Australian Government
Department of Agriculture, Fisheries and Forestry

Future Drought Fund

CHRRUP
Advancing rural communities

CASE STUDY
PREPARING FOR DROUGHT

MAYFIELD

GREG AND SONIA SPENCER AND FAMILY

JUNE 30, 2024

MAYFIELD SUMMARY OF RESULTS

Activity	Situation 2002	Situation 2024	Future plan
Number of stock water points	10	30	40
Number of paddocks	7	30	60
Number of cattle sustainably supported	350	600	1000

Mayfield is operated as an organic cattle breeding business and is managed using regenerative techniques. The owners emphasize that best management practices are crucial in this these fragile highly erodible soils, and that management must be flexible according to the seasons and rainfall pattern.

The average annual rainfall is 551mm and predicting drought is challenging. They have had to destock in the past due to a lack of fencing and water distribution.

Over the last 20 years, the focus has been on building drought resilience by enhancing cattle rotation to improve grass cover and the introduction and promotion of new fodder species. This strategy has gradually rehabilitated some of the eroded areas. A key factor in this success is increasing water points from 10 to 30 and paddocks from 7 to 30, ensuring livestock never have to walk more than 1 km for water. This is especially crucial during the summer season when temperatures often exceed 40°C. The use of high impact set time rotation on the increased number of paddocks optimizes fodder utilization and helps address erosion issues by allowing grasses time to recover. This comprehensive approach has resulted in an impressive 70% increase in production, with further improvements expected to boost this figure even more.

The owners have increased efficiency and reduced workload through the selection of cattle for temperament, use of quiet handling techniques, smaller paddock size and combining the use of drones with well-trained working dogs.

The erosion on Mayfield is extensive and severe and therefore investment in erosion control measures are restricted to areas that will give a large impact. Fire and chemicals are not used on Mayfield and the property has been registered as organic.

Camels have been introduced at Mayfield with the aim that micro-organisms, which allow camels to break down lower quality grasses, will be transferred into cattle when the animals eat or drink from the same trough.

The owners initially pledged to commit $50,000 as a cash or in-kind contribution to the planned activities. Demonstrating their strong commitment to the project, they have significantly exceeded this pledge by providing $102,500.

As a result of discussion stimulated by the project, the owners are very aware of biodiversity values to their business and are preparing to register as a soil carbon project with the Emissions Reduction Fund (ERF).

BACKGROUND

In 2002, the Spencer Family acquired Mayfield, a 5,000-hectare cattle property situated in the Brigalow Belt Bioregion and located 70 kilometres from Emerald. During the early 1900s, the land was used for grazing 3,000 sheep and 600 cattle. This historical grazing practice and subsequent drought conditions has caused the property to become degraded with widespread sheet and gully erosion.

The landscape is characterized by a series of hard, rocky ridges comprised of duplex silt clay with sodic and dispersive clay components. On these ridges, the dominant grass species is Flinders grass. Buffel grass die-back has occurred in lower areas with clay and clay loam soils. To address this issue, anthrax-resistant Caatinga stylo and Desmanthus is now being introduced. Secca stylo, which is tolerant to anthrax and performs well on hills with good drainage, is already present. Fitzroy stylo has succumbed to anthrax in the past and will not be used again.

The average annual rainfall has been 551mm over the last decade. However, in 2021, there was a significant drop to 470mm and the owners had to destock. In 2022, 2023 and 2024 the seasons have improved significantly with more rainfall, and evenly distributed.

When purchased, Mayfield had a carrying capacity of 350 head and relied on 10 water points. The property currently has 600 head of cattle which are rotationally grazed. Since the property's purchase, the number of paddocks has been increased from 7 to 30, and the plan is to further expand the paddocks to 60, which will increase the carrying capacity to 1000 head of cattle.

Over the past twenty years, Mayfield has undergone a series of steady improvements to enhance carrying capacity and productivity. This includes pulling scrubland, planting of buffel grass and legumes such as desmanthes, wynn cassia and secca stylo to improve pasture quality and productivity.

One of the most significant improvements was the increase of paddocks from 7 to 30, with plans for a further increase to 60.

Set time high impact rotation grazing is a key practice used on Mayfield to hydrate the soils. The practice allows animal impact to break up capped soil, and smooth erosion areas and promote soil health by allowing for rest and recovery periods for

This practice helps to maintain the long-term health and productivity of the property, making it an important part of the sustainable management. Overall, the improvements made on Mayfield have enhanced carrying capacity and productivity and the welfare of its stock while promoting the health of its natural resources.

