Landcare-led Landscape Resilience

Tools and data for restoration decisions

The Muller Experiment

BILLS DREAM

Picture yourself strolling beneath the expansive canopy of a mature River Red Gum woodland along Merrybundinah Creek. The air is filled with the calls of diverse birdlife and native wildlife scurries about, showcasing a rich tapestry of biodiversity. However, this idyllic scene is increasingly rare in today's landscape. Whether due to altered river regulation, clearing or altered land management, most River Red Gum forests and woodlands have become highly modified environments. Unmanaged regeneration often results in thousands of stems per hectare, creating a monoculture with an understorey devoid of life. This stark contrast between the ideal and the reality sets the stage for our case study, which explores the challenges and potential solutions for restoring and managing River Red Gum ecosystems in Australia.



Unmanaged regeneration little to no understory Narrandera Flora and Fauna Reserve

REGENERATION OR ENCROACHMENT?

Eucalyptus camaldulensis, is a fighter with deep roots and a prolific seeder causing mass germination events in disturbed environments. During a favorable year saplings are easily established in weed proportions.

Healthy regeneration: in historically wooded areas enhances biodiversity, improves habitat quality and restores ecological balance, while boosting resilience against environmental changes.

Unhealthy in-fill encroachment: in historically wooded areas occurs when tree populations become excessively dense. This results in stands of smaller, closely packed trees, reducing biodiversity and forest health. The overcrowded conditions increase competition for resources, inhibit mature tree growth and limit understorey development.



2024 Site pic previous to fencing with 2012 unmanaged regeneration in background.

KEY STEPS

The Muller family has farmed this soldier settler block for four generations, with an ephemeral creek running right through the middle which was cleared and cropped. In wet cycles the creek runs from the Ulandra Nature Reserve and joins up with the Billabong Creek. Bill and Simon have fenced eight hectares of the creek and have left it unmanaged. Whilst cropping has ceased, it has become a monoculture of River Red Gum in patches so dense there is no understorey.

Through the Landcare-led Landscape Resilience project a series of five management practices would be implemented across the entire site to guide healthy regeneration and increase biodiversity through minimal input actions. These include:

- Active management of River Redgum Regeneration
- Micro scalping to introduce ground cover species
- Introduction of Shrub Layer
- Connecting corridors
- Ongoing Adaptive Managment

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Active management of River Red Gum Regeneration

OBJECTIVES

Revegetation/Regeneration of a River Red Gum riparian shrub/grassy tall woodland by means of active management of naturally regenerating *Eucalyptus camaldulensis.* The site is along an ephemeral creek line which was previously cleared and cropped. Half of the site was fenced of 10 years ago and unmanaged regeneration of Red Gum has cause a typical over crowded monoculture.

WHAT IS SUCCESS?

Red Gum can produce millions of seeds/ha and germinate prolifically on mass in disturbed areas, making the tree the perfect coloniser. This generally causes mass thickets of gum saplings, which results in overcrowded, unhealthy trees that will never reach maturity.

Success in this trial will see a healthy, well established grassy woodland where the Red Gum is not out competing itself and other species which have been introduced back into the site. This is a great way to compare managed vs unmanaged regeneration of Red Gum and how best to steer that process towards a healthy functioning landscape.



Healthy Red Gum regeneration at Doodle Coma Swamp Henty NSW



Demonstration of a tree popper taking out woody weeds at Narrandera Wetlands NSW

KEY STEPS

- Figure out the desired density of stems per hectare using PCT data and the Victorian Bioregion Benchmark for Vegetation Quality Assessments a figure of 15 large tree per hectare was decided on.
- When to intervene, it was decided to monitor the site for regeneration events regularly and then manage those events with in 6 to 12 months allowing healthier more dominant saplings to stand out from the crowd.
- Remove unwanted saplings to the desired density ensuring to leave some small unmanaged patches which can in this case help to increase biodiversity.
- Repeat until the site is established and self-maintaining.

KEY LEARNINGS FROM EXPERIENCE

Regulations: The patch you plan on work will fall under one of 3 Rural Land categories and even though the regeneration you plan on managing hasn't even germinated chances are you might need a permit. There are loads of resources out there to help navigate this.

Long-term Vision: Knowing what you want the site to look like is key, as rehabilitating degraded landscapes towards a natural state is not just set and forget. Knowing where to find bench marking information and reference sites for comparison can be time consuming, especially in areas where revegetation guides did not previously cover.

