Landcare-led Landscape Resilience

Tools and data for restoration decisions

Filling the Lindoris Gaps in Biodiversity

LINDORIS

"Lindoris" comprises 370 ha, located at The Gap approximately 30 kms Northwest of Wagga Wagga. The property straddles the Malebo Range, a series of hills approximately 5 km west of Wagga Wagga that runs North from the Murrumbidgee River towards Coolamon, traversing The Gap.

Lindoris was settled as a farm in 1895 by Ernest Lindner who paid 1£ per acre as a Conditional Purchase under the Robinson Land Act of 1861. The three purchasing conditions set by the NSW Government being:

1. Ringbark trees - to clear them and enable broadacre cropping of wheat,
2. Install fences - to contain his livestock to our acreage (as distinct from squatters widespread grazing), and
3. Live on the property.



The Malebo range to the North West of Wagga Lindoris Straddles the North Eastern end of the Range in the Houlaghans Creek Sub Catchment

ADRIANS VISION

To restore as much of the property to native vegetation and biodiversity without compromising agricultural production and to contribute to achieving a sustainable farming enterprise. Previous projects have included.

- 1970's soil works in the form of contour banks, silt traps and dams to combat erosion
- 1980's Remnant Protection works to successful Cypress and Eucalyptus have had to be thinned
- 2000's 15,900 trees planted through various funded projects many more self-funded unrecorded trees.

Adrian has a committed passion to improve native vegetation eco systems on the property and reverse wherever possible, the effects of the three conditions.



Adrian standing under a stand of farm forestry.

KEY STEPS

Site visits and initial conversations highlighted some rather interesting insights from Adrian, that he has picked up throughout the years.

These included poor provenance choices for farm forestry leading to some less than adequate outcomes. Difficulties attaining self-sustaining biodiversity improvements in certain areas and how regeneration can differ in the same species across the property.

Through the Landcare-led Landscape Resilience project a series of four trial management practices were implemented across the entire site to build resilience into previous works and increase biodiversity through minimal input actions. These include:

- Biodiversity Regeneration Cells, under White Cypress
- Improved biodiversity under failed farm forestry
- Climate Ready Farm Forestry
- Farm dam and spill way enhancement

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Biodiversity Revegetation Cells, under White cypress

OBJECTIVES

Establish small, modular revegetation sites within a paddock that remain part of the grazing rotation while also serving as vital connecting corridors across the property. By establishing protected nodes around existing old Cypress trees using low-cost materials, you can leverage the trees' microclimate and improved soil biome. This approach facilitates the reintroduction of endemic species within these zones, promoting enhanced biodiversity and creating stepping stones for broader ecological recovery.

WHAT IS SUCCESS?

Completely removing the grazing pressure would allow the Cypress to naturally regenerate and with ongoing management the ecological processes would return over time. However, in situations that remain a vitally important part of the grazing rotation, regeneration is not possible. To ensure the future of the remnant population of White Cypress, regeneration is crucial. The modular approach will, in the short term, provide small islands of biodiversity. In the long term, with extensions, these islands will go on to become shelter belts and essential corridors for biodiversity across the farm.



White Cypress sapling regenerating in an area fenced off from grazing on the property.



Old growth White Cypress on site near the installed Biodiversity regeneration cells.

KEY STEPS

- Identify the sites and determine the dimensions that best suit the land use and desired outcomes. In this case, positioned along existing fence lines.
- Decide on preparation methods for the cells. A combination of planting, cool burning, and mulch introduction from other areas was utilised.
- Select species carefully, focusing on a few small shrubs and ground covers. Consider the existing seed bank, which includes White Cypress and other large tree species.
- Monitor the Biodiversity Revegetation Cells as you would for a standard revegetation project, ensuring weeds and pest species are controlled.
- Over time, expand or replicate the cells in other areas, leveraging the existing seed bank to help kick-start the process.

KEY LEARNINGS FROM EXPERIENCE

Restoration in degraded agricultural landscapes requires a long-term vision and dedication to unlock the site's potential. On working farms, complete closure of areas to embark on restoration projects is often impossible, so a modular approach is crucial. By breaking the landscape into small, manageable areas, we can focus on the most effective interventions to kick-start ecological repair. This allows for targeted strategies and efficient use of resources, while also integrating with existing farm operations.

