Grassland Society of NSW Inc

Newsletter

Congratulations to Helen Burns and the Tablelands Farming Systems group on the 2015 Grassland Society of NSW Annual Conference at Goulburn in July. It was a great event with lots of interesting presentations and three thought provoking (albeit a bit chilly) bus tours. I encourage you to read through the proceedings. Some photos from the conference can be found on page 2.

Prior to the conference the Annual General Meeting was held on Tuesday 14th July at the Goulburn Soldiers Club. At this meeting the executive and committee were appointed for the 2015–2016 year. David Harbison was returned as President for a third term. Lester McCormick who has served as Vice President for a number of years stepped down and Keith Garlic was elected to this position. A full list of the state executive and committee can be found on page 12. There are two new faces on the committee – Chris Houghton and Luke Pope this year – welcome. I look forward to working with you over the coming year.

Have you paid your annual membership fee yet? If not a gentle reminder to please do so as soon as possible – payment details can be found on page 11.

A new financial year also brings new sponsors for the Grassland Society of NSW.

This year our sponsors are:-

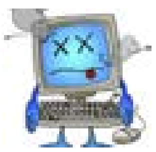
Premier - Department of Primary Industries, Local Land Services South East.

Major - Incitec Pivot, Ag Innovations, Water NSW, Meat and Livestock Australia.

Corporate - AusWest Seeds, Commonwealth Bank, Dow AgroSciences, Heritage Seeds, PGG Wrightson Seeds, Tableland Farming Systems, Upper Murray Seeds, Valley Seeds, Wengfu Australia.

Carol Harris, Editor

In this newsletter



Have you had trouble contacting the Secretary by email lately?

Janelle has had a few technical glitches, and is in the process of upgrading her computer. The new system will be operational by mid-September. If you have concerns that Janelle did not receive your email please try again. Please continue to use the email address - secretary@grasslandnsw.com.au

New Zealand Study Tour in 2016

Expressions of interest are being sought from Grassland Society of NSW members to participate in a "pastures tour" of New Zealand's South Island next year, potentially in June. At a state committee level, coordinating such a tour with a couple of key New Zealand pasture field days is gaining momentum.

The committee is keen to explore what state wide interest there would be in such a trip, planned for approximately 4-5 days. Costs are yet to be determined, obviously group size and timings would play a significant part.

John Ive and Frank McRae, both members of our state committee, are keen to hear from anyone potentially interested. Their contact details are;

John Ive - talaheni@webone.com.au
Frank McRae - fmcrae@auswestseeds.com.au

Faces from the conference

Photos provided by Neil Griffiths, Frank McRae and Carol Harris

Number and nitrogen fixation capacity of rhizobia in soils

Introduction

Before European settlement, Australian soils lacked the rhizobia needed for the pulse and pasture legumes that are now commonly grown in farming systems. However, after more than a century of legume cultivation, many soils have developed large and diverse communities of these introduced rhizobia.

Rhizobia become established in several ways. Many were introduced as high quality inoculants. Others arrived accidently with the movement of dust, soil and seed around the country and some have evolved via genetic exchange with other bacteria in the soil. However, because rhizobia are legume specific and their persistence is affected by soil characteristics and cultural practices, their diversity, number and nitrogen fixation capacity can vary greatly.

How do we know if a soil has the right rhizobia?

The legume history of the soil provides some guide. If a legume species, or others very similar to it, has not been grown in a paddock, then it is unlikely the rhizobia for that legume will be present in the soil in high numbers.

Conversely, where there has been a recent history of well-nodulated legumes in a paddock, there is a reasonable chance the rhizobia that nodulated the legume will remain in the soil.

Some extension materials suggest that inoculation is not necessary if the legume host has been grown in any of the previous four years. The problem with this simplistic rule is that it fails to recognise that the level of nodulation of the previous crop can affect the current population of rhizobia in the soil and that many soils are not conducive to the survival of large numbers of rhizobia because of factors such as extremes of soil pH and low clay content. Also, the communities of rhizobia that develop under legume cultivation often become less effective at fixing nitrogen over time.

How many soil rhizobia are needed for prompt nodulation?

The number of soil rhizobia needed for prompt nodulation lies somewhere between 100 and 1000 rhizobia per gram of soil.

We say this for two reasons. First, when commercial inoculants of rhizobia are applied at recommended rates, they add the equivalent of about 100 rhizobia per gram of soil to a 10 centimetre depth. This results in prompt nodulation. Second, the evidence from many field and greenhouse experiments is that there is poor nodulation once the number of rhizobia in soil is less than 100 per gram of soil.

