote property.

The biggest on-farm technology hurdles for the Ryans are:

- Reliable internet access.
- Confidence and skills to use new technologies.
- Time to learn new technologies.

Technological advances or adaptations to support the Ryans' future farm management include:

- High speed and reliable internet.
- Close to real-time satellite imagery to check water, ground cover, fences and stock.
- Surveillance technology with in-built privacy so users can only see / access information about their own properties.
- Virtual fencing for stock management and mustering.
- More intuitive, user-friendly tools calibrated for individual farm/property use.

Resilience is about decisions

Producers like Bill and Pip Ryan aim to make high quality, timely decisions based on the best available information. This project showed that for semi-arid saltbush rangeland, continual monitoring of stock condition, ground cover, species type and rainfall, and trigger points set for specific months (August) enable good decision making and pre-planning to minimise the impact of drought.

The RaPP mapping tool can help pastoralists identify trigger points and make timely management changes for the season ahead. For the Ryans, if vegetation cover was below 55% in August, then the following summer was very likely (86% chance) to be below 40% cover.

The Ryans have an operational management plan that prepares them for drought, and this aids in reducing their stress. They use various technologies to monitor and manage the farm and are keen to use and see the benefits of vegetation monitoring systems.

Part 2: Exploring Western NSW pastoralists' use of ag tech

Image: *After the Booligal technology workshop (L to R) Tanisha Shields (Agrista), Ian Armstrong (pastoralist), Bill Ryan (pastoralist), Dr John Leys (Wind Erosion Consulting), Caron Chester (NSW Farmers' Association) and Mary Goodacre (Southern NSW Innovation Hub)*

In December 2023, a workshop held at Booligal in western NSW gathered insights from a group of local pastoralists about how they use ag tech on farm, the value of the RaPP mapping tool and other digital tools for monitoring and managing rangeland. The Southern NSW Innovation Hub and NSW Farmers hosted the workshop and partnered with Agrista and Wind Erosion Consulting to gather feedback and assess the participants' awareness and understanding of key technology tools.

Baseline snapshot - workshop

- 12 participants
- 25% female
- Average age 58 years
- Most have an informal drought plan
- Before the workshop, the RaPP tool was new to 75% of participants, while the MLA and BoM tools were familiar to 60% of participants
- After the workshop almost 70% of participants were confident to try the RaPP too and over 80% confident to use the MLA and BoM tool

Local pastoralists agreed they are more aware of options that can be actioned in response to shifts in a season, including feeding and selling strategies and use of infrastructure such as grain silos, paddock feeders and stock management (containment) areas.

The RaPP map tool was new to 75% of the workshop participants but many said they would use it to help set on-farm trigger points for short- and long-term decisions on managing stock numbers as seasons change. At the workshop, Bill and Pip Ryan showed that local testing of the RaPP map demonstrated good predictability for ground cover changes in saltbush country. Feedback included that if a simple two-step

tool is developed to work with the RaPP map then participants would be prepared to use it annually to support decision making on farm.

Participants prefer to follow up with presenters, experts and local advisers and be able to try the tools at home over attending a webinar or workshop.

Pastoralists in Western NSW are using a wide range of ag tech in the paddock, office and on mobile phones. Weather apps are most commonly used along with office technology such as accounting and spreadsheet software. Participants are less satisfied with the paddock-based ag tech and farm management apps they use. See Figure 3.

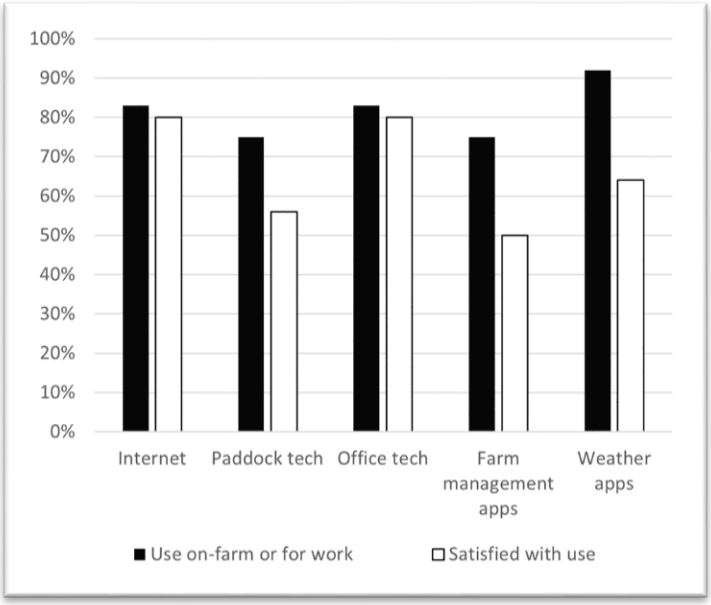


Figure 3: *Pastoralist satisfaction with ag tech used on farm*

Barriers remain for pastoralists wanting to use more ag tech on farm. With the broad range of ag tech on offer, pastoralists at the workshop felt limited by their knowledge of the tools and data availability. The cost and time required to learn to use ag tech competes with their existing workload and reliable connectivity remains a barrier.

One-on-one advisor support will continue to build confidence among pastoralists in using ag tech and helping them to choose the best tools suited to their specific farming enterprise. Technology and tools work best when tailored to the needs of the property and the business.

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