Sometimes it's not about what we plant but managing what grows

COST CONSIDERATIONS

Although the process is time consuming, the long-term benefit to Biodiversity is worth it. Thinning older regeneration is costly when permits and contractors are involved, with the heavy machinery causing more damage to the site and starting the process of encroachment off again in the disturbance.



Tumut Ecology Reserve managing encroachment of non-endemic Acacia decurrens on the right no intervention. On the left some light thinning and use of cultural fire is opening the landscape up to grassy woodland.

RESOURCES

Revegetation: There are ample resources available if you are not working in an area covered by a revegetation guide. Contact your Local Landcare Coordinator or Natural Resource Managment agency for further details.

- South West Slopes and Riverina Revegetation Guides **https://revegetation.org.au/**
- Trees near me ap **https://www.treesnearme.app/explore**
- Landcare NSW **https://landcarensw.org.au/**

Land Management: In New South Wales, Local Land Services consent authority when it comes to Rural Zoned land. Urban and peri Urban fall under your local Government areas environmental plan.

- Local Land service Land management. **https://www.lls.nsw.gov.au/help-and-advice/land-management-in-nsw**
- Native Vegetation Regulatory Map. **https://www2.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/native-vegetation-regulatory-map**

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Micro scalping to introduce ground cover species

OBJECTIVES

Inspired by Paul Gibson Roy's scalping for grass land restoration, the plan was to build small islands of ground cover species throughout the 16 Ha site, by removing the topsoil in Micro Scalp Trials. Scalping removes topsoil with its increased nutrient and weed seed burdens allowing for better establishment of native grasses and forbs.

WHAT IS SUCCESS?

Minimal input reintroduction of ground layer.

Established patches of native grasses and forbs which are no longer found across the site.

Active management of nonnative ground cover outside of the micro scalps will start to see recruitment from new seed banks.

Improved Biodiversity through the addition of all three strata layers into the revegetation/regeneration site



Mini excavator to scalping topsoil patches across the 16Ha site



Photo of Scalped Themeda plot at Wirraminna Educational center in Burrumbuttock. Photo take after a cool burn note large and small tussocks signs of establishment and recruitment

KEY STEPS

- Species selection is fundamental to successful revegetation projects. The site was found to have little to no evidence of native ground cover species. Lists were derived from PCT data and localised veg surveys.
- A number of 5m x 5m plots were scalped across the site, these were chosen with ease of access for ongoing maintenance in mind. The topsoil removed was taken away from these plots to minimise recontamination of the plots and a buffer sprayed.
- Due to the low species diversity commercially available for planting a combination of techniques were decided on
  - Tube Stock planting.
  - Hand seeding.
  - Application of ground cover mulch.
- On going maintenance of these micro scalps is critical to ensure they are not overrun with nonnative weed species.
- Once established these sites will act as seed banks for the site. It is hoped that the seed will naturally start to recruit throughout the site or at worst provide a seed production for manual spreading.

KEY LEARNINGS FROM EXPERIENCE

Diversity is key in ground layer reintroduction; but where to start as ground cover species are not as readily available for planting. Revegetation guides and resources like trees near me are great starting points but to get a good idea of what should be there more localised vegetation surveys should be done.

Size while the method of scalping removes the weed seed bank for the area, a lot of time and effort is required to o stop the re infestation of weeds. Time is not something that farmers have loads of, so making smaller patches requires less maintenance but still allow introduction of ground cover species.

From small patches, big patches grow

COST CONSIDERATIONS

Not everyone has access or the money to pay for machine operators to scalp massive tracts of land. By using micro scalp sections, the method becomes accessible for small sites and anyone who has access to a hire company to get a small excavator for the day to scalp.



The Muller family planting Themeda into a micro scalp

RESOURCES

- Revegetation: There are loads of resources out there if you are not working in an area covered by a revegetation guide to start looking, getting in contact with your local Landcare or Natural Resource Managment agency is a good start. Otherwise here are some links.
- South West Slopes and Riverina Revegetation Guides **www.revegetation.org.au**
- Trees near me ap **https://www.treesnearme.app/explore**
- Landcare NSW **https://landcarensw.org.au/**
- Reconstructing grassy understories in south-eastern Australia: Interview with Paul Gibson-Roy **https://www.greeningaustralia.org.au/wp-content/uploads/2017/11/INTERVIEW_EMR_GrassyRestoration_Interview_PaulGR.pdf**

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Introduction of Shrub Layer

OBJECTIVES

To establish a self-sustaining shrub layer across the entire site through planting and hand seeding.
Due to previous clearing of the site, no remnant shrub layer existed and there has been no natural recruitment in the previously fenced off site.