High numbers of rhizobia result in prompt nodulation and plants tend to have many nodules on the tap root, close to the top of the root system. Low numbers of soil rhizobia can result in delayed nodulation and smaller number of nodules on the roots.

Measuring the number of rhizobia in soil

First it is necessary to point out that soils often contain several species of rhizobia. For example, it is common to find clover, lucerne and field pea rhizobia in the same paddock, of all those legumes have been grown before.

A laboratory-based plant nodulation test is used to determine the number of rhizobia in soil. The legume of interest is inoculated with a sequence of dilutions of the collected soil. After four weeks plant growth and the number of plants with nodules in each of the different soil dilutions is used to calculate the number of rhizobia in the original soil sample (called a most-probable number calculation). While this test is not available to growers, it has been used by researchers to quantify numbers of rhizobia in thousands of Australian paddocks.

The test is generally used with soils collected from the top 10 centimetres of the profile, because this is where most rhizobia concentrated and this where most nodulation of annual legumes occurs.

Rhizobia are also found deeper in the soil profile and play an important role in nodulating annual legumes towards the end of their growth and in nodulating perennial legumes such as lucerne. These rhizobia are seldom measured. The number of rhizobia also vary within a growing season, particularly when a legume host is grown. Numbers start to increase at the break of the season as soils become wetter and the legume host germinates. The rhizobia are stimulated to multiply in the immediate vicinity of the root (rhizosphere). They can quickly multiply to levels of 10 000 per gram of soil.

Once the rhizobia have infected they multiply and change in bacteroids that are able to fix nitrogen (which they cannot do in the free living form). The root cells infected with rhizobia collectively form the nodules.

When annual legumes set seed, their nodules begin to shut down as carbohydrates that provide energy to the nodules are diverted to seed development. Eventually the nodules senesce and the rhizobia are released back into the soil. Measures of rhizobial numbers at this time can exceed one million per gram of soil.

Rhizobial numbers may then decline to less than 100 per gram of soil over the next few months if soil conditions are unfavourable, or persist at a level of many thousands under more benign conditions. Rhizobia are sensitive to desiccation and so tend to be at their lowest number at the end of hot dry summers in temperate regions. Hence soil samples collected close to the start of the growing season provide a good conservative guide to the number of rhizobia available for legume nodulation.

KEY POINTS

- Many soils have developed communities of rhizobia that are able to nodulate the legumes used in agriculture
- The number of rhizobia in soil is influenced by legume use and soil properties, particularly pH.
- Different legumes and their rhizobia have different tolerances to pH.
- Where the legume host has not been grown recently or where soil conditions are stressful to short and long-term survival of the rhizobia, there is a good likelihood of response to inoculation.
- Communities of rhizobia in soil tend to become more diverse with time and often less effective at fixing nitrogen, compared to commercial inoculant strains.
- Some legume species readily form less effective symbioses with soil rhizobia, while other legume species do not.
- Inoculant strains, when applied at high numbers, can compete with background soil rhizobia. This provides the opportunity to introduce effective strains.

What numbers of rhizobia persist in soils?

Where soil conditions are favourable, rhizobia are able to survive in the soil for many years, even in the absence of their legume host. In this state, the rhizobia are known as saprophytes (microorganisms that live on dead or decaying organic matter). They can also live in or near the rhizospheres of non-leguminous plants and utilise their root exudates. Even so, in the absence of a legume host, numbers will progressively decrease.

Surveys of soils provide a snapshot of the number of rhizobia at a given time and reveal that many soils support large numbers of rhizobia. It is not unusual to measure more than 1000 rhizobia per gram in the top 10 centimetres of soil at the end of summer. A million rhizobia per gram have been measured in some instances.

Rhizobia for pasture legumes such as medic and clover are abundant, with more than 60 per cent of soils containing 1000 or more rhizobia per gram. Large areas that grow sown, regenerating and naturalised pasture legumes aid the multiplication and survival of these rhizobia.

Rhizobia for the pulse legumes are less abundant. Fore peas, chickpeas and lupin, more than 25 per cent of the soils contained less than 100 rhizobia per gram. Understanding why some soils support fewer rhizobia is important to making sensible decisions about further inoculation.

Factors affecting the survival of rhizobia in the soil

Regional (local) influences can strongly affect the occurrence of rhizobia in the soil. These regional effects reflect both historical differences in legume use as well as differences in the physical and chemical characteristics of the soil.

Influence of host legume

At a regional level, the more widely a legume has been grown, the more likely soils will contain the compatible rhizobia.

