2018

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ILLAWONG CASE STUDY: THE ILLAWONG STORY

Prepared by Mark Parsons

Introduction

Bryan Ward's property, Illawong, comprises 160 hectares and carries up to 140 beef cattle at any one time. While this is a relatively small property, it is perhaps typical of thousands of farms producing beef in Australia (see Table). There's a trend to smaller holdings, many operated by people with little farming background. But Bryan's achievements over 24 years of managing Illawong provide valuable lessons for producers seeking to maintain production while also regenerating and improving the condition of the land.

Proportions of farms and cattle, by herd size, Australia, 2016–17

Farm size	Number of farms	Proportion of farms
Small (100 to 400 cattle)	15,100	60%
Medium (400 to 1,600 cattle)	7,600	30%
Large (1,600 to 5,400 cattle)	2,100	8%
Very large (More than 5,400 cattle)	400	2%
Total farms	25,200	100%

Source: ABS; ABARES Australian Agricultural and Grazing Industries Survey
http://www.agriculture.gov.au/abares/research-topics/surveys/beef#detailed-physical-characteristics-findings

Background

Bryan came to southern New South Wales from Victoria in 1965, having been appointed manager of Woomargama Station, a large merino sheep and cattle property about 40 kilometres north-east of Albury. After 29 years in that job, by 1994, it was time to take on a new challenge where he could try innovative ways of farming he had read about while a farm manager, but had been unable to implement. Finally he could call *"a piece of dirt my own, be a one man band who could shout out orders in the morning, and alone proceed to obey them!*"

To fulfil that ambition, Bryan found two paddocks of neglected hill country, a small part of a large sheep grazing property called Table Top Station located at Bowna, about 10 km north of Lake Hume and 20 km north-east of Albury. In late 1994, these run-down paddocks, comprising undulating slopes with clay loam soils rising to rocky granitic soils on steep slopes, became Illawong.

After decades of set stocking on annual pastures, Patterson's curse, rabbits and gully erosion were prevalent on Illawong and the remaining woody vegetation comprised remnant red box, yellow box, red stringybark, Blakely's red gum and long-leaf box trees. Average annual rainfall in the area is a respectable 650 mm, but that is little use if it falls on bare impenetrable soil and most of it rushes down the gullies, taking topsoil with it. Carrying capacity was a low

1.5 DSE. This was the condition of the property when Bryan acquired it. Just to add to the challenge, 1996 was around the beginning of the 'millennium drought' which saw 10 years of severely below average rainfall across southern Australia.

Environmental

The sheep, rabbits and kangaroos had left little groundcover across Illawong. When the drought set in around 2000, Bryan feared that massive soil erosion would ensue when the rain returned. He was keen to contour-rip so that when rain eventually came it would penetrate, rather than run off, be wasted and exacerbate the gully erosion. That work was assisted by a drought relief program subsidy available at the time from the Commonwealth Government through the Natural Heritage Trust. Today the contour ripping is indistinguishable, but the dams constantly have water because the rain that falls infiltrates and seeps in to the dams from the water table.

Adding to the soil and water conservation work, Bryan fenced off remnant trees in patches up and down the gullies to prevent further stock disturbance and to enable regrowth to stabilise gully erosion. These patches also protect livestock from wind, rain and heat. Adding to the mosaic of woody vegetation, Bryan used a direct seeding method to revegetate the rocky ridges with a range of eucalypts, acacias and other understorey species. After about 10 years, these are becoming self-regenerating. In all, about 30% of the property is now fenced off from grazing and is revegetated with woody species. In Bryan's words: '*the wind used to whistle across the hill, the animals are far more comfortable and warm now*'.

A further benefit of the revegetation that Bryan has undertaken is a resurgence in native fauna; he says: '*When I came here, you couldn't find goannas, echidnas, etc. … plus all the little birds … they have come back!*'

Expert hydrologists will advise that increasing catchment cover of perennial woody vegetation as Bryan has done increases 'evapotranspiration', that is, plant water use, and therefore leaves less water to flow downstream. According to the Commonwealth Government's "National Water Policy", this can be a problem in catchments such as the Murray River and its tributaries, where water used by trees in the upper catchments does not wind up in Lake Hume and other water storages, to be delivered to irrigators downstream in the Murray-Darling Basin. The flip side of that argument is that, while a larger proportion of rainfall might be used by evapotranspiration, less is evaporated from the soil surface and a larger proportion can infiltrate and seep through the soil profile to the water table without causing soil erosion. From there it can recharge dams on farms and enter streams lower in the catchment, but by then it has a much reduced silt load. Soils For Life describes this process as 'rehydrating the landscape', and it is a recurring feature of Soils For Life case studies. Stream flow lower in the catchment might be lower in some cases, but it is probably more constant and water quality is likely to be higher.

The rabbit problem has now largely been fixed, using ripping followed by baiting with Pindone as required. Having ready access to water, kangaroos are prolific and numbers must be controlled regularly to prevent over-grazing. The only practical way to do this remains to engage professional shooters to remove a proportion of the population each year.

Weeds, and therefore herbicide use, are considerably reduced. With 100% ground cover of vigorous pasture 100% of the time, weeds get little chance to establish.

Production

Initially, Bryan ran 1500 super-fine merino wethers producing 15–19 micron wool, until drought and falling wool prices forced him to change. The easing of the 'millennium drought' in the mid 2000s gave him the impetus to apply lime to overcome acid soils and to sow improved pastures. Perennial pasture species, predominantly phalaris and clover, were established on approximately 80% of the grazing area. Together with spraying and grazing with sheep, this eliminated the Patterson's Curse and other weeds, and paved the way to phase out sheep and introduce beef cattle.

The remaining unimproved pastures comprise kangaroo, wallaby and red grasses. Beef production began with agisted stock before the business turned to the current pasture-based steer finishing enterprise.

There are now seven dams, up from two in 1994, and these are the only sources of water on the property.

Image of Illawong paddocks, boundary and dams.

Over a ten-year period, the fencing was re-designed using electric fences so that rotational grazing could be introduced, rotating the stock around seven paddocks, leaving the pasture height at least 100 mm (1500 kg dry matter per hectare). Cattle spend 5 to 7 days in each paddock at a time, fewer in the unimproved pasture paddocks, at a stocking rate of 36 DSE/ha. This ensures that the cattle receive sufficient nutrition and provides time for pastures to recover. The native pasture species paddocks are grazed for a shorter time when animals are moved between the

higher quality paddocks. This enables Bryan to better match animal feed requirements to feed availability and the nutritional needs of particular groups of animals.

Bryan plans to reticulate groundwater from bores to troughs so that the paddocks can be further sub-divided. As well as improving flexibility for rotational grazing, a major benefit of troughs would be that disturbance of the dams could be reduced so that the water would be less silty. This has benefits for animal health, and therefore their rate of weight gain. Bryan has observed that cattle go for the cleaner water and, once troughs are installed, he does not believe he would have to fence off the dams to exclude cattle.

Bryan buys Angus trade steers, selecting from producers whose stock he has found suitable for finishing on pasture. Three different genetic lines typically make up the annual herd. These arrive in spring at an average live weight of around 370 to 400 kg and leave by the following winter at around 630 kg live weight. The number of steers bought each year depends on seasonal conditions, so ensuring that the pasture available at the time can sustain the grazing pressure. With no dependence on maintaining breeding stock, this means there is never any pressure to overgraze in dry seasons. The timing of moving stock onto and off the property can also be adjusted to allow both for seasonal conditions and for cattle market conditions.

The finished cattle are sold into JBS Australia's pasture-fed Food Assurance program[1]. That requires demonstrating compliance with specifications including grass-fed only, fat colour, meat colour and fat depth, and incurring penalties or receiving lower prices for animals that do not meet specifications. Illawong cattle now consistently achieve amongst the highest level of compliance, earning Bryan an award from Meat and Livestock Australia for being one of the Top 100 producers in New South Wales and state finalist in the "Excellence in Eating Quality Awards". This is attributable primarily to ensuring good animal nutrition, which depends on the pasture, and on managing the temperament of the animals to minimise their stress levels.

Bryan regularly takes samples of his pastures to be analysed for feed quality in order to understand what the animals are eating and to assess whether it is sufficient for their needs. Nine-month-old steers at an average live weight of 370 kg require pasture with a metabolisable energy (ME) of at least 12 MJ per kg of dry matter and a minimum crude protein content (CP) of at least 12% of dry matter to maintain their weight. To increase their weight at a rate of 1 kg/day or better requires ME of at least 9.9 MJ per kg dry matter and CP of 18.8% or more. Pasture foliage testing shows levels of protein and metabolisable energy from improved pastures across the year range from 8.3–11.1 MJME/kg dry matter, and a little less on native pastures. Lime and single superphosphate are applied regularly to maintain these levels, as determined by soil tests. The lime maintains soil pH at levels that ensure nutrient availability and microbial activity are sustained and the superphosphate replaces phosphorus that is exported with the cattle.

Cattle temperament is important for the Farm Assurance quality program because muscle glycogen is depleted when the animals are stressed. This increases pH, which affects meat quality, making it dark and less tender. Frequent handling means the cattle are used to human presence and alleviates that problem. Bryan finds that frequent moving in accordance with the rotational grazing system, monthly weighing to monitor weight gain and to check for health issues and an occasional stroll through the paddock all contribute to getting them used to human presence, so that they maintain a calm temperament. This practice ensures that they are not mixed with unfamiliar cattle on trucks, which avoids stirring them up and increasing stress levels, and is a specific requirement of the Farm Assurance program.

Financial

Bryan has variable costs of $119/ha, considerably lower than the regional average of $181. This can be attributed in part to his reliance on pastures. Feed supplements are not needed and animal health costs are minimal. Compliance with the quality assurance program ensures that prices received are at the high end of the range, which adds substantially to the total gross margin received [see table].

[1] http://jbssa.com.au/OurCompany/OurQualityPromise/JBSFarmAssurance/default.aspx

Financial comparison of Farm Assurance Program results

	Farm Assurance Program	Non Farm Assurance Program
Price received ($/kg carcass weight)	$4.40	$3.82
Gross margin ($/DSE)	$172	$119
Gross margin ($/ha)	$893	$618
Enterprise gross margin	$62,334	$43,131

Source: Ritchie et al. 2016.

Conclusions

Over 24 years of changing from sheep to cattle, introducing rotational grazing, establishing perennial pastures and improving stock shelter, productivity has increased from 1.5 DSE to 12–14 DSE. Cattle growth rates of over 2 kg live weight per day have been recorded in winter. Most importantly, the business can adjust to seasonal conditions so that pastures do not suffer from over-grazing in dry periods and there is no loss of soil capital.

The practices adopted by Bryan at Illawong are not ground breaking [no pun intended] or revolutionary. It is simply common sense land management based on self-evident principles. Nor is it complicated or particularly expensive to implement … but it is surprising how uncommon, common sense can be and how avoidable obstacles prevent people from changing habits ingrained after decades and generations.

References

Ritchie, A., Ferrier, G and Crawford, M. 2016, Targeting the winter premium market, Bryan Ward, Illawong. Agriculture Victoria, Hamilton.

2019

ILLAWONG CASE STUDY: SUMMARY ECOLOGICAL REPORT

Prepared by Richard Thackway

Key findings

Illawong is a 160 hectare grazing property which has been managed by the same land holder, Bryan Ward, since 1994. Illawong is located nearby the city of Albury and to the north of Lake Hume. This ecological assessment commences in 1989. The date reflects Bryan's recollections of managing similar rolling and hilly soil-landscapes on the nearby Woomargama Station. Bryan was the Farm Manager at Woomargama for almost 30 years prior to purchasing Illawong in 1994.

In 1995, Bryan developed a farm plan for Illawong by matching the establishment and development of pasture types to land capability classes (Attachment A, Table 1). Improved pasture was planted on the gentle slopes and deeper soils. Native pastures were promoted on upper slopes and ridgelines and sleeper mid-slopes on shallower soils. That detailed knowledge of the land capability classes was also used to design a farm plan and implement management regimes including the arrangement and amount of revegetation, arrangements of fence lines and paddock sizes, and the location of earthen dams (Attachment A, detailed paddock maps).

The graphical summaries for each of the 10 ecological criteria shown in the Supplementary Report for Illawong demonstrate that there is a close relationship between the land manager's goals/ideals and the ecological outcomes in each of the four phases:

Phase 1: 1989-2004	Conventional non-regenerative regimes and practices
Phase 2: 2005-2008	Intensive conventional interventions and small-scale trials of revegetation projects
Phase 3: 2009-2010	Transition to broader scale regenerative grazing land management regimes and revegetation projects
Phase 4: 2011-2018	Increasing maturity of regenerative grazing land management regimes and revegetation projects

An assessment over time of the responses to 10 ecological criteria shows that, by phase 4, compared with the previous three phases, most ecological criteria have been assessed as nearly fully achieved or having achieved their reference state (i.e. a scores between 0.8 – 1.0). For example:

- Minimising effects of extreme climatic events across the whole property and its place in the broader catchment, including preparedness for drought (Criterion A);
- Managing pastures for production and to maintain ecological health of the property. Ecological changes include: improving the reproductive potential of plant species (Criterion F) and maintaining high levels of ground cover across the property (Criterion H);
- Improving soil health and function. Ecological changes include: soil nutrients and soil carbon (Criterion B), soil hydrology (Criterion C), soil biology (Criterion D) and soil physical properties i.e. soil as a medium for plant growth (Criterion E); and
- Tree and shrub species structure (Criterion G) and composition (Criterion I) have improved across the property.

An independent assessment of the land manager's self-assessment across all 10 ecological response criteria is supported by the information he has presented.

That independent ecological assessment examined three measures of ecological responses within and outside the property using nationally consistent scientifically credible information: 1) ground cover, 2) biomass and 3) fractional cover. That independent assessment highlights the importance of the land manager's understanding of, the planning for, and implementation of well-informed land management regimes that aim to achieve sustainable ecological outcomes. These results show that Illawong is performing above the regional benchmarks for ground cover, biomass and fractional cover. A conclusion of that assessment is that Illawong is an outstanding example of regenerative landscape management in an agricultural setting.

Introduction

Illawong is located 32 kilometres north of Albury, New South Wales in the locality of Table Top. The average annual rainfall of Albury is 650mm and it is winter dominant. Illawong is 205 metres above sea level.

Illawong was acquired by Bryan Ward in 1994, after Bryan had managed Woomargama Station, a large merino sheep property about 40 km north-east of Albury since 1965.

Illawong comprises 160 hectares of box gum grassy woodland and improved pastures consisting of clover and phalaris on undulating slopes with clay loam soils rising to rocky granitic soils on steep slopes.

At first, Bryan ran an enterprise of up to 1500 merino wethers. At the time Illawong consisted of two large paddocks with two dams for the entire property. Weeds were prevalent, the quality of the pastures and soil were poor, and the condition of the vegetation on the property was poor.

In 1996 the millennial drought started and would last for the better part of ten years. Over the course of the drought, Bryan Ward's management regime changed dramatically.

At the height of the drought in 2000, he conducted contour ripping across Illawong to protect the top soil of the property from being blown away and eroded.

In 2000, Bryan trialled the fencing off of remnant paddock trees from livestock, and direct seeded native trees and shrubs within the fenced areas. The revegetation trials conducted were successful.

Subsequently, the land holder implemented the same revegetation technique across the property. Particular areas of focus for revegetation were above and in existing erosion gullies and on top of bare rocky ridges. The land holder used a rock hopper machine to direct seed the tops of ridges. In 2018, 53 bird species were discovered in 30 minutes in the biodiversity plantings. This suggests the revegetation plots are providing critical habitat for birds on Illawong.

In 2005, Bryan made the transition from a sheep enterprise to a cattle enterprise. From 2005 until 2011, he agisted cattle on Illawong. Since 2011, he has operated a steer finishing enterprise, by buying in the steers in late summer, fattening them over winter and selling them before spring. The cattle are managed using a rotational grazing method and are moved between paddocks ensuring pasture heights do not go below 10cm on average.

In early years weeds were prevalent across Illawong including Paterson's Curse. The land manager has used numerous weed control methods over the years. Weed control measures have included; chemicals, strategic grazing with livestock, establishing deep-rooted perennial grass species to out-compete weeds and maintaining a high level of ground cover.

In 1994 (Phase 1) when Bryan acquired Illawong, the dry sheep equivalent (DSE) of the property was 1.5. In 2018, the DSE was between 12 and 14. These figures confirm that the management regime implemented by the land holder since 1994 has significantly improved Illawong's pasture quality and growth.

Between 2011-2018 (Phase 4), there were four main land uses on Illawong shown in Figure 1; three land uses involve grazing cattle on different pastures with a total of 78.6% (125 ha) of Illawong being managed regeneratively for finishing of cattle over winter on improved and native pastures for spring cattle sales. Revegetation i.e. fenced-off direct-seeded revegetation plantations occupy 21% (33.5ha) of the property. These revegetation areas are not grazed by cattle and are protected for biodiversity conservation.

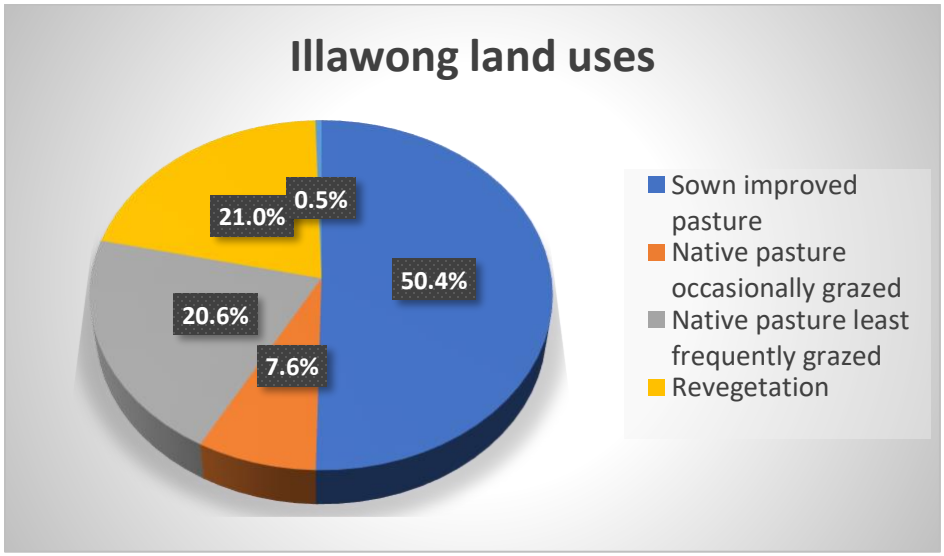


Figure 1. The relative areas of land uses on Illawong in 2018.

The transformation of Illawong towards a regeneratively managed property has been achieved through deliberate planning and is based on a sound understanding of the links between land management regimes and ecological responses. Consistent implementation of management ideals has enabled the land manager to develop high-quality winter pastures that are used to finish cattle for the spring cattle sales.

In addition, the increasing maturity of the fenced-off revegetation plantations has yielded an outstanding result regarding bird counts. In 2018 Ian Davidson, a local ecologist, counted 53 bird species in 30 minutes while surveying the revegetation plots. Ian compared Illawong with other grazing properties in the district, many of which have over-simplified the structure and composition of their property's trees and shrubs. The revegetation plots on Illawong provide a diverse structure and composition of trees and shrubs, providing valuable resources for sedentary and migratory birds including habitat, shelter and food. It is worth noting that the revegetation plots have been planted with locally endemic tree and shrub species. These revegetation plots were designed in the early 1990s to augment isolated mature and senescent paddock trees in this critically endangered and nationally threatened box-gum vegetation community.

Assessment of ecological and biodiversity outcomes

Regenerating pastures and vegetated areas to minimise effects of extreme climatic events

The ability of Illawong to withstand extreme climatic events i.e. drought, has improved since 1989 (Figure 2). The different land classes highlighted are related to land use. Land use is divided into areas which are used for livestock and conservation.

The area set aside for conservation has improved its resilience to drought and bushfires due to the work done by the land holder through increasing the extent of vegetation and its structure, as well as species composition.

The area used for livestock has also improved its resilience to drought and bushfires due to management regimes and actions conducted by the land holder. Constructing fences and dams across the property was pivotal in the improvements recorded in this criterion.