University of Queensland scientists found micro-organisms, which allow camels to break down lower quality grasses, can be transferred into cattle when the animals eat or drink from the same trough. Based on this study, camels have been introduced at Mayfield.

In terms of biodiversity, the owners report a significant increase in birds and reptiles since rotation began. They do not see this as a problem but as a sign of the country's improving health. Pest species such a cactus is being managed by camels. used in wetter areas with parthenium. Parthenium weeds have been replaced with buffel grass and desirable species using cattle management.

The Future Drought Fund (FDF) project at Mayfield approaches landscape rehydration by utilising grazing management as the primary tool for improving landscape health and function with targeted interventions on alluvial features.

The primary alluvial pattern in the landscape was one of a non-cascading chain of ponds. Steep slopes run into long and narrow valleys. Erosion material from the slopes 'fills up' lower lying areas. These alluvial areas are the most productive on the property. Across the landscape, they vary in condition with some being intact and some highly degraded.

On Mayfield, it was decided that the most effective tool for landscape repair is grazing management. It is the management of grass and plants under grazing that will maintain and build function such as water infiltration and soil deposition. Building earthen and stick barriers also has a role and there are significant examples where such intervention would be of benefit, increasing soil carbon through management of grass and plants, and maximising green leaf area for photosynthesis are the two main drivers for function and rehydration.

PRACTICES – BEFORE AND AFTER

Grazing management system – (e.g. grazing periods, rotation time)	High Impact, time controlled grazing.
Water management strategies	Have enough water but need to increase the number of troughs to reduce distance to water in the heat and to allow reduction of paddock size. Currently have 30 water points. Have bores but these are limited to supplying yards. Bores – 7 (5 are reliable) 14 Open dams 14
Cattle numbers	In the early 1900's 3000 sheep and 600 cattle were run on 8,000ha. This is the reason for the current degradation. In 2002 – 350 head of cattle Had to destock early 2022 due to drought conditions. Average carrying 350-400 breeders. In 2024 - 600 head cows. Future plan for 1000head.
Pasture species grown	On ridges native flinders grass dominates. In lower, die-back areas plan on planting Caatinga stylo that is well suited to clay and clay loam soils; and Desmanthus is adapted to medium and heavy-clay soils. Have Secca stylo which is tolerant to anthrax and thrives especially in hills with good drainage. Fitzroy stylo has died out due to Anthrax. By introducing control grazing where once there were only 1-2 plants Desmanthus (a great legume) in a paddock, it now it even outcompetes parthenium. Desmanthes prefers heavy soils. Recently seeded the creek and gully areas of Woodbine paddock using a drone.
Land use by area - grazing, forest.	100% of country is used. In past about 3000 ha of the 5000ha was cleared. In 2018 the suckers were chain pulled. Timber was laid on the contour and successfully slowed water velocity and therefore, pulling did not cause erosion problems. New rotation grazing management means tree pulling will not be necessary in future.
Sale of cattle	Have organic status since 2018.

	Cattle are sold at a premium to JBS. Most go to Malthoid first for fattening and then sold to JBS. Old cows from Mayfield go straight to JBS.
Time of joining bulls	Join at green date. Usually, late Dec early 1 Jan. Leave with cows until weaning. Wean at 6 mths.
Burning regime	Don't burn. Some people say fire controls dieback disease but remain uncertain about the benefits of burning on this country.
Biodiversity	Plant and animal numbers are increasing rapidly. This is not a problem but is a sign the country's health. If the land can sustain multiple species, this is good sign. We have no problem with pigs, some problem with dogs and roos.
Grazing management strategy	Time control grazing. Cattle and land are healthier and in better condition since introduction of time- controlled grazing. Introduced camels for weed control and to allow transfer of camel micro-organisms to aid cattle digestion. Use MaiaGrazing, an easy to use, online grazing management tool designed to maximise pastures and profits.
Plans for more infrastructure	Will lay poly pipe and connect it to 10,000 gallon hour bore and pump to elevation and distributed throughout property.