Pasture legume rhizobia often occur in high numbers in soils. This is likely due to the naturalisation and constant presence of sub clover and medic in many soils. Even so, there are some species within the clovers and medics that do consistently nodulate with the soil rhizobia. An example is gland clover (cv. Prima). A combination of limited usage and a specific rhizobial requirement means that inoculation of this species is needed even where there are rhizobia that nodulate other annual clovers.

Such nodulation specificity is not common and cultivars within a legume species almost always behave similarly in terms with their rhizobial requirement.

Influence of soil type

Soil chemical and physical properties affect the survival of rhizobia, especially pH, texture (clay content) and organic matter.

Soil pH is the best understood. It affects both the survival of the rhizobia and the formation of nodules. Different symbioses have different pH preferences. Although the rhizobia tend to be a little more sensitive to pH extremes than legumes, understanding pH preferences of the host legume will provide a reasonable insight into the pH preferences of the legume-rhizobia symbiosis.

The preferred pH range of some of the more common pulse and pasture legumes is shown in Table 1.

The effects of acidity in the field are not always obvious. In a sub clover pasture, moderate acidity results in fewer, but larger nodules. It is not until nodule mass falls below the level needed to supply the plant with adequate nitrogen that the effects of the acidity become obvious. At this point the legume content of the pasture can decline rapidly.

In some cases the acidity stresses are avoided by the rhizobia. Large numbers of rhizobia and adequate nodulation have been measured in regenerating sub clover pastures, even though the pH of the bulk soil is less than 4.5. This is attributed to the survival of the rhizobia in small niches of the soil, often associated with soil organic matter. When these soils are disturbed as result of cropping or at pasture renovation, the number of rhizobia are reduced when they are displaced from these niches that provide protection. There is a moderate likelihood of responses to inoculation in these soils when pastures are renovated, even though nodulation constraints may not have been apparent previously.

The relationship between soil organic matter or clay content and rhizobia is less understood and has been shown to improve the survival of clover and pea rhizobia in soil. It is also worth noting that most commercial inoculants produced for growers use peat (high organic matter) or clay as a carrier, because rhizobia are known to survive well in them.

Other factors

The extensive use of herbicides in farming systems is known to affect the legume-rhizobia symbiosis. However, their impact seems mostly detrimental to the plant, rather than to the growth, survival or effectiveness of the rhizobia. Even where rhizobia are present in high numbers, the damage to the legume root systems by some herbicides (e.g. Group B herbicide residues in both acidic and alkaline soils in low-rainfall regions) can effectively halt nodulation.

Desiccation is also detrimental to the survival of the rhizobia. Rhizobial numbers can decline by the end of a dry summer. Soils that experience long dry summers and are subject to higher temperatures may have fewer rhizobia particularly where clay content is low or other soil stresses are present.

Diversity of soil rhizobia

There is nearly always more than one strain of a rhizobial species in a soil. Molecular methods make it possible to 'barcode' the strains that form nodules and has shown that different nodules on a plant are often formed by different strains.

In some cases, more than 10 different strains of rhizobia can form nodules on a single legume plant growing in the field. Sometimes it is obvious that different strains of rhizobia occupy different nodules because the nodules differ in their appearance.

The spectrum of strains is also likely to differ from soil to soil. A common observation of strains in different soils and within soils is that few are identified as the strains that have been used in commercial inoculants. In some instances this may simply be the result of inoculants not being used or not properly applied.

Table 1. Optimal pH (in calcium chloride) for a range of legumes (most acid tolerant at the top and least acid tolerant at the bottom).

Legume species	Optimal pH range
Lupin and serradella	4.5 to 7.0
Peanut	4.5 to 7.0
Mungbean	5.0 to 7.5
Soybean	5.0 to 7.5
Sub clover	5.0 to 8.0
Burr, murex, sphere medic	5.5 to 8.0
Pea/faba bean/lentil	5.5 to 8.0
Chickpea	6.0 to 8.5
Lucerne	6.0 to 8.5
Strand and barrel medic	6.5 to 8.5

However, even where inoculants have been correctly used, the diversity of rhizobial communities in the soil tends to increase soon after legume introduction. This is often, but not always, associated with an increase in the number of less effective strains within the community.

The recent introduction of the pasture legume biserrula and its rhizobia into Australian farming systems has provided a unique opportunity to study the evolution of rhizobial communities. Studies have shown that the development of strain diversity can be rapid (years not decades) and is associated with the transfer of symbiotic genes to other members of the microbial community.