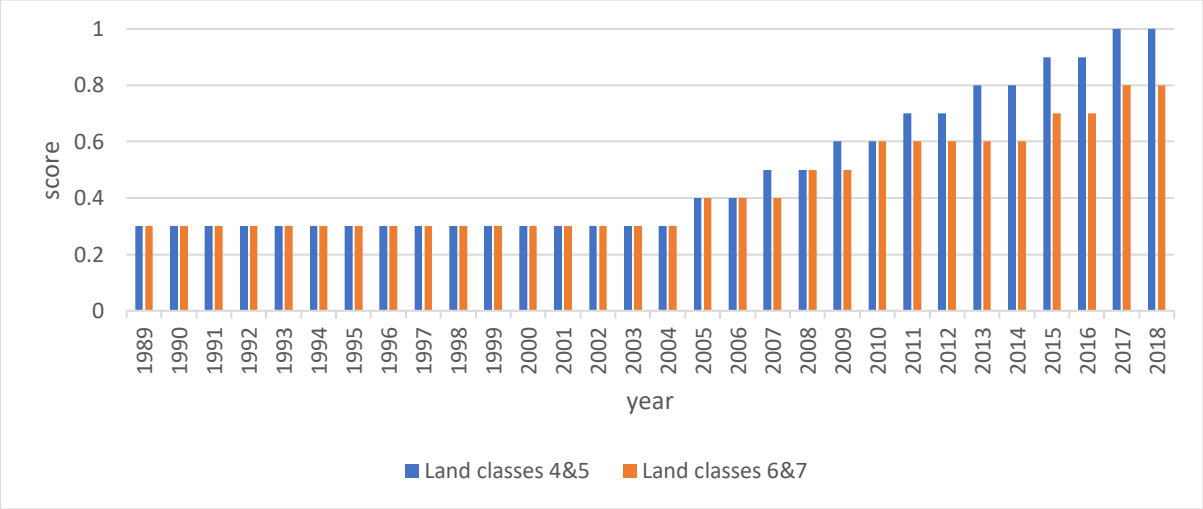


Figure 2. Minimising the effects of the extreme climatic event - drought - in response to changes in land management regimes.

Managing soils to prevent erosion, restore eroded areas and to maintain ecological health, productive capacity and water quality

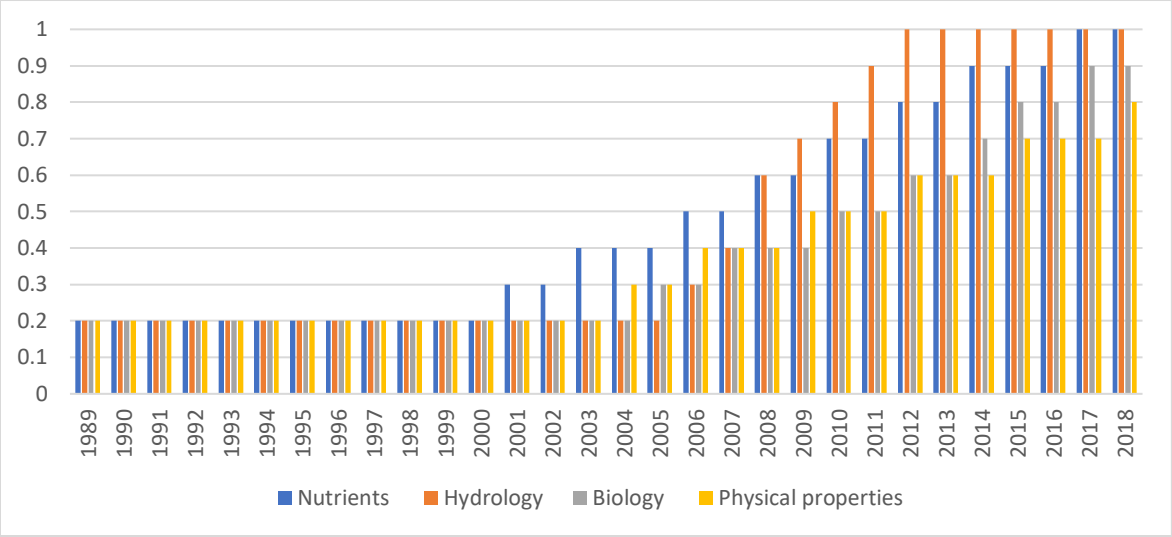


Figure 3. Status of soil indicators over time at Illawong

Soil indicators have improved significantly on Illawong since 1994 (Figure 3). The improvement is due to changes in the land management regimes, including changing from a sheep to a cattle enterprise in 2005, resulting in an immediate improvement in most of the soil indicators. The application of lime in 2005 improved the pH levels within the soil. PH levels were 4.2 in the early years and are currently 7 in 2018.

Since Bryan introduced a rotational grazing system in 2011, all the soil indicators have improved. This is due to an increase in ground cover levels and the prominence of deep-rooted perennial grass species. The soil indicators are directly tied to the health of the ground cover. Ground cover provides organic matter to the soil, reduces erosion and improves the percolation ability of the soil.

Managing ground layer vegetation for production and to maintain ecological health

From 1989 until 2005, Illawong was managed under a set stocking regime with merino sheep (wethers). The set stocking regime impacted the ground layer of vegetation reducing its structure and species composition. In 2005 the land holder changed to a cattle enterprise, agisting cattle on the property and implementing a rotational grazing system in the following years. The impact the management actions had on the ground layer vegetation were profound. Improvement was recorded across all of the ground layer indicators post 2005 (Figure 4). Other management actions that influenced this improvement include: sowing pastures with deep-rooted perennial grass species; reducing the grazing pressure applied by livestock; and maintaining grass heights above 10cm in the grazed areas of the property.

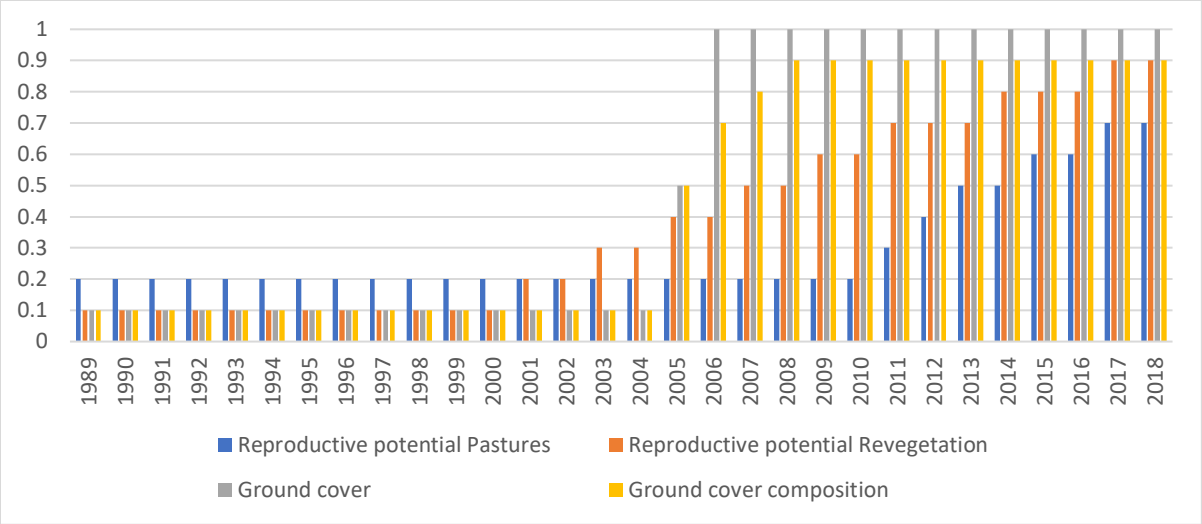


Figure 4. Status of ground layer vegetation for production and to maintain ecological health over time at Illawong

Managing trees and shrubs for production and to maintain ecological health of the property and watershed

In 1994 the structure and species composition of trees and shrubs on Illawong was relatively poor. Remnant paddock trees were scattered throughout the property with dead or dying crowns prominent. The land holder attempted to protect and conserve the remnant paddock trees on Illawong by fencing some of them off from livestock and direct seeding native vegetation plots around their bases. The direct seeding lots were successful on Illawong. The species structure and composition of trees and shrubs on Illawong has improved significantly since 1994, largely due to the revegetation work undertaken by the land holder. The crown health of the remnant paddock trees has also improved since 1994, due to the removal of disturbances caused by livestock grazing and resting under the trees.

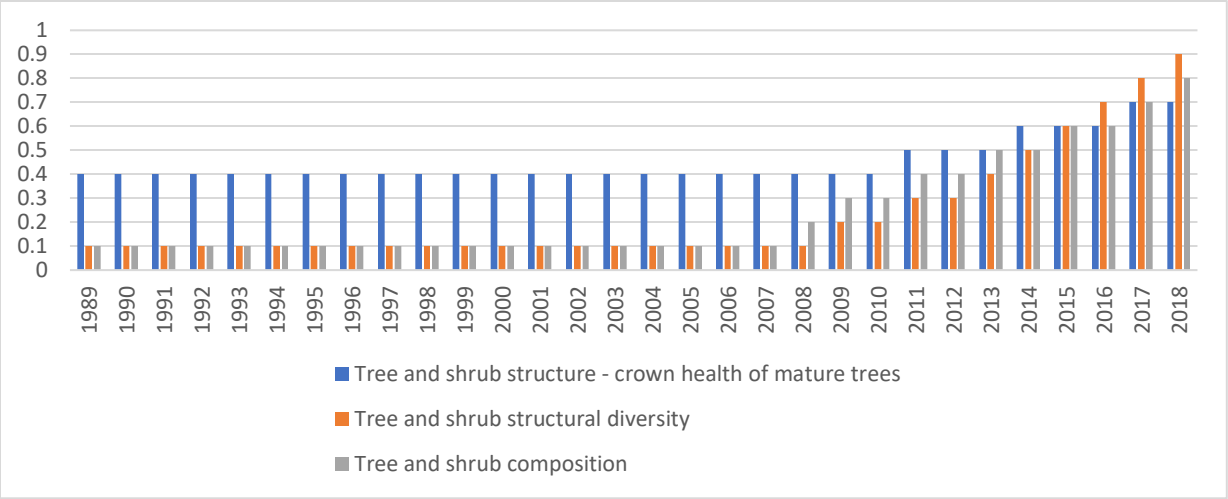


Figure 5. Status of trees and shrubs for production and to maintain ecological health of the property and watershed over time at Illawong

Managing natural watercourses, riparian areas, natural lakes and wetlands, to protect ecosystems that are sensitive to agricultural land management.

Illawong has no permanent rivers or creeks. However, the land manager has implemented erosion control measures in erosion gullies across the property to reduce the risk of further erosion. This has included: deep ripping on the contour on slopes adjacent to the gullies; direct seeding native trees and shrubs above erosion gullies to slow the passage of water through the landscape; direct seeding native trees and shrubs within erosion gullies to stabilise existing eroded areas; direct seeding of trees and shrubs above earthen dams to act as water filters to improve the water quality in the dams on Illawong. Over time these management interventions have obviously controlled the effects of erosion on Illawong and reduced the risk of soil erosion.

2018

ILLAWONG CASE STUDY: SUPPLEMENTARY ECOLOGICAL REPORT

Prepared by Richard Thackway

Key findings

Illawong is a 160 Ha grazing property which has been managed by the same land holder Bryan Ward, since 1994. Illawong is located nearby the city of Albury and to the north of Lake Hume. This ecological assessment commences in 1989. This date reflects Bryan's recollections of managing similar rolling and hilly soil-landscapes on the nearby Woomargama Station. Bryan was the farm manager on that Station for almost 30 years prior to purchasing Illawong in 1994 and is presented an analogue to the way Illawong was managed between 1989-94.

Commencing in 1995 the land manager developed a form plan for Illawong by matching the establishment and development of pasture types to land capability classes (Attachment A, Table 1). Improved pasture was planted on the gentle slopes and deeper soils. Native pastures were promoted on upper slopes and ridgelines and sleeper mid-slopes on shallower soils. That detailed knowledge of the land capability classes was also used to design a farm plan and implement management regimes including: the arrangement and amounts of revegetation, arrangements of fence lines and paddock sizes, and the location of earthen dams (Attachment A, Detailed paddock maps).

This report demonstrates a close relationship between the land manager's goals/ideals and the ecological outcomes in each of the four phases.

This assessment identified four phases land management regimes including; production regimes and biodiversity enhancements:

	Production regimes	Biodiversity enhancement
Phase 1: 1989-2004	Conventional wool production (wethers), grazing of a mosaic of native and improved pasture. Management regime for pasture was non-regenerative. Contour ripping commenced in 2000 until the end of the millennial drought. This was conducted to reduce the risk of erosion and protect the top soil on the property.	Commenced trailing of direct drilling of native trees and shrub seeds to establish diverse plantings in fenced-off revegetation plantations.
Phase 2: 2005-2008	Transition from wool production (wethers) to beef production (steers). Contour ripping continued until the end of the millennial drought. This was conducted to reduce the risk of erosion and protect the top soil on the property. Land management regimes focused on restoring ecological function (soil condition and high functioning pastures). Pasture management regime was non-regenerative.	Continued direct drilling of native trees and shrub seeds to establish diverse plantings in fenced-off revegetation plantations.
Phase 3: 2009-2010	Transition from non-regenerative to regenerative pasture management regime involving cattle grazed on short rotations on small paddocks and long recovery times of pastures.	Continued direct drilling of native trees and shrub seeds to establish diverse plantings in fenced-off revegetation plantations.
Phase 4: 2011-2018	Continued regenerative pasture management for beef production involving finishing steers over winter on improved and native pastures. Aim to target spring cattle sales.	Increasing maturity of fenced-off revegetation plantations.

An assessment over time of the responses of 10 ecological criteria shows that by phase 4, compared to the previous three phases, most ecological criteria have been assessed as nearly fully achieved or having achieved their reference state (i.e. a scores between 0.8 – 1.0). For example:

- Minimizing effects of extreme climatic events, which considers the whole property and its place in

the broader catchment; this includes preparedness for drought (Criterion A);
- Managing pastures for production and to maintain ecological health of the property. Ecological changes include: improving the reproductive potential of plant species (Criterion F) and maintaining high levels of ground cover across the property (Criterion H);
- Improving soil health and function. Ecological changes include: soil nutrients and soil carbon (Criterion B), soil hydrology (Criterion C), soil biology (Criterion D) and soil physical properties i.e. soil as a medium for plant growth (Criterion E); and
- Tree and shrub species structure (Criterion G) and composition (Criterion I) and have improved across the property.

The transformation of Illawong toward regeneratively managed property has been achieved through deliberate planning and is based on a sound understanding of the links between land management regimes and ecological responses. Consistent implementation of management ideals has enabled the land manager to develop high-quality winter pastures that are used finishing-off of cattle for the spring cattle sales.

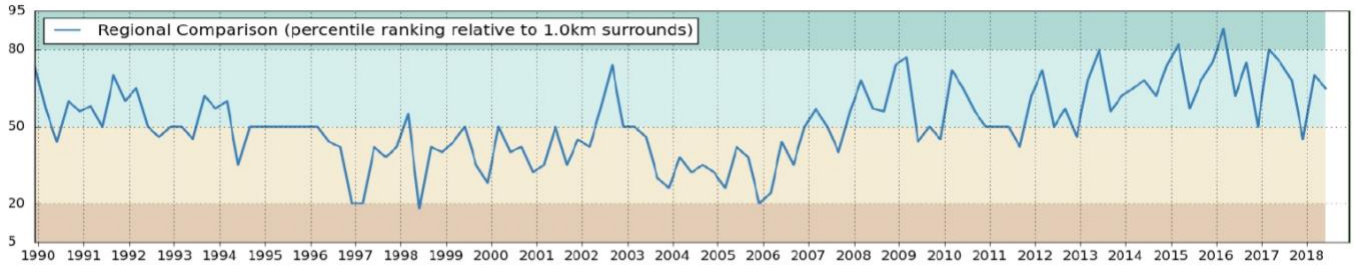
In addition, the increasing maturity of the fenced-off revegetation plantations has yielded an outstanding result regarding bird counts. In 2018 Ian Davidson, a local ecologist, counted 53 bird species in 3 hours while surveying the revegetation plots. Ian noted that, compared to other grazing properties in the district, many of which have over-simplified the structure and composition of their property's trees and shrubs; the revegetation plots on Illawong provide a diverse structure and composition of trees and shrubs, providing valuable resources for sedentary and migratory birds including habitat, shelter and food. It is worth noting that the revegetation plots have been planted with locally endemic tree and shrub species. These revegetation plots were designed in the early 1990s to augment isolated mature and senescent paddock trees in this critically endangered and nationally threatened box-gum vegetation community.

Independent scientific assessment

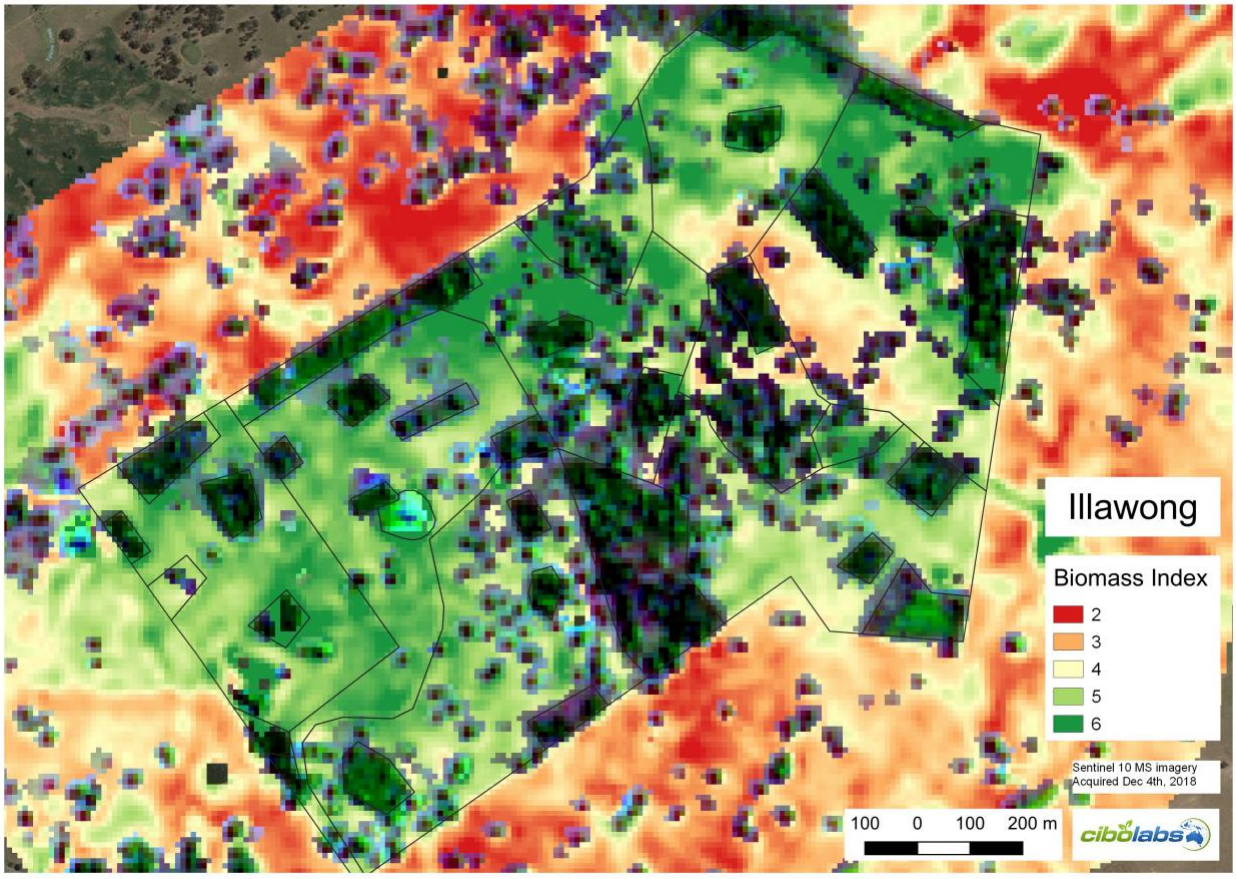
An independent assessment of the land manager's self-assessment across all 10 ecological response criteria supports information presented by the land manager.

This independent assessment examined three measures of ecological responses found inside and outside the Illawong property boundary: 1) ground cover, 2) biomass and 3) fractional cover.