TRANSITION TO DROUGHT PREPAREDNESS

What made you think of taking part in the project?	Encouraged by neighbour. Wanted to try using leaking weirs to slow water velocity. Soil erosion is a major problem and need technical advice on how to address the problem.
What are the "on-ground" objectives that you want to achieve as part of your project?	Slow water Reduce erosion Make better use of water that falls on the property – to allow more pasture growth. Rotation. Plan to cut property into cells with single wire electric and putting in water squares. Plan to cut property into cells with single wire electric and putting in water squares.
What were the essential requirements that you need - to consider the project a success?	Gaining knowledge and other peoples experience and apply relevant ideas that to our business

Do you plan to continue to expand the project activities into the future?	Will use the project experience to expand in all problem erosion areas of the property. Will use lessons from other participants to decide on what legumes to introduce; how to best establish a water system; undertake landscape hydration; increase the number of paddocks; seed eroded areas with legumes.
How long do you think it will take to improve the drought preparedness of all your property?	10 years
Do you envisage any impediments to implementation - (risk analysis)	Lack of rain may cause us to sell animals. If it is too wet, can't use machines

REGENERATION IN ACTION

What are the main degraded areas on the property	Woodbine paddock has the largest areas of erosion and dieback. Erosion occurs in all soil types. Less sheet erosion on ridges but do get gully erosion.
Main pests/weeds and control	Currently have bad dieback in buffel grass and native grasses. Pasture is being replaced with weeds like parthenium. Will not treat with poison but will manage cattle to avoid these areas.
Farm plan and/or grazing charts	Have a detailed farm plan. Use several tools for day to day management - including • MaiaGrazing. https://www.maiagrazing.com/ • Farm map 4D • Use agriweb- farm management package use for day to day management. Agriweb is used to allocate tasks to staff and map is used to show where to work eg fix fence or bore. The program has detailed reporting for the Organic Status Audit. An audit is required every 12 mth. Selling organic beef gets a significant premium and the average price is more stable.
Use of technology to assist in management	Use farm map 4D. Use drones for mustering cattle.

	Use drones for seeding paddocks with legumes. The drone allows specific soil types to be pin-pointed for seed placement.
Past success in water retention and erosion control	Time control grazing has reduced erosion. Placed rocks on contour and in gullies. Rock was most effective in bad gullies. Used timber on contour.
In what way have the changes you have made met your expectations?	Cattle and land are healthier and in better condition since introduction of time- controlled grazing. Cattle are healthier because fresh paddocks reduce parasite load and offer good nutrition.
Which innovations do you believe will have most impact on drought preparedness?	Resting country. Getting the rest period right. ie using a scientific approach
If you had your time again, what would you do differently?	If had the knowledge would have introduced paddock spelling 20 years ago. I would also have introduced the science into decision making.

SHORT TIME HIGH IMPACT CATTLE ROTATION

The owners of Mayfield use Short-time High-impact Cattle Rotation, a strategy designed to maximize pasture productivity and improve soil health. This system involves grazing cattle on small paddocks for short durations before moving them to a new area. The reason for selecting this intensive management system is widespread erosion. Here are the key components and benefits of this approach:

Key Components

Small Paddocks:

- The pasture is divided into multiple small paddocks.
- Cattle are moved frequently, sometimes daily, to a new paddock.

High Stocking Density:

- A large number of cattle graze a small area for a short time, ensuring even grazing and trampling.

Rest Periods:

- Each paddock is rested for a period (often several weeks) to allow grass to recover and regrow before being grazed again.

Planning and Monitoring:

- Continuous monitoring of pasture condition and growth rates.
- Adjusting grazing times and rest periods based on grass growth and weather conditions.

Benefits:

- Improved Pasture Productivity:
- Better utilization of available forage.
- Enhanced growth rates due to adequate rest periods.
- Enhanced Soil Health:
- Increased organic matter and soil fertility due to manure distribution and plant root growth.
- Improved water infiltration and retention.

Weed and Pest Control:

- Frequent grazing and trampling can reduce weed growth.
- Natural disruption of pest cycles.

Animal Health:

- Access to fresh forage regularly.
- Reduced exposure to parasites and diseases.

Environmental Benefits:

- Reduced soil erosion.
- Enhanced biodiversity in pastures.
- Implementation Steps

Design the Grazing Plan:

- Assess the available land and divide it into suitable paddocks.
- Develop a rotation schedule based on forage growth rates and seasonal variations.

Infrastructure Setup:

- Install fencing to create small paddocks.
- Ensure water availability in each paddock.

Cattle Management:

- Train cattle to adapt to frequent movements.
- Monitor animal health and adjust the grazing plan as needed.

