Thinking BiGG

Biodiversity in Grain & Graze

Mixed-farming families tell their stories of biodiversity

Grain & Graze
Profit through knowledge

Australian Government
mla MEAT & LIVESTOCK AUSTRALIA
GRDC Grains Research & Development Corporation
australian wool innovation limited
Australian Government Land & Water Australia

Front cover photo: Children participating in a bug catching activity during the BiGG Farmer Forum field trip to 'Bangor' Tasmania, January 2008

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Grain & Graze
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The Grain & Graze Program

The Grain & Graze Program aims to boost the profitability of mixed farms, while helping to protect natural resources. One of the strengths of the program is the direct involvement of farmers and farming groups in local trials and extension activities.

Grain & Graze is a collaboration between four leading research and development Corporations: Meat & Livestock Australia (MLA), Australian Wool Innovation (AWI), the Grains Research & Development Corporation (GRDC) and Land & Water Australia (LWA) – along with more than 60 farmer and landcare groups, research providers and regional management authorities.

For more information about the Grain & Graze Program, please contact:

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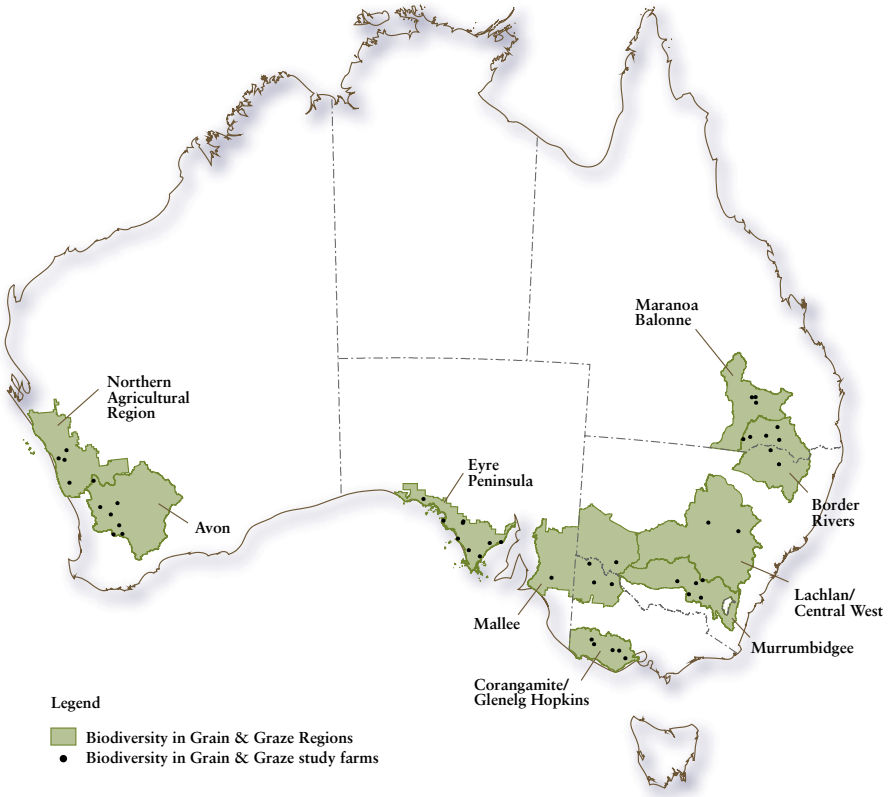

Grains Research and Development Corporation (GRDC)

The Grains Research & Development Corporation is one of the world's leading grains research organisations, responsible for planning, investing and overseeing research and development, delivering improvements in production, sustainability and profitability across the Australian grains industry.

The GRDC's mission is to invest in research and development for the greatest benefit to its stakeholders – grain growers and the Australian Government. The corporation links innovative research with industry needs.

Collaboration with other Research and Development Corporations (RDCs) in the Grain & Graze Program to find a more profitable and sustainable balance between growing grain, producing meat and wool and enhancing biodiversity on-farm, will help all of the RDCs work better together which will, in turn, contribute to achieving the GRDC's mission.

For more information about the GRDC visit **www.grdc.com.au**

Land & Water Australia (LWA)

Land & Water Australia commissions, manages and delivers research and development (R&D) to farmers and natural resources managers.

Its aim is to increase the profitability of Australian farmers and natural resources managers through innovation, research, development and communication. R&D has helped Australian agriculture double its productivity over the past 25 years.

Land & Water Australia works directly with farmers, farming groups, agribusiness and regional bodies to identify local needs and produce results that can be taken up by farmers and land and water managers.

For more information about LWA visit **www.lwa.gov.au**

Australian Government

The Biodiversity in Grain & Graze project received generous support from the Australian Government through the Natural Heritage Trust (NHT). This support provided the core resources to enable the project to commence and paved the way to attract substantial industry funds. In addition to this direct support, the Australian Government provided further assistance through the participation of several catchment management organisations across Australia, each of which receive funds from both State and Federal Governments.

Australian Wool Innovation (AWI)

Australian Wool Innovation is a fully independent public company limited by shares and owned by Australian woolgrowers. AWI's mission is to drive research, development, innovation and marketing that will increase the long-term profitability of Australian woolgrowers.

AWI initiates, commissions and delivers research and development (R&D) to Australian woolgrowers. The company works through alliances and contracts and, where possible, R&D outcomes are commercialised with the primary aim being the adoption of technology - on farm and along the global wool pipeline.

Grazing management is one area of AWI's focus for R&D. The productivity and profitability of many grazing enterprises in the high rainfall and sheep-wheat zones of Australia can be improved by increasing the attention paid to grazing management. AWI investments in grazing management are focused on providing wool growers with knowledge, tools and practices to improve the productivity and sustainability of their business. AWI has invested in the Grain & Graze Program because it helps producers in the sheep-wheat zone identify what combination of livestock, pastures and crops will increase profitability and improve the natural resource base on which they farm.

For more information about AWI visit **www.wool.com.au**

Meat & Livestock Australia (MLA)

Meat & Livestock Australia Limited is a producer-owned company that provides services to livestock producers, processors, exporters, foodservice operators and retailers. MLA has around 40,000 livestock producer 'members' who have stakeholder entitlements in the company.

MLA's mission is to deliver world-class services and solutions in partnership with industry and government. The company's core activities are building demand for Australian red meat, improving market access for its products, conducting research and development (R&D) to provide competitive advantages for the industry, and collaborating with its partners to build capability within the industry.

As part of its goal to develop competitive advantages for the red meat industry, MLA is involved in a broad range of research and development on-farm and throughout the supply chain. On-farm projects include grazing management, parasite control, meat quality, animal genetics for improved efficiency and environmental management. Grain & Graze is an important component of both MLA's grazing management and environmental management R&D.

For more information about MLA visit **www.mla.com.au**

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Introduction – thinking BiGG

Getting down on hands and knees

For the past two years a group of farmers and researchers have been crawling around on hands and knees peering at the ground, setting traps for insects, laying cotton strips in the soil and peering up into the sky to count birds. More than 230,000 bugs and thousands of samples have made the trip by airfreight across the country to the University of Tasmania, where each one is examined and categorised by the project staff.

These farmers and researchers are part of BiGG, which stands for Biodiversity in Grain & Graze. The BiGG project is investigating the relationship between biodiversity and on-farm production and has involved around 100 people on 47 farms across Grain & Graze's nine regions in Australia.

With the approval and support of the collaborating farmers, BiGG field research officers have monitored and collected biological samples each autumn and spring in four paddocks per farm, each with different land uses, over two years. The biodiversity monitoring goes hand-in-hand with landholders actively working towards improving natural resources on their farms.

BiGG set out to answer these questions:

- What are the relationships between selected measures of biodiversity and patterns of land-use?
- How is enterprise diversity on farm related to biodiversity?
- How do landscape and terrain influence farming practices and biodiversity?

What started out as a project to understand relationships between mixed farming and biodiversity rapidly became a participatory project though the enthusiastic involvement of 47 farming families.

As a result, BiGG has emerged as an example of community science.

'In BiGG, farmers are living through a research process and feeling part of it,' says Grain & Graze's national operations coordinator, Dr Richard Price. 'They are witnessing data come off the paddocks in the form of bugs and bird counts and soil tests and they are seeing what happens to the research once it leaves the farm. More importantly, the BiGG farmers are helping the researchers to interpret the data and communicate the results to their peers. They are connected to it and enthusiastic.'

What is biodiversity?

Biodiversity is the variety of life. It is about the structure, function and composition of ecosystems, including farming systems.

Biodiversity is relevant to both production and conservation. All on-farm management decisions, such as what and where to crop, how much fertiliser to apply and intensity of grazing, influence a farm's biodiversity.

'Biodiversity reinforces people's sense of place about their farm and their region, because combinations of plants and animals are often regionally unique,' says Dr Peter McQuillan, entomologist with the School of Geography and Environmental Studies at the University of Tasmania, and BiGG researcher.

'Biodiversity can be harnessed for sustainable farming purposes because living creatures are responsible for recycling nutrients in the soil or controlling pests or feeding birds or bats. There are positive things that can be done to maximise the contributions those species do make to the farm.'

230,000 'bugs' have a story to tell

Productive, healthy ecosystems have an abundance and diversity of species.

BiGG researchers have found more than 181 bird species (including 33 rare and threatened species) on the 47 participating farms. Team members logged more than 230,000 individual 'bugs' representing more than 504 different species of beetles, 858 ant taxa and 330 different spiders. New beetles and several rare native weevils were found.

Preliminary analysis indicates that the occurrence of bugs differs between land uses and management practices. Dr Kerry Bridle, national coordinator of the BiGG project, says that the input of farmers is vital to understanding the results, and in particular the connection between their specific practices and the biodiversity on their farms.