The presence of ineffective rhizobia is not always detrimental because the legume plant has some influence over nodulation. In some situations the plant is able to foster occupancy of its nodules by the more effective strains from within the rhizobial community. In other situations the plant can increase nodule number in order to satisfy nitrogen demand. Ineffective rhizobia are therefore most likely to become problematic where the rhizobial community is dominated by ineffective strains and where opportunities for continued nodulation are limited, as may be the case in stressed soils.

It is likely that about 50 per cent of legumes sown in each year will be reliant on soil rhizobia for nodulation, because they are either not inoculated or because the inoculant rhizobia are present in low numbers on the seed (as in many preinoculated seeds). Most regenerating pasture are nodulated by existing soil rhizobia.

Even where inoculation is practiced and inoculants applied well, the soil rhizobia will compete and can form a significant proportion of nodules. It is therefore important to consider their nitrogen fixation capacity.

Editors Note: This article has been modified from Chapter 3 in Inoculating legumes - a practical guide. Reprinted with permission.

Copies of this book are available from Ground Cover Direct - 1800 110 044 www.grdc.com.au/bookshop

Rural women to Gather in the Glen

Glen Innes in the Northern Tablelands of NSW is hosting the 2015 NSW Rural Women's Gathering

What is the event about?

The NSW Rural Women's Gathering is an annual event hosted by a different NSW community every year. The Gathering is a well-established event with a large following; each event attracts between 200 and 400 women. The event is organised by a local committee, with the support of the NSW Rural Women's Network.

When will the event be held?

Gather in the Glen will be held on the weekend of the 9-11th of October, 2015. Write this date in your diary!

Where will the event be held?

The Gathering will be based at the Glen Innes Showgrounds, and will include educational and interactive field trips to a number of interesting sites in the local area. Some examples include Rangers Valley Feedlot, the local History House, and local gardens.

How can I become involved?

If you'd like to volunteer on the weekend, please let staff know and they will pass that information on to the Gathering committee, or you can email the committee directly at gatherintheglen@gmail.com

Registrations will be open in July, and forms will be available on the GLENRAC website. The Gathering committee is focussing on bringing women from the region together, as well as those from afar. Attendees will be encouraged to bring a friend or relative, and there will be discount for mother and daughter bookings.

The programme for the weekend will be released soon, so keep an eye out for it on the website and on our Facebook page (just search for 'Gather in the Glen'). Please spread the word!

Gather in the Glen

Women For All Seasons

9-11 October 2015

Email. gatherintheglen@gmail.com

A hungrier, wealthier, choosier, smarter, riskier world: five challenges for Australian agriculture

Sandra Eady, Principle Research Scientist, CSIRO and Stefan Hajkowicz, Leader CSIRO Futures, CSIRO

You don't need a crystal ball to know Australia's rural industries will face significant change at global, national and local levels over the coming decades.

This will create opportunities and challenges for small and large farms, and will affect rural lifestyles, agricultural landscapes and Australia's society and economy.

In a new report, we describe this future through a series of interlinked "megatrends" set to hit Australia over the coming 20 years. As we describe below, each prompts some serious questions (or "conversation-starters", as we have termed them) for Australian farmers. We don't yet know the answers, but we do know they will be crucial for how the industry fares in the future.

The world will get hungrier

We know that the world is going to require more food as populations grow – about 70% more by 2050, according to the United Nations. This will come primarily from increasing yields, along with some expansion of agricultural land.

The target is achievable but should not be taken for granted. There are competing uses of land for biofuels and urbanisation; in some places land is degrading; and we don't have good predictions yet of the effect of climate change on agriculture.
As a significant exporter of food, Australia has a vital role to play in supplying world food markets and buffering supply shocks.
We are well positioned — both in terms of geography and comparative advantage — to supply overseas markets. And while Australia can't hope to feed Asia or the world, with astute R&D investment it can increase production and exports. How well we step up to that challenge depends largely on our ability to maintain a price competitive position and continue to improve yields. So the key questions are:
Will farms be able to scale up production and performance to meet this challenge?
What is a sensible investment in innovation, and how should it be funded?

Megatrends impacting Australian Rural Industries (RIRDC/CSIRO)

The world will get wealthier

Some 1.02 billion people will move out of poverty and into the middle classes in the developing Asia region alone by 2040. Along with wealth comes the ability to diversify food choices – wealthier households will consume more meat, dairy and vegetable oils.
This presents an opportunity for Australian rural industries to identify new food types and connect to new markets.