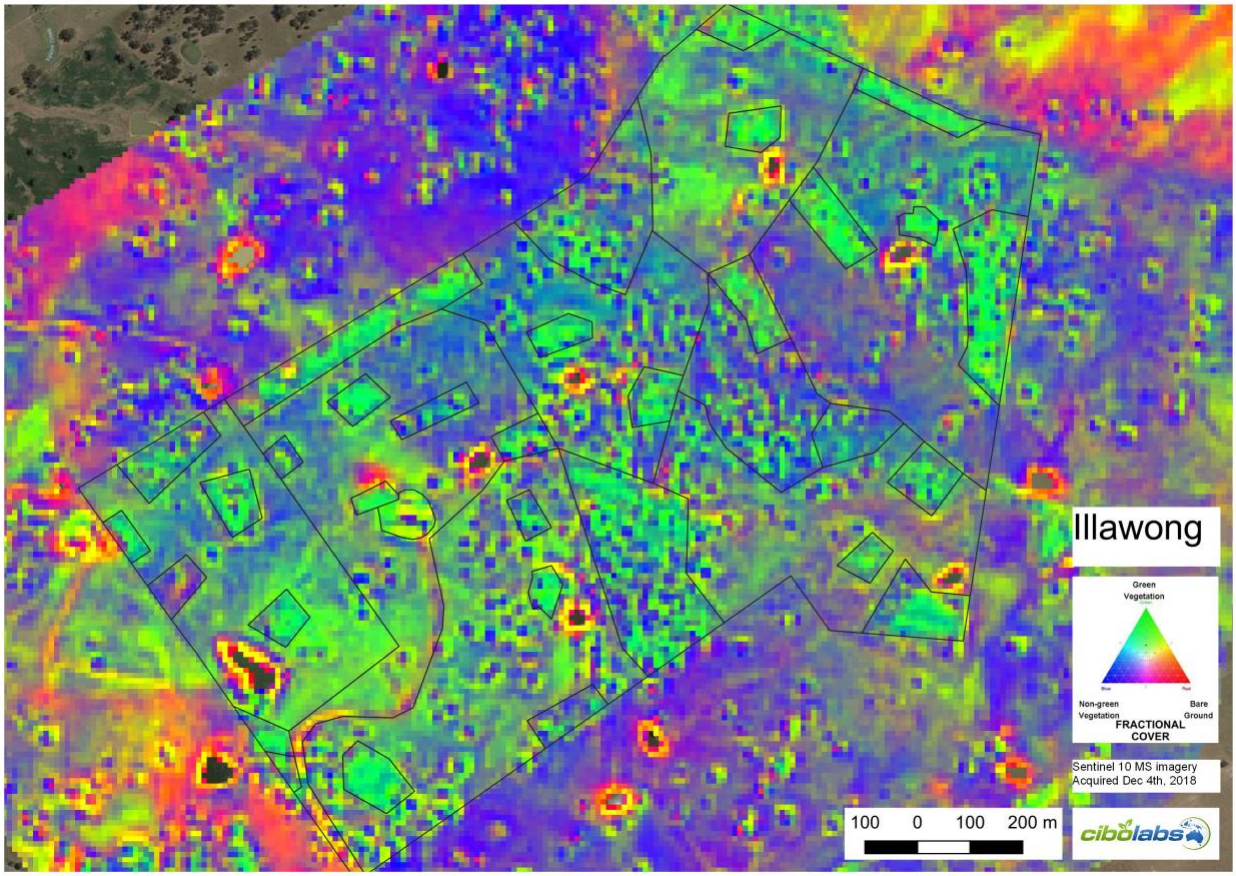
1) An assessment of ground cover information for Illawong was derived from a standardised national ground cover dataset (Landsat satellite using a 30m resolution) between 1990-2018. This ground cover analysis supports the graphical ecological summaries provided by the land manager, showing an obvious transformation in ground cover at Illawong; in the mid-1990s to mid-2000s the property had consistently low levels of ground cover (20-50%) compared to neighbours; whereas by 2008 the property had established consistently high levels of ground cover (50-80%) compared to neighbours. In early 2015 and 2016 Illawong reached 80-95% ground cover. It is worth noting that even though there was below average rainfall in the district in 2017-18, Illawong maintained high ground cover levels.



2) An assessment of biomass information for Illawong was derived from a standardised national biomass dataset (Sentinel satellite using a 10m resolution) for 4th December 2018. An index of biomass ranging from 2 (low) to 6 (high), shows that Illawong has obviously much higher biomass than the surrounding paddocks on different properties. These surrounding properties are implementing production systems which maintain continuous total grazing pressure over summer, whereas Illawong destocks over summer. One small area in the centre right of Illawong has low biomass, this is associated with native pastures on skeletal soils on a northerly aspect (Land capability class 7).



3) An assessment of fractional cover information for Illawong was derived from a standardised national fractional cover dataset (Sentinel satellite using a 10m resolution) for 4th December 2018. This independent assessment shows Illawong has predominantly a greater area of green (i.e. actively growing) vegetation, with scattered patches of non-green (i.e. not actively growing) vegetation. Almost all revegetation plantations are high functioning green vegetation. One small area in the centre right of Illawong has non-green vegetation, this is associated with native pastures on skeletal soils on a northerly aspect (Land capability class 7). When Illawong is compared to the surrounding paddocks on different properties, the ground cover is predominantly non-green vegetation (i.e. not actively growing), with scattered patches of green vegetation (i.e. actively growing) and with relatively large extents of bare ground. This finding is important given the below average rainfall for the district.



This independent ecological assessment highlights the importance of a local land manager understanding, and planning for, and implementing well-informed land management regimes that aim to achieve sustainable ecological outcomes. These results support the conclusion that Illawong is an outstanding example of regenerative landscape management in an agricultural setting.

Assessing responses to land management regimes according to the ecological criteria

This Supplementary Report is underpinned by the Soils for Life *Conceptual Model* and *Assessment Framework* that documents the responses of 10 criteria corresponding to ecosystem function, composition and structure.

Prior to undertaking a field visit to Illawong in October 2018, the landowner, Bryan Ward, was asked to document the production systems that have been developed and implemented at Illawong including land management regimes associated with the following: soil and vegetation condition (pastures, shrubs and trees); weed and pests; surface and ground water and animal production. That production history aimed to document land management phases which lead up to the current regenerative landscape management in this agricultural setting.

This included collation of all relevant available published and unpublished ecological relevant data and information about the farm and how it was managed. It also included paddock-based photographs, fertiliser history, paddock-based management histories, as well as grazing charts, bird surveys and names of interested parties who had visited the farm over time (Attachment A). This 2017 assessment has incorporated information which was compiled in September 2012 as part of the Soils for Life (SFL) Innovations for Regenerative Landscape Management Project.

Assessment of Response Criteria

This ecological assessment commences in 1989 - this date reflects Bryan's recollections of managing similar rolling and hilly soil-landscapes on the nearby Woomargama Station. Bryan was the farm manager on that Station for almost 30 years prior to purchasing Illawong in 1994. Based on Bryan's knowledge of the period between 1989-94, this period is presented as an analogue of the way Illawong would have been managed.

A. Resilience of landscape to natural disturbances - Drought Preparedness

Why track changes and trends in resilience to major natural disturbance/s?

Resilience to major disturbance/s includes the following factors depending on the agro-climatic region (wildfire, drought, cyclone, dust storm, flood). A major natural disaster or natural disturbance event can occur at any time. Some disturbances give a warning, such as a wind storm or electrical storm preceding a wildfire or a flood. Once a disaster happens, the time to prepare is gone. Lack of preparation can have enormous consequences on farm life including; social, ecological, economic and production.

Assumptions and definitions

Drought is the major regular natural disturbance event affecting Illawong. Drought preparedness is an aggregate score across all paddocks within Illawong. Appropriate drought management dictates dynamic monitoring of stock numbers and available pasture to avoid groundcover loss and expensive fodder purchases.

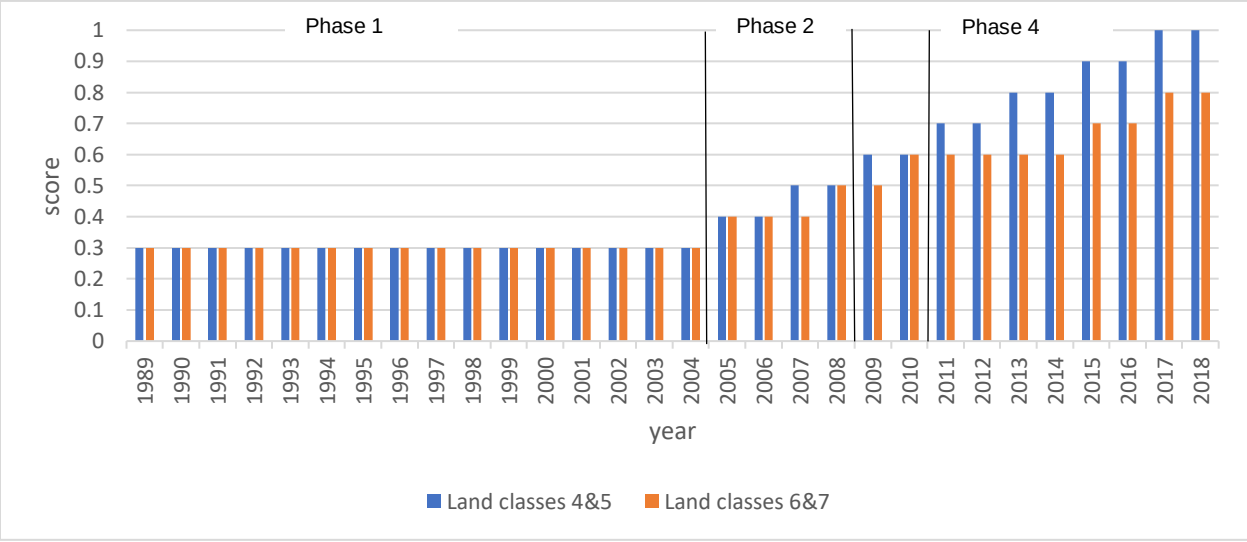
Results and Interpretation

Phase 1 extended from 1989-2004 and was associated with conventional grazing. Pastures under this management regime were not actively regenerated. During periods of below average rainfall, ground cover was relatively low.

In Phase 2 the land manager continued with conventional grazing; extending from 2005-08. During this phase the land manager focused on restoring ecological function (soil condition particularly on the steep slopes and high functioning pastures particularly on the mid and lower slopes). The pasture management regime was non-regenerative. Commencing in this phase the land manager developed separate land management regimes between the two soil-landscape classes found on Illawong. Land capability classes 4 and 5 include gentle slopes and deeper soils, while classes 6 and 7 include shallower soils found on upper slopes and ridgelines as well as steeper areas found on mid-slopes. Pastures in Classes 4 and 5 performed better (in terms of resilience and persistence) with the onset of dry periods, compared to classes 6 and 7.

Phase 3 saw the land manager transition from non-regenerative to regenerative pasture management. This production system enabled soil condition to improve and pasture biomass to increase through implementing short duration grazing followed by a relatively longer duration of pasture resting.

Phase 4 commenced in 2011 and continues to this day. The pastures are managed using planned grazing with short duration grazing followed by a relatively longer duration of pasture resting. In this phase the resilience of the soil-landscapes has shown that land classes 4 and 5 are more resilient to the onset of, and during droughts, compared to land classes 6 and 7. This is because of deeper soils with planned grazing of perennial pastures improves the amount of soil water held in the soil profile, thus the pastures hold their feed value for grazing animals.



Resilience of two groups of land capability classes to severe climate events – drought.

B. Status of soil nutrients – including soil carbon

Why track changes and trends in soil nutrients – including soil carbon?

Soil organic matter (SOM) is the basis of soil fertility. As a general rule-of-thumb, for every tonne of carbon in SOM about 100 kilograms (kg) of nitrogen, 15kg of phosphorus and 15kg of sulphur become available to plants as the organic matter is broken down. Thus, SOM releases nutrients for plant growth, promotes the structure, biological and physical health of soil, and is a buffer against harmful substances.

Assumptions and definitions

This is an aggregate score of the soil nutrients of all paddocks found in Illawong. This includes SOM, soil carbon, and a range of major and trace elements.

Soil organic carbon accounts for less than 5% on average of the mass of upper soil layers and diminishes with depth. According to the CSIRO, in good soils, soil organic carbon can be greater than 10%, while in poorer or heavily exploited soils, levels are likely to be less than 1%. Under conventional grazing in the intensive land use zone, heavy applications of inorganic fertilisers (inputs) are commonly used to drive higher production outputs. Regenerative landscape management regimes may be described as low input, but high quality/lower quantity output systems.

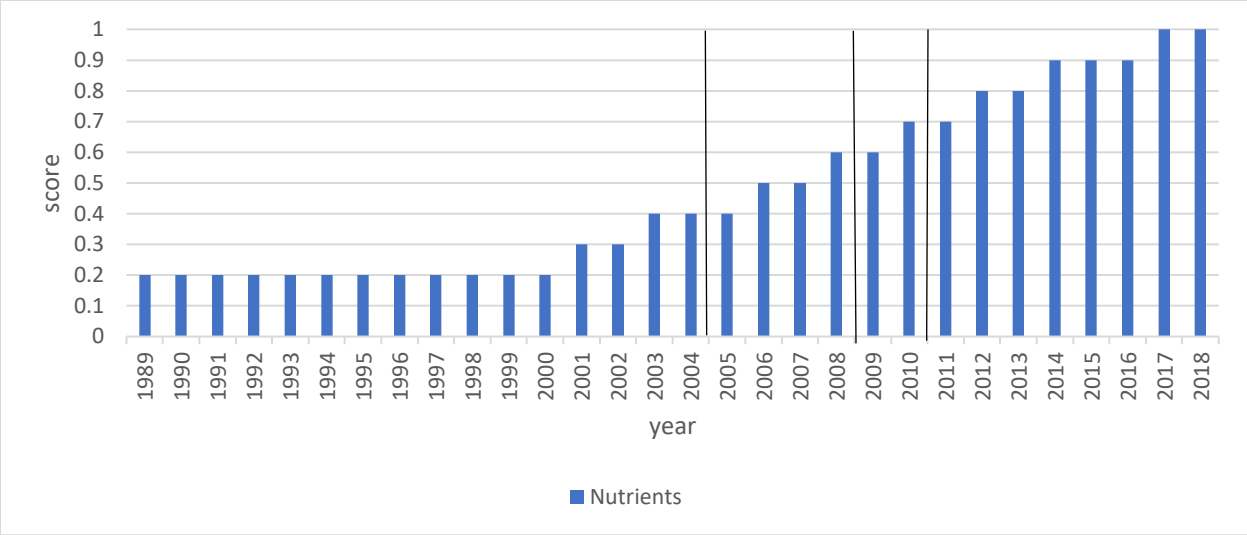
Results and Interpretation

Phase 1 extended from 1989-2004 and was associated with conventional grazing. Pastures under this management regime were not actively regenerated. Commenced contour ripping. This was conducted to reduce the risk of erosion and protect the top soil (nutrients) on the property.

Phase 2 continued with conventional grazing and extended from 2005-08. During this phase the land manager focused on restoring ecological function (soil condition and high functioning pastures). The pasture management regime was non-regenerative. Continued contour ripping until the end of the millennial drought. This was conducted to reduce the risk of erosion and protect the top soil (nutrients) on the property.

Phase 3 saw the land manager transition from non-regenerative to regenerative pasture management. This production system has enabled soil condition to improve and pasture biomass to increase through implementing short duration grazing followed by a relatively longer duration of pasture resting.

Phase 4 commenced in 2011 and continues to this day. The pastures continue to be managed using planned grazing with short duration grazing followed by a relatively longer duration of pasture resting. A good layer of humus has been built within the root zone, which is indicative of higher levels of stable soil carbon in the soil profile.



Status of soil nutrients.

C. Status of soil hydrology - Soil surface water infiltration

Why track changes and trends in soil surface water infiltration?

Soil physical properties have a direct relationship to soil moisture. Soil texture and structure greatly influence water infiltration, permeability and water-holding capacity. Of the water entering a soil profile, some will be stored within the root zone for plant use, some will evaporate, and some will drain away. In agro-ecological settings, by increasing water infiltration, permeability and water-holding capacity this will usually act as a stimulus to ecological function.

Assumptions and definitions

This is an aggregate score of the soil surface water infiltration and water holding capacity across all paddocks found in Illawong.

Plant available water is the difference between field capacity (the maximum amount of water the soil can hold) and the wilting point (where the plant can no longer extract water from the soil) measured over 100 cm or maximum rooting depth.

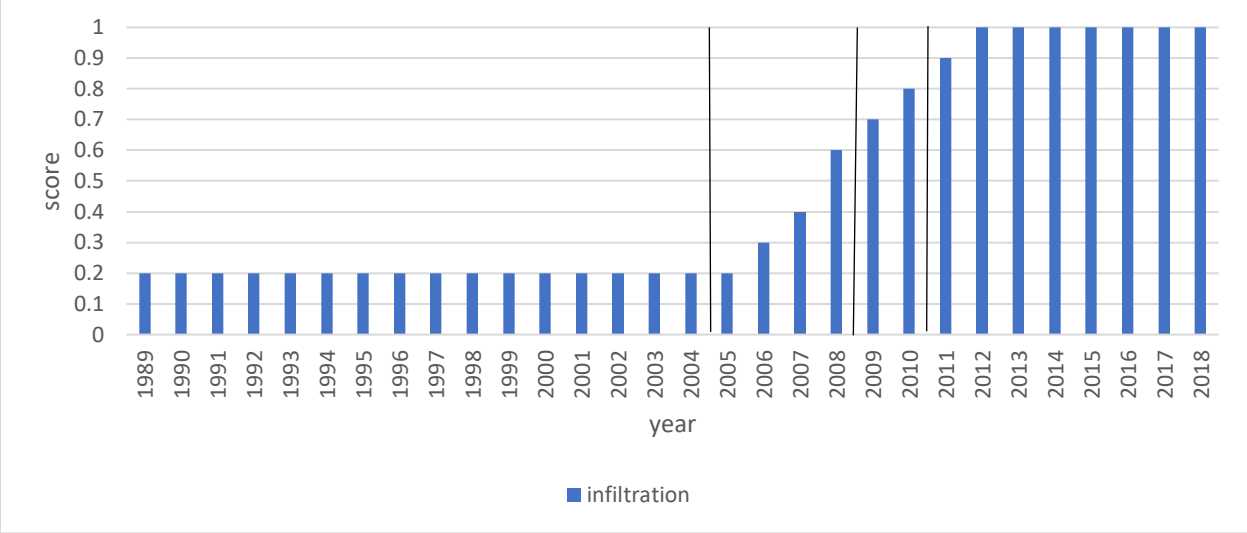
Results and Interpretation

In Phase 1 pastures were conventionally grazed. Commenced contour ripping. This ripping aimed to reduce the risk of erosion and protect the top soil (nutrients) on the property.

Phase 2 continued with conventional grazing and extended from 2005-08. During this phase the land manager continued to focus on restoring ecological function (soil condition and high functioning pastures). The pasture management regime was non-regenerative. Continued contour ripping until the end of the millennial drought. The land manager observed a reduction in overland surface flows resulting from intense rainfall events. In this phase surface water began to be absorbed into the soil via infiltration.

Phase 3 saw the land manager transition from non-regenerative to regenerative pasture management. This production system has enabled soil condition to improve and pasture biomass, associated with perennial grasses, to increase through implementing short duration grazing followed by a relatively longer duration of pasture resting. The land manager observed improvements in water infiltration associated with increasing perenniality and pasture biomass.

Phase 4 commenced in 2011 and continues to this day. During winter pastures are managed using planned grazing with short duration grazing followed by a relatively longer duration of pasture resting. Pastures are destocked over the summer. During intensive summer storms, surface flows are trapped against high biomass levels of perennial vegetation; there is minimal bare ground and soil erosion during such events is avoided.



D. Status of soil biology - Soil biology

Why track changes and trends in soil biological activity?

Soil biology affects plant (and animal) production by modifying the soil physical, chemical and biological environment within which plants grow and persist. The ratio of fungi to bacteria is important for land managers to understand - too many bacteria can indicate an unhealthy and unproductive soil. Soil fungi contribute to:

- natural processes (litter transformation, micro-food web participation and soil engineering);
- the decomposition of organic material resulting from compost applications and disturbance from cattle grazing; and
- enhancing nutrient distribution for plant health and productivity.

In healthy soils, invertebrates including arthropods and worms, also form a vital part of a soil food web.

Assumptions and definitions

This is an aggregate score of the soil surface condition properties of all paddocks found in Illawong.

Decomposition of plant and animal residues is a dynamic process involving trophic levels. While some of the residues are being broken down for the first time by the litter transformers (detritivores), other residues have already been sequestered by soil microflora, which are in turn consumed by microfauna predators.