WHAT IS SUCCESS?

Long term we are aiming for a 10 to 15% canopy cover in the mid storey across the entire 16 hectare site. Instead of going for a traditional planting of row upon row of plants, it was decided that shrubs would be planted in dense patches throughout.
This will promote biodiversity hot spots through the sight and long term birds will disperse seed.
To compliment this hand seeding of some shrub species will be conducted throughout the site which will implant an artificial seed bank, to automatically kick the process off.



Yellow Box Grassy wood land just outside of Wagga Wagga with healthy shrub and ground cover layer



Note the open space and scattered shrub species under stringy bark in Tumut.

KEY STEPS

- Species selection is key to restoration, gone are the days when any old tree or shrub would do, with the use of resources like the new revegetation guides species selection is much easier. www.revegetation.org.au
- Ground preparation, know how much to do, in this case small, condensed areas were ripped to create the island effect which was planned.
- These patches were then densely planted with ground cover and shrub layer, and scattered large trees, knowing that the managed red gum regeneration with fill in the bulk of the large tree canopy.
- Direct seeding by hand was then carried out across the remainder of the site which should result in scattered shrubs which will ultimately germinate at different times allowing for a mixed age shrub layer into the future.

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Connecting corridors on Farm and in the Landscape

OBJECTIVES

Over the years, the Mullers have embarked on many different projects across the property. This project will connect those previous works on farm, and in the greater landscape will help to connect Ulandra Nature Reserve in the east to Billabong creeks in the west. this section of Merrybindinah creek was the final piece to be locked up.

WHY IS CONNECTION IMPORTANT

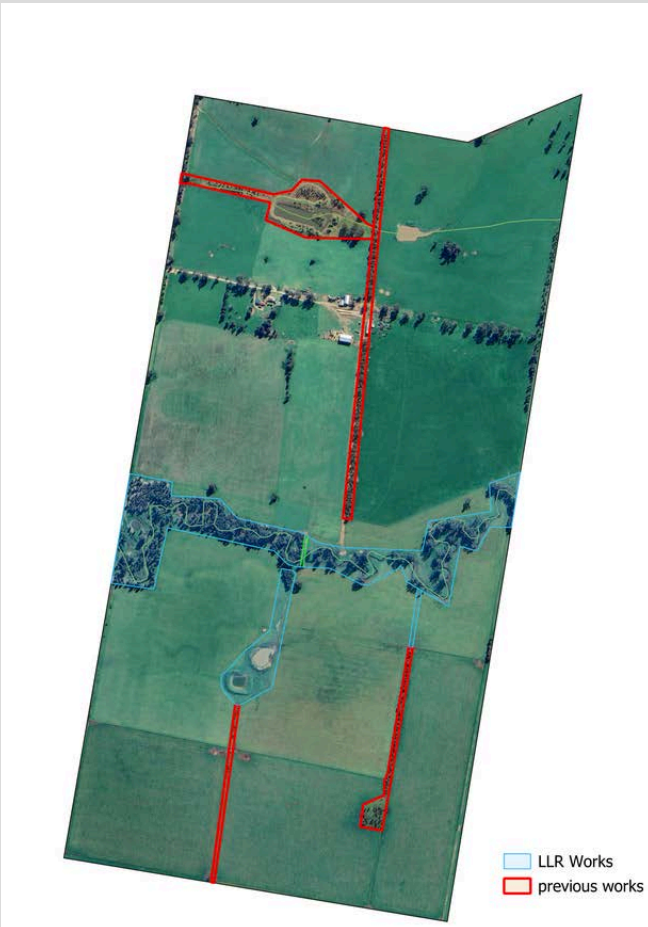
Ecological connectivity promotes the migration and colonisation of plants, animals across the landscape. By providing a safe passage between isolated patches of habitat, allowing them to access resources, expand their range, and maintain genetic diversity

Habitat expansion: Corridors can act as additional living spaces for various species, not just as transit routes.

On-farm tree corridors provide wildlife shelter, movement routes, and ecological connectivity across agricultural landscapes.



Large scale tree lanes at Oura NSW provide connections across the landscape from rocky out crops to creek lines.



On farm connections.

ON FARM CONNECTIONS

Previous works on the farm can be seen above outlined in red these include they include

- Tree lanes for stock shelter.
- Fenced off small rocky out crop.
- An enhanced farm dam project.
- Isolated paddock trees.

New works through the Landcare-Led project connect these works on farm providing enhanced stock shelter and wildlife refuge.