A diversified rural export base is likely to be more resilient to supply-and-demand shocks in markets.

Is Australia better off focusing on commodity markets that have provided solid export earnings, or should it be working hard to respond to the demand for a more diverse range of boutique, luxury and niche food and fibre goods?
Does Australia have the infrastructure and the persistence to get a wider range of desirable agricultural products into Asian markets competitively?

Customers will get pickier

The consumer of the future will be increasingly able and motivated to choose food and fibre products with certain characteristics. This has impacts both within and beyond the farm gate.
Information technology will increasingly enable the consumer to access, share and validate information about products along the whole supply chain from farm to fork.

Health is likely to become a particularly prominent driver of food choice and consumption patterns – be that from a desire for food safety or to help prevent chronic disease. Many people's lives are being cut short by poor diets, and at current trajectories government budgets could become crippled by unsustainable growth in healthcare expenditure.
The issues of environment, provenance and ethics will also play a vital role. The consumer of the future will have greater expectations for these qualities in the food and fibre products they choose to buy. Consumers will be "information-empowered" and rural industries stand to gain or lose market share based on this increase in consumers' knowledge.
In the face of soaring diet-related health costs, will governments increase control of the components of food and diets?
How does agriculture in Australia build and safeguard its clean, green reputation?

Technologies will transform farm life

Advances in digital technology, genetics and materials science will change the way food and fibre products are created and transported.

Many plant productivity breakthroughs will be from gene technology. Big data systems and digital technologies will bring better risk-management approaches to Australian agriculture; weather and yields will be much more predictable and farmers will have sophisticated tools to assist with decision making.

Knowledge about land use and framing practices will increasingly move into the public domain as remote monitoring, be it from drones or satellites, makes available new data in a highly interconnected world. Business and capital models will change with the introduction of "disruptive" technologies such as peer-to-peer lending.

Will market perceptions hold back Australian agriculture by restricting access to advanced technologies being used by our major competitors?

How will farmers manage a higher level of scrutiny of their operations?

The rollercoaster of risks will get bumpier

Risk is an ever-present characteristic of Australian agriculture. However, the coming decades will see changes in the global climate, environmental systems and the world economy which will create new and potentially deeper risks for farmers.
Australian agriculture has shown a strong capacity to adapt and respond to risks in the past. But as trade globalises and we rely more on imported inputs such as fertiliser and fuel, the risk of supply chain shocks increases.

More international trade and passenger travel brings greater biosecurity risks. Climate change impacts are not well understood, and the need to cut greenhouse gas emissions will set up competing land uses for both biofuels and carbon storage.

Do we understand the likely implications of a global price on carbon of US$50-100 per tonne?

Is the agriculture sector at risk of complacency and underinvestment when it comes to risk management?
Overall, there is a bright future for Australian agriculture, laden with deep and diverse opportunity. The future outlined above will be a challenge for some producers and industries but an opportunity for others. The effectiveness with which Australian agriculture captures these opportunities and avoids the risks will largely come down to innovation.
Through centuries past, repeated innovation has allowed Australian farmers to expand into new land areas, develop water resources and increase crop and pasture yields. As we look to the decades ahead, innovation becomes ever more important. In a world of exponential growth in both technology and global trade, it's about working smarter, not just harder.

Editors Note: This article is reprinted from The Conversation (http://theconversation.com/a-hungrier-wealthier-choosier-smarter-riskier-world-five-challenges-for-australian-agriculture-46183)

The full report - Rural Industry Futures: megatrends impacting Australian agriculture over the coming twenty years - can be purchased at https://rirdc.infoservices.com.au/items/15-065

MLA delivers new-look website

Livestock producers are being encouraged to explore Meat & Livestock Australia's (MLA) new website which launched recently.

MLA Managing Director Richard Norton, said the redesign had been driven by feedback from levy payers who wanted an easier resource to find information such as price and market data, tools they can use on-farm, research outcomes and clear information on how and where each levy stream is invested.

"The website is one of our most important information sources so it's crucial that it is both easy to navigate and contains the tools and resources producers need. 'As the red meat industry's service provider, MLA's mission is to deliver value to levy payers, including easy access to marketing investments and the outcomes of research and development to help inform farm business decision making."

The site has incorporated six core information areas – prices and markets; research and development; extension, training and tools; meat safety and traceability; marketing beef and lamb; and about MLA. A second phase will be completed later this year, with additional online tools and functions to allow greater personalisation.

"While MLA reports on this information each year, our feedback showed it was difficult for users to find a simple snapshot of each levy, and a breakdown of what proportion is invested in research and development, marketing and other areas," Mr Norton said.