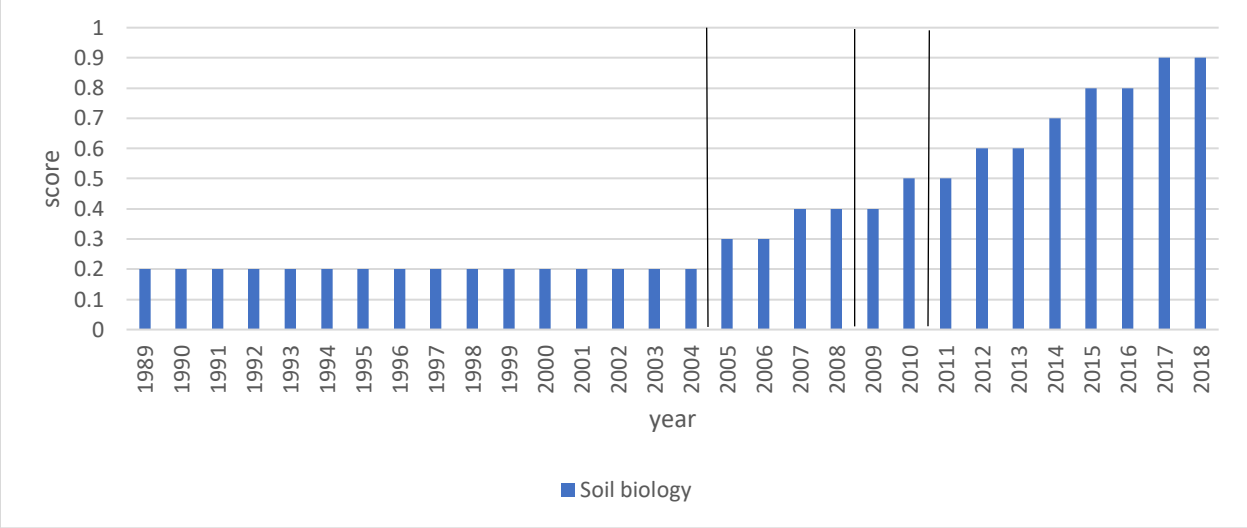
Results and Interpretation

In Phase 1 pastures were conventionally grazed. Commenced contour ripping. This ripping aimed to reduce the risk of erosion and protect the top soil (nutrients) on the property.

Phase 2 conventional grazing extended from 2005-08. During this phase the land manager continued to focus on restoring ecological function (soil condition and high functioning pastures). Continued contour ripping until the end of the millennial drought. The land manager observed improvements in pasture establishment and development; with overland surface flows being absorbed into the soil via infiltration.

Phase 3 transition from non-regenerative to regenerative pasture management. Pastures began to be managed by short duration grazing followed by a relatively longer duration of pasture resting. Observed improvements in pasture biomass, associated with perennial grasses, which led to improvements in soil condition.

In Phase 4 pastures are destocked over the summer. During winters, pastures are managed using planned grazing with short duration grazing followed by a relatively longer duration of pasture resting. Soil surface organic matter was observed to be increasing.



E. Status of soil physical properties – As a medium for plant growth

Why track changes and trends in soil physical properties?

Declining soil surface condition involves the depletion of nutrients, soil organic matter and of key elements of the soil biology from the soils. Soil degradation is the result of high levels of bare ground, water erosion, wind erosion, chemical and physical deterioration. It is often associated with unsuitable land management regimes. Over time loss of soil physical properties will have consequences on production, economic, other ecological criteria as well as social outcomes.

Assumptions and definitions

This is an aggregate score of the soil physical properties of all paddocks found in Illawong. This includes effective rooting depth of the soil profile and bulk density of the soil through changes to soil structure or soil removal.

The rooting depth of plants was observed by the landholder over time when the soil was ploughed or dug with a shovel. Under more intensive management, involving continuous grazing, grass tussocks were observed to be low in height and relatively shallow rooted.

Indicators of landscape function over time include: soil surface rain-splash protection, cryptogam cover, soil surface erosion type and severity, washed/deposited materials, physical features on the soil surface to retain resources during surface flows, and ground cover complexity which influences permeability.

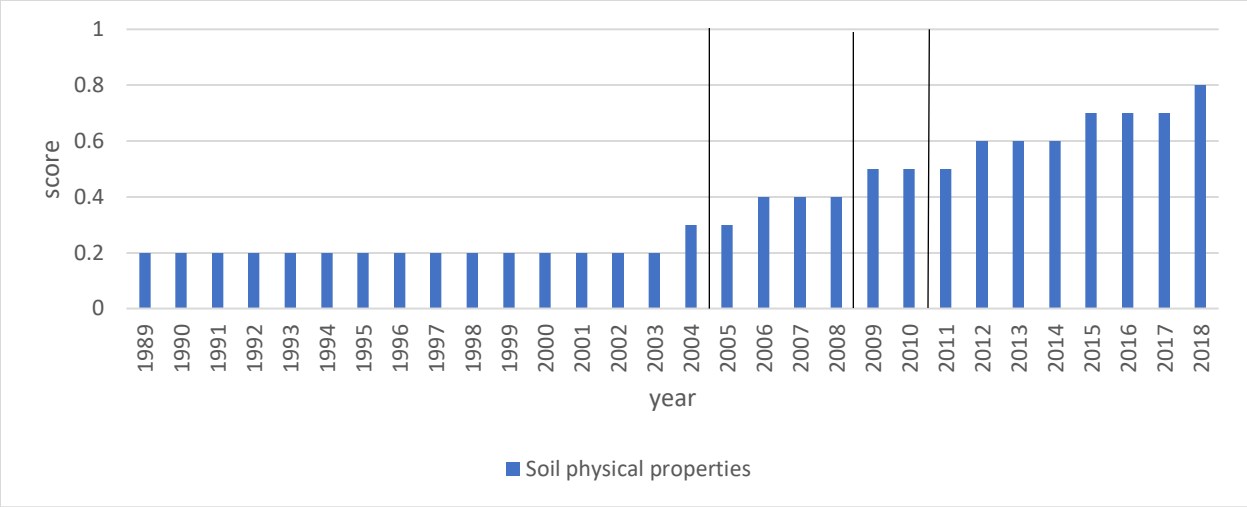
Results and Interpretation

In Phase 1 pastures were conventionally grazed. Commenced contour ripping. This ripping aimed to reduce the risk of erosion, protect the top soil (nutrients) and provide a stable medium for plant growth.

Phase 2 continued to focus on restoring ecological function (soil condition and high functioning pastures). The pasture management regime was non-regenerative. Continued contour ripping until the end of the millennial drought.

Phase 3 began to implement holistic management through short duration grazing followed by a relatively longer duration of pasture resting. The land manager observed improvements in pasture perenniality and pasture biomass. The soil has becoming a spongy, aerobic medium for plant growth.

Phase 4 saw winter pasture management use planned grazing with short duration grazing followed by a relatively longer duration of pasture resting. Pastures are destocked over the summer. Soil surface is a spongy, aerobic medium for plant growth.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F. Status of plant reproductive potential – Reproductive potential of pastures

Why track changes and trends in reproductive potential of pastures?

An understanding of successful reproduction, germination, establishment and development of plants is important in managing agri-ecological ecosystems. This understanding of successful plant reproduction is vital in the manipulation of planned production outcomes - e.g. grazing regimes can prevent seed-setting by undesirable or invasive plants and for increasing the longevity of perennial pastures before they need to be resown.

Assumptions and definitions

Reproductive potential is the relative capacity of a species to reproduce itself under optimum conditions, including trees, shrubs and grasses. In the context of grazing land management regimes this is an aggregate score assigned across all pastures found on Illawong. In the context of revegetation this is an aggregate score assigned across all revegetation plantations.

Where continuous grazing is the preferred grazing management regime or where total grazing regimes limit or prevent reproductive success of a species mix in pastures, this can lead to bare ground and can lead to the dominance of some species which have low feed value for grazing animals.

With the construction of numerous smaller paddocks and large water dams, this infrastructure on Illawong permitted easier stock movement and the development of a program that allowed the perennial pastures to set seed, germinate and grow; the pastures thickened and became more resilient to climatic extremes. Fencing out revegetation plantations from sheep and cattle grazing enables trees, shrubs and grasses reseed, establish and develop in structural diversity.

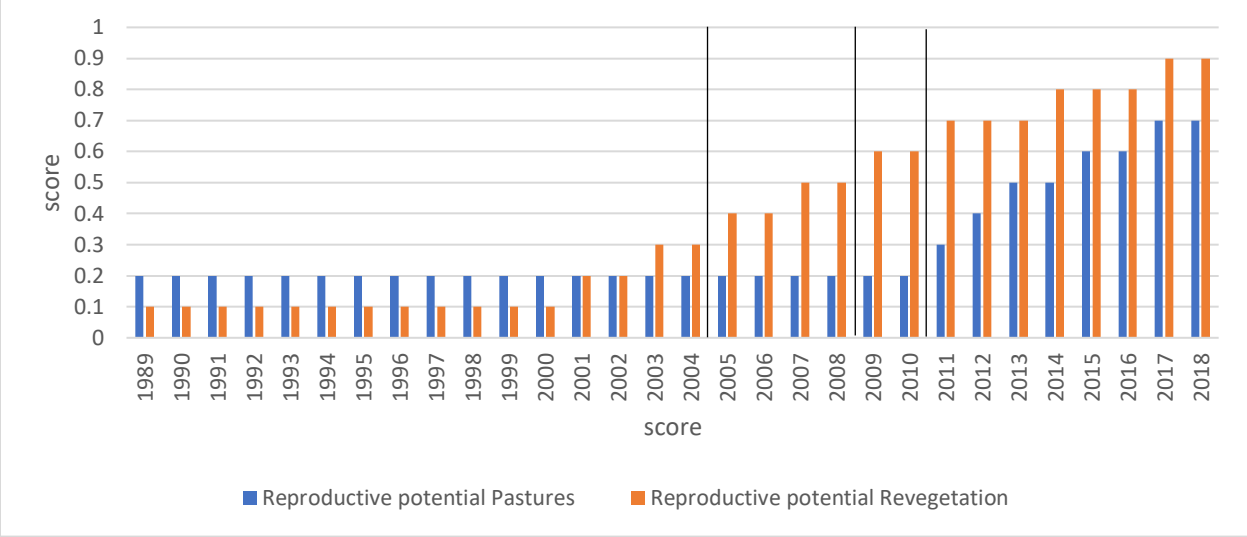
Results and Interpretation

In Phase 1 there was little potential for the pastures set seed, germinate and develop and became more resilient to climatic extremes. Trees compromised isolated and scattered paddock trees which were not protected from grazing sheep. The health of these trees was diminished because of heavy herbivory by insects. Commenced trailing direct drilling of native trees and shrub seeds to establish diverse plantings in fenced-off revegetation plantations.

Phase 2 land management regimes focused on restoring ecological function (soil condition and high functioning pastures). Pasture management regime was non-regenerative with the land manager running sheep. Transition from wool production (wethers) to beef production (steers). Continued direct drilling of native trees and shrub seeds to establish diverse plantings in fenced-off revegetation plantations. Increasing structural maturity of fenced-off revegetation plantations.

Phase 3 began a further transition from non-regenerative to regenerative pasture management regime involving cattle grazed on short rotations on small paddocks and long recovery times of pastures. Continued direct drilling of native trees and shrub seeds to establish diverse plantings in fenced-off revegetation plantations. Increasing structural maturity of fenced-off revegetation plantations.

In Phase 4 pastures are destocked over the summer. The land manager continued regenerative pasture management for beef production involving finishing steers over winter on improved and native pastures. Pastures managed on a short rotation using small paddocks and long recovery times. Beef production aims to target spring cattle sales. Increasing structural maturity of fenced-off revegetation plantations.



G. Status of tree and shrub structural diversity and health

Why track changes and trends in extent of tree cover?

Tree cover in agricultural landscapes provides important ecosystem benefits including: mitigation of soil erosion, shelter for pastures, improved animal welfare; enabling added revenue from stacked enterprises; habitat and breeding sites for pollinators and predatory insects, birds and animals; improved salinity management; improved interception of rainfall and improved aquifer recharge management.

Assumptions and definitions

By gradually increasing the area and connectivity of tree cover on Illawong, in the form of fenced-off revegetation plantations, the landholder expected this would lead to improvements in stock health, pasture productivity, improved habitat and breeding sites, and food for native wildlife. This would also lead to improved visual amenity of the formerly over-cleared landscape.

Results and Interpretation

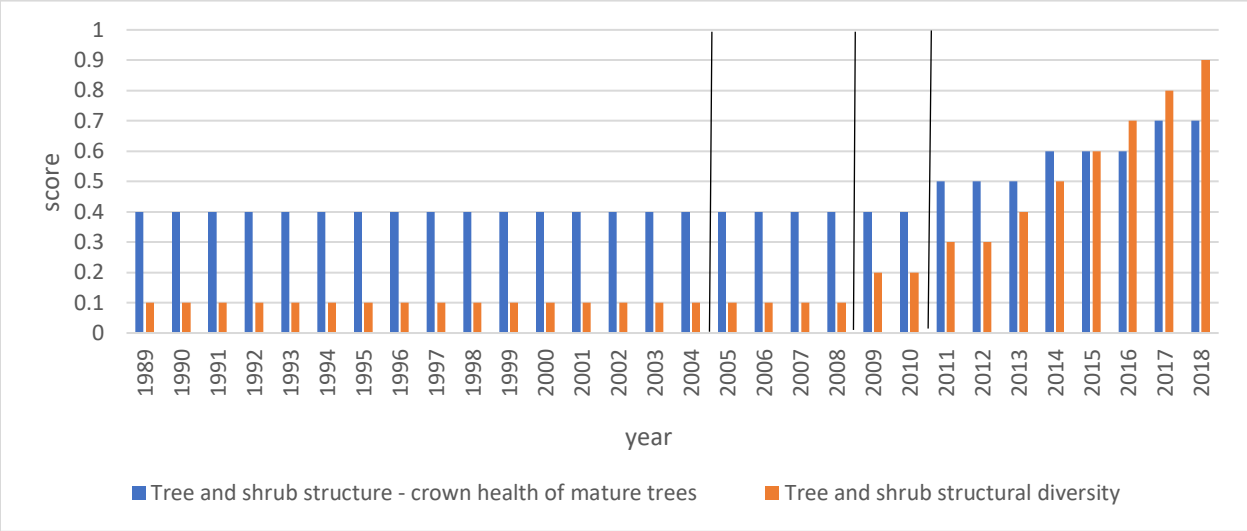
During Phase 1 the area of Illawong with isolated and scattered paddock trees was 8 ha (5%). These isolated and scattered paddock trees were mature and senescent.

Phase 2 continued to direct seed with locally endemic trees and shrubs around isolated and scattered paddock trees. Plantations were fenced off. Biodiversity plantings was 17 ha (11%). Increasing structural maturity of fenced-off revegetation plantations. Health of mature trees observed to improve with the growth and development of biodiversity plantings.

In Phase 3 continuation of direct seeding with locally endemic trees and shrubs around isolated and scattered paddock trees occurred. Plantations were fenced off. Biodiversity plantings was 25 ha (16%).

Increasing structural maturity of fenced-off revegetation plantations. Health of mature trees observed to improve with the growth and development of biodiversity plantings.

During Phase 4 the area of Illawong set aside for biodiversity plantings is 33.5 ha (21%). Fenced-off revegetation plantations provide numerous ecological and farming benefits including; reduced siltation of dams because the plantings intercept overland flow in the gully bottoms before the water enters the dams, reduced wind disturbance on ridge tops, improved shelter for cattle around the fenced margins of the revegetation plantations. Increasing structural maturity of fenced-off revegetation plantations. Healthy mature trees observed within biodiversity plantings.



H. Status of grass and herb structure - Ground cover

Why track changes and trends in ground cover?

The quality of ground cover in summer provides essential protection to keep the soil cool against direct, searing summer heat by reducing evaporation, protecting bare soil against raindrop splash and wind erosion. Good summer pastures also slow overland flows during the storm season and assist with infiltration of intense rainfall events, thus mitigating water erosion and replenishing soil moisture.

Winter grazing is an important management consideration in landscapes that are managed for livestock production. Conservative grazing land management is both ecologically and economically sensible.

Definitions and Assumptions

This is an aggregate score across all pasture production paddocks in Illawong.

The commonly espoused grazing land management regime in the district is that of continuous or set stocking throughout the year means that the height (i.e. the biomass of pastures) is generally low. In dry summers the height (i.e. the biomass of pastures) in winter is very low.

In contrast to continuous or set stocking, holistic grazing of pastures involves short duration grazing followed by a relatively longer duration of pasture resting. Because winter rainfall at Illawong is adequate, and the temperatures suitable for growth, recovery of pastures that were grazed earlier will occur during winter.

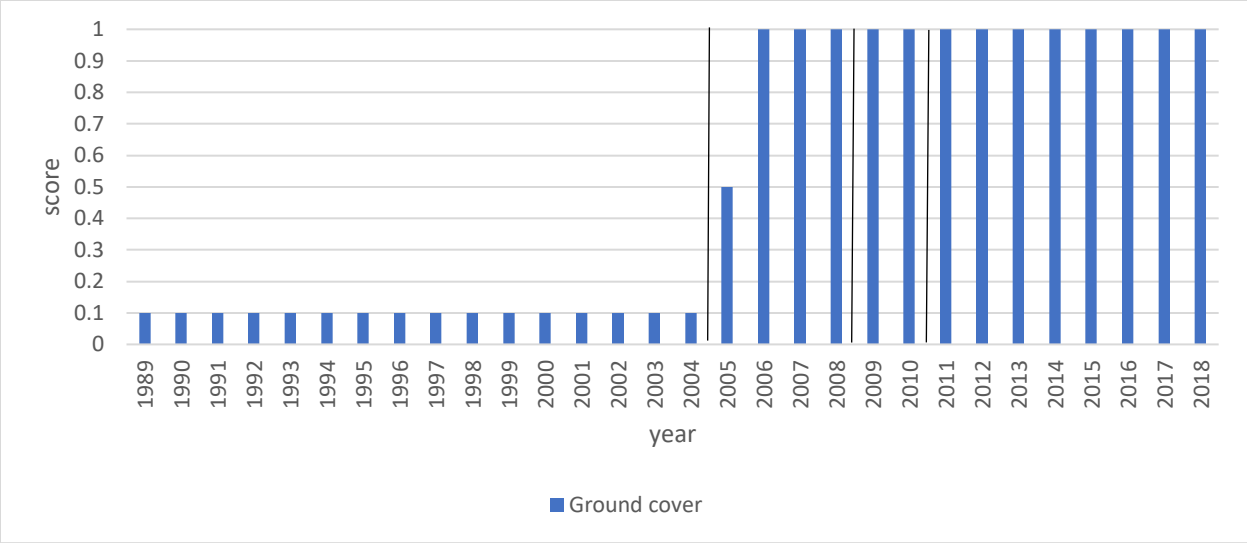
Results and Interpretation

In Phase 1 pastures were conventionally grazed. Commenced contour ripping. This ripping aimed to reduce the risk of erosion and protect the top soil (nutrients) on the property. Ground cover was low in winter and very low in summer.

In Phase 2 the land manager transitioned from wool production (wethers) to beef production (steers). Contour ripping continued until the end of the millennial drought. This was conducted to reduce the risk of erosion and protect the top soil on the property. Land management regimes focused on restoring ecological function (soil condition and high functioning pastures). While the pasture management regime was non-regenerative there was an obvious increase in ground cover in winter. Ground cover in some of the improved pasture paddocks reached 90-95%.

In Phase 3 the land manager transitioned from non-regenerative to a regenerative pasture management regime involving cattle grazed on short rotations on small paddocks and long recovery times of pastures. Ground cover in many of the improved pasture paddocks was maintained at 90-95%.

In Phase 4 continued regenerative pasture management for beef production involving finishing steers over winter on improved and native pastures.



I. Status of tree and shrub species richness and functional traits

Why track changes and trends in the status of tree and shrub species richness?

Functional richness refers to the number of species inhabiting a place and what is/are their roles in that place. Functional diversity reveals how evenly the species are distributed in an area. Decrease in functional richness and evenness decreases an ecosystem's productivity and stability. How an ecosystem is managed in an agricultural setting will determine its productivity and stability.

Grazing land management regimes typically result in a reduction in the numbers of species of trees and shrub species as the landscape is modified for pasture production. Grazing animals can inhibit the regeneration of trees and shrubs species.