Over time by improving the connection on farm the migration of ground layer should be supported across the farm.

Connected landscapes: resilient ecosystems, stronger against change, vital for survival.

LANDSCAPE CONNECTIONS

While we generally think about projects on a farm scale it is important to look at a landscape scale to maximise its benefit. In the past, landscape connection has involved over the fence collaborations, but with modern technology it is much easier than it ever has been to achieve landscape connectivity on a much grander scale.

In the map below the Mullers project site is indicated in the red, as you can see it sits halfway between Ulandra Nature Reserve and Billabong Creek, most farmer along the creek have either fenced off the Merrybundinah creek or at minimum restricted grazing. The project site will hopefully influence the biodiversity along this corridor and improve its functionality

KEY STEPS

- Create a farm map, approach your Local Landcare Coordinator or NRM agency they should be able to help you as part of creating a natural capital profile for your property.
- Identify preexisting either remnant or previous plantings don't forget to look beyond the farm boundary because an eco-system is the landscape.
- Connect the dots weather its old creek lines or even existing fence lines plan your revegetation, in a way that helps to build connections to those other protected on enhanced areas on farm and in the greater landscape.

RESOURCES

- Revegetation Guides are a great place to start to learn about how to build connective revegetation project: www.revegetation.org.au
- What is a natural capital profile: https://www.youtube.com/watch?v=kJE3IIYndSM
- For basic GIS and satellite imagery try goggle earth or 6 maps: https://www.google.com.au/earth https://maps.six.nsw.gov.au



Connecting the Landscape project site mapped out in red

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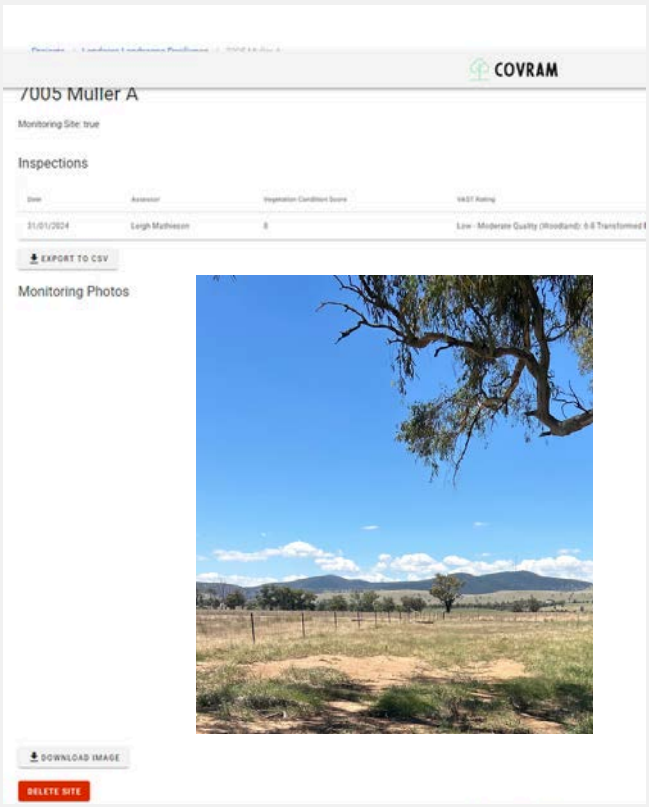
Ongoing Adaptive Managment

OBJECTIVES

Gone are the days when a simple photo point is the only measure of how a site is progressing. So the objective was to set up a long-term adaptive management plan for the site, which will allow management of the site to be adjusted over the years.

WHAT IS ADAPTIVE MANAGEMENT?

Adaptive management combines targeted monitoring with actions to guide decision-making in ecosystem restoration. Implementing an adaptive management plan allows for the adjustment of site-specific interventions to address the complex and dynamic nature of ecosystems. With the use of technology, these systems are easy to set up and follow, with landholders able to collect real-time data and help guide future decisions based on quantifiable data.



Screen shot of a photo point monitoring site on the Mullers property in COVRAM ap where data is being collected and stored.



Landcare-led Landscape Resilience project managers Kylie Durant and Leigh Mathieson conducting Vegetation Surveys trialing different adaptive management resources.