Monitoring and Adjustment:

- Regularly inspect pasture conditions and cattle performance.
- Adjust rotation schedules to optimize forage use and pasture recovery.
- Challenges

Initial Setup Costs:

- Fencing, water systems, and planning can require significant investment.

Intensive Management:

- Requires diligent planning and monitoring.

PROBLEMS & SUCCESS

Historic overgrazing on fragile soils has caused widespread sheet and gully erosion. The country is now recovering due to a management change to short time, high impact cattle rotation.

Evidence of recovery. Left. Deep erosion gullies continue to grow if not treated. Right The steep edges of a deep gully have been smoothed by animal impact and the use of logs or soil to slow water flow. The newly established grass cover will continue to protect the gully.

Left. Sheet erosion areas were extensive due to historic over-grazing. Right. A recovering area that was previously bare due to sheet erosion.

Strategies to restore erosion. Left. Use of electric fencing to divide paddocks. Middle. Increase the number of water points. Right. Use fallen timber to construct leaky weirs in deep gullies and on contours.

PROBLEM & OPTIONS FOR TREATEMNT

Site1. This site is challenging in the current stage due to the depth of the gully and the narrowness of the alluvial flow line. Some options exist currently these are:

•Hardening the head cut by battering it back and building a large rock chute would manage flow into the stream bed. This would stop the active erosion but provide little productive or ecological return. This would also be an engineered structure that would have a design life and require maintenance.

•Drowning out by building a gully plug (similar to a dam wall) in the gully and raising the water level above the height of the headcut, the erosion would be halted. This would reconnect run-off to the overland flow pattern that has been degraded.

•Diverting – an earthen bank could be built above the gully to divert flow away from the headcut would halt the erosion. Similarly to the management of overflows from the gully plug, the re-entry of flow from soil surface to the stream bed would need to be managed to prevent another gully forming and moving upslope.

Site 2. There are three options for treatment that would restore overland flow to the landscape:

•Recharge – generally ridges, where organic matter, nutrients and water can be added to the landscape.

•Raise the stream up to the soil surface to restore overland flow. Structures would be built progressively up-stream to ensure that the flow from the up-stream structure would flow into the pool of the down-stream structure. This would manage the re-entry of overland flows and reduce the risk of additional erosion features.

•Bed control structures (leaky weirs) – building a series of leaky weirs in the channel would reduce the capacity of the channel and increase the frequency of over-banking events.

Site 3. A large alluvial feature.

This feature extends to the main creek downstream and offers significant scale for landscape rehydration works. There is scope to work up using a series of gully plugs and or weirs to restore overland flow patterns that no longer operate in the landscape. Existing road crossings and rock bars offer low-risk options to installing weirs as the hard rock/concrete base of these features provides excellent scour protection. These features can be enhanced to constrict flow in the channel thus reintroducing overland flow to engage secondary flow paths across the plain.

Site 4. An existing rock rundown structure provides a safe re-entry for a secondary flow path.

Incised stream bed with potential to spill out onto alluvial plain.

PRIORITISING STEPS IN LANDSCAPE HYDRATION

Grow More Plants

When dealing with erosion, it's essential to improve groundcover and soil health across the landscape. More plants mean healthier soil, which helps water and energy contribute positively to the property instead of causing damage. By planting more, you

can trap, store, and use more moisture, which boosts production and can solve some erosion problems entirely.

For any water that does end up in streams, having more plants in its path slows it down. This helps change the land from losing soil to one that gathers and recycles vital nutrients, effectively healing itself.

Protect and Expand Moisture-Storing Features

Preventing erosion is easier than fixing it. If there are stable areas, they should be managed to promote plant growth and keep them intact. Simple actions like fencing and better grazing management can make a big difference. Erosion often starts downstream and moves uphill, damaging alluvial features. Rebuilding these features and reconnecting water with the landscape can stop active erosion and expand areas that store moisture.

Halt Active Erosion

The first sign of serious erosion is headcut migration, which leads to deeper channels and sidewall erosion. These channels deepen until they hit bedrock. This can be stopped by reinforcing headcuts with rocks or by reducing water flow with contour dams. This strategy can be effective in some cases.

Retain Sediment Close to the Source

After years of erosion, the most active areas are often out of the alluvial zones. While they may look bad, their impact on large moisture storages is limited. It is possible to trap large amounts of sediment with vegetation, often by changing management practices. Techniques like brush mattressing, ripping, and contouring can also help retain sediment.