Definitions and Assumptions

This is an aggregate score across all paddocks in Illawong.

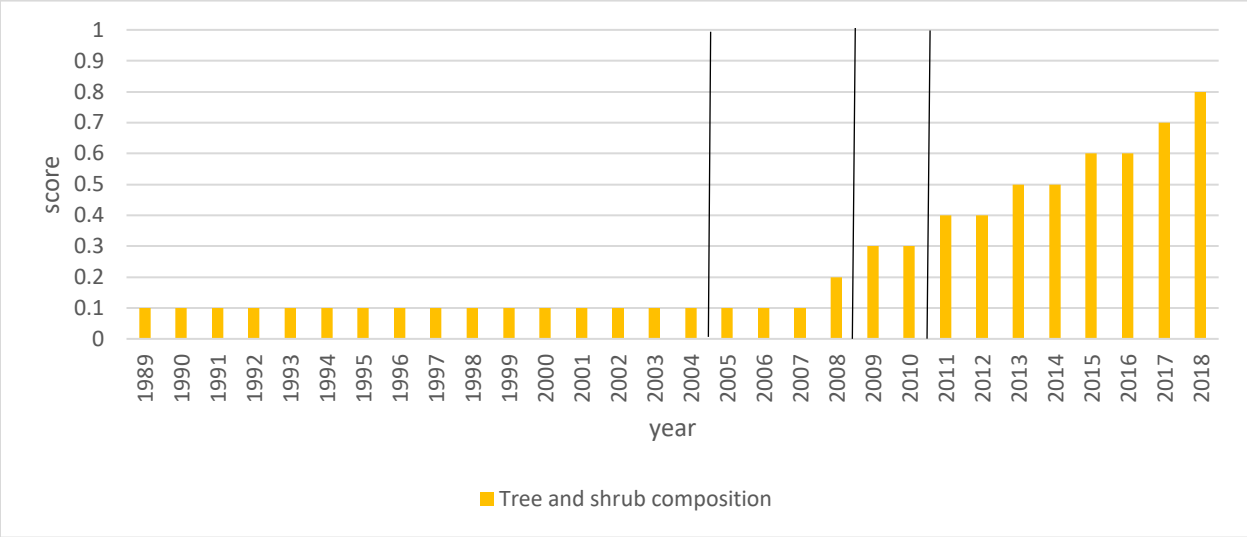
Results and Interpretation

During Phase 1 the number of tree and shrub species was very low and was restricted to mature and senescent trees. There were no shrubs in the grazing paddocks. Direct drilling seeds of native tree and shrub species was trailed in fenced-off plantations to establish species rich revegetation plantings. Plantings were protected from sheep grazing.

Phase 2 saw the number of tree and shrub species begin to increase because of germination and establishment of locally endemic direct-seeded trees. Shrubs were protected from sheep grazing.

In Phase 3 as more areas were direct-seeded and fenced off the number of tree and shrub species began to increase. Plantings were protected from cattle grazing.

In Phase 4 the fenced off revegetation plantations were observed to be self-seedling and regenerating. It is expected that additional shrubs species can be added via direct seeding, particularly in those fenced off plantations where the canopy is open. Plantings are protected from cattle grazing.



J. Status of grass and herb species richness and functional traits

Why track changes and trends in grass species diversity?

Functional richness refers to the number of species inhabiting a place and what is/are their roles in that place and functional diversity reveals how evenly the species are distributed in an area. Decrease in functional richness and evenness decreases an ecosystem's productivity and stability. How an ecosystem is managed in a production setting will determine its productivity and stability.

In many grazing land management regimes, the variety of pasture plants (annuals and perennials) can improve production, protect natural resources (soil and water) and build the capacity of farming systems to adapt to future production and environmental challenges. The intensity of the grazing management system will determine the health and vitality of pastures and their longevity.

The selection of which perennial pasture species, on which to base a grazing production system, should be based on considerations of climate, soil conditions and performance of pasture species under different management regimes.

Assumptions and definitions

This is an aggregate score across all pasture species found on Illawong.

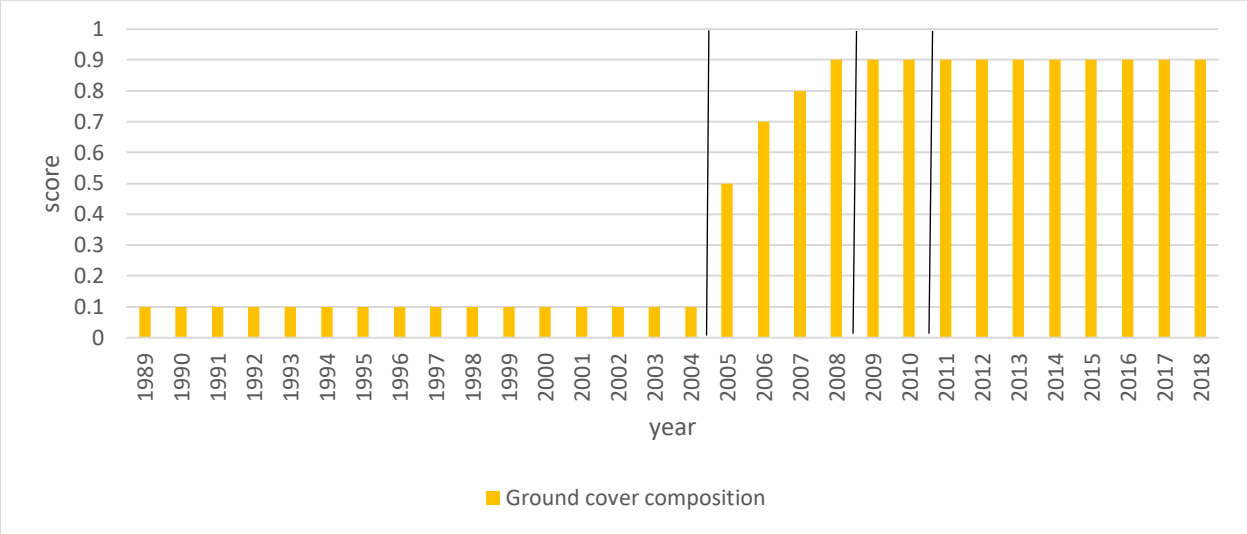
Results and Interpretation

Phase 1 land capability classes were used as a planning tool to establish grazing land management systems. Improved pasture was planted on the gentle slopes and deeper soils. Native pastures were promoted on upper slopes and ridgelines and sleeper mid-slopes on shallower soils (Attachment A, Detailed paddock maps). Land management regimes focused on restoring ecological function (soil condition and high functioning pastures), conventional wool production (wethers), grazing of a mosaic of native and improved pasture. The management regime for pasture was non-regenerative.

Phase 2 pasture management regime was non-regenerative. Transitioned from wool production (wethers) to beef production (steers). Land management regimes focused on restoring ecological function (soil condition and high functioning pastures). This production system enabled a diverse mix of species to germinate, establish and develop.

In Phase 3 the land manager transitioned from non-regenerative to a regenerative pasture management regime involving cattle grazing on short rotations on small paddocks and long recovery times of pastures. This production system continued to enable a diverse mix of species to germinate, establish and develop.

Phase 4 continued regenerative pasture management for beef production involving finishing steers over winter on improved and native pastures. All pastures are destocked during summer with cattle grazing limited to the winter months. More species are expected to establish and develop over time under this grazing land management regime.



Attachment A

Production systems

Information below describing land management regimes or production systems was compiled from a field visit and interview with Bryan Ward at Illawong, conducted during October 2018.

The following chronology was established as a partnership with the land manager for each of the phases 1-4:

Phase 1

A. Years:

1989-2004

B. Land area:

160 hectares

C. Management ideals:

The land holder's focus during this phase was on 'livestock production' rather than on 'pasture production-based grazing'.

D. Animal management and production:

Prior to 1994 the current land holder of Illawong managed a nearby station, and purchased Illawong in late 1994.

Prior to 1994 Illawong was set stocked with Merino sheep for superfine wool production.

In 1994 Illawong consisted of two paddocks.

E. Crop and pasture management:

The land holder at the time set stocked Merino sheep on pastures of annual species.

Weeds on the property consisted largely of thistles and Paterson's Curse.

Rabbits were widespread throughout the property in large numbers.

Cropping was not conducted on Illawong during this phase.

F. Monitoring and observations:

The production system utilised throughout this phase caused the depletion of pasture diversity and groundcover, leading to poor soil health, seasonal short-falls in ground cover and increasing erosion risk.

G. Evaluation:

The management practices of the Land holders, lead to the property being unable to cope with seasonal variability, resulting in long term degradation of the land base.

H. Improvements:

Nil.

Phase 2

A. Years:

2004-08

B. Land area:

160 hectares

C. Management ideals:

The land holder investigated, trialled and implemented land management regimes to enhance the ecological function (soil condition and high functioning pasture) of land capability classes. Direct drilling seeds of native tree and shrub species was developed and implemented to establish revegetation plantations to derive multiple ecosystem services.

D. Animal management and production:

During this phase the land holder ran sheep on the property.

The land holder ran 1500 merino wethers before the onset of the millennial drought in 1996.

E. Crop and pasture management:

Contour ripping was conducted from 2000 at the end of the millennial drought. This was conducted to reduce the risk of erosion and protect the top soil on the property.

In 2000 the land holder trialled erecting fences around remnant paddock trees and direct seeding the fenced off areas with native vegetation.

Chemicals were utilised to control weeds on the property when necessary.

Cropping was not conducted on Illawong during this phase.

F. Monitoring and observations:

The production systems adopted during this phase started to halt the loss of ground cover and grass species on the property.

G. Evaluation:

The land holder was managing the land for production during this phase whilst trialling regenerative farming techniques on the property.

H. Improvements:

Constructed fences around remnant paddock trees and direct seeded native vegetation in the fenced off areas to conserve and improve vegetated areas on the property.

Utilised a “rockhopper machine” to direct seed rocky outcrops on the property.

Phase 3

A. Years:

2009-2010

B. Land area:

160 hectares

C. Management ideals:

The land holder focused on establishing areas of revegetation to benefit from multiple ecosystem services throughout this phase.

D. Animal management and production:

The land holder switched from a sheep enterprise to a cattle enterprise in 2005.

Throughout this phase the land holder agisted cattle on the property.

E. Crop and pasture management:

The land holder focused on increasing the amount of grass grown on the property.

The construction of fences throughout the property enabled the land holder to manage the grazing pressure applied on the land by livestock.

The land holder continued erecting fences around remnant paddock trees and direct seeding the fenced off areas with native vegetation.

The use of chemicals to control weeds on the property was reduced during this phase.

The land holder started to control weeds by establishing deep-rooted perennial pasture species such as phalaris and clover.

Cropping was not conducted on Illawong during this phase.

Applied lime to overcome acid soil constraints in 2005.

F. Monitoring and observations:

Woody vegetation on the property started to naturally regenerate during this phase.

The amount of bare ground on the property reduced as the structure of grasses and their species diversity increased.

The land holder observed improvements in soil health at the property throughout this phase.

G. Evaluation:

The management practices of the land holder changed in the phase to adopt a focus on increasing pasture production across the property.

H. Improvements:

Constructed fences throughout the property increasing the number of paddocks.

Constructed dams on the property.

Fenced off erosion gullies and direct seeded native vegetation above and around existing erosion gullies, with the aim of reversing existing erosion damage and preventing further damage.

Phase 4

A. Years:

2011-2018

B. Land area:

160 hectares

C. Management ideals:

The land holder had successfully established areas of revegetation across the property and was benefitting from multiple ecosystem services by the end of this phase.

D. Animal management and production:

In 2011 the land holder adopted a steer fattening enterprise, based on fattening livestock over winter and selling early spring.

The carrying capacity of the property is up to 140 cattle.

The land holder specifically selects his steers for a quiet temperament and aims to keep their stress levels down for the duration of their time on his property.

E. Crop and pasture management:

The land holder focused on increasing the amount of grass grown on the property.

The construction of fences throughout the property enabled the land holder to manage the grazing pressure applied on the land by livestock.

Electric fencing is used extensively across the property.

The land holder practices rotational grazing of paddocks ensuring the height of pastures doesn't go below 10cm.

The land holder continued erecting fences around remnant paddock trees and direct seeding the fenced off areas with native vegetation.

The land holder avoids the use of chemicals to control weeds on the property, attempts to control them through natural methods such as grazing and establishing perennial pasture species, where possible.

Perennial pasture species have been established throughout the property.

Kangaroo numbers on the property are controlled and kept at a sustainable level through the use of professional shooters.

Pindone is used when rabbits are sighted on the property, this keeps their numbers low and reduces their potential environmental impact.

Cropping was not conducted on Illawong during this phase.

F. Monitoring and observations:

Woody vegetation on the property continued to naturally regenerate during this phase.

The amount of bare ground on the property continued to reduce as the structure of grasses and their species diversity increased.

The land holder observed improvements in soil health at the property throughout this phase, Ph of 4.2 in earlier years to 7 in 2018.

The DSE of the property increased from 1.5 in 1994 to 12-14 in 2018.

G. Evaluation:

The land holder is happy with the state of his property but he aims to continue improving the ecological health of the property in the years to come.

The land holder has plans to implement a reticulation system on the property with the goal of improving water access and usage.

The method of direct seeding native vegetation utilised on the property has increased the species diversity of trees and shrubs significantly on the property.

The structure and extent of trees and shrubs has also increased on the property, currently 20.97% of the property is protected for conservation purposes.

78.6% of the 160 hectares of the property is utilised for grazing, this percentage is further divided into three types of grazing management. The three types consist of: “sown improved pasture” 50.4%, “native pasture occasionally grazed” 7.62% and “native pasture least frequently grazed” 20.67%.

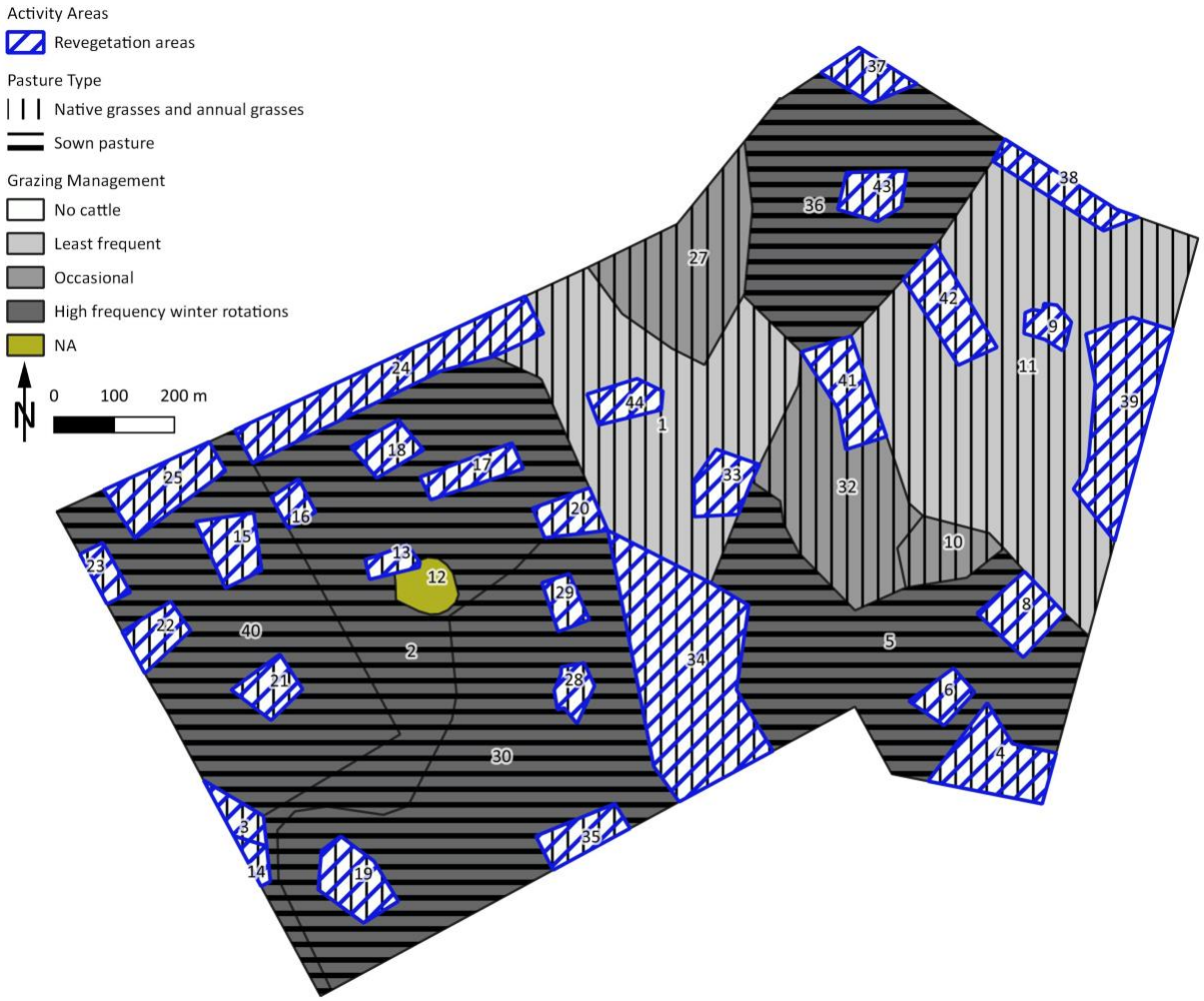
Ian Davidson, a local ecologist in 2018 found 53 bird species in 30 mins while surveying the revegetation plots.

H. Improvements:

Continued constructing dams throughout the property increasing the number of dams from two in 1994 to seven in 2018.

Detailed paddock maps

The spatial arrangement of the Illawong’s paddocks and land uses are shown in the following paddock maps. Most of the western portion of the property is sown improved pasture and the eastern portion is a mosaic of native pasture and annual grasses. Patches of revegetation are located with these pasture types and provide the cattle with shelter from the sun and wind.


Activity Areas
Revegetation areas
Pasture Type
Native grasses and annual grasses
Sown pasture
Grazing Management
No cattle
Least frequent
Occasional
High frequency winter rotations
NA
N
0 100 200 m
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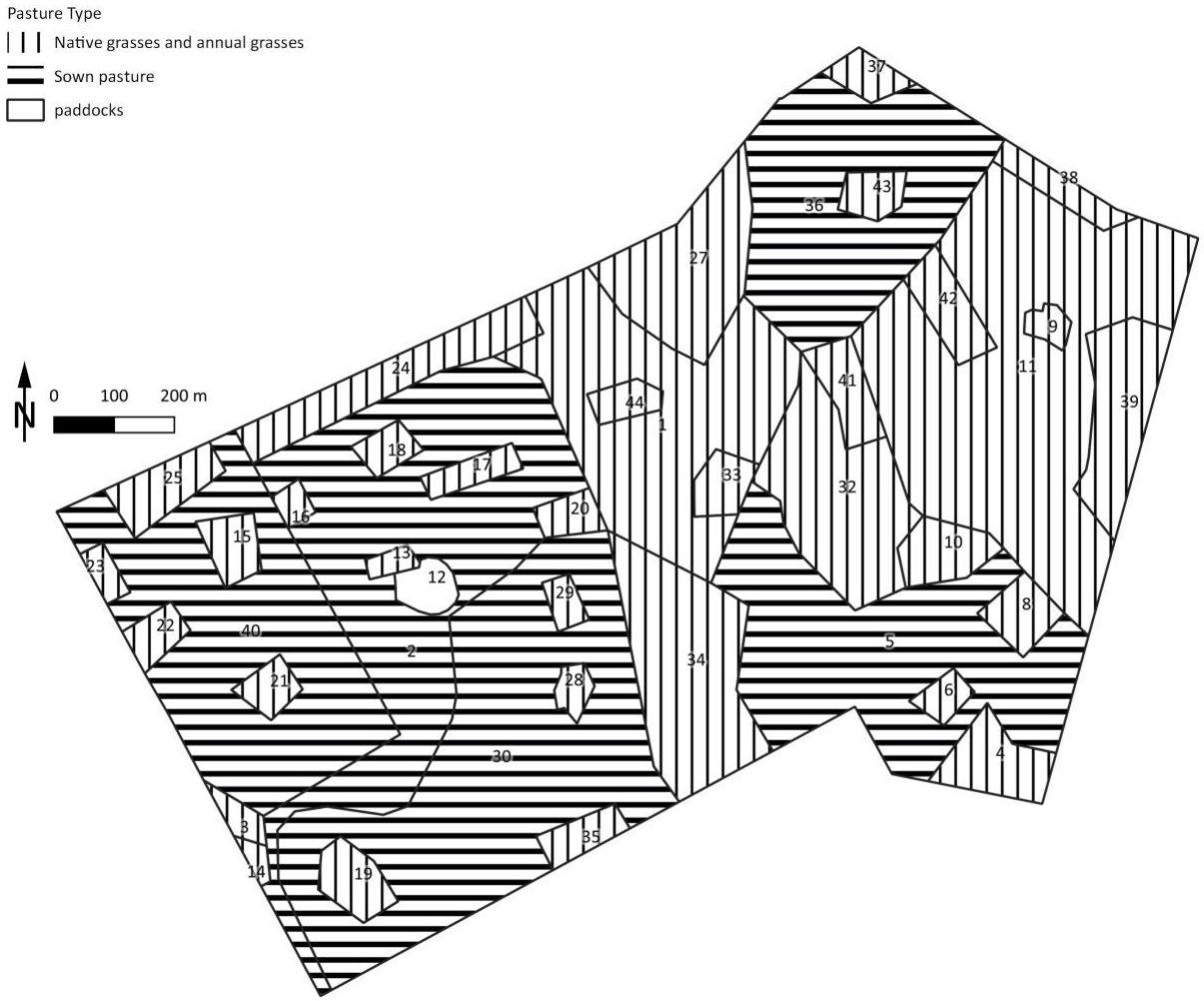
Pasture Type
Native grasses and annual grasses
Sown pasture
paddocks
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During winter, cattle are rotationally grazed on different pastures to ensure a long recovery time for the different pasture types. Sown pastures have a high frequency grazing and shorter recovery time compared to the native pasture and annual grasses; the latter are occasionally and infrequently grazed with an associated longer recovery time. All pastures are destocked during summer.