Creating concentrated pockets of high biodiversity within the landscape serves as ecological steppingstones, connecting with existing canopy and providing habitat islands. This strategic, modular approach enables meaningful improvements in biodiversity and ecosystem function, even in highly degraded spaces. By balancing agricultural needs with ecological goals, we can create resilient ecosystems and ensure the long-term sustainability of the landscape.

Even modest budgets can yield significant ecological benefits.



Biodiversity Revegetation cell replication made from old gates, protecting climate ready Themeda being reintroduced to a Box gum grassy woodland site in Wagga Wagga

COST CONSIDERATIONS

Small-scale patches can be very cheap and effective, by utilising existing resources and carefully planning interventions, even modest budgets can yield significant ecological benefits. Making this approach to revegetation and regeneration, both economically viable and environmentally, are impactful for farmers and landowners. This modular approach would also be a cost effective way of protecting paddock trees and positively increasing biodiversity in cropping systems.

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/**
- NSW state Governments Trees near me ap **https://www.treesnearme.app/explore**.
- Australian Association of Bush regenerators https://www.aabr.org.au/
- Greening Australia https://www.greeningaustralia.org.au/

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Improved biodiversity under failed farm forestry

OBJECTIVES

Farm forestry took off in the late 80's and through the 90's as a way of addressing timber shortages and income diversification for land holders. These plantings are now maturing and most often farmers have no real drive to harvest them. The objective here is to expand upon the Biodiversity Regen cells to encompass a failed Red Box forestry planting, situated in the middle of a massive forestry planting

WHAT IS SUCCESS?

Using minimal input techniques like:

Hand angering
Hand seeding
Mulching
Mosaic Burns

Will implant a diverse shrub and ground cover layer under the failed Red Box planting with the intent that established future recruitment of improved biodiversity will occur across the entire site.



Using small scale low temperature mosaic burns to reduce leaf litter to aid germination of seed in Narrandera.



Failed Red Box Farm forestry site

KEY STEPS

- Species selection vegetation surveys of the site and species-lists from previous plantings were compared against Plant Community Types (PCT's). The goal was to select species which should be there and were not present or previously been reintroduced.

- Ground prep how do we manage this in a previously established site
  - Small mosaic burns to clear the leaf litter for seeding
  - Hand Angering for tube stock.
  - Introduction of mulch for nearby roadside

- Long term monitoring of establishment and recruitment throng out the entirety of the Farm forestry Plots.

NOTES ON SPECIES SELECTION

It was noted on our first visit to Lindoris, when Adrian made comment around previous projects and species selection, that;

1. Shrubs generally only live for a few years and die off quickly.
2. Farm forestry species were often not endemic species

We couldn't do anything about the species selection of farm forestry, however most shrub species historically used in revegetation have been those coloniser species which live fast & die young and are generally easy to propagate. With the creation of the new Gap creek sub catchment revegetation profile we were able to identify longer lived shrubs for planting endemic to Lindoris.

Colonising plant species play a crucial role in environmental repair

WHAT IS A COLONISER SPECIECS

Colonising plant species play a crucial role in revegetation efforts across Australia. These hardy plants are often the first to establish themselves after environmental disturbances, such as bushfires or floods. They typically belong to families like Poaceae (grasses), Acacia (wattles), and Fabaceae (peas). Colonisers are characterised by their ability to quickly germinate, grow rapidly, and produce abundant seeds. In revegetation projects, these species are valuable for their high survivorship rates and capacity to kickstart ecological succession. By utilising colonising species in the initial stages of revegetation, practitioners can improve the long-term success of ecological restoration efforts.



Previous biodiversity planting on the property with shrubs but no ground layer

RESOURCES

- Revegetation: There are ample resources available if you are not working in an area covered by a revegetation guide to start looking. The first point of contact should be your local Landcare or Natural Resource Management. Otherwise here are some links.
- Southwest Slopes and Riverina Revegetation Guides **www.revegetation.org.au**
- Trees near me ap **https://www.treesnearme.app/explore**
- Landcare NSW **https://landcarensw.org.au/**

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Climate Ready Farm Forestry

OBJECTIVES

Within the previously failed Camden White Gum *(Eucalyptus benthamii)* which failed due to the climatic differences between the Sydney basin where the tree is endemic and the Coolamon area. It was decided to use already existing and establish methodologies of farm forestry and adding in a climate ready element to the project planting.