'Farmers – especially those who have been there a long time – know more about their landscapes than we do,' she says. 'We need their understanding and observations and feedback to help us interpret the data we are getting.'

Research across Australia's mixed farming landscapes shows that many have been extensively cleared, and species that relied upon them – like woodland birds – have declined in number. This makes on-farm remnant vegetation of considerable national significance, but its value to farms is also significant.

The BiGG forum – bringing farmers and researchers together

In January 2008, the BiGG project findings were presented to farmers in a forum where hard science came face-to-face with life on the land. Participating farmers shared their experiences of the project and researchers presented their interpretations of the data, its relationships to their farming systems and implications for the future.

'The unique thing about BiGG is that it's not only looking at the impact of agriculture on biodiversity,' says Richard. 'It's also exploring the benefits that biodiversity can add to farm production. It's a social and biophysical project too. It's looking at biodiversity in a very holistic way.'

The BiGG case studies

This booklet brings together 17 perspectives on biodiversity from farmers who have been collaborating in BiGG. They come from eight of the nine Grain & Graze regions in which BiGG is operating.

These stories provide insights into the reasons why farmers are participating in the project, the changes they have made or are considering making as a result of it and their learning over the past two years.

Both farmers and researchers are in a process of learning. These case studies are a step towards better understanding the full potential that can come from supporting greater biodiversity in farming systems, and how this might contribute to even greater productivity benefits.

BiGG is a bright spot in the midst of drought

Doug and Roma Parker

After Doug and Roma Parker attended the January 2008 BiGG forum in Hobart, they came home with a good dose of enthusiasm for the future of farming. They needed it. Like other farmers in the district, Doug and Roma have been through some tough years recently, which forced them to substantially de-stock their 2200 hectare cropping and sheep property and wait for conditions to improve.

'Pri-inga', Mingenew, Western Australia
Northern Agricultural Grain & Graze region
400 mm average rainfall
2200 hectares
Cropping and sheep

'Pri-inga' comprises around 1600 hectares of arable land and 600 hectares of remnant vegetation on rough uncleared or partially-cleared country. The South Irwin River runs through the property so it contains significant amounts of riparian vegetation. The Parkers normally crop 1000 hectares of wheat and 600 hectares of lupins and barley for sheep feed. At one stage their sheep flock was up to 1800 ewes producing replacement ewes and first cross lambs.

'We've had shocking heat and two quite nasty droughts,' says Doug. 'We haven't had many reasonable years since the turn of the century. In the last two years we haven't delivered any grain and our flock is down to about 700 merino lambs.'

Doug, along with many of his neighbours, has turned to mine work as a maintenance fitter while he waits out the drought. Roma is working as a facilitator for the Western Australian grains company CBH Group, and school volunteer program coordinator. In Doug's absence, she also runs the farm.

Looking after remnant vegetation

But the challenging conditions haven't dimmed the couple's enthusiasm for farming in the long term. They've taken advantage of the lull in normal farming activities to get involved in BiGG and also fence out most of their remnant vegetation over the past two years.

'The BiGG forum really reinforced that I need to budget my feed better and handle my stock better.'

'We've got a very good local grower group, the Mingenew Irwin Group, which has done a lot of research in our area, and we've had funding for our remnant vegetation fencing and tree planting,' says

Far left: Roma & Doug Parker

Below: Irwin River valley with protected remnant vegetation and revegetation

Right: Biodiversity success!

Doug. 'We've put in 15 hectares of perennial grasses as a trial and because we're the most eastern area growing perennial grasses in our situation, the Department of Agriculture is very interested.

'When the opportunity came up to be involved in BiGG, Roma and I were keen to come on board because we appreciate what people have done for us in this area. We were also interested in what's happening in our paddocks.

'We've got a lot of country locked up in remnant vegetation. The BiGG team had documentation from 1928 which gave bird counts for that area and our bird count now in the remnant vegetation very closely matches what they observed back in 1928. So we have a microcosm of what was here originally.

'We're lucky because we've got natural corridors between the Coalseam Conservation Park, the river and our property that the birds use to move between the park and our place.'

'Our bird count in the remnant vegetation very closely matches what they observed back in 1928. So we have a microcosm of what was here originally.'

Looking down the microscope

BiGG gave Doug and Roma the opportunity to examine some living creatures they hadn't looked at before – and to see what benefits they were providing.

'One of the things that we hadn't considered before was the fact that the greater the bird population, the greater the numbers of bug life and therefore, the ecosystem.' says Roma.

'We've got to look down a microscope at a lot of bugs that had been trapped on our place,' Doug says. 'We found that there are natural insect predators in the remnant vegetation and we didn't realise that they are keeping other problem insects under control, like red legged earth mites and lucerne fleas.

'You look out there and you've got plants and animals and birds interacting. It gives you an inner buzz. But some of the results are showing us that maintaining biodiversity is having a good effect on our pastures as well as giving us a feel good feeling.

'We realise if we flog things grazing-wise, we reduce the biodiversity and get rid of a lot of the natural insects.'

Changing grazing management

Doug is now reappraising some of his farm management strategies in the light of new knowledge from BiGG and other programs. In 2006 he says he was carrying too much stock for the drought. The overgrazing meant that a lot of country blew away.

'Having had that in 06, we made sure we didn't have it in 07 by reducing grazing pressures,' he says. 'In 07 we put in some barley thinking we were going to have a crop. When we realised the season wasn't looking good we kept seeding but dropped off fertiliser and seed rates. We just wanted to have something in there to stop the country blowing.

'I need to learn more about feed budgeting so I don't get myself in that situation again. The BiGG forum really reinforced that I need to budget my feed better and handle my stock better.'

The forum was an affirmation for Doug that he was on the right track and there is strong potential for him to apply new methods in the future.

'Some of the results are showing us that maintaining biodiversity is having a good effect on our pastures as well as giving us a feel good feeling.'

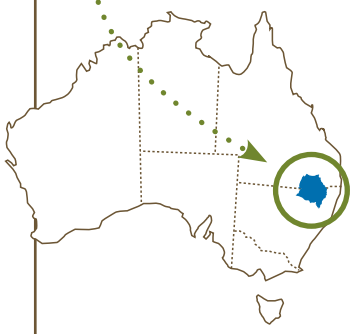
'I really enjoy getting out and meeting other farmers and in a situation like that, you come home with a good dose of enthusiasm,' he says. 'You look around your own place and it's all doom and gloom, but you can take the positive view, meet some other guys who are positive and see what they've got to show for the past year.

'There are so many good things happening in agriculture and so much good research going on. At the moment we can't fully utilise it because of the dry seasons, but come the good seasons, we're going to cash in on that, just like everyone else is cashing in on it now.'

Sustainability is important for managers – not just owners

Steve Wilkins

While most farmers participating in the BiGG project are property owners, farm manager Steve Wilkins says the project is just as important for managers as owners because of their responsibility to manage farms sustainably.



'Kioma', Toobeah, Queensland	
Border Rivers Grain & Graze region	
500 mm average rainfall	
14974 hectares	
Merino sheep, cattle and wheat	

Steve manages 'Kioma', a mixed farm in the Toobeah district of Queensland which is owned by JH Fairfax and Son. The property supports 1500 merino sheep, a cattle breeding herd of 500 head and nearly 2500 hectares of wheat.

On behalf of the owners, Steve has made Kioma a collaborating farm in the BiGG project. It is one of the largest properties in BiGG and Steve says that its involvement reflects the commitment of JH Fairfax and Son to improving biodiversity.

'Before we were involved in the program, we had a straight down the line approach where we developed the country in the aim of profitability,' says Steve. 'Now in the Grain & Graze program we're looking at a bit of everything for the future.'

Rotational grazing helps pastures survive and thrive

Steve has adopted a number of sustainable farming practices that aim to improve biodiversity values on the property while helping make it sustainable for the long term. For example, he uses a rotational grazing system for cattle and sheep which retains ground cover, ensuring that diverse pasture species survive and thrive.

'With rotational grazing, we expect to see the return of more native grass species that tend to become overgrazed and eventually die out in set stocking situations,' he says. 'The rotational grazing system retains ground cover, which I am sure in turn encourages the build up of biodiversity.'

Steve says that increased levels of soil organic matter should lead to an increase in the amount of rain stored in the profile rather than having it run off. No-till and minimum-till cropping techniques also play a role in increasing the amount of groundcover and organic matter.

'Biodiversity is an investment in the future, for the sustainability of the farm into the future.'

Far left: *Steve Wilkins*
Below: *Swathing Bambatsi panic for seed production*
Right: *Heifers in improved pasture*

'We were able to conclude that we had quite rich biodiversity on the property. Now we just need to make sure we preserve it.'

Setting benchmarks

Steve first thought that becoming involved in the BiGG project was an opportunity to gather some data on Kioma's biodiversity status – both in terms of setting a benchmark for the property and comparing it with how other farmers were doing. He was heartened to find that BiGG surveys on Kioma indicated that the farm supports a wide range of living creatures.

'We always noticed heavy dung beetle activity in cow pats and I read that as a good sign,' says Steve. 'This was confirmed when we had a high amount of beetles caught on this property in comparison to others.

'We were able to conclude that we had quite rich biodiversity on the property. Although these results only cover a small period of time, it was encouraging to see what diversity we had.

'Now we just need to make sure we preserve it.'

Trading off short and long term

Improving ecosystem health on Kioma isn't without its challenges. Increasing reserved or fenced off areas can have consequences, including an increase in native or feral animal populations like kangaroos, wallabies and pigs.

'We have to be better at managing the pest problem,' says Steve. 'It's a trade-off. Sure there are financial costs – for example in fencing out shade lines to protect trees from stock. The long term benefits of these actions are probably not measurable in the short term.'