Managing Fenceline and Road Erosion – Whoa-boys

Fencelines. roads and tracks across a property are susceptible to erosion as they provide an easy path for water to follow. This concentrates the water instead of allowing it to spread and flow across the area. Once the runoff is concentrated, its velocity and the subsequent risk of damage increases. Mayfield has constructed effective woa boys using the following key points:

- Use a level to take readings and mark out all whoa-boys.
- Calculate spacing on the slope.
- Locate whoa-boys where there is a significant change in slope, rill or approach to the creek or drainage line.
- Check the direction of overland flow adjacent to the road; to outlet on the bottom side.
- Choose a location with a stable outlet.
- Soil should be ripped to ensure it binds together with the soil below.
- Whoa-boys are started at the top of slope and spaced down from there.
- Whoa-boys should generally be constructed from the topside or high slope, however, in dispersive soils present at Mayfield, whoa-boys are constructed from the bottom side or import stable soil to reduce the risk of further exposing these subsoils.

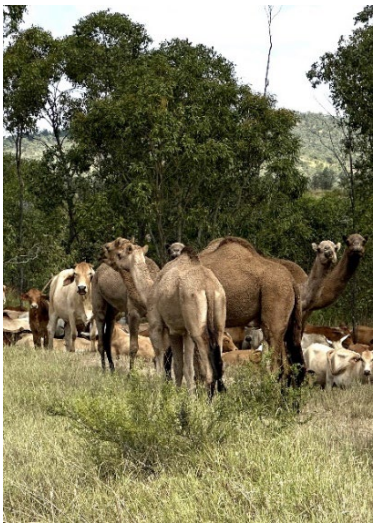
• When working with dispersive soils, stockpile the topsoil and after construction, spread the topsoil or imported stable soil over the bank.
• Runoff from whoa-boys should flow into a grassed, flat-bottomed drain.
• Where possible, roads are realigned to allow traffic to cross the whoa-boy at 90 degrees.

LOW STRESS CATTLE MANAGEMENT IN MUSTERING

For animals unfamiliar with human contact, mustering can be very stressful. Cattle are rounded up and chased by horse, motorcycle, quad bike and even helicopter. Animals who don't comply may face rough handling. On Mayfield low stress techniques are used. This is important for the welfare of the animals, but is also good for productivity, meat quality and carcase yield.

Low stress cattle mustering techniques are used on Mayfield. Cattle are selected for temperament and trained from birth. They are never forced to run.

Buggies are used in conjunction with a drone and well-trained dogs to muster the cattle. The cattle are used to the sound of the drone and immediately start to walk towards the gate.



Camels (left) have been recently introduced and are successfully controlling an invasive pest cactus (right – note outer layers of cactus removed).

A second aim is that micro-organisms, which allow camels to break down lower quality grasses, will be transferred into cattle when the animals eat or drink from the same trough.

LINKAGE TO SOIL CARBON AND BIODIVERSITY CREDITS

Mayfield, one of five properties involved in the Future Drought Fund project, has adopted various drought-resilient strategies that align with the Clean Energy Regulator's 2021 soil carbon method for estimating soil organic carbon sequestration. These strategies include:

Altering Grazing Practices:

Adjusting the stocking rate, duration, or intensity of grazing to promote better soil health and carbon sequestration.

Land Remediation:

Modifying landscape or landform features to remediate and improve the land, thus enhancing its ability to sequester carbon.

Pasture Re-establishment:

Re-establishing or rejuvenating pastures through seeding efforts, contributing to improved soil organic carbon levels.

These activities fit well with the soil carbon and proposed nature repair market. The owners have registered for soil carbon methodology of the ERF. This partly due to exposure to technical experts through the project and supported by the results that other local graziers have achieved with the scheme.

BASELINE SAMPLING FOR SOIL HEALTH

The project only runs for two years but has embarked on a soils health monitoring program to provide a baseline to inform future management. Soils were collected to depth of 30cm at four representative sites. Since the project sampling, soil sampling has been completed as part of the registration process of the ERF.

We present a summary of the project sample results as a record here.

Soil was collected at depth 30 cm, 22.01.23 at five representative sites.

Sample 1.
Light brown clay with small stone shale. Eroded water flow area.
30% grass cover.
Buffel, forest Mitchell, wire grass, love grass. board leaf ironbark, bauhinia, bauhinia, sandalwood, ironwood and leopardwood.

