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Ecological regeneration in a low rainfall environment using long-rest grazing management

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Abstract
In 2020, after 3 years of severe drought which heavily impacted the productivity of Buckleboo Station, we commissioned the design of a detailed 5-year Ecologically Sustainable Rangelands Management (ESRM) Environment Plan.

Buckleboo Station has fast-tracked the ESRM Environment Plan, with the added benefits of producing more lamb in a shorter timeframe and championing innovative and industry-leading regenerative grazing practices. The station has changed from set stocking to long-rest grazing. The dorper ewes are now running in one mob. The station is sub-divided into 6 grazing areas of approximately 40,000 acres, each area being grazed for 3 months followed by 15 months complete rest. Every watering point has a trap yard around it. More watering points are being prepared to ensure even grazing of each area.

Badly degraded and scalded country has been treated with a crocodile seeder, to divot the surface, aiming to slow down the flow of water and re-hydrate the soil. These areas will be closely monitored to determine if the native grasses return.

New technology has been adopted for key project outcomes: Ceres satellite tags for livestock movement monitoring, NDVI satellite monitoring, satellite monitoring of water storage tanks, and soil probes to measure moisture available to plants in a range of different soil types. Twelve monitoring sites are being constructed across the station to monitor the changes in vegetation.

In October 2021, the Emissions Reduction Fund (ERF) approved a large carbon project (over a million tonnes of carbon sequestered) for Buckleboo Station. This project is managed by Australian Integrated Carbon. More fencing will be constructed in the future to control the grazing of livestock. Our key action is managing the carbon project with long-rest grazing and not destocking the carbon project areas.

Introduction

Buckleboo Station endured a severe three-year drought 2018 – 2020, that heavily impacted the station's ability to efficiently and sustainably produce dorper lambs. In early 2019, management decided to urgently

address these issues by improving long term sustainability through regenerative grazing, improved water management, improved monitoring and drought resilience activities. Buckleboo Station commissioned the design of a detailed 5-year Ecologically Sustainable Rangelands Management (ESRM) Environment Plan through Contour Environmental and Agricultural Consulting. The Buckleboo Station ESRM Environment Plan is based on the ESRM project tool that follows the principles of regenerative grazing to maximise the restoration of biodiversity, water and nutrient cycling and energy efficiency within the local ecosystem. The ESRM methodology was selected for the following reasons:

• Involvement of a rangeland ecologist to build a better understanding of how different actions would impact the environment.

• The process aligns the goals for the property and the business with the capability of the land.

• Proven track record of success in Western Australia with pastoralists and mining companies.

In 2020, Buckleboo Station engaged the services of Contour Consulting to prepare a detailed ESRM Environment Plan in conjunction with the existing business plan. This is a new way of planning as far as the pastoral industry is concerned. Contour Consulting has used satellite imagery and GPS mapping to locate key problem areas across the station and develop strategies to address them. Additionally, as part of the initial commencement of the ESRM Environment Plan, we used an innovative mapping process to locate deep underground water using electromagnetic data sets. The concept of long-rest grazing on a pastoral property is quite innovative in South Australia.

Sustainability improvements on Buckleboo will be achieved through activities that will:

• Increase ground cover from 20% to 70%. Ground cover of 70% will reduce water and wind erosion to almost nil. The increased ground cover also has significant production advantages due to increased water infiltration, good microbial activity, improved soil structure and buffering from extreme temperatures. We anticipate that it will take several years to reach such levels of groundcover in an arid environment.

• Regenerate the grasslands which have been badly degraded due to overstocking and under grazing by sheep and kangaroos. These grasslands are essential in the dietary mix for our sheep so once the higher quality and more palatable native grasses return this will provide better quality feed. Sheep require the correct amount of protein and energy in their diet to maximise production. The chenopod shrubland is very high in protein and the grasses provide the energy component. Historically the grasses have been overgrazed leaving an imbalance in the diet which has caused low production.

• Re-generate the Chenopod shrublands. The rest period (approx. 15 months) will allow these bushes to re-foliate and recover much more quickly. The areas around watering points require close monitoring as they have been badly affected due to the long-term effects of heavy grazing pressure. It is important to keep the chenopod shrublands healthy as these plants are a tremendous feed reserve through dry times and also help protect the landscape from wind erosion in dry periods.

• Introduce and install more watering points so that a much larger area of land can be grazed, allowing the flock to grow by a predicted 60%, and ensuring the grazing areas will be grazed more evenly.

• Provide opportunities for Carbon Farming. Vegetation assists the retention or accumulation of soil carbon. There is significant interest in the potential for soil carbon projects across the Australian rangelands. While

sequestration rates are generally low, there is a large area available, providing the opportunity for substantial abatement. Unfortunately, at this time, the significant cost of establishing projects, undertaking the required soil sampling at a suitable scale and monitoring project delivery and change require further developments before a methodology can be adopted in pastoral or rangeland areas. We will be in a good position to immediately apply this methodology once it has been established.