MLA will be seeking feedback from producers on the content and structure of the new website to refine improvements in the second phase and encourages all producers to visit www.mla.com.au and send any questions or comments through to info@mla.com.au or contact the call centre on 1800 023 100.

Research Update

Keeping you up-to-date with pasture and grassland research in Australia. Abstracts of recently published research papers will be reprinted as well as the citation and author details in you wish to follow up the full paper.

100 Years of superphosphate addition to pasture in an acid soil—current nutrient status and future management

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Abstract. Pasture-based animal production systems, which occupy a significant proportion of the landscape in Victoria, Australia, have historically been nutrient-limited, with phosphorus (P) often the most limiting nutrient. The Permanent Top-Dressed (PTD) pasture experiment was established in 1914 at the Rutherglen Research Station, Victoria, to investigate the management of this deficiency. The main objective of the PTD experiment was to demonstrate the value of adding P fertiliser at two rates to increase pasture productivity for lamb and wool production. We report on the status of the PTD soils after 100 years, investigating the long-term implications of continuous grazing and fertiliser management (0, 125 and 250 kg/ha of superphosphate every second year) of non-disturbed pasture. We investigated the long-term effects of P fertiliser on the forms and distribution of P and other relevant soil parameters. In the fertilised treatments, P has accumulated in the surface soils (0–10 cm) as both orthophosphate and organic P, with an Olsen P of 16–21 mg P/kg, which is non-limiting for pasture production. In the treatment with 250 kg superphosphate, there has also been movement of P down through the soil profile, probably due to the high sand content of the surface soil and the transfer through the profile of small quantities of water-soluble P and P bound to organic ligands. Over time, the site has continued to acidify (surface 0–10 cm); the soil acidity combined with aluminium (Al) concentrations in the fertilised treatments approach a level that should impact on production and where broadcast lime would be recommended. After 100 years of non-disturbed pasture, the surface soils of these systems would be in a state of quasi-equilibrium, in which the fertilised systems have high levels of carbon (C), nitrogen, P and exchangeable Al. The continued stability of this system is likely dependent upon maintaining the high C status, which is important to nutrient cycling and the prevention of Al phytotoxicity. There are two risks to this system: (i) the declining pH; and (ii) soil disturbance, which may disrupt the equilibrium of these soils and the bio-chemical processes that maintain it.

http://www.publish.csiro.au/paper/SR14241.htm

Carbon neutral farming at Talaheni in Yass, NSW

Natalie Doran-Browne, Research Scientist, The University of Melbourne

Sustainable farming has become increasingly important to ensure farming remains viable with the ability to increase productivity into the future. In recent years, environmental impacts have focused more heavily on the greenhouse gas emissions produced on farms and the importance of reducing or offsetting these emissions. Researchers at the University of Melbourne undertook the task of calculating the carbon balance of Talaheni, a 250 hectare farm near Yass, NSW owned by John and Robyn Ive, that specialises in ultrafine wool of around 12 to 14 micron. Talaheni has focused on becoming sustainable, increasing productivity and becoming a carbon neutral sheep farm. When Talaheni was purchased in 1980 it was non-viable due to previous unsustainable management practices, particularly overstocking. The property, like many other farms in the region, had major dryland salinity (Scown 2000) which reduced plant growth and deteriorated soil health, also reducing plant survival (Rengasamy 2002).

Sheep, cows and other ruminant livestock produce more greenhouse gas emissions (GHGE) than other farming activities. Therefore it is desirable to reduce emissions where possible. Scientists have studied numerous options to reduce emissions by changing the feed management, flock structure or breeding management of animals. While these options help to reduce the impact of emissions from livestock farms, they only decrease emissions by around 30% and there is currently no way of reducing all emissions from animals. However, sequestering carbon in trees has the potential for livestock emissions to be offset in their entirety.

The carbon balance of Talaheni was analysed by calculating the GHGE from livestock, energy and fuel, and comparing these emissions with the carbon that was sequestered in trees and soil. Greenhouse gas emissions were calculated using the same method that is applied to calculate Australia's National Inventory of greenhouse gas emissions (IPCC 2006; DIICCSRTE 2013). The majority of greenhouse gas emissions that come from livestock farms are in the form of enteric methane, but methane is also produced in manure. Nitrous oxide is another greenhouse gas produced on farms and occurs when soil is cultivated as well as in dung and urinary depositions. Nitrous oxide is also produced indirectly when nitrogen is lost with leaching, runoff and through the process of ammonia volatilisation. The amount of carbon sequestered in trees and soil can be calculated using a model called FullCAM (Richards and Evans 2004). The FullCAM model uses data from trees and soils that have been measured and estimates how much carbon is stored in soils and trees as they grow.