Sample 2.
Ridge top (above water flow area in sample 1).
Red-Brown clay soil**. Dark Biocrust**.
Board leaf ironbark, brigalow, bauhinia, blackberry, sandalwood. Herbs
70% vegetation cover.
Mitchel grass, buffel.

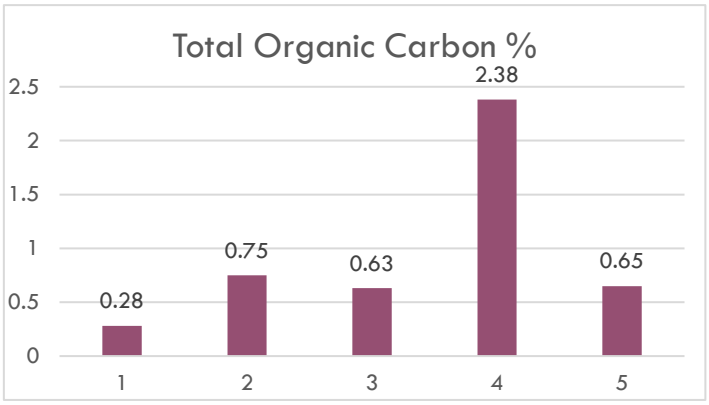
Sample 3.
Erosion site. Tracey flat. Brown sandy loam.
Light woodland- broad leaf ironbark dominates.
60% grass cover. Wire grass, with forest Mitchell.
Some buffel.

Sample 4.
Water flow area below ridge. Brown silt clay.
Open grassland.
80% grass cover. Buffel dominant with some black spear, Indian couch and forest mitchell.

Sample 5.
Laneway on ridge top. Brown silt clay
50% ground cover
Forest Mitchell is dominant, some kangaroo grass, little buffel and spear grass.

Total Organic Carbon

In arid rangelands, the Total Organic Carbon (TOC) levels in the soil can vary widely depending on various factors such as climate, vegetation cover, topography, and soil type. Generally, arid rangelands have lower TOC levels than other ecosystems due to the limited availability of water and nutrients that restrict the growth and decomposition of organic matter.



TOC levels in arid rangelands can range from less than 0.5% to 3%, depending on the specific conditions. However, it is important to note that these values can vary greatly depending on the region and local conditions.

TOC content at Mayfield is generally low, although there are some exceptions. For example, sample 3 (brown sandy loam soil with 60% ground cover), collected from a relatively wet area had a notably high TOC level. Conversely, sample 1 (light brown clay soil and 30% ground cover), collected from an eroded area, had a low TOC level, while sample 2 (red brown clay with biocrust and 70% ground cover) , which was taken from a ridge, had three times the carbon levels of sample 1. Samples 1 and 2.

Sample 4, (brown silt clay and 80% ground cover), collected from drier soils higher on the ridge and with less ground cover (50%), had a higher carbon content compared to sample 5 (brown silt clay and 50% ground cover).

Soil type appears to be the primary factor influencing the Total Organic Carbon (TOC) content, as heavy and medium soils had lower TOC levels compared to the light soil with higher ground cover. Moisture content and ground cover may also play a role, as wetter

areas with high ground cover had a high TOC level and higher ground cover in some cases correlated with more carbon. However, soil type seems to have the biggest influence on TOC content.

TOC is a vital measure of the carbon present in soil organic matter, and it is an essential indicator of soil fertility and health. The observed differences in TOC content can have significant implications for the ecosystem and agricultural productivity in the region. Therefore, managing soil and ground cover is crucial to maintaining healthy TOC levels for optimal soil health and productivity.

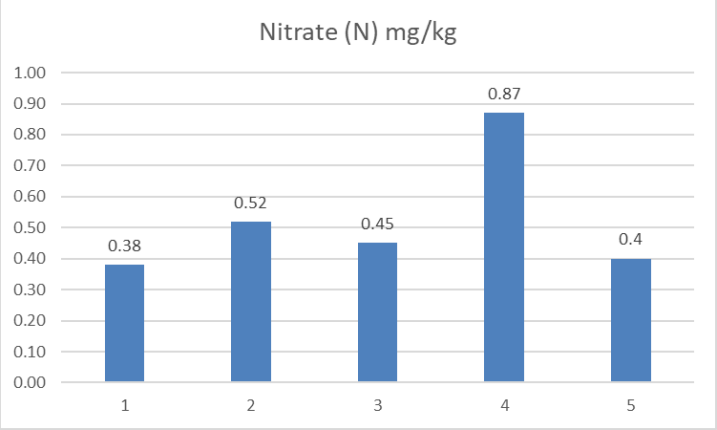
Importance of Soil Nitrogen and Phosphorus

Nitrogen and phosphorus are essential nutrients for all living organisms. Phosphorus is bound to soil minerals, while nitrogen is converted by plants into protein. Plants use Nitrogen for leaf growth and good green colour, while Phosphorous helps form new roots, make seeds, fruit, and flowers.