Similarly, improving the numbers of different birds, beneficial insects, plants and animals has implications for future policies of chemical use.

'I'm not sure that our current rates of chemical use will be sustainable into the future, say for the next 10-20 years,' says Steve. 'We may have to try some new things.'

Overall, Steve says it is important to balance farm profitability with biodiversity needs.

'You shouldn't need to sacrifice farm profitability when encouraging and increasing populations of biodiversity,' he says. 'Biodiversity is an investment in the future, for the sustainability of the farm into the future.

'A lot of farmers are already conscious of this, though some of them might need reminding. A lot of the farmers in our area are younger and they've got children on their farms. I think this makes them look instinctively towards the future.'

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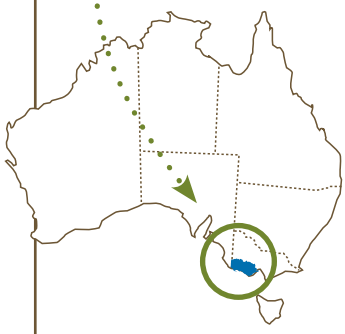
Predatory insects and 'farm-stayers' are money in the bank

Rob and Jill Gardner

Rob and Jill Gardner's biodiversity program has literally given them money in the bank. They recently saved $900 by choosing not to spray their brassica summer crop for cockchafer grubs. Instead they let other predatory insects do the work of pest control for them.



'South Mokanger' Cavendish, Victoria
Corangamite Glenelg / Hopkins Grain & Graze region
620 mm average rainfall
1800 hectares
Sheep, canola, red wheat, barley oats and lupins

'I am careful about trying to cultivate bugs and grow trees on the place and look after our pastures,' Rob says. 'I'm trying to make decisions like not to just blanket spray a crop. I will look at the bugs that are there. If there's a grub eating the summer crop, there will be other grubs around too, plus other things like lady beetles.

'This year I didn't spray the brassica crop. The other insects that were there got on top of the grubs that were eating the crop. All of a sudden the cockchafer grubs seemed to disappear and we only lost a little of the crop.'

'Nature is always right. We have to work with it, not against it.'

Rob and Jill are collaborating farmers in BiGG. Considering and protecting biodiversity on the property is part of Rob's decision making framework. He says that the BiGG trials on the farm will give him valuable information on the biodiversity in his ecosystem, including bird, invertebrate and microbial populations.

Multiple farm enterprises

Rob and Jill Gardner's property 'South Mokanger' near Cavendish in Victoria lies across two land types – Western Victorian red gum country and the grassy basalt plains. The Gardners run a self-replacing fine wool flock of about 14 000 merinos, as well as breeding and running 3500 first cross ewes. They crop 200 hectares of country each year. Most of the crop grown is sold for cash flow, while a large silage program provides stockfeed during low growth periods. They also have several cottages for farmstay tourism.

Far left: Rob and Jill Gardner

Left: A pasture paddock found to have more invertebrates than the remnant vegetation paddock - including 6 spider, 12 beetle and 4 ant species

Below: Rob Gardner in the brassica crop that he chose not to spray

Like much of the region, the farm did not have stands of native timber on the basalt country. Establishing tree plantations for shelter and encouraging biodiversity on improved country has been a priority. Rob and Jill have planted melaleucas, blackwoods, black wattle, manna and sugar gums. They have fenced out a lowland area of 10 hectares, which is covered with self-seeded red gums. This will complement the biodiversity habitat provided by the farm's remnant native vegetation.

'Monocultures just don't work. Nature needs a mixture of everything.'

The reserve is out of bounds to the sheep and is a harbour for kangaroos, wallabies and some koalas. It turns out this diversity is also money in the bank for the Gardners, as the chance of seeing native wild mammals is a great drawcard for visitors to the farmstay cottages.

Rob takes the opportunity to tell farmstay visitors about sustainable farming.

'Thirty per cent of visitors are keen to know more about the farm, while 70 per cent are just there for a holiday,' Rob says. 'I give them a good experience and they realise farming isn't as easy as they thought. They go away thinking that farmers aren't all that bad and that we're actually looking after the land.'

'This year I didn't spray the Brassica crop. The other insects that were there got on top of the grubs that were eating the crop. All of a sudden the cockchafer grubs seemed to disappear.'

Crop preparation encourages healthy soil

Rob takes a long term view of preparing soil for crops, on the basis that making changes now will have benefits in the long term. He says he has always avoided monocultures.

'Monocultures just don't work,' he says. 'Nature needs a mixture of everything.'

Because the soils on South Mokanger are quite acidic, he has applied lime top dressings to three quarters of the farm. He has also done a lot of preparation to change to direct drill cultivation, which has benefits for biodiversity and soil health.

Rob is reducing stubble burning to protect soil microbes. He is also considering using microbe sprays in the future to hasten stubble breakdown.

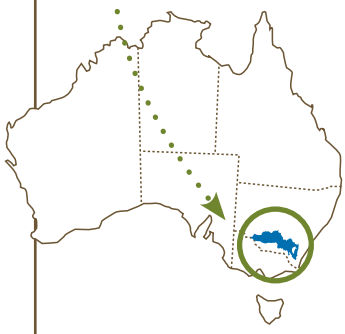
'A few guys in the area have spread bugs on their stubbles to try and get them to break down. But there's still a bit of debate on whether to do that or just incorporate the stubble early and leave it to break down by itself,' Rob says.

The Gardners' involvement in BiGG has opened their eyes to some of the bottom line benefits that can come from improved biodiversity. This has been complemented by the Integrated Pest Management project of Grain & Graze, a feature of the research effort in the Gardner's region.

'You can think about biodiversity in economic terms,' says Rob. 'It's a matter of balancing a bottom line of sustainability, profitability and lifestyle. Nature is always right. We have to work with it, not against it.'

Healthy soils, healthy lives

Malcolm and Kerrie Plum



Plenty of four legged creatures were born on Malcolm and Kerrie Plum's sheep and cereal property 'Burradool' near Wagga Wagga after they started farming there during the 1970s. But after some special two legged newborns came along, doubling the size of their family, the Plums took a long hard look at their farming practices.

'Burradool', Tarcutta, New South Wales
Murrumbidgee Grain & Graze region
600 mm average rainfall
410 hectares
Sheep, cattle and cropping

'In the early 1980's we became a little reckless with our farming and were a bit off track,' says Malcolm.

'We started to notice a few health problems within our family and began to question whether this was connected to our increased use of commercial fertilisers and chemicals.'

The possibility was enough to make them reappraise the business and change their whole farm management approach.

'Healthy soils mean healthy plants, which in turn, lead to healthy livestock and healthier humans.'

'We decided we had to take a new direction,' Malcolm says.

Now their mission statement says: 'Healthy soils mean healthy plants, which in turn, lead to healthy livestock and healthier humans'.

Biofarming rather than organic farming

Burradool's enterprises now consist of around 1000 first cross merino/border leicester ewes, 70 cows and cropping on one-third of their property. In a key step for their farm management, Malcolm and Kerrie became collaborating farmers in BiGG.

While they are not certified as organic farmers, the Plums have been practising 'biofarming' for about 15 years. They use biological solid and foliar preparations from the BioAg company in Narrandera, as well as similar products made in Young and Wodonga.

'The benefits of rotational grazing have gone beyond our expectations.'

Far left: Malcolm and Kerrie Plum
Below: Prime lambs grazing a crop of millet
Right: A rolling prickle harrow bar used to knock down stubbles

'The biological preparations have a two-fold effect on the crops and pastures,' says Malcolm. 'They provide trace elements for the soils and the plants and also feed the living micro-organisms in the soil.'

Malcolm uses several other methods to increase soil microbes. He uses a rolling prickle harrow to flatten and bend the standing cereal straw, giving the microbes a larger surface area to work upon during the decomposition process. He also sprays his stubble with a mix of molasses and urea to help break it down and encourage soil biota populations to thrive.

Direct drilled crops, strategic spraying, stubble management and managed grazing are some of the other tools in the Plum's quest for more sustainable soils.

Animal husbandry for soil health

'We're working from the soil up,' says Malcolm. 'In the past three years we've changed to set stocking for eight weeks of the year during lambing and then rotational grazing for the rest of the year.'

The rotational grazing pattern involves stocking paddocks for short periods and then allowing them to recover. The Plums purchased a soil aeration machine to help them overcome soil compaction problems from large stock numbers.

'We've found the benefits of rotational grazing have gone beyond our expectations,' says Malcolm. 'It allows legumes and grasses to regrow and replaces old roots with new ones, creating more organic matter for the soil.'

'Our efforts to improve soil health, combined with the use of biological solid and foliar fertilisers, result in healthier pastures and thus healthier livestock and greater biodiversity,'

Controlling sheep parasites

In the animal husbandry side of the business, Malcolm and Kerrie have a strong focus on nutrition. They give the sheep nutritional oral drenches and supplements of calcium, magnesium and salt. Any sheep or lambs brought onto the property are given a quarantine drench of Ivermectin, mixed with white and clear drenches.

Since early 2007, the Plums have been using an organic nutritional supplement called Preobiotic, which contains probiotics, preobiotics, minerals, vitamins, enzymes and selenium in a base of apple cider vinegar. They drench ewes twice a year and lambs every six weeks until they are sold. Malcolm says that the drench helps with weight gain and encourages a healthy bacterial gut in the sheep.

'It also provides a benefit to farm biodiversity, with fewer animal health chemicals passing through the sheep into the pastures and soils,' he says.

The Plums carry out monthly worm egg counts between October and March to set their summer drench program. They have not had to drench their first cross ewes since October 2005. The offspring of the first cross ewes had summer drenches in 2005 and 2006 and were then sold as prime lambs. However, in 2007/08 the lamb egg counts were not high enough to require drenching.