Methods

The ESRM process works closely with pastoralists to develop an ecologically sustainable, profitable and respected pastoral community. It enables land lessees to receive support to develop whole of property plans that include mechanisms for reporting on rangeland condition, implementing rehabilitation works, managing threats, and coordinating landscape and catchment approaches to maintain and improve vegetation cover. ESRM planning at Buckleboo Station incorporated grazing and fire management with erosion mapping and erosion control works to improve the rangeland condition of the property. A desktop analysis of Buckleboo was carried out using data from the South Australian Government, Australian Government, Trove and the Rainman Streamflow software package. Available information was used to undertake a preliminary landscape function assessment, characterise the flora, fauna and vegetation present, and to understand the context of management history and previous work carried out on Buckleboo and in the surrounding area. Maps of infrastructure, land systems and satellite imagery were prepared for use in discussions during a station visit which occurred between the 24th – 27th October 2020. It was attended by James Kerr and James Wright (Paroo Pastoral) and facilitated by Richard Marver (Contour Consulting). During the visit, detailed discussions around the prepared maps provided the framework for the infrastructure development plan. A preliminary assessment of the condition of Buckleboo Station and areas of interest was made based on discussions with the property owner. Participants were asked to identify these areas on a map, and to document their own knowledge and observations regarding the environmental condition of the station. Targeted on-ground and aerial surveys (using an Unmanned Aerial Vehicle or drone) of areas of interest and proposed areas of infrastructure development were then conducted.

The proposed grazing strategy for Buckleboo is to have six secure paddocks with reliable (12 month) water supply that encompass the entire station area. To achieve this, dams will be supplemented with tanks and troughs supplied by several bores and a pipeline. The paddocks are created by subdividing the current infrastructure to create paddocks that encompass similar land types. The paddocks will be grazed under a rest-based system giving each paddock approximately 3 months grazing with 15 months rest. A more intensive rotation may be implemented in the future dependent on the success of the proposed 6-paddock rotation in encouraging pasture regeneration, and how well it fits into the management schedule for the station.

Two grassland regeneration paddocks will be created which will exclude kangaroos and wallabies and which, after being rested for a season, will be grazed conservatively during lambing (May/June). The existing paddocks near the homestead will be strategically grazed with sale/young stock that will provide them with a short graze, followed by a longer rest period. Any mechanical regeneration works that are carried out within the paddocks will have a greater chance of success if they are rested from grazing until vegetation has colonised the area. Resting these historically heavily utilised areas will speed their recovery. A rest-based grazing system will provide the most amount of benefit to the highly productive grassland areas of the lease. A short, heavy graze period applies the same level of grazing pressure to an area as a long, light graze period, while maximising the length of the rest period. This will result in a healthier root system, and a more resilient tussock that has a better chance of surviving long dry spells.

As part of the ongoing project, we will be using the following new technology:

- NDVI satellite monitoring; we have engaged CIBO Labs to monitor the increase in biomass using NDVI technology.
- Ceres satellite tags: These tags are the world's first real time satellite tracking ear tags for livestock. The tags not only indicate the location of animals and allow lifetime traceability but also provide health information such as temperature and elevated heart rate. Livestock movement data will help us understand the movement/concentration of sheep in a grazing cell in line with our objective to encourage more even utilisation of the available grasslands and Chenopod shrublands by provision of additional water points.
- Satellite water monitoring of storage tanks: These monitors are designed to improve productivity and efficiency on pastoral stations. The daily reporting enables the station manager to monitor the amount of water stored and to identify issues such as major leaks in the system very quickly. Monitors also increase productivity as there is no need to drive around watering points every day.
- Soil probes: Soil probes inserted 1 m into the ground enable us to understand the amount of moisture that is available to the plants in a range of different soil types.

Results

The changes to the landscape biomass are observed with satellite images from Cibo Labs (Figure 1). These images are acquired in January each year. 2020 was the end of a three-year drought, 2021 was an average rainfall year, however, the recovery was slow due to low levels of biomass, 2022 was a higher-than-average rainfall year with 485mm, 2023 was another average rainfall year, however, the good rainfall in 2022 is reflected in the satellite image, 2024 was a very dry year with 175mm recorded. The biomass continued to improve and the image for January 2025 is the evidence of the significant increase in biomass since 2020.

Evidence of the success of the program to date is provided by the following observations on landscape changes by James Thiessen and Kylie Moritz (Australian Integrated Carbon) and Richard Marver (Contour Consulting) in 2022.

James Thiessen and Kylie Moritz:

- Traditionally, trees and shrubs that are not observed regenerating on pastoral stations were observed - notably
    - Western myall *(Acacia apyrocarpa)* estimated to only regenerate 5 times per century – after massive rainfall. Readily grazed by sheep and rabbits. Young recruits were observed
    - Pin bush (*Acacia burkittii*) – in the book Acacia's of South Australia (D.J.E Whibley & D.E Symon 1980) the authors predicted that within a century A. burkittii will be close to extinction where both rabbits and sheep occur together. So, it was great to see this species regenerating at multiple sites across the station
    - Bullock Bush *(Alectryon oleifolius)* – new growth shoots observed suckering off old established trees – Bullock Bush is a favoured plant by all herbivores
    - Other notable species regenerating at various sites were the native apricot (*Pittosporum angustifolium*), Black Oak *(Casuarina pauper),* Sheep Bush *(Geijera linearifolia)*, Sugarwood (*Myoporum platycarpum*)
- Buckleboo's road to recovery after being heavily grazed last century is looking very promising. Planned and well executed rotational grazing is enabling the regeneration of many trees and shrubs. This was observed alongside a very healthy ground cover full of grasses, forbs and an amazing-looking soil crust.