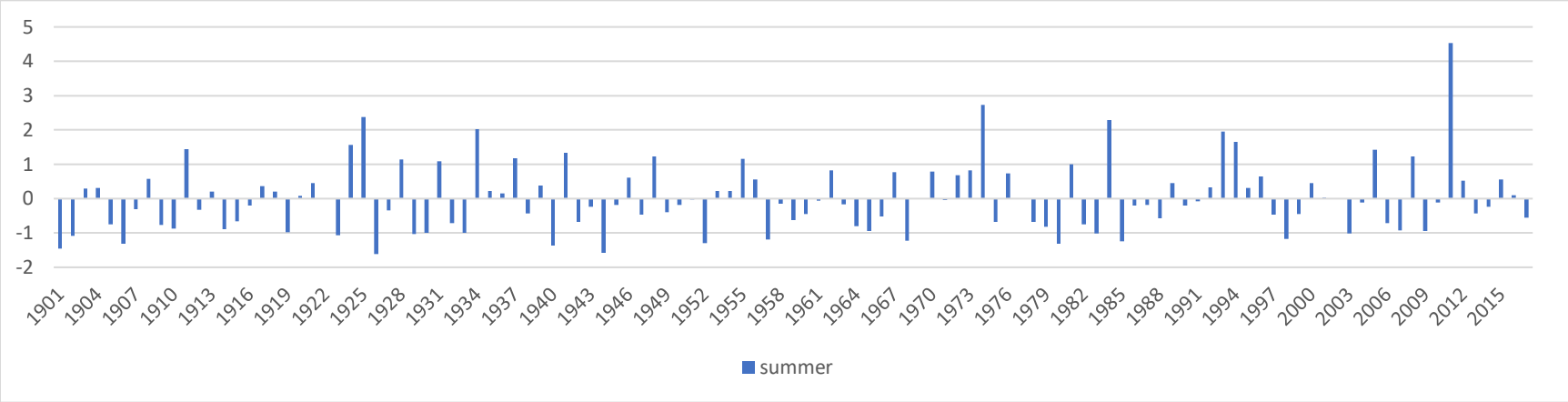
Table 1. Land capability class and land management for each paddock at Illawong

Land class	Paddock	Land management
4-7	1	Table Top native grasses and annual grasses plantations in Table Top 44, 33, 24, all Direct seeded.
4-6	2	Hume sown pasture plantations 14, 13, 17, 18, 16 all Direct seeded No. 12 Homestead area.
4	3	Direct seeded plantation which is a part of 14 all one plantation – no subdivision between them.
4	4	Plantations – wooded all hand planted No. 31 Direct seeded all one plantation no subdivision between them.
4	5	Hovell sown pasture part of 7 all one paddock no subdivision between them.
4-5	6	Direct seeded plantation.

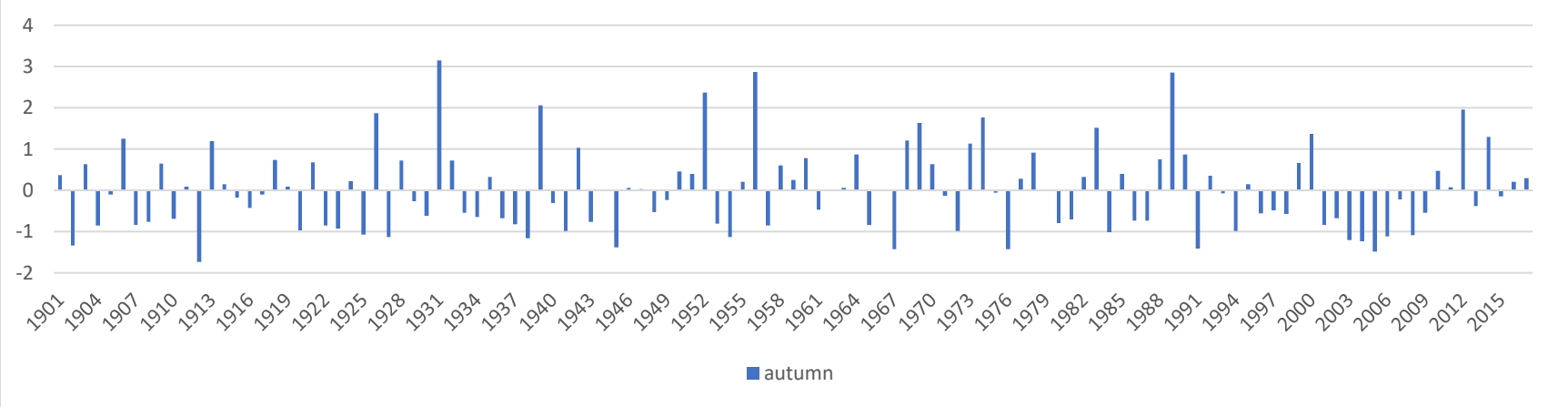
4	7	Hovell sown pasture part of 5 all one paddock no subdivision between them contains plantations 6+8.
4-5	8	Direct seeded plantations Hovell.
6-7	9	Direct seeded plantation in Yambla.
7	10	Bowna native and annual and tree regeneration taking place .
4-7	11	Yambla native grasses and annuals plantations 9, 42, 38 & 39 all Direct seeded.
4	12	Homestead area home & garden.
4	13	Direct seeded plantation in paddock 2, Hume.
4	14	Direct seeded plantation in 2 paddock Hume.
6+7	15	direct seeded plantation in 40 paddock Lawson.
4+5	16	Direct seeded plantation in 2 paddock Hume.
4	17	Hand planted plantation in 2 paddock Hume.
4+5	18	Direct seeded plantation in 2 paddock Hume.
4	19	Direct seeded plantation in 30 paddock Charwell.
4+5	20	Direct seeded plantation No. 2 paddock Hume & Charwell paddock 30.
4	21	Direct seeded plantation in No. 40 paddock 40 & Lawson.
4+5	22	Direct seeded plantation in 40 paddock Lawson – plantation not finished - very poor results.
4+5	23	Direct seeded plantation No. 40 paddock Lawson.
4	24	Direct seeded plantation part in No. 1 paddock Table Top plantation 26 & 24 all one plantation no subdivision between them.
4	25	Direct seeded plantation in No. 40 paddock Lawson.
4	26	Direct seeded plantation part of 24 all one plantation- no subdivision between them.
7	27	Glints Glimpse paddock native and annuals – some Direct seeded areas only grazed occasionally.
4	28	Direct seeded plantation in No. 30 paddock Charwell.
4	29	Direct seeded plantation in No. 30 paddock Charwell.
4+5	30	Charwell Paddock sown pasture containing plantations 19, 35, 28, 29.
4	31	Plantation part of 4 all one plantation no subdivision 31 small section Direct seeded 4 all hand planted for woodlot.
7	32	Williams Wish some good regeneration of shrubs and trees beginning only grazed occasionally.
4-5	33	Direct seed plantation in No. 1 Table Top paddock.
4	34	Direct seeded plantation Toms Park.
4	35	Direct seeded plantation No. 30 Charwell paddock.
4-7	36	Sown pasture paddock Wyndham plantations 43 and 37.
6+7	37	Direct seeded plantation – paddock 36 Wyndham.
4+5	38	Direct seeded plantation No. 11 paddock Yumbla.
4+5	39	Direct seeded plantation No. 11 paddock Yumbla.
4+6	40	Lawson sown pasture plantation 3. 21, 27, 23, 15, 25.
4+5	41	Direct seeded plantation.
4+5	42	Direct seeded plantation in No. 11 paddock Yumbla.
4+5	43	Direct seeded plantation in No. 36 paddock Wyndham.
4+5	44	Direct seeded plantation in No. 1 Table Top.

Attachment B

Patterns of seasonal rainfall derive from modelled monthly rainfall data for Illawong[2] showing variants around the mean.



[2] Source: Bureau of Meteorology modelled 5-kilometre resolution rainfall data. Seasons are defined as the standard 3 monthly intervals e.g. summer comprising December, January and February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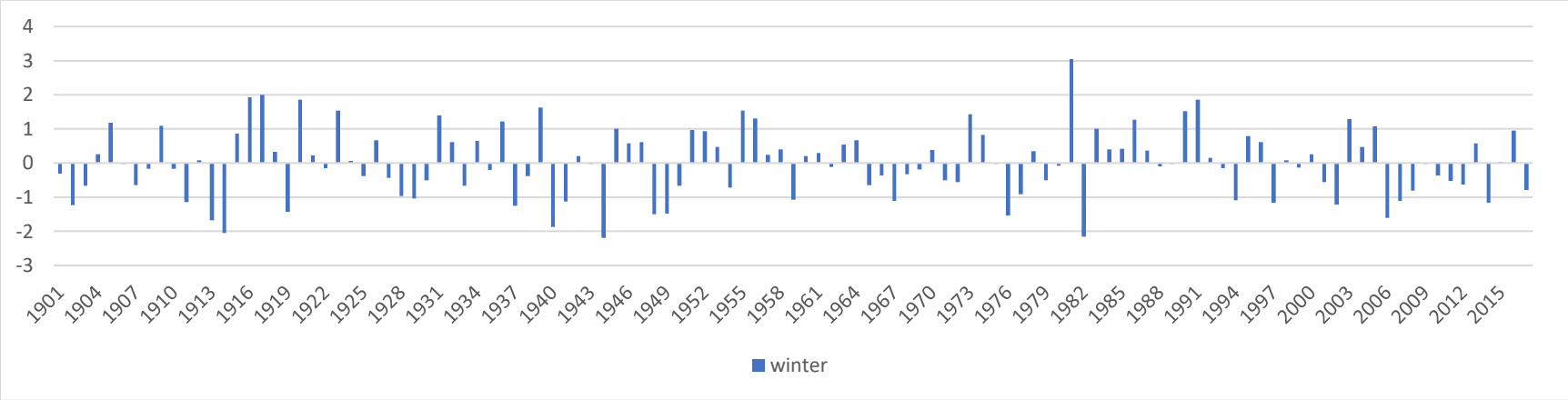
autumn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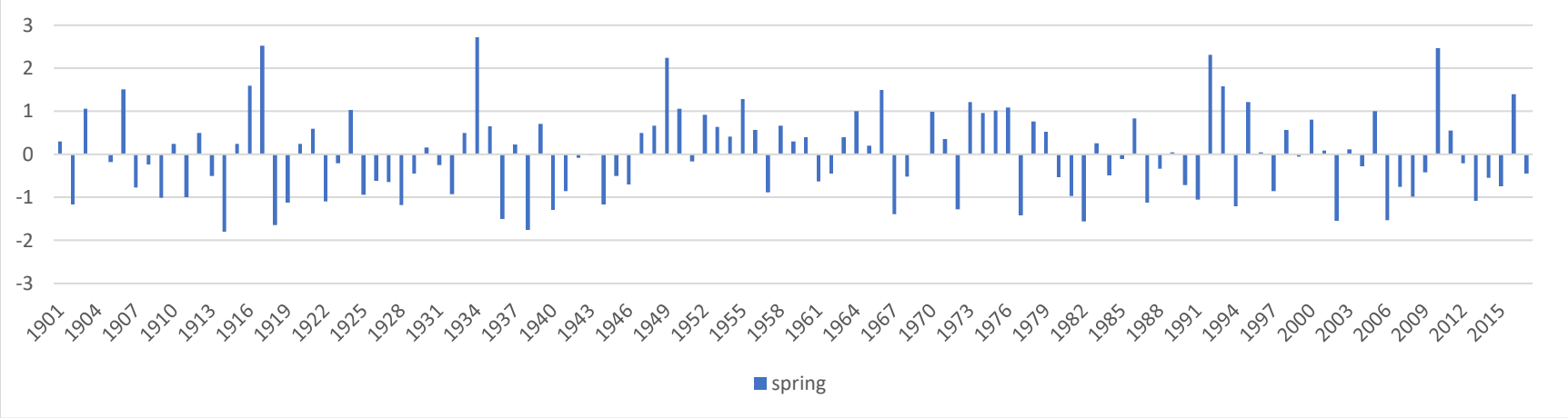
winter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2012
2015
spring

Acknowledgements

Shane Cridland provided the seasonal rainfall record from modelled monthly rainfall data for Illawong (Attachment C).

Phil Tickle CiboLabs for generating the data used for the independent assessment.

Roxane Blackley for generating the property and paddock boundaries and for producing the maps of Illawong's land use.

2018

ILLAWONG CASE STUDY: ECONOMIC REPORT

Prepared by

RSM

Introduction

The Illawong farm is located 32km from Albury. The 160Ha farm is made up of two distinct sections; 136 Ha of grazed land and 34 Ha of native vegetation. By having his property set up in this manner, Bryan is able to support up to 140 beef cattle while maintaining and improving native vegetation and biodiversity on his land.

As discussed in the Ecological Report, Bryan has implemented a number of regenerative farming practices designed to improve his land – from both a business and biodiversity perspective. These improvements have significant positive effects on the profitability, productivity and natural capital of Illawong. In addition, by making these improvements Bryan has been able to achieve the same level of productivity and efficiency on Illawong as other farming enterprises, with a significantly larger footprint.

We understand that Bryan is continually improving his farm with regenerative practices and therefore we expect there to be continued improvements to these financial, productivity and natural capital aspects.

This economic report illustrates the positive effects regenerative practices have on the profitability, productivity and natural capital of Illawong. To do this, we compare current financial and production figures to historical figures and industry benchmarks.

Please note –in the interests of privacy the data throughout this economic report has been 'de-identified'. That is, the data has been reported so that it does not represent the owner's actual financial position, rather it proportionally highlights the changes of incorporating regenerative farming practices. In particular, we have used an index to proportionally represent the financial figures. Where two datasets are compared, we index both sets of data to the benchmark data.

Also, due to availability of suitable data, some years are missing throughout our analysis.

Report Data Sources:

Industry Benchmarks – MLA Farm Survey Data (http://apps.agriculture.gov.au/mla/)

Financial Data – Bryan Ward Financial Accounts

Seasonal Conditions and Rainfall Data – Australian Government Bureau of Meteorology

Industry Insights – Published Industry Reports by:

- Meat and Livestock Australia
- Australian Bureau of Agricultural and Resource Economics
- Department of Agriculture
- Department of Primary Industries
- Rural Bank Australia
- Future Beef

Key Findings

Profitability

We compared the financial accounts for Bryan's beef cattle enterprise to specialist beef cattle farm benchmark data with a herd size of 100-200 cattle ('the average farm'). This benchmark has been sourced from MLA Farm Surveys.

Illawong is significantly more profitable than the average farm. The profitability analysis shows that Bryan's enterprise achieves more consistent business profits.

High business performance results from Bryan's focus on maintaining quality pastures to ensure his stock receive the appropriate level of nutrition each season. Bryan's works ensure his pasture availability results in a more sustainable and resilient enterprise – even when faced with difficult seasonal conditions.

Bryan incurs significantly lower expenses (both in total and percent of revenue) than other specialist beef farms. We compared the following key expense items, for Illawong, with the benchmark; Fuel and Oil; Repairs and Maintenance; Seed, Fodder and Fertilizer; and Pasture Chemicals.

Key information from expenses analysis:

- The key expense items analysed for this Economic Report make up a significantly lower percent of overall revenue when compared to the average farm.
- Fuel and oil expenses are much lower than the benchmark farm
- Bryan's repairs and maintenance expenses are consistently lower than the average farm.
- Overall, seed, fodder and fertilizer expenses are significantly lower than average. Fertilizer expenses are the main driver in this expense item. Due to Bryan's management of high-quality pastures, he is able to limit the amount of reseeding required and has no requirement to conserve fodder.
- To support his pastures naturally, Bryan limits the use of chemicals (both herbicides and pesticides) unless necessary.

Illawong achieves a gross margin per hectare per 100mm of rainfall that is significantly higher than the MLA industry benchmark. This benchmark is used to describe strong performance in the industry which highlights the real success of Bryan's work on Illawong.

Productivity

Due to Bryan's focus on quality pasture, he has been able to maintain a herd size with a considerably smaller footprint leading to significantly higher beef production per hectare than the average farm. Bryan's beef cattle enterprise consistently outperforms the MLA industry benchmark for kilograms of beef sold per hectare per 100mm of rainfall.

By maintaining adequate pasture all year round, Bryan has been able to consistently produce quality beef in typically difficult periods of the year leading to higher margins, resulting from the following:

- Winter Month Sales – Bryan has been able to sell his cattle in the winter months where the price for beef cattle is at a premium. By undertaking a price analysis, we noted that a producer is able to receive an additional $20.36 per head sold converting to 4.97 and 9.90 c/kg live weight and carcass weight, respectively.
- JBS Farm Assurance Program – Bryan meets specifications to sell into the JBS Farm Assurance Program marking Illawong as a top producer of beef cattle. By selling into this program he earns on average, an additional 58 c/kg (carcass weight) than producers who are not part of the program.

Bryan attributes weight gain to a number of factors. Primarily his focus has been on pasture management ensuring stocking density matches that of carrying capacity, combined with rotational grazing and shelter belts to provide protection from both heat and cold extremes. Thereby allowing livestock to preserve energy otherwise consumed in body heat regulation.

Natural Capital

The natural capital improvements made to Illawong have proven significant benefit to the cattle enterprise and his property in general. Some of these include:

- Water Access
- Resilience (refer Ecological report)
- Pasture Management
- Farm Sustainability (refer ecological report)

Bryan has recently sunk a bore and found clean water. He has done this as overseas results indicate cattle increase weight gain by up to 25% through drinking clean water. Bryan intends to sub divide his paddocks from 15 Ha down to 7.5 Ha and reticulate this water to each of these paddocks. This is expected to increase productivity by 30% – 40%.

Profitability

To understand Illawong's profitability, we have compared the financial accounts to industry averages of specialist beef enterprises, with a similar herd size, across Australia ('the average farm') – based on MLA farm survey data. Specialist beef enterprises are those where over 50% of farm income is generated from the sale of beef cattle. The figures are benchmarked to the financial year, using nominal values.

This is done to ensure this report delivers an accurate understanding of how Illawong relates to similar farming enterprises and places the profitability, expenses and income in context with industry performance.

Income

Figure 1 illustrates Bryan's farm profit relative to the average farm. As can be seen, Illawong is significantly more consistent than the industry average.

In 2014, the average farm showed a significant decrease in business profit. Many farms experienced significant drought in 2014, which led to a significant increase in cattle turn-off rates. The price for beef cattle fell considerably, resulting in decreased business profits for the average farm.

However, due to Bryan's farm and ecological management, he has been able to maintain a consistent business profit. As noted in Figure 2 of the Ecological Report, by improving his land, creating additional water sources and increasing the extent of vegetation, Bryan has made Illawong more resilient to seasonal conditions and thus, a more sustainable enterprise. This has allowed Bryan to achieve higher productivity levels than the average farm, across all seasons. To maintain this level of productivity, Bryan ensures that he does not overgraze his land by only stocking to capacity.