KEY STEPS

- Contact your local Landcare organisation or Natural Resource Management (NRM) agency. They likely use an established platform for monitoring and data collection, which allows for long-term access and regional site comparisons. In this case, COVRAM is being used.
- Conduct baseline surveys of the site, capture data on the entire site, establish specific monitoring points for sensitive or troubled areas
- Research historical ecological data and consult local experts to understand your target reference community. Define specific interventions and create an implementation timeline to address identified issues. This approach ensures a well-informed and structured restoration process.
- Repeat your surveys and monitor or alter course of interventions with the aim of tipping the scales back to full ecological function.

HOW DOES COVRAM WORK

1.Field Data Collection

Users assess vegetation condition through a structured process:

- **Site evaluations:** Criteria include structural layers (e.g., presence of large trees, shrubs), weed density, and regenerative capacity.
- **Photo documentation:** Captures site visuals with automatic geolocation tagging.
- **Simplified inputs:** Uses dropdown menus and minimal text entry to reduce complexity (e.g., selecting "sparse," "common," or "abundant" for weed coverage).

2. Condition Scoring

- Assigns a numeric score to vegetation characteristics, translating into one of five condition states. Which intergrate with the Vegetation Assessment State and Transition (VAST) model to predict ecosystem trajectories.

1. **Protect/Maintain:** The highest-quality vegetation with minimal degradation. Requires ongoing protection (e.g., controlling minor weed incursions) to preserve biodiversity and ecosystem function.
2. **Upper Middle (Natural Regeneration Potential):** Moderately healthy vegetation needing minor interventions like selective weed removal or controlled grazing to stimulate natural regeneration.
3. **Middle (Assisted Regeneration Needed):** Degraded sites requiring active management, such as seedbank stimulation, supplementary planting, or prescribed burning to restore ecological processes.
4. **Lower Middle (Active Intervention Required):** Severely compromised vegetation demanding intensive efforts like large-scale revegetation, soil rehabilitation, or invasive species eradication.
5. **Question Intervention:** The lowest condition state where restoration may be impractical due to extreme degradation or prohibitive costs. Managers must assess whether resources are better allocated elsewhere.

3. Evaluation & Analysis

- **Apply prescribed management actions:** based on initial assessments decide interventions needed and to start the process. implement.
- **Conduct regular timed assessments:** by using the quick inspections regularly on a pre planed timetable.
- **Revise management strategies:** levels based on updated condition scores.

4. Adapt and Adjust

- **Modify approaches:** where needed or extend treatments to larger parts of the project where desired results are gained.

"The standardisation of assessments reduces a reliance on botanical expertise and therefore empowers diverse stakeholders to manage ecosystems restoration effectively."

RESOURCES

- Revegetation Guides are a great place to start to learn about available adaptive management tools: www.revegetation.org.au
- COVRAM app site: https://app.covram.com.au/ https://www.youtube.com/@Covram-dd2us
- Vegetation Assessment State and Transition model https://vasttransformations.com.au
- International Standards for the Practice of Ecological Restoration https://www.seraustralasia.com/wheel/index.html

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THE SCORE SHEET

- **19 hectares of land positively influenced**
- **Three on-farm connection established**
- **Two major landscape connections influenced**
- **2.86 kilometres of ephemeral creek fenced off and protected**
- **Three dams enhanced for improved ecosystem function**
- **In the 2024 season, 6,000 tube stock plants comprising 19 species were planted, achieving over 50% ground cover**
- **An imported seed bank consisting of 10 species was introduced to enhance biodiversity.**
- **Plans for 2025 season include planting an additional 5,150 tube stock, with a focus on ground cover species**



Bill and Simmon Muller showing off there 2024 plant deliver

WRAPING UP THE STORY

The funding supplied by the Federal Governments Federal Drought Fund through the Landcare-led Landscape Resilience project has gone a long way on the Mullers property. Significant steps have been taken in a targeted ecological restoration to build resilience in the Billabong sub catchment of the North Murrumbidgee Slopes. A collaborative approach including the Mullers, Landcare and NRM agencies, utilising adaptive management techniques.

These achievements highlight the Muller families commitment to the restoring the River Red Gum ecosystem, enhancing biodiversity, and improving overall landscape resilience. By combining scientific knowledge with practical on-ground actions, this project serves as a model for future restoration efforts in similar Australian landscapes.

A local network of demonstration sites are being established utilising 'best practice' restoration and revegetation techniques for climate resilience. This is showcasing of the positive economic, production and environmental impacts of native vegetation restoration, and the potential for income streams for business resilience.

"Unfortunately we couldn't deliver on Bill's dream of reintroducing Koala's but if everyone does their part one connection at a time they will get there".



LEIGH MATHIESON
Project officer
Murrumbidgee Landcare Inc

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