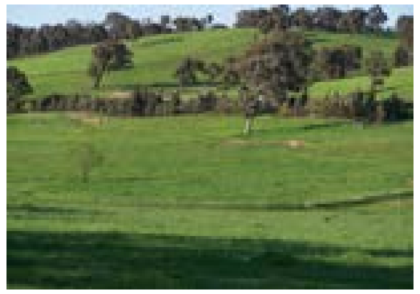
Australian soils naturally have high levels of salt, creating problems with salinity in many regions (John *et al*. 2005). Although groundwater tables in Australia were once stable, after European settlement land was cleared of trees, causing more rainfall to enter the ground water (Eichhorn *et al*. 2006). Water tables then rose which mobilised salt and created dryland salinity (Rengasamy 2002). At Talaheni, planting trees absorbed this excess water, lowering the water tables and reducing salinity (John *et al*. 2005).

At Talaheni the terrain is rolling to hilly with the flatter areas (100 ha) most suited to grazing and the upper slopes containing the majority of trees (mainly *Eucalyptus polyanthemos* and *Eucalyptus macrohyncha*). Trees provide important benefits such as reduced salinity, increased pasture and crop production (Lin *et al*. 2013), windbreaks, shelterbelts for animals in winter to improve survival, reduced soil erosion and increased biodiversity (Brandle *et al*. 2004). Revegetation was achieved by intensively grazing selected areas and then removing the sheep to allow tree seeds to readily establish on the disturbed ground. In areas where trees numbers were too low to provide sufficient seed, seedlings were planted in row strips with local species such as Red Box (*Eucalyptus polyanthemos*) that produce quality timber. Selective thinning was used for more vigorous and sustainable tree stocking rates. An estimated 200,000 trees were established by managed seedling regeneration, compared with about 20,000 seedlings planted by hand.

When Talaheni was purchased in 1980 the soil carbon under pastures had degraded to only 0.8% total organic carbon in the top 30 cm of soil. The reclaimed flats were planted with perennial pasture species (*Phalaris aquatica*) while native perennial grass, *Microlaena stipoides*, re-established on the lower slopes which increased the amount of carbon in the soils under pasture to 1.4 % over the following 30 years. On the upper slopes, carbon also accumulated in the soils as trees were planted, adding debris to the soil and contributing further to the soil carbon sequestration.

At Talaheni 115 ha of land had tree cover and therefore the farm had a good ability to sequester carbon. While 2,800 t CO2 equivalence (CO2e) was emitted from Talaheni, mainly from livestock (2,500 t CO2e), it was estimated that 18,400 t CO2e was sequestered in trees between

Near-lambing ewes grazing in a paddock protected by portion of a network of integrated shelterbelts.



Landscape view now highly productive reclaimed saline flats (foreground) and shelterbelt and revegetation particularly on rocky ridges

1980 and 2012. The soils under pastures contributed 8,400 t CO2e and the soils under trees sequestered a further 3,400 t CO2e. Therefore, the final carbon balance of Talaheni from 1980 to 2012 offset greenhouse gas emissions completely and sequestered a further 27,400 t CO2e. Emissions were completely offset from the year 1985.

Environmental initiatives such as planting trees to reduce salinity have helped to increase productivity at Talaheni. As a result of the additional trees and management on the property, the Talaheni farm reduced salinity, increased soil carbon and also increased the productivity and profitability of the farm. Since 1983 there has been a steady increase in stocking rate of 0.15 DSE/ha/year on average and cattle weaning weight has also increased by 1 kg/year as pasture management and pasture availability have improved.

The results showed that after 30 years the farm sequestered nearly eleven times more carbon in trees and soil than was produced by livestock and energy useage. The majority of the carbon sequestration occurred in trees, although soil sequestration alone entirely offset emissions. This study demonstrated that a wool farm with an average stocking rate of 8.4 DSE/ha required 15% of the farm under tree cover for the farm to be carbon neutral. Currently the tree cover at Talaheni is nearly three times this level. Further research would be beneficial on the carbon neutral potential of farms in more fertile, high rainfall areas that commonly have higher stocking rates than the current study.

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Natalie Doran-Browne, Dr Richard Eckard (Melbourne University Research team) and John Ive at Talaheni.