Soil sample results – nitrogen & phosphorus

The results of soil N and P analysis on soils collected at Mayfield are depicted in the graphs below.

Results of soil Nitrogen at Mayfield.



Accding to some studies, the total soil nitrogen content in arid rangelands can range from 0.01 to 0.5% by weight, with the highest levels typically found in areas with more favorable soil conditions and vegetation cover. However, it is important to note that the availability and mobility of nitrogen in rangelands can vary widely, depending on factors such as soil moisture, pH, temperature, and vegetation cover.

The soil Nitrogen (N) content at Mayfield is relatively low, as in the TOC result there are some exceptions. For example, sample 3 (brown sandy loam soil with 60% ground cover), collected from a relatively wet area had a notably high N level. Sample 2 had a relatively high N level. This is most likely due to the biocrust. Biocrust is a living community of mosses, lichens, and cyanobacteria that forms a layer on the soil surface. This crust plays a significant role in nitrogen cycling, as the cyanobacteria can fix atmospheric nitrogen into a form that is available to plants. In addition, the biocrust may also release organic matter and nitrogen into the soil as it decomposes.

Improving soil nitrogen levels can be achieved through various management practices that focus on promoting nutrient cycling, enhancing soil organic matter, and supporting diverse plant communities. Some of these practices include:

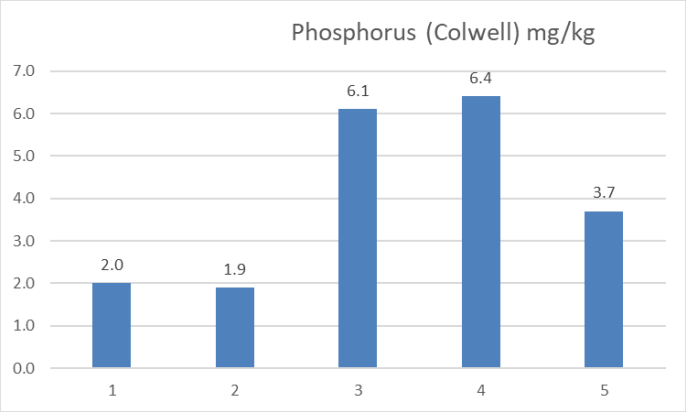
- Legume incorporation: Introducing nitrogen-fixing legume species (e.g., clovers, alfalfa, or native legumes) into the rangeland can help improve nitrogen levels, as

these plants have a symbiotic relationship with nitrogen-fixing bacteria that convert atmospheric nitrogen into a form plants can use.

- Rotational grazing: Implementing rotational grazing or rest periods allows for better nutrient cycling and promotes plant growth. Giving plants time to recover between grazing periods can lead to increased root biomass and nutrient uptake, improving nitrogen levels in the soil.
- Soil conservation practices: Preventing soil erosion and maintaining soil structure through practices like maintaining ground cover, minimizing tillage, and establishing windbreaks can help retain soil nitrogen and promote its cycling.
- Diversifying plant species: Encouraging a diverse range of plant species in the rangeland can help improve soil health and nutrient cycling. Different plants can contribute to soil nitrogen in various ways, and a diverse plant community is more resilient to disturbances like drought or pests.

Results of soil Phosphorus at Mayfield.

The average Colwell-extractable P level in arid rangeland soils of Australia is estimated to be around 3.9 mg/kg, with a range of 0.5 to 12.2 mg/kg. It is important to note that the Colwell test measures only a fraction of the total P in the soil, and the results may not necessarily reflect the total P status of the soil.



However, the Colwell test can provide a useful indicator of the potential availability of P for plant growth in rangeland soils.

The test results show low levels of phosphorus (P) in Mayfield soils ranging from a high of 6.4mg/kg in brown sandy loam to a low of 2mg/kg in eroded soil.

The reasons for low P levels include:

- P is often tightly bound to mineral particles or organic matter, making it less available for uptake by plants.
- low and unpredictable rainfall can limit the weathering of rock and mineral particles, which is an important source of phosphorus for many ecosystems.
- the removal of vegetation through grazing can further reduce the amount of phosphorus in the ecosystem, as plants are the primary source of phosphorus in many ecosystems.