WHAT IS SUCESS

Sucess is the establishment of a farm forestry trial using Bull Oak *(Allocasuarina luehmannii)*. Unlike traditional farm forestry plantings the provenance of the seed stock will be collected from multiple climate analogues of the coloamon region to build in climate resilience. Alternatively unlike other climate ready planting, the differing provenance sourced plants will not be randomly distributed but planted in designated rows to compare long term survival growth rates.



Typical established farm forestry planting



Failed Cambden White Gum planting

KEY STEPS

1. Define the areas climate analogs for this project we used the climate change in the Australian web resource.
2. Choose resilient species with consideration. Allocasuarina luehmannii was selected for short term planting, that could be alternatively be used as a seed production area while growing up to be a great timber tree.
3. Using the climate analogue data and the Atlas of Living Australia, 5 potential climate ready provenance areas were selected. Unfortunately, due to time constraints and a lack of seed, we were only able to source seed from close by and the Narrandera area (hotter dryer climate).

CLIMATE CHANGE IN AUSTRALIA WEBSITE

How to research climate analogues of your area NSW using the Climate Change in Australia website:

1. Navigate to the 'Climate Projections' section and select 'Climate Analogues'
2. Enter your town as the location of interest
3. Choose the desired time period (e.g., 2050) and emissions scenario (e.g., high or low)
4. Run the analogue search
5. Review the results, which will show locations with similar projected climates to your future climate
6. Analyse the map and data to understand potential climate shifts
7. Use this information to inform adaptation strategies for agriculture, infrastructure, and natural resource management
8. Consider exploring the Climate Projections for global warming levels to understand impacts at different temperature thresholds

This approach will provide valuable insights into your potential future climate, enabling informed decision-making for climate readiness.



Mature Bulloak at Narrandera collection site

SPECIES PROFILE

Scientific Name: Allocasuarina luehmannii
Common Names: Buloke, Bull Oak, Bull Sheoak, Bull-oak
Family: Casuarinaceae
Description:

- Tree growing 5-15m high with rough, deeply fissured bark and ascending branches.
- Branchlets pointing up, to 40 cm long with 10–14 tightly appressed teeth forming whorls.
- Dioecious (separate male and female trees)
- Cones are hairy when young, 5-12 mm long and 8-20 mm in diameter.

Conservation Status:

- Listed as threatened in Victoria
- Allocasuarina luehmannii Woodland in the Riverina and Murray-Darling Depression Bioregions is an Endangered Ecological Community in NSW.

Timber Uses:

- Dark red, very hard, strong, and heavy wood
- Moderately durable but unsuitable for in-ground use
- Used for, wood turning, and historically for shingles and tool handles.

"Farm forestry, but adding in a climate-ready element"

RESOURCES

- Revegetation Guides are a great place to start to learn about how to climate ready revegetation projects: www.revegetation.org.au
- Revegetation guides deeper reads https://revegetation.org.au/?page_id=7975
- Royal Botanic Gardens Restore and Renew Web Tool www.restore-and-renew.org.au
- Climate Change in Australia https://www.climatechangeinaustralia.gov.au/en
- Farm Forestry resources https://www.lls.nsw.gov.au/help-and-advice/private-native-forestry
- Climate Future Plots https://www.greeningaustralia.org.au/projects/climate-future-plots

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Farm Dam and spill way enhancement

OBJECTIVES

Since the 1920's, Aussie farmers have tackled dam erosion and water quality dramas using rock walls and silt traps. The Soil Conservation Service (Soil Con) stepped in during the 70's with contour banks and new dams. To compliment these works, a dam and its spill way near farm forestry blocks was identified as a suitable to trial the Sustainable Farm Dams method of Dam enhancement. Coupled with an open woodland planting along the extensive dams spillway, this will reduce sediment inflow and stop erosion on the out flow of the dam.