These practices have ensured that Bryan's cattle have access to the appropriate level of nutrition to maintain their growth – allowing Bryan to continue producing and selling his cattle throughout difficult seasons with minimal effects on quality and profitability.

By implementing these practices, Bryan is able to maintain consistent business profits where other farms may face significant business challenges. Consistency of business profitability further reinforce that Bryan's farm is more sustainable when faced with difficult and dry seasonal conditions as compared to the average farm.

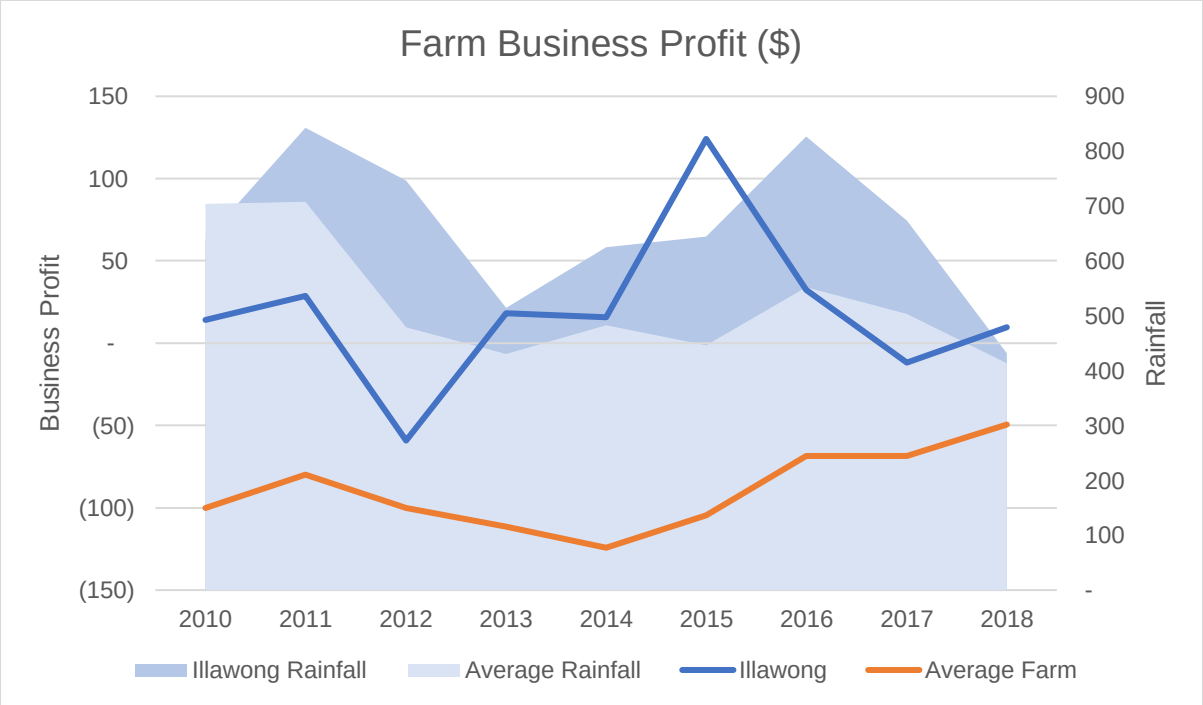

Figure 1

Data Insights:

- Bryan's profitability fell in 2017 due to a significant increase in purchases. Cost of Goods Sold increased due to increasing annual rainfall allowing Bryan to increase his stocking rate. These additional cattle purchased are not sold until the following financial year.
- Bryan (and the average farm) experienced a significant increase in business profits in 2015. This is due to beef cattle price fluctuations. In 2015 wholesale beef prices experienced a 30 year high resulting in greater profits from the sale of beef cattle. Prices increased from 182.7 c/kg LWT in 2014 to 265.6 c/kg LWT in 2015 (based on MLA price data)
- The significant decrease in rainfall for the average farm in 2013, 2014 and 2015 resulted in a fall in business profits for the average farm. This led to farmers increasing their cattle sales to reduce the number of cattle on their property and resulted in significant drop in meat prices – due to supply and demand.

Expenses

We have analysed Illawong's trading statement for key expense items since 2013 and have compared expenses to the average farm benchmark outlined in the introduction of this Economic Report. Bryan has significantly lower expenses (proportionally and in actuality) than the average farm.

The following graphs outline detailed expenditure, year-on-year, since 2009, where data was available. The following are the key expense items assessed in this report:

- Repairs and Maintenance
- Fuel and Oil
- Seed, Fodder and Fertilizer
- Pasture Chemicals

This graph represents the total expense over 2013-2018 for each expense item as a percentage of the total revenue over the same period. This is compared to the same analysis of the average farm. This graph shows that Bryan's expenses are proportionally lower than that of the average farm when compared to overall revenue.

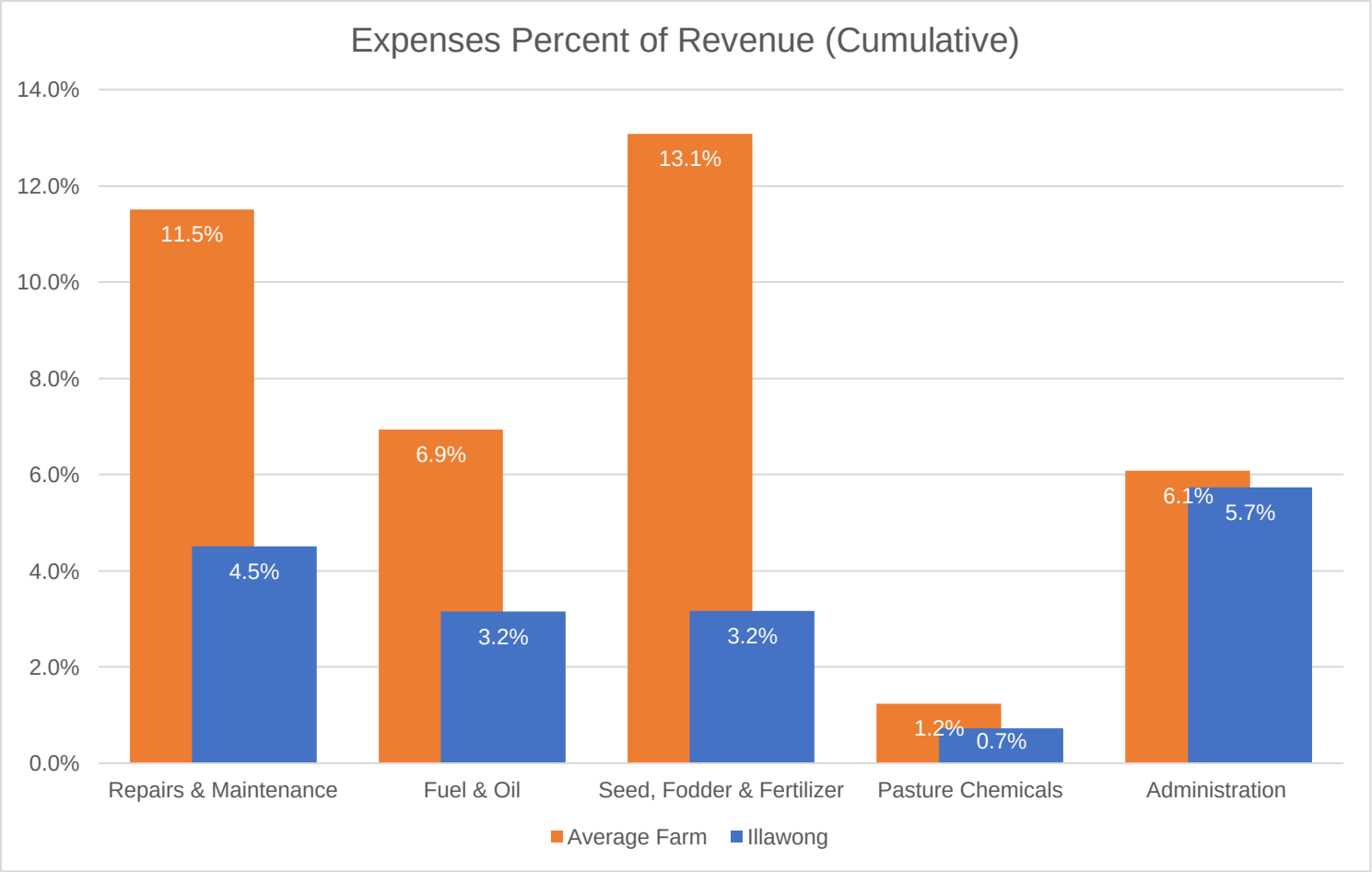

Figure 2

Fuel and Oil

Over the period of 2009 to 2018, fuel and oil expenses for the average farm are significantly higher than that of Illawong.

The graph below outlines the comparison between Bryan's fuel and oil expenses and that of the average farm, from 2009 to 2018.

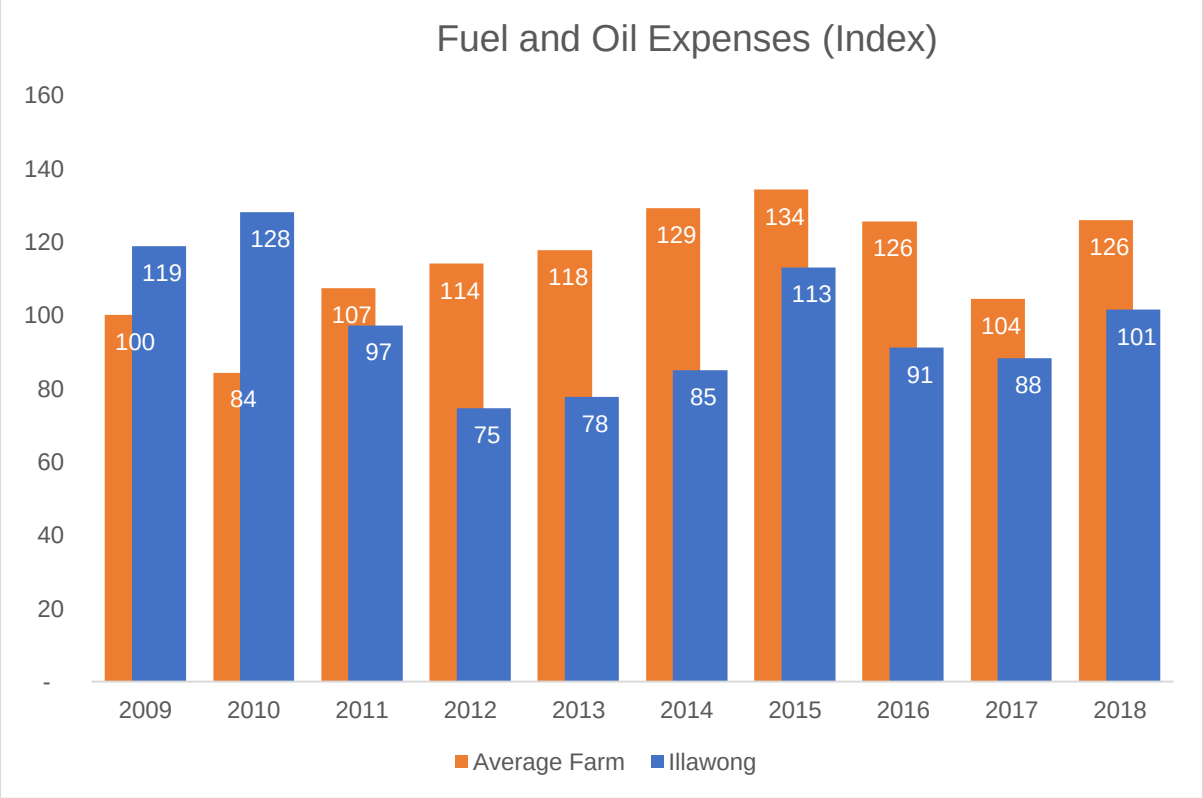

Figure 3

Data Insights:

- In 2015, Bryan purchased a range of new machinery (skid steer, water pump and an all-terrain vehicle) to assist in the operation of the farm. This additional machinery required additional fuel to run, thus resulting in an increased fuel and oil expense in 2015

Repairs and Maintenance

Similarly, Bryan's repairs and maintenance expenses (from 2008 to 2018) are significantly lower than the average farm.

The graph below illustrates the difference between the repairs and maintenance expenses for the average farm and Illawong.

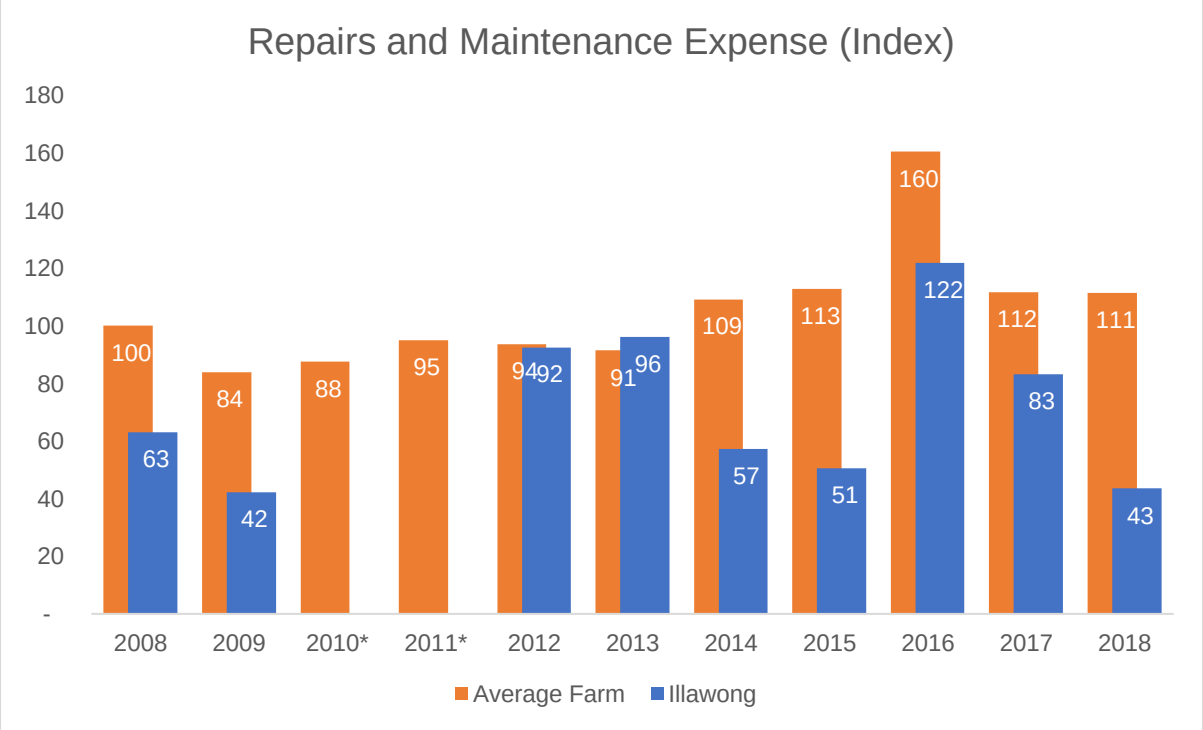

Figure 4

Illawong 2010 and 2011 data unavailable

Data Insights:

- In 2012, 2013 and 2016 Bryan experienced a significant increase in repairs and maintenance expenses. This increase comes from significant repairs and maintenance outlays for plant and machinery, water, motor vehicle and property repairs.

Seed, Fodder and Fertilizer

Due to his pasture, soil and feed management, Illawong has considerably lower seed, fodder and fertilizer expenses than the average farm. This reduced expense is due to successful establishment of perennial pasture vegetation to supplement native pastures.

The below graph illustrates how Bryan is excelling in this area through his farm management practices as compared to the average farm, over the period of 2013 to 2018.

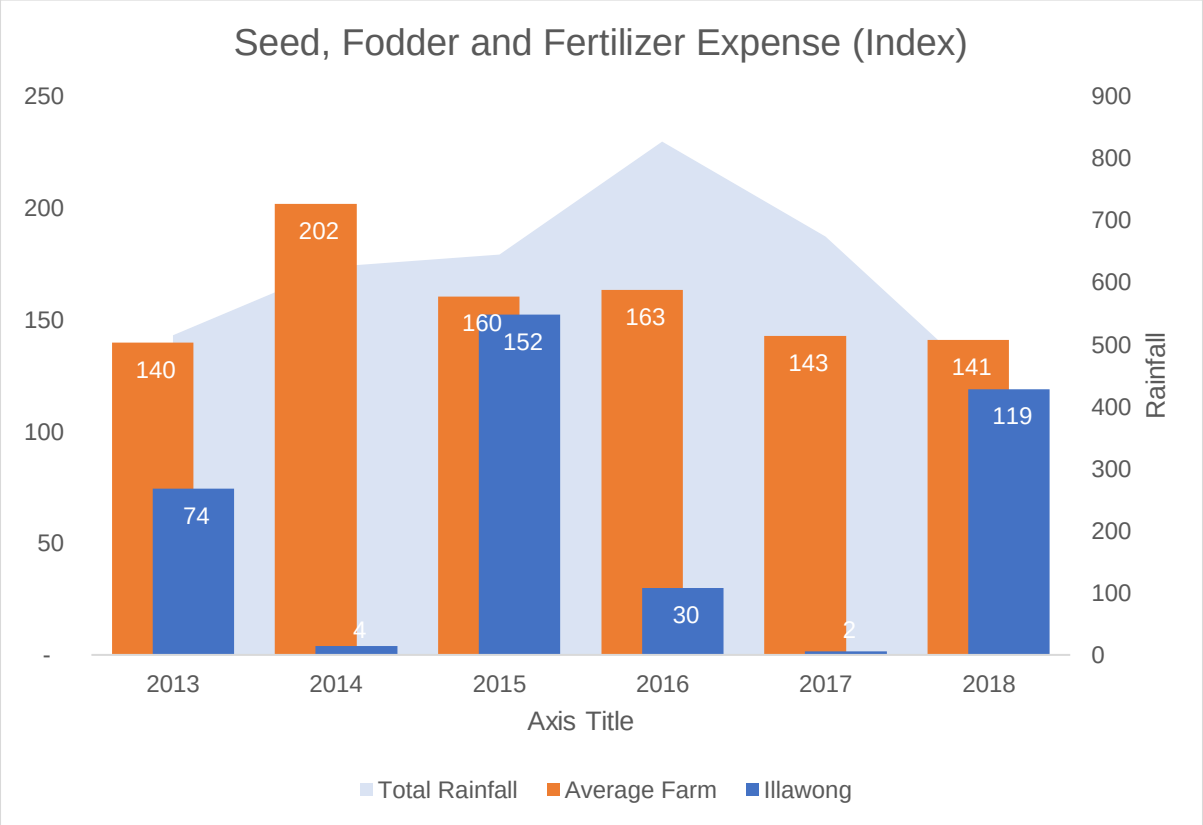

Figure 5

Data Insights:

- Illawong incurred high Seed, Fodder and Fertilizer expenses in 2013, 2015 and 2018, driven by increased Fertilizer costs in these years. There is a significant seed expense in 2015 related to the sowing of improved pasture.
- With Bryan's emphasis on pasture management there is no requirement to supplement pasture feed or conserve fodder. A requirement of the JBS Farm Assurance program is that no supplementary feeding is permitted.

Pasture Chemicals

As with Seed, Fodder and Fertilizer expense, Bryan's management of Illawong through – improved perennial pasture and integrated weed management methods (intense rotational grazing) – has led to lower Crop and Pasture Chemicals expense over the period of 2009 to 2018.

Figure 6 illustrates crop and pasture chemical expense compared to that of the average farm.