'Our efforts to improve soil health, combined with the use of biological solid and foliar fertilisers, result in healthier pastures and thus healthier livestock and greater biodiversity,' Kerrie says.

'In the end it comes down to the food chain,' adds Malcolm. 'Whatever you feed something, be it animal or plant, will influence how it performs.'

Student farmers collect award for sustainable farming

'Sims Farm' Cleve Area School

South Australia's future farmers are already winning awards for their efforts at sustainable farming and protecting biodiversity – and they're not even out of school yet. Students enrolled in Cleve Area School's new subject – Sustainable Futures – are participating in BiGG and have scooped two Landcare awards.

Cleve, South Australia
Eyre Peninsula Grain & Graze region
350 mm average rainfall
400 hectares

'Our involvement in BiGG, along with other conservation activities at the school and the sustainable practices used on the school farm, contributed to our winning the South Australian Westpac Landcare Education Award for the second time in 2007,' says teacher Greg Treloar.

Sims Farm, which was bequeathed to the school by the late Gordon Sims, provides students with practical experience in agriculture related courses. The school operates a rotational cropping and livestock program on the 400 hectare property, incorporating wheat, barley and oats, plus merino sheep and some prime lamb production.

Farm technician Rodger Story attended the BiGG forum in Hobart in January 2008 and says the school's involvement in BiGG has been an ideal way of broadening the focus of the Sustainable Futures subject.

'The students are enthusiastic about their involvement with BiGG,' says Rodger. 'BiGG provides a hands-on component that enables them to get out of the classroom. They see it as something new, interesting and different. They're not scared to offer their own ideas and perspectives.'

Monitoring five ecosystems

Under the BiGG project, the high school students have compared four different land-use types on the Sims Farm, including crops, long-term pastures, pasture/crop rotations and native vegetation. During autumn and spring they monitor numbers and species of birds, insects, soil biota and small vertebrates.

Rodger says that the material collected during the project has shown that the biodiversity in the crop paddock is far more rich and varied than he anticipated.

Far left: Rodger Story

Left: Reece Baillie and Amy Summers (Year 12 Students 2007) collecting quadrat details from Dingle Dell paddock

Below: Students monitoring biodiversity in native vegetation, with Greg Treloar

‘The BiGG project has been a tremendous encouragement to me and to the students. It’s great to know that the ideas you have in place or in your mind are on the right track.’

The research has also been a learning experience for the students who participated.

‘I learnt how data was collected and what kinds of data were analysed for large scale trials,’ says student Ben Dohnt. ‘I found out that some animals I didn’t even know existed were contributing to biodiversity.’

‘The subject has definitely broadened my perspective on the environment and what we can do to help,’ says another student, Rebecca Lehmann, who is planning to apply for a Bachelor of Agriculture degree at university when she has completed Year 12.

‘The skills and knowledge I’ve gained through BiGG will be invaluable to my family farm, and therefore to the community,’ says Jared Siviour.

‘We’re heading towards a more environmentally sustainable system in life and in farming, so this is an important choice we’re offering our students. They’re coming into an age where dealing with environmental issues is the norm. They know they’ve got to do something to help.’

The school’s involvement in BiGG is part of a broader focus on sustainable agriculture. The school program aims to give students the opportunity to solve problems, teach each other and learn new life skills. Teachers believe that BiGG’s combination of research and its focus on solving problems and seeking practical answers has made a positive contribution to student learning.

From school farm to home farm

When Rodger leaves his day job as school farm technician, he goes home to his own 600 hectare property where he is also applying sustainable agriculture principles to his cropping and strategic grazing operation. He says that his involvement in BiGG through the school has influenced his approach to farm management at home.

Rodger only grazes sheep on agistment over summer and autumn, giving himself the ability to move stock on or off depending on seasonal conditions.

‘In the early days they did so much clearing in the area that we are lacking shelter these days,’ he says. ‘We have fragmented areas of remnant vegetation, mostly on old creek lines and non-arable areas. There are also some areas that we’ve fenced off and direct seeded to create shelter belts.

‘The stock does so much better when they have shelter belts,’ he says. ‘You get higher lambing percentages and the sheep just do better.

‘We’d like to fence off more native vegetation areas and link them up to make proper corridors for biodiversity.’

BiGG ideas and findings have inspired Rodger on his own property.

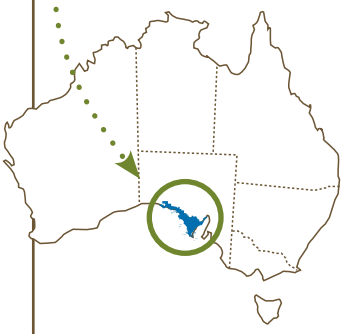
‘I like to transfer the ideas there and if I don’t think they’re quite right, I will change them a bit and adapt them to my situation,’ he says.

‘The BiGG project has been a tremendous encouragement to me and to the students. It’s great to know that the ideas you have in place or in your mind are on the right track.

‘We’re heading towards a more environmentally sustainable system in life and in farming, so this is an important choice we’re offering our students. They’re coming into an age where dealing with environmental issues is the norm. They know they’ve got to do something to help.’

Staying true to their natures

Malcolm and Sue Heddle, with Bruce and Kathryn Heddle



Eyre Peninsula farming couple Malcolm and Sue Heddle don't like doing things by halves. When they decided to fence out 485 hectares of remnant vegetation on their 2145 hectare sheep and cropping property, they made a promise that the land would never be grazed again.

Minnipa, South Australia
Eyre Peninsula Grain & Graze region
350 mm average rainfall
2145 hectares
Merino sheep and cereal cropping

'The sheep were devastating the under story of the scrub and it was against my nature for that to continue,' Malcolm says.

'We have now put in about 20 kilometres of fencing to section off native vegetation and different soil types and stock will never go back in the native vegetation areas again.'

Malcolm and Sue farm the remaining 1659 hectares with their son Bruce and daughter-in-law Kathryn. They run 1300 merino sheep, growing 21 micron wool. The average wool cut is 6.5 kilograms a head including the lambs, which are shorn at six months.

Fencing for the long term

The Heddles have recently become involved in the BiGG project, but their interest in sustainable agriculture stretches back at least 20 years.

'We started the fencing program at our own expense in the first place, but more recently grants through government programs have helped greatly,' says Malcolm.

Once the areas were fenced out, then various saltbushes and native grasses started reappearing.

'You must be patient. It won't happen overnight, but it happens. We feel very rewarded when it does.'

One of the dreams behind the fencing program is to create a refuge for mallee fowl and echidnas. Each spring and autumn the family lays up to 50 fox baits to keep numbers of the feral pest to a minimum.

'It's a good few years since we have seen the mallee fowl, but I live in hope,' Malcolm says. 'Our continuing efforts at fox baiting certainly won't do our farm any damage and on the upside might perhaps mean the ongoing future for the mallee fowl.'

'The sheep were devastating the under story of the scrub and it was against my nature for that to continue.'

Far left: Malcolm and Sue take a closer look at some of the invertebrates collected on their property

Below: The most recently fenced patch of native vegetation, showing the all-dropper fence, with barbed wire at the bottom

Right: 25 years of stock-free management has resulted in a re-invigorated understorey, including native grasses

'You must be patient. It won't happen overnight, but it happens. We feel very rewarded when it does.'

The vision has extended beyond the Heddles' farm. A community approach to the fencing project has seen the creation of a corridor running from the Gawler Ranges to the north and heading out to the southwest to country consisting of scrub and stone. The result is an almost continuous corridor of about 10 kilometres that allows bird and animal populations to travel.

'Some of our neighbours have gone down the same path and most of their native vegetation is now fenced out,' says Malcolm. 'I can't say it is a completely continuous corridor, but I think it's sufficient to allow the birds and animals to move between different areas.'

Project results confirm the Heddles management

Monitoring through the BiGG project has mapped indicators of biodiversity on the Heddle's property. Birdlife, invertebrates and soil microbes all appear to be at a healthy level in cultivated and grazed areas as well as in the remnant vegetation.

'From my point of view, it confirms to us that we are heading in the right direction with our management,' Malcolm says.

The Heddles continue to explore ways to make their long term farming more sustainable in both cropping and grazing. They are using grass-free and medic-only pastures to eliminate dependency on nitrogen fertiliser and they see stubble retention, no fire and minimising tillage as essential to the health of the soil.

The farm's crop areas are fenced to soil type which allows fertiliser rates to be adjusted to yield potential. The Heddles apply between eight and 12 units of phosphate, depending upon the history of the paddock. Some trace elements are applied through the soil, and topped up with foliar spray applications.

The sheep help with the control of grass weeds in the medic pastures and reduce the dependency on chemical control for summer weeds. They also help disturb snails – a pest common to Eyre Peninsula – and reduce the critical feed supply to mice.

'For us the sheep are a key part of integrated pest management,' Malcolm says.

Farmers as custodians

Sue considers farmers to be custodians of a significant part of Australia's natural resources, with an obligation to care for it as best they can. However, she says there must be a balance ensuring farming families can survive and prosper.

'The BiGG project's findings that were discussed at the Hobart forum showed it is possible to do both,' says Sue.

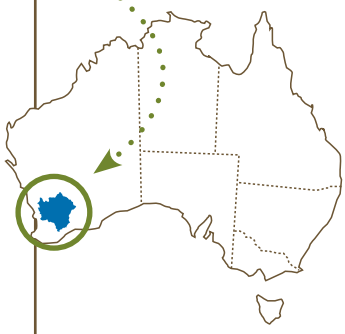
The results of monitoring carried out on mixed farming properties in southern Australia over the past two years showed that cropping and grazing operations do support biodiversity in crop and pasture country, and that there is potential for them to support even greater levels with the right management.