Management practices that promote the conservation and accumulation of organic matter and the reduction of soil erosion can help to improve phosphorus availability and promote the health and productivity of pastures.

BIODIVERSITY ASSESSMENT

Mayfield Station

Size (ha)	5196 ha
Local Government	Central Highlands Regional
Bioregion	Brigalow Belt
Subregions	South Drummond Basin
Catchment	Fitzroy

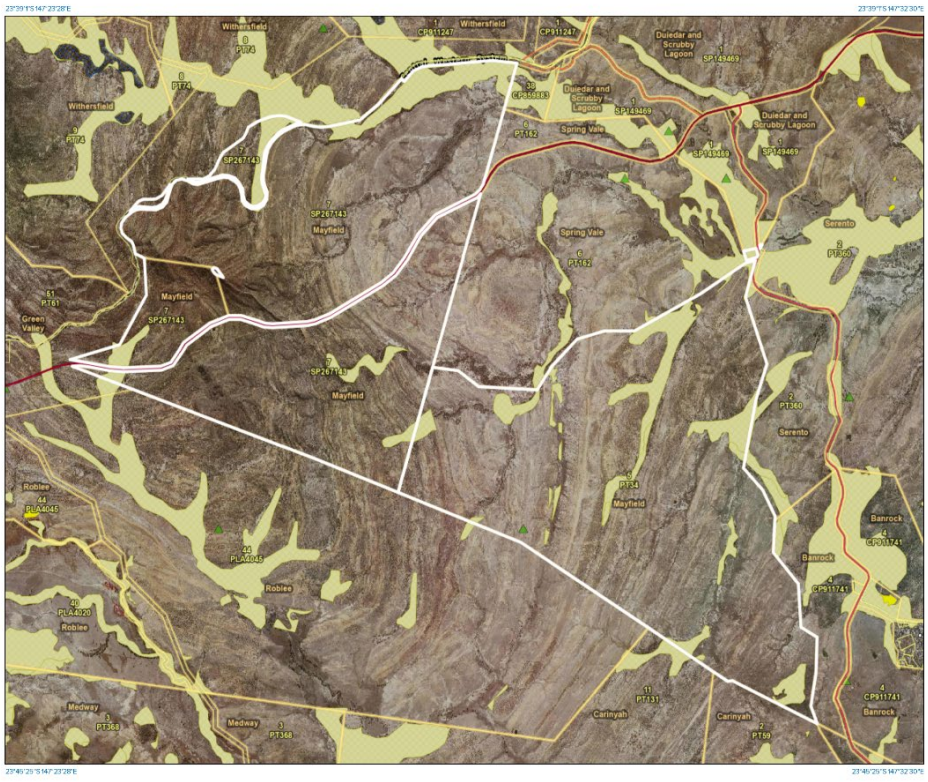
Mayfield Station is situated within the South Drummond Basin Sub-bioregion of the Brigalow Belt Bioregion. Dominated by extensive sandstone ranges and hills supporting Eucalypt open woodlands with *Acacia spp*, *Eremophila spp* and *Cassia spp*. Lowland landscapes may have areas of Brigalow, (*Acacia harpophylla*).

The intermittent Woodbine Creek drains the northwestern part of the property and forms a largely intact and continuous wetlands corridor through the ranges with values to fauna especially when actively wet.

The southwestern portion contains more intact landscapes of open woodlands and supports the priority species Lace Monitor (Varanus varius). There is also potential habitat for NCA listed species: *Capparis humistrata, Corymbia clandestina, Corymbia xanthope, Cycas megacarpa, Cycas ophiolitica*.

The wetland flats contain open Eucalyptus populnea woodlands with a shrubby understorey and a tussock grass ground layer. This habitat has value to arboreal species including Koalas and possums. Areas in the

The property has been largely modified containing large areas of non-remnant vegetation and a visual assessment is required to make any further determinations.



CONCLUSIONS

There is strong evidence of success in addressing severe erosion and soil capping through short term high impact cattle rotation grazing and carefully prioritised and planned rehydration works.

The management system using low stress cattle handling techniques and the registration as organic beef providers and has improved the value of cattle.

The project has provided the owners with the knowledge and confidence to decide to register as a soil carbon project with the ERF. They will also be eligible and are interested in registering for the nature repair market in the future.