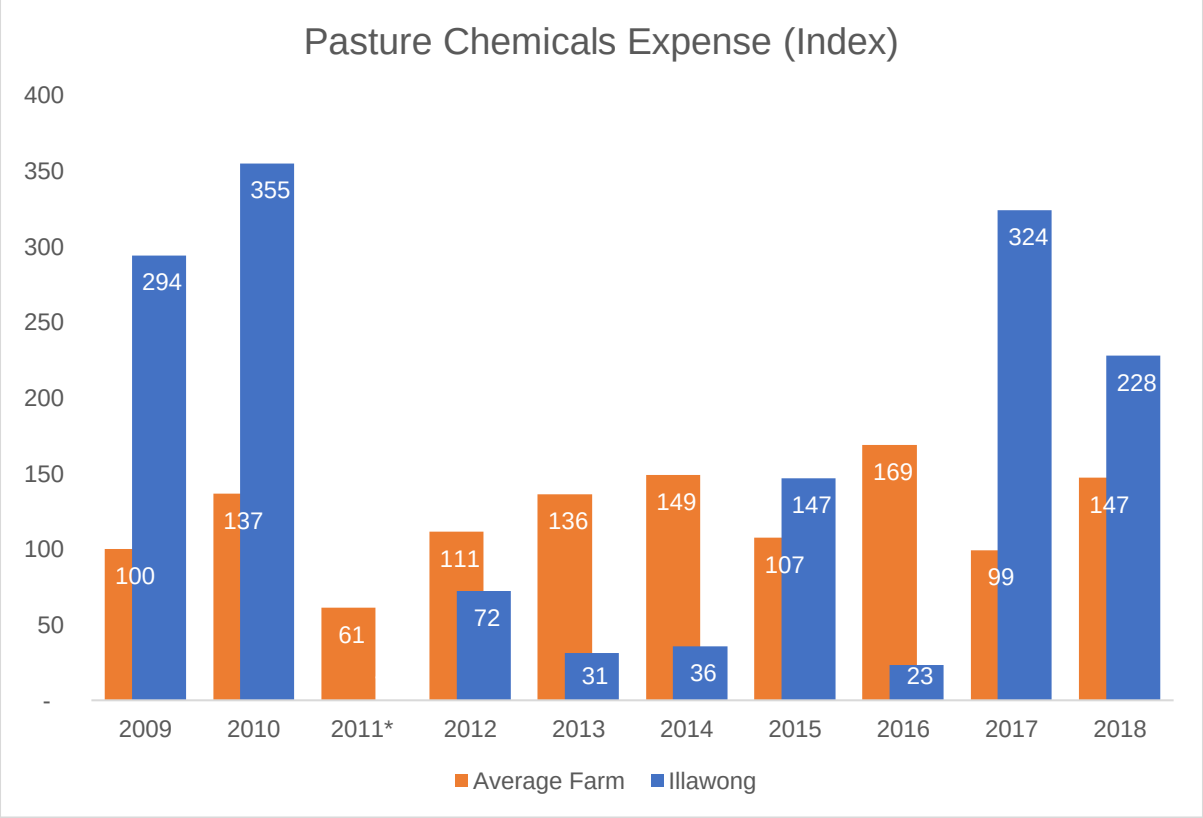

Figure 6

Illawong 2011 data unavailable

Data Insights:

- Chemical weed control is avoided on Illawong, instead Bryan attempts to control weeds through integrated methods. Where possible Bryan focuses on establishing vigorous growing grasses and perennials to improve ground cover and reduce weed growth in improved pastures. Where necessary, Bryan implements methods such as intense grazing to remove established weeds before resorting to chemical sprays.
- Pesticide chemicals are used on the property sparingly, primarily to manage red earth mite. This limits chemical use and the impact on biodiversity.
- There were considerable increases in chemical expenses in 2009, 2010, 2015, 2017 and 2018. This is due to pasture improvement activities in those years.

Gross Margin

Figure 7 summarises the changes in gross margin (as a percentage) and gross margin per hectare per 100mm of rainfall from 2007 to 2018. Gross margin is the net sales of the business less direct costs of production.

Gross margin per hectare per 100mm of rainfall (GM/Ha/100mm) is a standard measure to illustrate farm profitability. We have compared these figures to the Meat and Livestock Association's GM/Ha/100mm enterprise benchmark.

As can be seen, Bryan's GM/Ha/100mm is significantly higher than the industry benchmark, illustrating Illawong's strong financial performance compared to other farms in the industry.

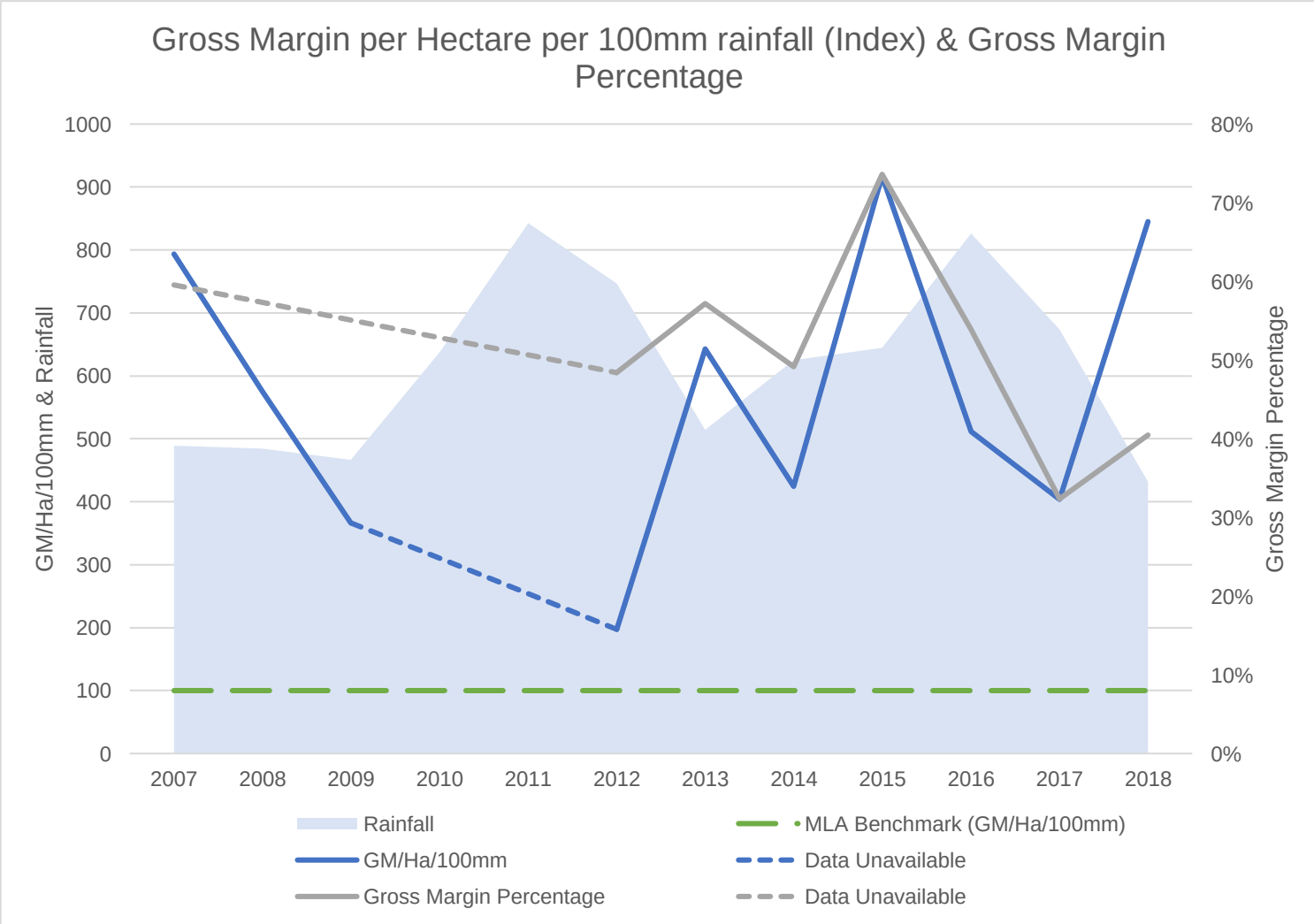

Figure 7

Data Insights:

Illawong's GM/Ha/100mm is significantly higher than the MLA benchmark due to productivity in relation to parcel size. Bryan's farm being considerably smaller than the average, yet produces the same, or similar head of beef cattle.

In 2015, Illawong achieved a gross margin percentage of above 70%. This is due to the decrease in rainfall in 2013 and 2014. In 2014, Bryan reduced his numbers in order to maintain pasture and growth rates – resulting in a low cost of production for cattle sold in 2015. In addition, significant increase in market prices lead inventory to become more valuable in the market place thus, increasing his gross margin percentage come sales time.

Essentially, the flexibility in Bryan's enterprise allows him to match stocking rates with carrying capacity, with benefits accruing in dry years when he is able to maintain a herd where others are forced to destock or hand feed. Those sales in dry years have maintained his income during fluctuating seasonal conditions.

Productivity

Land Productivity

As noted in the Introduction section of this Economic Report, Illawong can stock up to 140 cattle per year. The stocking rates are adjusted based on seasonal conditions to maintain pasture. The average farm used for comparison purposes has been chosen based on a comparable herd size of 100 to 200 cattle. The average size, based on MLA Farm Surveys of a farm supporting a herd of 100-200 cattle is 567 Ha (2018 data).

When comparing Illawong's 160 Ha (126 Ha allocated to grazing) to the average farm size, it is clear that Bryan's beef cattle enterprise is significantly more productive. The graph below compares the kilograms of beef sold per Ha per 100mm for Illawong with the MLA benchmark.

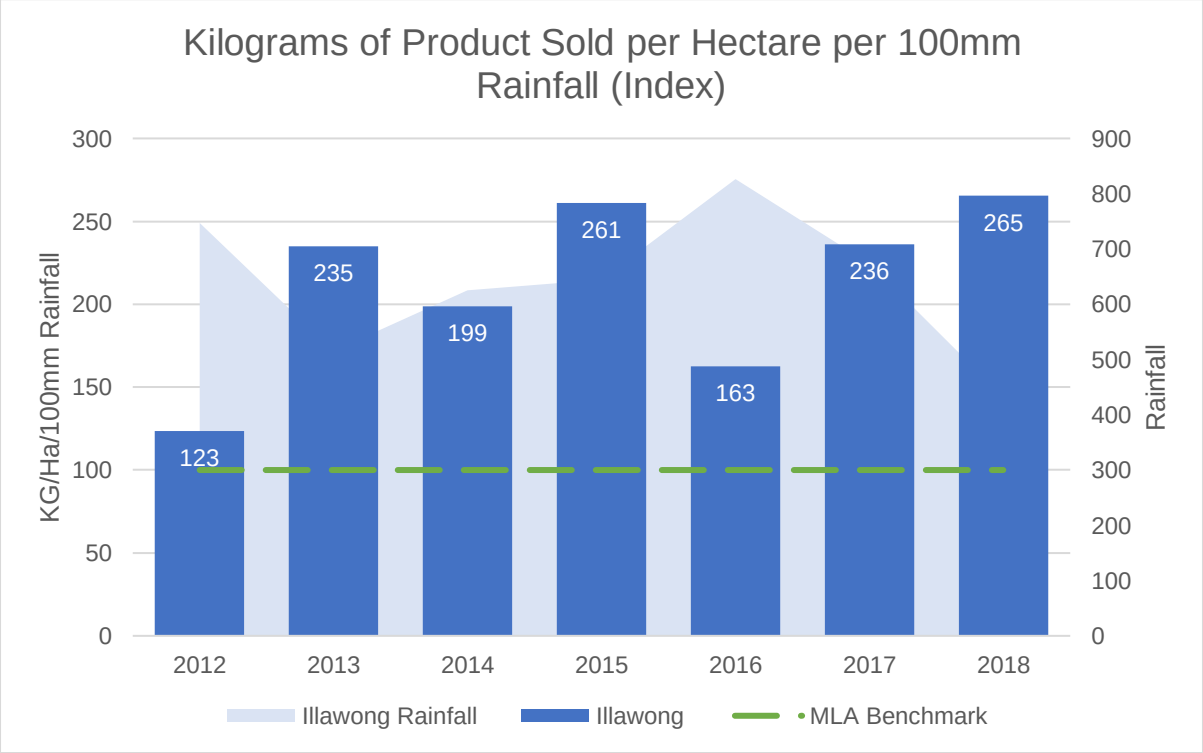

Figure 8

Data Insights:

- The kg sold per Ha per 100mm of rain follows a similar path to the level of rainfall resulting from Bryan's flexible stocking rates and his timeframe for purchasing and selling cattle. In years immediately following higher rainfall, there will be an increase in cattle sold which results in an increase in kg/Ha/100mm of rain.
- Figure 8 illustrates that productivity per Ha per 100mm of rain is consistently higher than the MLA benchmark. In 2015, 2016 and 2017 Bryan's productivity is over 2 times greater than the Benchmark for performance and approaching 3 times greater in 2018.

Bryan's Illawong property is significantly more productive than that of the average farm.

Premium Beef Price

Winter Sales

Bryan's management of Illawong has allowed him to achieve consistent production of high-quality beef cattle, throughout the seasons. In particular, Bryan has found success during periods of the year other farmers find difficult, namely the winter months. In particular, Bryan's focus on maintaining pasture levels (through rotational grazing) and supplementing native pasture with improved perennial's, allows for weight growth in in winter and other difficult conditions (i.e. drought)

By targeting the winter months, Bryan is able to receive premium prices for his cattle. The table below provides an average price received and number of cattle sold in the winter months as compared to the remaining months of the year (based on 3 year MLA saleyard data). By selling cattle in the difficult winter months, sellers are able to receive an additional; $20.36 per head, 4.97c per kg live weight and 9.90c per kg carcass weight.

Price Received in winter months vs remaining months (2016-2018)

	$/head	c/kg lwt	c/kg cwt
Winter months	921.40	272.26	516.42
Remaining Months	901.04	267.29	506.52
Increase (Decrease)	20.36	4.97	9.90

Weight gain

By improving his pastures, Bryan has been able to maintain consistent pasture levels with high quality feed. In particular, Bryan regularly achieves high levels of crude protein percentage and metabolisable energy in his improved pastures.

In addition to helping minimise the costs of maintaining pastures, this practice allows Bryan to achieve consistently high growth rates for his beef cattle. By managing livestock in this way, Bryan ensures that his cattle always have both high feed quality and high feed quantity.

The table below summarises the average daily growth (ADG) rate for the cattle on Illawong over the period April to October in 2017.

Month	April	May	June	July	August	September	October	Overall
ADG (kg LWT/Day)	0.5	1.5	1.3	1.0	1.2	1.5	1.3	1.2

Seasonal effects:

- Low weight gains in April are typical of Bryan's 'tight' start-up at the beginning of a season.
- A fall in weight gain is to be expected in June and July due to the fall in temperature during winter.
- Weight gain increase again in spring due to greater pasture growth.

The flexible stocking rates encourage the growth rates on Illawong to be reasonably consistent each year. As such, this sample from 2017 is representative of the growth rates on the farm for seasons after Bryan began implementing flexible stocking rates.

An ADG of 1.2 kg LWT per day is a growth rate comparable to those found in feedlots (on average 1.4 kg LWT/day). Based on MLA expected growth rates, the average growth rate for pasture fed cattle aged 16 to 20 months (350 to 400 kg) is 0.6 kg LWT per day. Considering this as a benchmark growth rate for beef cattle, it is clear that Illawong is significantly outperforming average beef cattle producers in terms of productivity.

To highlight the potential productivity of Bryan's land improvements – there have been growth rates of up to 2.6 kg LWT per day recorded in the improved pastures.

Ensuring cattle receive the appropriate nutrition leads to the high productivity and quality of beef from Illawong.

Natural Capital

The Story of Illawong Property Improvements

Phase 1 1992-2004	Phase 2 2005-2008	Phase 3 2009-2010	Phase 4 2011-2018
Bryan first purchased Illawong in 1992. At this time, the purchase price of the land was $250,000. Initially the property was infested with rabbits, thistle and Patterson's Curse. The 160 Ha property had two large paddocks and two dams as the primary water source for the property. In 2000, Bryan began applying lime to increase the soil pH. In 2001, Bryan began direct seeding of plots to improve the revegetation plots.	Contour ripping was commenced in 2005 to increase water infiltration and to avoid the wash away of top soil once the millennium drought ended. This also improved the water quality on the farm. In 2006, revegetation plots started to improve biodiversity and enhance shelter belts	Implemented rotational grazing on smaller paddocks to prevent overgrazing of pastures and maintain pasture, soil health and ground cover. This grazing regime allows for long recovery times of pastures.	Bryan continues to progressively improve the soil, biodiversity and sustainability of his property. Over the time he has owned Illawong, he has subdivided the two paddocks into seven and implemented a rotational grazing system. This ensures the pastures are maintained and not overgrazed. Additionally, five extra dams were created – resulting in seven total water sources on the property.

Bryan continues to improve the natural capital of his property and his regenerative farming practices so that Illawong can continue to perform financially, productively and sustainably in the future.

The Profitability and Productivity sections of this Economic Report outline Bryan's improvements to increase the property's natural capital which provide significant benefits to the enterprise. In particular, the following are key to Bryan's success:

- Water Access – more dams improve access to water and enables rotational grazing
- Resilience – improved pastures enhances resilience in difficult seasons leading to greater consistency in business performance and minimising risk
- Pasture Management – high quality pastures increases weight gain and improves meat quality.
- Flexible Production Systems – by stocking cattle flexibly, Bryan ensures that pastures are maintained and not overgrazed – particularly in difficult seasons. This reduces expenses of maintaining pastures and increases overall profitability.
- Farm Sustainability – Based on a survey by property valuers, it is expected that a property, with above average farm management and emphasis on sustainable management practices (such as Illawong), can achieve up to a 20% premium in the property market.

2019

"ILLAWONG" CASE STUDY: SOCIAL REPORT

Prepared by

Terry Harkness and Niree Creed

At the age of 80, Bryan Ward has the energy of a man decades younger. On a daily basis, he rows at least 2 kilometres, runs up his hills, plays golf once a week and swims at least a kilometre in summer. All of this is on top of transforming what was once a rundown property - two paddocks of neglected hill country which had been a small part of a large sheep grazing property called Table Top Station. In late 1994, these run-down paddocks became Illawong. They comprised undulating slopes with clay loam soils rising to rocky granitic soils on steep slopes..

Today, Illawong has been transformed by Bryan's vision and energy into a showpiece of regenerative agriculture. One third of Bryan's 160 hectares have been set aside for remnant trees on the ridges and in patches up and down the gullies. They serve to prevent further stock disturbance, enable regrowth to stabilise gully erosion, and protect livestock from wind, rain and heat. He is proud of his direct seeding method to revegetate the rocky ridges with a range of eucalypts, acacias and other understorey species and takes great pleasure in observing the numerous bird species attracted to the abundant growth.

A PRODUCTIVE FARM

If anything, Bryan undergrazes Illawong. He buys Angus trade steers for finishing on a pure grass fed diet. They arrive in spring at an average live weight of around 370 to 400 kg and leave by the following winter at around 630 kg live weight. The number of steers bought each year depends on seasonal conditions, so ensuring that the pasture available at the time can sustain the grazing pressure.

The finished cattle are sold into JBS Australia's pasture-fed Food Assurance program[3]. Illawong cattle now consistently achieve amongst the highest level of compliance, earning Bryan an award from Meat and Livestock Australia for being one of the Top 100 producers in New South Wales and state finalist in the "Excellence in Eating Quality Awards". Bryan is proud of his 100% compliance, and his beef extracts a 30c/kg premium above market rates. Much of his product is sold to the USA, where grass fed beef is sold at a premium, and to selected high-end Australian restaurants.

There's a high level of satisfaction and understanding of his market. Bryan points out that consumers are more conscious of what they're eating and where it comes from, and he's conscious that he is supplying meat for the premium market, knowing that his compliance is assured through audited results.

…IN HIS SPARE TIME

…Bryan is actively involved in showcasing Illawong. He holds field days at Illawong twice a year, operates as an environmental consultant and works with "Water For Rivers", especially apt given his

[3] http://jbssa.com.au/OurCompany/OurQualityPromise/JBSFarmAssurance/default.aspx

location near the Murray River and Lake Hume. When he has time, he also attends regional field days to expand his knowledge of regenerative practices.

Bryan is also involved with Riverina Highlands, Water for Rivers, Green Corp seed collecting, Victorian grasslands incorporated, and the Riverina vegetation grasslands committee, as well as attending meetings of local bushfire and Landcare groups.

BRYAN'S FAMILY INVOLVEMENT

Bryan is fortunate that he has family members close by, with a son and his family just over the hill, and regular communication with his late wife, Dinah's, family.

A LIGHT WORKLOAD FOR MAXIMUM PRODUCTIVITY

Bryan estimates that he works on Illawong for an average of 5 hours a day, 3 days a week. When he bought Illawong in 1994, he wanted *"a piece of dirt my own, be a one man band who could shout out orders in the morning, and alone proceed to obey them!*"

The one man band has transformed Illawong since then, with an enormous amount of hard physical work, the taking of risks and a big dose of common sense.

The result, he says, is *"the pinnacle of total improvement of landscape, and restoration to its original state".*