'That initial data will provide a useful benchmark for the future and should give today's farmers confidence they are being responsible custodians of their land,' says Sue.

Losing the view, but gaining the birds

Gene Stone

Gene Stone's involvement in BiGG came about from a desire to do more to protect remnant native vegetation. The remnant vegetation on Gene's farm, like much of that in the Avon region, is extraordinarily rich in bird life compared to other land use types, something confirmed by the BiGG findings.



'Frankston', Quairading, Western Australia
Avon Grain & Graze region
375 mm average rainfall
1457 hectares
Wheat and sheep

'We've always appreciated the patches of bush on the property,' he says. 'They were a part of the farm we were never going to use or clear. Our local Landcare coordinator suggested we place a covenant over the property and apply for funding to protect it.

'WWF-Australia and others came and assessed the land and the results formed the basis of the covenant, which we set up through the WA Department of Conservation and Land Management.

'It was good to go in to the bush with the experts. I learnt a lot from observing what they were doing and it was amazing what they discovered in a bit of bush we never used.'

Gene has already done a lot to enhance the farm's native vegetation. As well as protecting his bush blocks through the conservation covenant, in 1999 he started a tree planting program on the property's waterways.

'Before 1999 we could look across the creek and see everything,' he says. 'Now, because I've been planting since then, the trees have grown up and you can't see across the creek. Plus the trees in that area have dropped seeds and new plants are coming up naturally now.

'The birds are coming back and with birds come insects. That's all part of it.'

While increased populations of birds and invertebrate insects can play a role in natural pest control, the newly planted tree lines also provide protection from drying winds and help to keep any rising water tables at bay.

Far left: *Gene Stone*
Left: *Revegetated creek*
Below: *January 2008 - reclaimed salt land*

Coin-sized spider turns up in unexpected places

Unrelated to the BiGG monitoring occurring on 'Frankston', a remarkable example of biodiversity was discovered by WWF project officer Mick Davis on another of Gene Stone's properties - 'Bridlevale.'

He found a rare tree-stem trapdoor spider, a small native creature about the size of a 10 cent coin which builds a distinctive burrow against the stems of shrubs and trees. The burrow extends above the ground with a silk-lined tube capped with a trapdoor. The spider arranges twigs leading from the rim of the burrow to the ground, directing prey to the burrow entrance. The species is ranked as endangered under the Wildlife Conservation Act, with populations threatened by fire, vegetation clearing and trampling by stock.

The spider turned up in one of two patches of original remnant vegetation being preserved on Gene's farm. It's not the only unusual creature to have been spotted. A small flock of crimson chats has been seen too. They are usually desert birds and an uncommon sight in the far south west of Australia.

'We've always appreciated the patches of bush on the property. They were a part of the farm we were never going to use or clear.

Saltbush breathes life into unproductive country

Three years ago Gene planted nine hectares of saltbush on a 'practically useless' patch of ground that only grew barley grass. It turned out to be a lifesaver in dry times.

'It's been really valuable,' says Gene. 'We get seedlings from the nursery and on the salt affected areas I've planted four varieties. I shut it up during winter and let it grow up and then I open it in February through to when it rains again.

The saltbush has not only returned this area to productivity, but also allows Gene to reduce pressure on other pastures. Feeding off the saltbush helps maintain ground cover in other paddocks and provides protection for soil biodiversity.

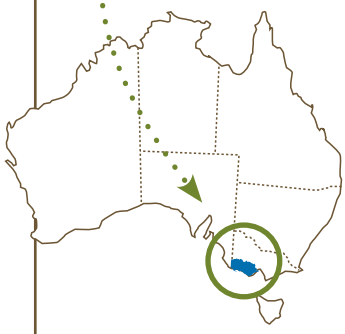
'We've had two dry years and we used the saltbush for feed. We fed it right down to the stem twice now! You couldn't find a leaf in the whole area. That's how valuable it was. You've still got to have grain to feed the stock, but the saltbush is virtually a living haystack.'

'The birds are coming back and with birds come insects. That's all part of it.'

Passing on the benefits to the next farmer

Chris and Val Lang and brother Andrew Lang

As he nears retirement age, Chris Lang is becoming more reflective about what life on the land means to him, his family and the other living creatures that share their country.



Chris and his wife Val and brother Andrew farm the 2500 hectare property 'Titanga', near Lismore in Western Victoria. Titanga is a mixed sheep and cropping farm, with merino sheep comprising two-thirds of the business and cropping the remaining one third, on some 800 hectares of country.

'Titanga,' Lismore, Victoria
Corangamite-Glenelg/Hopkins Grain & Graze region
600 mm average rainfall
2500 hectares
Merino sheep, barley, wheat, canola, oats and field peas

'People farm for different reasons,' he says. 'We're not trying to expand. My aim first of all is to enjoy myself, and for everyone else and the animals to enjoy themselves too – the sheep and the dog and the birds and all the rest. I don't want to make a million dollars or buy the farm next door. I do want to make sure I don't stuff it up for the next farmer.'

Val is also vocal about what she values on the farm – and over the years has been sharing her interest in native grasslands with other farmers, including presenting a paper 'What you value is what you get' to a conference on balancing conservation and production.

'I didn't have any idea at the start that all this was going to be such an important issue.'

'Different farmers look at the same situation in different ways,' she says. 'Where one person might have seen a waterlogged swamp, one of my neighbours saw a valuable wetland and he put a Trust for Nature covenant on it before he sold his land, to make sure it was protected for the long term.'

Val's paper estimated that 99.5 per cent of the original flora of the grassy landscapes of the basalt plains has been lost due to the focus on increasing agricultural production in the region after European settlement. Val would like to see farmers valuing conservation and biodiversity more highly.

'I don't want to make a million dollars or buy the farm next door. I do want to make sure I don't stuff it up for the next farmer.'

Far left: Chris and Val Lang
Left: Remnant vegetation on 'Titanga'
Below: A revegetated creekline on the property

Nurturing native vegetation and woodlots

Two years ago Chris and Val became collaborating farmers the BiGG project. It was a natural progression from their involvement with Landcare going back to the 1980s.

'The farm is on basalt plains that were naturally treeless before early European settlement,' says Chris. 'There are some lighter soil types running through the property that supported open woodlands with banksias, she-oaks and blackwoods.'

In tandem with the local Landcare group, Chris and Val started restoring the vegetation along the creeks and gullies of Titanga by planting tree lines. They established she-oaks, wattles, callistemon, hakeas, red gum and swamp yates.

Around 1994, Chris's brother Andrew started developing woodlots planted with blue gums, sugar gums, spotted gums and red ironbarks. They have a harvesting cycle of more than 30 years. Now around a tenth of the farm is planted to shelter belts of mixed species or woodlots.

Funding woodlots and shelterbelts

Chris says he expects the area planted to trees will stay between 10 and 15 per cent. The family uses joint venture and leasing for the blue gum plantations that are in block and windbreak layouts, and have self funded the planting of blue gums in wide windbreaks and break of slope planting.

'It's pretty hard to put a dollar value on it, but it wouldn't return the same value as cropping,' he says. 'Every two years we're cutting down trees from the woodlots, but I doubt we get an economic return from them. The greatest benefit is probably from the shelter they provide.'

However some of the non-financial impacts of the trees planted over the past 25 years are clearly visible – and audible – to the Langs.

'We've got a couple of resident bird watchers in the area that have been doing some interesting stuff, and keeping us posted with what is happening in the bird world,' Chris says. 'We've got about 90 species of birds that they've found. You can also tell if a crop has got an outbreak of grubs by the line of crows on the fence posts. And it gives us a buzz to hear the brolgas calling in the early morning.'

Chris says that common bird species he sees on the property include crows, magpies, mudlarks, wagtails, rosellas, hawks, ibis, several varieties of waterbirds and migratory birds including cuckoos and wattle birds. There are also some bats and small marsupials.

The new sawlog plantations are also linking different areas of vegetation, allowing the spread of diverse species across the property and to the creek line planting areas.

Comparing gross margins

While farming is the business, lifestyle consideration is an important part of the decision making process.

Chris says that on a long term average the woodlots return a gross margin of $120 per hectare per year, the sheep return $250 per hectare per year and the cropping returns more than $350 per hectare per year. However, the family is prepared to accept a slightly lower return on crops by taking actions that encourage biodiversity both above and below the ground.

Setting priorities and making decisions around these issues is something the Langs do together.

'If I wanted to bulldoze the plantation, I'd have to put it through the group first or I wouldn't get a meal!' Chris says.

The family is committed to keeping Titanga healthy and diverse. 'We've been running around planting trees everywhere and hopefully encouraging a mixture of animals and things on the property,' says Chris. 'I didn't have any idea at the start that all this was going to be such an important issue.'

'We've got about 90 species of birds that they've found.'

Passing down a passion for the land

John and Elizabeth Nolan, with Shaun and Amanda Nolan

John and Elizabeth Nolan didn't have biodiversity in mind as they developed new farming practices on their second generation family farm. The Nolans adopted policies like zero till and controlled traffic farming to minimise the loss of soil from wind and water erosion. But they are happy to find out that additional benefits include enhancing biodiversity values on the land.

'Bindaroo' Roma, Queensland
Maranoa/Balonne Grain & Graze region
565 mm average rainfall
3642 hectares
Cattle, cropping and nursery trees

John and Elizabeth, along with their son Shaun and his wife Amanda, run the two farms as a 3642 hectare mixed enterprise. Their passion for the land led them to participate in the BiGG forum, which has given them the chance to meet other farmers who share their interest in life under, on and above the ground.