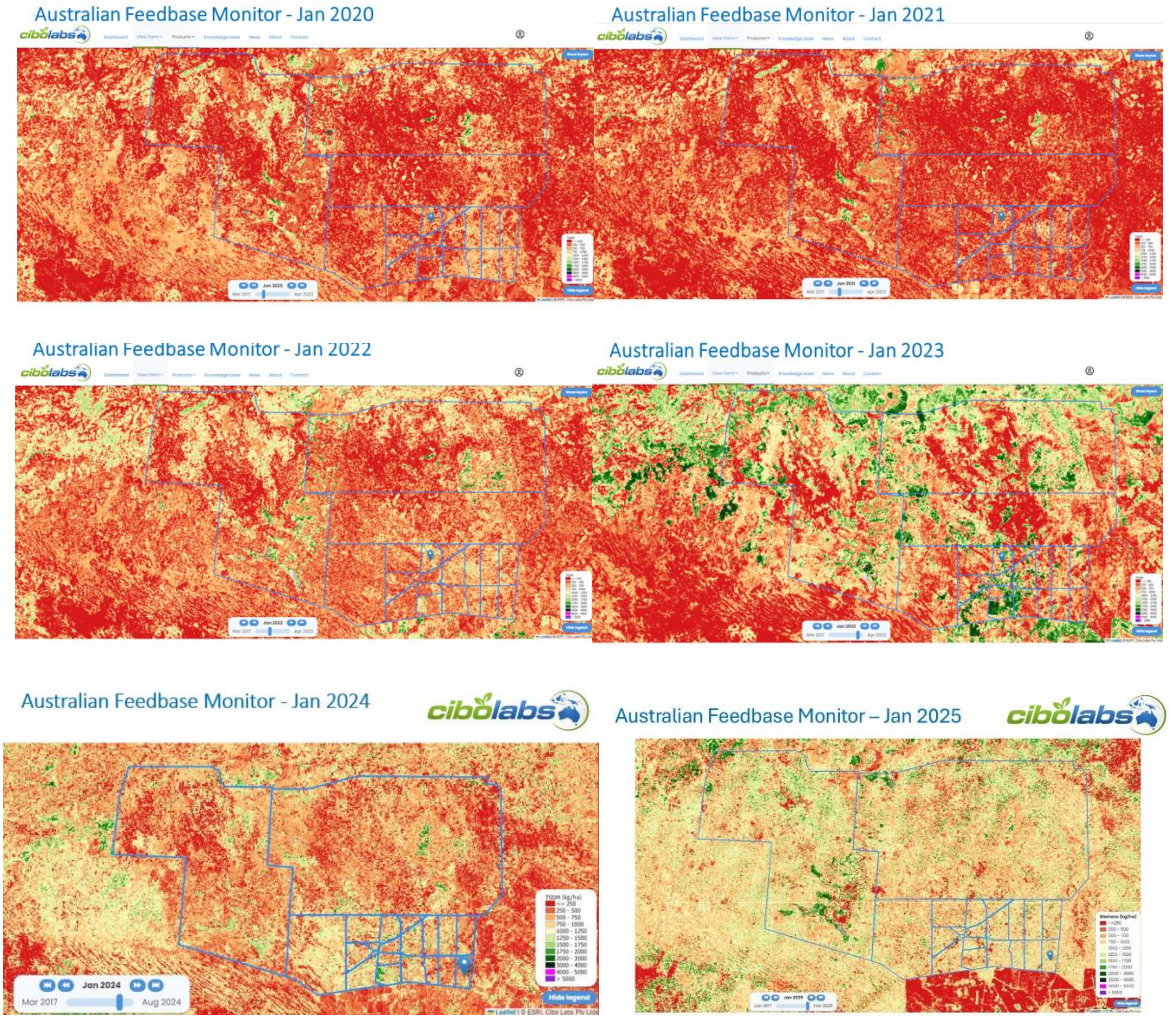

Figure 1. Increase in biomass using CIBO Lab, NDVI technology

Richard Marver:
"Since my first visit to Buckleboo I have been privileged to be able to witness the amazing recovery and transformation of the landscape through the implementation of a regenerative management plan. The plan has allowed the station to capitalise on the recent good seasons. The aspects of the improvement that I have been most pleased to see are the recruitment and establishment of the palatable saltbush species within the lake country, and the universal improvement in groundcover due to increased abundance of perennial grasses, particularly in the naturally Spear Grass dominated vegetation areas. With continued regenerative management I expect this recovery to result in a far improved landscape resilience through the next dry season".

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