Welcome to new members of the Grassland Society of NSW

Belinda Bolding, Killara, Michael Bonanno, Horsley Park, Richard Cameron, Adelong, Phil Cranney, Orange, Richard Dalglish, Goulburn, Rod Dean, South Melbourne, Baden Dickson, Cowra, Roger Dietrich, Wagga Wagga, Robert Eaglesham, Theresa Park, Duncan Fraser, Cobbitty, Simon Kensit, Crookwell, Ross Kuchel, Weitaliba, Virginia McCoy, Berridale, Susan Mills, Goulburn, Cesar Pinares-Patrino, Canberra, Sally Playfair, Springside, Luke Pope, Cooma, Dougal Pottie, Orange, Peter Shannon, Bookham, James Stonestreet, Milthorpe, David Thompson, Gerroa, Leigh & Roger Tuck, Bowral, Vincent Walsh, Yass and Helena Warren, Binda.

From the President

What a winter. The coldest July in many places for some years, and snow aplenty, albeit quite damaging in some areas. Fortunately there has been some very useful rain during June and July, and we are now hoping that all the talk of El Niño is just that. Pasture growth has been slow on the back of the colder conditions, and as I write, Orange is a 'tropical' 2 degrees today, at 3.10 pm!

Our 2015 conference "Making pastures pay" has come and gone, and our thanks to Goulburn Soldiers Club for hosting us. The program, organised by Helen Burns and the Tableland Farming Systems Group (and we thank them greatly), gave those attendees plenty to refocus on, especially our phosphorus levels and the recycling of it, and many presentations emphasised the ongoing importance of grazing management when it comes to keeping our pastures. The bus tours visited some terrific and very enthusiastic farmers, and on behalf of the society, I thank them for opening their doors for our benefit.

The "Pasture Updates" have continued this year, with the most recent one at Collerina being conducted late July. Approximately 50 attendees got the best from a range of speakers that Trudie Atkinson had co-ordinated. Obviously there is still plenty of interest in pastures 'West of the Newell', and why wouldn't there be with cattle and sheep prices where they currently are. Here's hoping they stay with us for a long time. Other "pasture updates" planned for this year at Mandurama (between Blayney and Cowra) on September 15th, with talk of another in the north of the state late in the year. Keep an eye on the web site for more information. For those close to these venues, I strongly encourage you to get along.

All the best for spring, and here's hoping 'Huey' looks after us all.

All the best,
Regards,

David Harbison,
President.

Membership subscription due now for 2015/2016

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17th Australian Agronomy Conference

The 17th Australian Agronomy Conference will be held at the Wrest Point Convention Centre in Hobart, Tasmania from 20 to 24 September 2015.

The theme of the 2015 conference is Building Productive, Diverse and Sustainable Landscapes. This theme has been chosen as it reflects the role and importance of agronomy in all aspects of production agriculture and the wider environment.

For more information go to http://www.agronomy2015.com.au/

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The Grassland Society of NSW Inc is a unique blend of people with a common interest in developing our most important resource - our Grasslands

The Grassland Society of NSW was formed in March 1985. The Society now has approximately 500 members and associates, 75% of whom are farmers and graziers. The balance of membership is made up of agricultural scientists, farm advisers, consultants, and or executives or representatives of organisations concerned with fertilisers, seeds, chemicals and machinery.

The aims of the Society are to advance the investigation of problems affecting grassland husbandry and to encourage the adoption into practice of results of research and practical experience. The Society holds an annual conference, publishes a quarterly newsletter, holds field days and is establishing regional branches throughout the state.

Membership is open to any person or company interested in grassland management and the aims of the Society. For membership details go to www.grasslandnsw.com.au
or contact the Secretary at secretary@grasslandnsw.com.au or at PO Box 471 Orange 2800

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If you are interested in reactivating an old branch or forming a new branch please contact the Secretary at secretary@grasslandnsw.com.au or by mail at PO Box 471 Orange NSW 2800

Grassland Society of NSW News

Next Newsletter: The next edition of the newsletter will be circulated in December 2015. If you wish to submit an article, short item, a letter to the Editor or a photo please send your contribution to the Editor - Carol Harris at carol.harris@dpi.nsw.gov.au or DPI NSW 444 Strathbogie Road Glen Innes 2370. The deadline for submissions for the next newsletter is 6th November 2015.

Electronic newsletter: Don't forget you can receive the Grassland Society of NSW newsletter electronically. Just email your details to Janelle (secretary@grasslandnsw.com.au) and you will be added to the list. Next newsletter you will receive an email notification with a link to the newsletter on the website.

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