'Bindaroo' was taken up by John's father after he drew it in a 1933 land ballot. It was an unsurveyed block of 2428 hectares with a mix of timber types including brigalow, belah, wilga and bottle tree, with yapunyah (Eucalyptus ochrophloia) growing along the creek line and stands of box trees. In line with the official policies of the day, John's father cleared the block over years of backbreaking work.

'Dad had nothing,' says John. 'He couldn't borrow and the place wasn't worth anything. He just battled on with the ringbarking, making roads and digging dams by hand with his own horse team.'

While it is generally accepted that removing native vegetation alters the balance of biodiversity, John believes that the opening up of the country by his father has in fact had a positive impact on biodiversity.

'When my father went there in 1933, there was nothing around, no water and no feed,' he says. 'The native animals haven't declined since then. They've had a huge increase.'

John's father left around 12 per cent of Bindaroo uncleared, which remains today. The stands of vegetation contain a mix of all the indigenous timber types in lines and blocks and provide habitat for emus, kangaroos and wallabies.

After attending the BiGG forum, John says he realised he had already been looking after the natural diversity on the property.

Far left: John and Elizabeth Nolan
Below: Aerial photo of palms
Right: Shaun Nolan transplanting a bottle tree

'When my father went there in 1933, there was nothing around, no water and no feed. The native animals haven't declined since then. They've had a huge increase.'

'Without quite understanding what we've been doing, we've looked after the country with the tree lines, by using zero-till and trying not to flog the paddocks,' he says. 'However, I haven't understood the downstream impacts of it before. I'll pay more attention to it in the future.'

Following their passions

John and Liz are pursuing their personal passions on Bindaroo. For John, it is exploring his long standing interest in soil microbiology.

'The next step forward in agriculture will be gaining a better understanding of the animals that are under the soil rather than on top of it,' he says. 'The testing that's been done so far is really just the tip of the iceberg. Our industry needs to be pushing for an extension of this program so we can understand how to maximise the benefits of biodiversity.'

'I have so much attachment to my land.'

Liz's passion lies in ensuring the survival of indigenous bottle trees on the property and in the district. When she realised that the trees weren't regenerating naturally she decided to take matters into her own hands.

'You just don't see small trees out in our paddocks,' she says. 'The kangaroos, rabbits and cattle eat them all off. They just pull the tops off and that's the end of them.'

Already a keen gardener, Liz started her own bottle tree nursery. Over the years she has collected seeds from bottle trees all over the country, building up a stock of parent trees.

'You've got to be dedicated and passionate,' she says.

The nursery is on the verge of being an economically viable business now that Liz has learned her propagating skills by trial and error. Demand comes from home gardeners through to landscapers working in larger civic projects seeking an authentic and easily identified native Australian tree.

A shared passion

'There's one word that sums it up: passion,' says John, of what struck him about meeting other farmers at the BiGG forum.

'We're all here because we're doing innovative things on our farms and thinking about things and looking for sources of knowledge. Passion and searching. There's no silver bullet – we've just got to try and do what we believe is the right thing.'

With 65 years on the farm, the Nolans have the commitment to stick to their land for coming generations.

'I have so much attachment to my land,' says John. 'My dad battled on and battled on here. He worked on his own to achieve this. I was lucky enough to come along after that and I've put in all my working life here. My son went away to do his own thing, but now he's come back and I've got three little grandsons. We're here for the long term.'

Mimicking nature with pasture and 'no-kill' cropping

Angus and Lucy Maurice

Pasture croppers Rick and Brenda Maurice, and their son Angus and his wife Lucy, have been concentrating on creating a diverse ecosystem for years now – and the BiGG project has confirmed that they are heading in the right direction with their efforts to raise carbon levels in the soil.

'Gillinghall', Wellington, New South Wales
Central West/Lachlan Grain & Graze region
590 mm average rainfall
2500 hectares
Pasture cropping, cattle and sheep

'We've been pasture cropping and improving our grazing management for five years because of strong desire to have a healthy natural resource,' says Angus.

'Biological activity is a lot higher if you've always got something growing.'

The Maurices have been focusing on building up perennial grasses, pasture cropping and 'no-kill' cropping on their 2500 hectare cattle, sheep and cropping operation. They own 1400 hectares and lease 1100 hectares, running some 5000 dry sheep equivalent (DSE) sheep and cattle and sowing wheat, barley, cereal rye and oats.

Pasture and no-kill cropping involves sowing zero-till winter cereal crops directly into summer-growing native perennial pastures that are dormant through winter. The pasture can be grazed right up to the point of sowing and stock can be put back on the pasture after harvest to graze stubble and green perennial grasses.

The philosophy is that combining cropping and grazing into one land management system means each enterprise benefits the other. Farmers in the Central West district of NSW are also finding that it leads to measurable increases in soil carbon levels.

'One of the Grain & Graze researchers doing pasture cropping here asked us to get involved,' says Angus. 'BiGG was a chance for us to set up monitoring sites and gather some baseline data on our biodiversity that we could add to over time.'

Measuring soil carbon

The most interesting findings for Angus were the levels of soil carbon under different land uses.

'The level of soil carbon in the remnant vegetation area was up around four per cent, while our cropping paddocks were still only around 1.5 per cent,' says Angus. 'That showed us what we're missing out on and what we can aim for.

Far left: Angus and Lucy Maurice
Below left: March 2007 - Native grasses responding to rain
Below middle: Sept 2007 – Wheat crop sown into native grasses
Below right: March 2008 – Native grasses and wheat stubble

'Biodiversity provides the best opportunity we have of utilising a natural mineral cycle and removing the need for chemical fertilisers.'

'We believe the only way to get up to that level is through perennial grasses. We don't believe it's possible through a cropping program alone or through normal conservation farming. Under those systems the grasses aren't there.

'To increase soil carbon you need activity under the soil and the large amounts of roots that perennial grasses provide, plus full ground cover on the surface. Pasture cropping gives us the perennial grasses and also gives high litter levels on the soil surface, because we're constantly adding to those perennial grasses with a vigorous crop.'

Angus believes that biodiversity is a key driver of a healthy and sustainable stock and cropping system.

Carbon levels weren't the only indicators of healthy soil under the pasture cropping system. Measuring microbial activity in the soil and monitoring insects showed strong results too.

'The program monitored one paddock in which we have perennial pasture and no-kill crops,' says Angus. 'It is really trying to replicate a native system. That paddock had very high biological and insect activity – a lot higher than a traditional no-till conservation farming paddock.

'It highlighted that biological activity is a lot higher if you've always got something growing. To me it shows that the summer fallow, which is pretty standard practice in most of our cropping systems, is a good way of actually reducing biological activity.'

Angus has been involved with the Central West Conservation Farming Association, but his interest in pasture cropping is seeing him move away from traditional no-till methods.

'Traditional no-till croppers will spray out all the grasses, while we are going for improving our grasslands,' he says.

Angus's philosophy is that less interference (through chemicals or poor grazing management) means more biological activity, which means a better chance of a natural mineral cycle and low cost production system driven by good ecology.

'We are using a lot less chemicals and fertilisers. We believe that improved soil biology and health will ultimately out-perform moisture retention through chemical fallow. This summer we made decision to use no chemicals at all and let the growing plants do their thing to improve the soil.'

Angus believes that biodiversity is a key driver of a healthy and sustainable stock and cropping system.

'It provides the best opportunity we have of utilising a natural mineral cycle and removing the need for chemical fertilisers,' he says.

'BiGG strengthened our resolve to refine our production systems, and really achieve improvements in our triple bottom line. We know we still have a long way to go to achieve the level of biodiversity we desire on our farm.'

'We believe that improved soil biology and health will ultimately out-perform moisture retention through chemical fallow.'

Thanks to a pioneer who had foresight

Rachel and Jason Charles

An unusual degree of foresight in the person who originally cleared their land of native vegetation has proved a bonus for Rachel and Jason Charles, mixed farmers on 'Bendidee' near Goondiwindi.

'We've only been on the property just over four years, so I can't tell you how long ago it was originally cleared, but whoever did the initial clearing did it quite thoughtfully,' says Rachel. 'They left tree lines everywhere. Most paddocks have at least a couple of tree lines in them, either running up the side of the paddock or along the laneways.

'Bendidee' Goondiwindi, Queensland
Border Rivers Grain & Graze region
2400 hectares
622 mm average rainfall
Cropping, sheep and beef

'They are a great resource and not just for biodiversity. As far as farming goes, they provide a really good windbreak. They shelter the stock and slow the wind down so it doesn't dry out the crops as much. There are lots of benefits in having them there.'

Rachel is in a good position to understand the benefits of remnant vegetation and shelterbelts, having been a Grain & Graze coordinator before the family chose to collaborate in BiGG.

'I'm no biodiversity expert, so I believe the more you can learn, the better,' she says. 'Our farm was the right sort of typical mixed farm that was needed for the BiGG project and it was the chance to get some help from people who really knew what they were doing.'

Using gut instinct to protect the land

Jason and Rachel run 'Bendidee' as part of a larger farming business, with other properties owned by Jason's family. The business consists of two thirds stock and one third cropping, though the Charles's are aiming for a 50/50 split between the two enterprises. They have minimised their use of tillage and they rotate their stock based on weather conditions to try and reduce grazing pressure.

'We rotate the stock as much as possible, though we don't cell graze or anything,' Rachel says. 'We look at what feed is available where they are and how much feed is available ahead of them. My husband's family has always come from this region and I guess they work on a gut feeling, having done it their whole lives.

'You need to look after your stock, but you also need to look after the pastures they're on. It's been very hard in the past few years. It's been so dry that it's put pressure on everything – the livestock and the land.'