WHAT IS SUCCESS

By using very dense plantings of grasses at the inflow, a significant reduction in erosion and sedimentation will be seen. Water quality will improve, and the ecosystem will flourish, providing a model for sustainable dam management in similar environments. While at the other end of the system, the very long spill way will further improve biodiversity by being planted in a way such as would mimic a Box Gum Grassy woodland in the area.



Wood ducks common visitors to the dam.



Note the turbity of the water and the Red Watermilfoil (Myriophyllum verrucosum) which is the only emergent species currently present.

KEY STEPSFARM DAM ENHANCEMENT

- Fence the Dam: Exclude livestock from the dam area to prevent trampling, grazing, and direct contamination.
- Provide Alternative Water Access: Install a pipe and trough system to supply clean water to livestock.
- Revegetate Surroundings: Plant native vegetation around the dam to stabilise soil, filter runoff, and improve water quality.
- Enhance Habitat Features: Add elements like submerged logs, shallow areas, or islands to support biodiversity (e.g., frogs, birds, and turtles).
- Manage Grazing: Reduce grazing intensity in the dam catchment to minimise sediment and nutrient runoff.
- Monitor and Maintain: Regularly check water quality and manage weeds or competing grasses in the revegetated area.
- This approach improves water quality, supports biodiversity, and enhances farm productivity

WATER ACCESS

While fencing off a dam can be great for Biodiversity and water quality, the question becomes how to create access to water for stock.

- **Hardened access** points are cost-effective and simple to implement, offering flexibility if trough systems fail. However, it can compromise water quality through livestock contamination, cause nutrient build-up and algal blooms, and lead to erosion and vegetation damage, ultimately reducing the overall health of the dam ecosystem.

- **Solar-powered pump** to troughs provides cleaner water and protects the dam by excluding livestock, reducing erosion and sedimentation. It is environmentally friendly and ideal for remote areas but has higher upfront costs and relies on sunlight, requiring planning and maintenance for reliability during cloudy periods or low sunlight.

Enhanced dams support biodiversity by providing habitats for native species, increase water quality.

PLANTING AN OPEN WOODLAND

In periods of extreme wet the dam can and will overflow as part of the original Soil Con works in the 70's a large flat spill way was created. Trees near me indicates the area should resemble Blakley's Redgum- Yellow Box grassy woodland.

- Plant selection was based off the PCT and with most tubestock planted came from the ground cover and shrub levels. Along with scattered direct seeding sites across the site.
- The area already has substantial native grass species, so a double helix set of rip lines were used to minimise impact erosion of future overflows.
- Habitat Features: Retain fallen timber, patches of bare ground, and other natural features to support fauna like invertebrates and reptiles.
- Ongoing Management: Monitor progress, control pests and weeds, and manage fire regimes to maintain ecosystem health.

RESOURCES

- Revegetation Guides are a great place to start to learn about how to build wetland and open woodland projects: www.revegetation.org.au
- Trees near me: https://www.treesnearme.app/
- ANU Sustainable Farms Enhanced Dams https://www.sustainablefarms.org.au/on-the-farm/farm-dams/



Spill way planting note the lake of straight lines in the planting

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THE SCORE SHEET

- **6 hectares of land protected**
- **One on-farm connection along the ridge positively influence.**
- **One farm dam enhanced for improved ecosystem function with Solar powered pump for stock access.**
- **2 modular Biodiversity Revegetation Cells to be expanded into the future.**
- **Biodiversity of farm forestry improved**
- **In the 2024 season, 960 tube stock plants.**
- **An imported seed bank consisting of 14 species was introduced to enhance biodiversity and genetic diversity.**
- **Plans for 2025 season include planting an additional 400 tube stock, with a focus on ground cover species**



Adrian Lindner.

WRAPPING UP THE STORY

Through the Landcare-led Landscape Resilience project, a series of minimal-input trial management practices were implemented, to add to compliment the years of hard work and dedication of the Lindner family.
These efforts showcase a modular approach to landscape restoration, where small, targeted interventions yield significant ecological benefits, creating stepping stones for broader ecological recovery and demonstrating that even modest budgets can drive meaningful improvements in biodiversity and ecosystem function within working farms.

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.

"Rectifying generational environmental degradation for future generations to appreciate"
Adrian Lindner



LEIGH MATHIESON
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www.revegetation.org.au

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