Far left: Jason and Danielle Charles - learning from Dad
Below: Steer on the last of a forage sorghum crop
Right: Danielle in a cowpea rotation crop

'Generally you don't spend a lot of time crawling around on the ground looking at insects. When you do take the time to go and look, it's amazing to see what variety is there.'

Meeting point of temperate and tropical

'Bendidee' lies in a region that already contains high levels of biodiversity, as it receives both tropical and temperate influences.

'We're at the interface between tropical and sub-tropical, so we have some cross-over of species in this area,' says Rachel. 'That is good to know, and might be something we can use for our benefit at some stage when we understand it better.

'What it has made us think about is the things that are happening in a cropping paddock compared to an area of remnant vegetation.'

'On the down side, we've had such dry seasons in the past couple of years while we've been gathering the results of soil tests and biodiversity monitoring, that I don't know how useful those figures will really be.

'It's made us think about the things that are happening in a cropping paddock compared to an area of remnant vegetation. In a cropping paddock you've got the influences of fertiliser and then times of fallow when you've got a lot more moisture in there in certain times of the year. That probably makes it an even better environment to be in for the insects and soil microbes.'

Rachel says that although she studied agriculture and worked as a Grain & Graze coordinator, she still knew very little about biodiversity.

'Generally speaking you don't spend a lot of time crawling around on the ground looking at insects. When you do take the time to go and look, it's amazing to see what variety is there.'

'I was unaware of how little fundamental baseline information we have on the natural resources around us. When we first embarked on BiGG I thought I would get a lot further along in understanding some of the relationships between agricultural systems and natural systems and how they fitted together.

'But I realised that before we can go too far in that direction, we first need to know exactly what is here and what role it plays. I didn't realise before how little we really know about that.

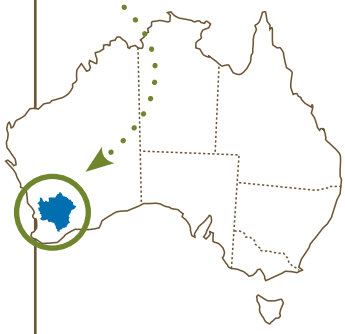
'I believe that natural resource groups and agricultural groups use different language,' Rachel says. 'What has become increasingly clear to me is that biodiversity, natural systems and agricultural systems are one in the same. The sooner we acknowledge this and that we are trying to achieve the same ends the better.

'It was good to have some affirmation that in most cases we are doing a pretty good job of looking after the land.'

'I went to the BiGG forum in Tasmania to meet other farmers who'd been involved in the project. It was good to have some affirmation that in most cases we are doing a pretty good job of looking after the land.'

Looking up by looking down

David and Fiona Lewis



Mixed farmers David and Fiona Lewis from the Kulin district of Western Australia originally became involved with Grain & Graze because they wanted to move away from a year-in year-out crop and pasture rotation that was only achieving average outcomes.

'Eighty Six Gate Farm', Kulin, Western Australia
Avon Grain & Graze region
350mm average rainfall
2800 hectares
Sheep, wheat and barley

The BiGG project was an add-on to Grain & Graze research – but the Lewis's say it has opened their eyes.

'When we fenced off our remnant vegetation, it opened our eyes to the effect that commercial land use – normal cropping and pasture – has had on the landscape,' says David. 'We realised the sheep did more damage than we thought they did.

'On the positive side, we also found out that biodiversity continues, even when we've altered the landscape.

'The soil of the remnant vegetation showed the least microbial activity compared to the areas of crop rotation and pasture. That was interesting, and we hope that it means we are on the right path with our other activities.'

'Biodiversity survives, even when we've altered the landscape.'

Understanding the reasons for this and its implications is important to both the family and to the BiGG researchers. While the microbial activity is higher in the farmed areas, this does not mean that the diversity is necessarily higher.

Three-fold returns from oil mallees

David and Fiona are collaborating farmers in the BiGG project. They use around 65 per cent of their 2600 hectare property for crops of wheat and barley, with an occasional break crop, and run sheep on the remainder.

They have fenced out several stands of remnant vegetation, which include specimens of the striking salmon gum. Stock are completely excluded from the stands.

Far left: *David and Fiona Lewis at the BiGG Farmer Forum*
Left: *Hand planting Oil Mallees*
Below: *Harvesting crops (background: Oil Mallees)*

David and Fiona have branched out from their traditional farming practices to establish their extensive oil mallee plantings on the valley floors of the property. David says planting E. loxlist oil mallees has had several benefits, protecting the soil, the lambing ewes and the farm's ecosystem.

'We've already noticed the difference in the land where we've planted alleys of oil mallee,' says David. 'The variety we've chosen isn't palatable to the sheep, which means we don't have to fence the sheep out. We plant the mallees in alleys across the paddocks and after a year the stock don't bother them at all. In fact the sheep appreciate the protection the plants provide.'

Having established the oil mallees, David and Fiona are now interested in turning their attention to their areas of remnant vegetation. David has been surprised by some of the initial findings of the BiGG research on the property.

'Our short term aim is to consolidate what we have, but we understand there is potential from increasing the levels of biodiversity across the farm. We want to continue on the path we're on and fine-tune it by finding out more about cooperation between the remnant vegetation and insects, and encourage some predator insects.

'We've always got one eye on keeping the land in good shape and looking after the surroundings, including the remnant vegetation.'

'You have to consider the feeling that comes from knowing you're not destroying something that was there before you'

Returns on investment

David recently attended a gathering in Tasmania of farmers and researchers involved in BiGG.

'It was stimulating and interesting,' he says. 'We learnt a lot about the depth of the research and the information that's being gathered on the various forms of biodiversity, such as invertebrates and birds and plants. It's quite a challenge to communicate this information to someone who hasn't been there to experience it.

'We fenced off our remnant vegetation, it opened our eyes to the effect that commercial land use - cropping and pasture - has had on the landscape.'

'It's hard to measure the bottom line of maintaining on-farm biodiversity. But you have to consider the feeling that comes from knowing you're not destroying something that was there before you. The knowledge that you're probably doing something right is important.'

Building diversity from the soil up

Geoff and Diana Chase, Stephen and Amity Chase

Geoff Chase is becoming interested in bugs – and the smaller the better. After his trip to the BiGG forum, he is keen to reduce his reliance on artificial fertilisers by building up organic and bacterial matter in his soil to increase the nutrients that are available to his plants.

'Waitara', Trangie, New South Wales
Central West/Lachlan Grain & Graze Region
5250 hectares
425 mm average rainfall
Cattle, cropping oilseeds, legumes and cereals

The Chase family property 'Waitara' is a mixed cattle and cropping business of 5250 hectares, growing oilseeds, legumes and winter cereals including canola, chick and field peas, wheat, barley and oats. The cattle enterprise consists of both commercial and stud Angus cattle.

'We're trying to find the cause and to treat it, not the symptoms.'

When he became a BiGG participant, Geoff discovered he had already been on the right track for increasing microbial activity and creating healthier soils. Some years back the family started using conservation farming techniques, including reduced tillage and retained stubble. Now, about 80 per cent of their cropping country is direct drilled and 20 per cent is minimum tilled with less than two passes by cultivation equipment.

'With conservation farming, our land is becoming softer and we have been able to sow crops in some years where it would have been impossible with a conventional approach,' Geoff says.

The Chases have also stuck to a policy of not overstocking their grazing country so as to maintain good ground cover. While the last four to five years have been tough, Geoff, Diana, Stephen and Amity made a commitment to not waiting until the last minute to look for agistment.

'One of the things I've learned is that you need to have that rest period,' says Geoff. 'Otherwise you are taking out what I call the "ice cream plants", which are the good ones the stock really like. Instead you're letting low succession plants come through, which we don't want.'

Far left: *Geoff and Diana Chase*
Left: *Cattle eating Old Man Saltbush*
Below: *Regeneration line*

Taking a close look at the soil

Geoff says that his management strategy now involves working out how to increase beneficial creatures in the soil.

'The majority of plant nutrients are in the roots of the old crop, so we're looking at moving even more into conservation tillage and leaving more plant roots in the ground,' he says. 'We'll also be trying to keep ground cover on top of the soil as much as possible.'

'I want to reduce our reliance on artificial fertilisers and make sure that microbes are available all the time for the plants.'

One tip Geoff picked up through BiGG is spraying crop stubbles with a molasses and urea mix to improve decomposition and increase the health of the soil.

'We have tried these kind of spray treatments before we struck seven years of drought,' he says. 'I'd really like to see how they will work now.'

'It is important for us to understand the role biodiversity plays in our farming and grazing practices.'

Geoff's interest in soil extends to using new technology to try and manage it better. The Chases are using a hand-held global positioning satellite (GPS) unit to more precisely understand the variability of soil health and its productive potential both within and across paddocks. A yield monitor fitted to the header as well as yield mapping can pinpoint higher and lower yielding zones within a paddock. The monitoring has identified variations in crop yield from three tonnes a hectare to nine tonnes a hectare in a single run by the header.

'I want to reduce our reliance on artificial fertilisers and make sure that micro-organisms are available all the time for the plants.'

'In some paddocks the majority of the wheat comes from just 25 per cent of the area,' says Geoff. 'This gives us enormous opportunity for gains if we can work out the reason through soil testing.'

Saltbush and vegetation

Geoff is interested in the role of vegetation in biodiversity and would like to eventually link remnant vegetation on farm with vegetation on roadsides and neighbouring properties.

He is also looking at how he can use vegetation to promote species diversity in pastures. The family has planted 150 hectares of old man saltbush. The area is divided up into 10ha blocks and rotationally grazed by the cattle, which prevents the saltbush from becoming too tall and rank for feed. Experimentation has led to relatively wide spacing between saltbush rows to maximise the amount of feed between them.

'The mix of saltbush and pasture between the rows has proved great feed for dry cows after early weaning and improved nutrition levels to ensure a good calving percentage,' says Geoff. 'The saltbush has been of great benefit to joined heifers as they do not become over-fat but stay very healthy.'

The family has calculated the stands of saltbush could pay for themselves in three years, through better cattle performance and better quality pastures due to the introduction of longer recovery periods for the grazed blocks.

'It is important for us to understand the role biodiversity plays in our farming and grazing practices,' says Geoff.

'We think monitoring our biodiversity might help us pick up on any problems early so that we can treat the causes rather than the symptoms. BiGG has given me some answers, but it has created about three or four times more questions!

'Being involved with the project has made me happy that some of the decisions we are making are heading in the right direction. It has also enabled us to be able to talk to a mix of like minded people.'

The grass comes first

David and Liz Hill

Overstocking is one of the greatest risks to Australia's native grasses, according to David and Liz Hill, who run a mixed cropping and beef business west of Goondiwindi in Queensland. The Hills have changed their attitude towards managing their cattle herd by putting the health of their native grasslands first.

'Dunkerry South', Nindigully, Queensland
Maranoa/Balonne Grain & Graze region
480 mm average rainfall
2924 hectares
Mixed cropping and beef

The Maranoa-Balonne Grain & Graze region in Southern Queensland stretches from the New South Wales/Queensland border, north to the Great Dividing Range. It has one of the most variable climates of any cropping area in Australia, creating a high-risk environment for mixed farmers, who face extremes of heat and cold as well as significant variability in rainfall.

Dunkerry South contains remnant and regrowth areas of coolibah and belah open woodland and poplar box woodland on alluvial plains. Some areas also contain cypress pine and silver-leaf ironbark. David and Liz have dealt with this risky environment by adjusting their entire enterprise to nourish and protect their native grasses, including mitchell grass and blue grass.

'We used to have a hereford breeding herd, but we got sick of building them up only to de-stock whenever we had a drought,' says David.

The couple explored providing short-term agistment for other producers, but in the end they decided the best business option for them was to buy cattle under 200 kilograms and grow them through to 450 – 500 kilograms.

'That way if the drought starts to bite again or things start to look a bit dry, we can de-stock,' says David.

David says that de-stocking the property in dry times leaves him in a strong position to capitalise on any rain that falls by getting back into the market.

'We don't want to pull the remaining standing timber. The country that hasn't been cleared is still quite productive.'

Far left: *Janna, Malcolm, Liz and David Hill*
Below: *Native vegetation-woodland, January 2008*
Right: *Coolibah tree on 'Dunkerry South' (background: zero till cultivation)*

Changing the balance of stock and cropping

The Hills follow a wheat-wheat-barley-pasture rotation for their cropping program, with David leaving in pastures for six to seven years after cropping.

'When it's time to return a paddock to the crop rotation I'm often reluctant to plough it up, especially if the grass is good,' says David. 'We are really in a marginal area for farming. Ideally we'd like to eliminate cropping completely and make a living just from the stock.'

'We've recorded more than 79 species of birds in a single birdwatching session on Dunkerry South.'

Eliminating cropping from 'Dunkerry South' would reduce the risk of crop failure and preserve the native grass species better. Bearing this in mind, David is constantly working on improving the grazing side of the business. Previously there was an open bore drain system on the property, now replaced with GABSI piping to troughs and cup-and-saucer tanks, better utilising the artesian water. The new system is also better for the cattle, as they don't need to walk more than two kilometres to find a watering point.

'It's like a sanctuary here.'

Protecting native vegetation

Their interest in native grasses led David and Liz to collaborate in the BiGG project. However, it's not only the native grasses that the Hills have decided to protect. They have kept a quarter of the property as native vegetation.

'We don't want to pull the remaining standing timber,' says David. 'The country that hasn't been cleared is still quite productive.'

The most obvious sign of Dunkerry South's biodiversity is in its bird life. The property is a popular spot for bird watchers and the well-thumbed bird identification manual is always handy in the kitchen.

'We've recorded more than 79 species of birds in a single birdwatching session on Dunkerry South,' says Liz. 'The biodiversity project recorded 76 species in the Maranoa/Balonne region in the short bird watching session during data collection.'

'We believe there are more birds because of the large number of stands of native timber,' adds David. 'It's like a sanctuary here. There are plenty of lizards and other creatures. We know they all need to be there as part of the chain.'

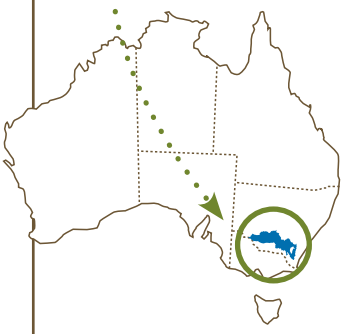
With daily evidence of biodiversity in front of their eyes, the Hills were not surprised by any of the data gathered on their property. However, David says the BiGG project is important in providing information for farmers of the future.

'Looking at nature comes naturally to us, but because we don't write down what we see, it's not considered science,' David says. 'I would like to see more scientific data collected, across all seasons and over a longer period of time.

'For those who come on to the land, the BiGG project will provide a bank of information and knowledge of how local biodiversity works and what can be achieved. If someone like my son comes back onto the land, he would be able to access that kind of backup.'

Being roped-in to trials had a positive impact

Charles Kingston, his parents John and Sue Kingston and brother David Kingston



Charles Kingston says he initially became involved in BiGG because his brother was on the committee for the Lockhart Ag. Bureau and was looking for another farm to include in the project.

But participating in trial projects such as BiGG has helped him stand back and reassess his farm practices – especially how he manages pastures.

'Yarrawah', The Rock, New South Wales
Murrumbidgee Grain & Graze region
500 mm average rainfall
1600 hectares
Cropping and sheep

Charles, his parents John and Sue and brother David run a mixed farming operation with two-thirds of the income from cropping and the remaining one-third from sheep on their property 'Yarrawah' at The Rock, south of Wagga Wagga.

As well as being a BiGG participant, Yarrawah is one of five focus farms in a joint research initiative between the Murrumbidgee Grain & Graze project and the Murrumbidgee Catchment Management Authority's (MCMA) Best Management Practices for Dryland Cropping Project, exploring the value of the grazing wheat in the farming system.

'We like to think we're forward thinking, so if we can help in trials then we're happy to do so,' says Charles.

The Kingstons crop around 1000 hectares of the property in a seven-year rotation with cereals like wheat, barley and occasionally triticale, combined with canola, before returning to a pasture of clovers, lucerne and chicory.

'To have someone collect microbes and insects and tell us what is there has been great. Now I'd like to find out a bit more about how they all fit in together.'

'We use a minimum-till system,' says Charles. 'If working the ground is necessary we'll do it, but not for the fun of it. We have limed the whole farm which improved the system dramatically and we now just apply maintenance liming at the start of the cropping rotation. We use soil tests to access available nutrients and base our fertiliser rates on a yield of 3.5 tonnes per hectare.'

Charles says that the dryland cropping program has brought about some significant changes in how he and his family manage the farm.

Far left: *Charles Kingston*
Left: *A fenced-off roadway on 'Yarrawah'*
Below: *The farm agro-forestry*

'We now rotationally graze our self-replacing merino flock and consistently lamb at more than 100 per cent of joined sheep,' he says. We use electric fences to split up the bigger paddocks and our pastures are mainly lucerne and clover based, to build up nitrogen and organic matter for the cropping rotation.'

Charles says that the rotational grazing helps keep more ground cover, which he hopes will improve biodiversity and encourage soil microbes to multiply.

Agro forestry to lift productivity on sodic country

Yarrawah has two fenced areas of remnant growth: an old billabong as well as an unused roadway, each of which have been fenced out to protect the natural vegetation.

The Kingstons have also planted tree lines for protecting soil and water. They have established a 15 hectare agro-forestry lot containing red gums, which was planted with grants provided by the Murrumbidgee Catchment Management Authority (CMA). The agro-forestry plantation aims to lift productivity levels on sodic country. Trees aged between four to five years are between five and 6.5 metres high and have been pruned to improve potential timber quality.

While the economic productivity of the red gums is the overall goal, Charles would like to explore how he can develop other tree resources in the emerging carbon credit trading market.

'I see spraying insecticides as one of the worst things to do on a farm.'

'I believe a big thing in the future with biodiversity is going to be carbon credits,' he says. 'Our first lot of agro-forestry was done through the CMA and in return for the grants we signed over the carbon rights from those trees. But we've got plenty of other areas that we could sign up for carbon credits. I believe it's going to become more profitable in the future.'

BiGG monitoring confirms farm direction

While the dryland cropping program has influenced him to make specific farm management changes, the findings of the BiGG monitoring on Yarrawah has confirmed many of the choices Charles has made.

The BiGG project has monitored four different sites, in autumn and spring for the past two years.

'I was quite surprised to see that biodiversity levels didn't vary much between the four different types of paddocks,' says Charles. 'I thought the cropping paddocks would have the least diversity, the remnant vegetation the most and the pasture paddocks would be somewhere in between.

The BiGG researchers suggest, however, that data may be saying as much about the condition of the remnant vegetation as about the biodiversity in the farmed land. However, even poor quality remnants provide important habitat for many plants and animals, including beneficial invertebrates that may provide integrated pest management services, particularly in regions where remnant vegetation has been cleared from the landscape.

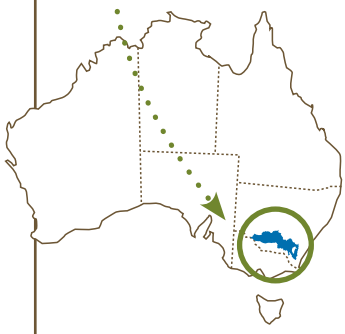
Charles agrees that caution is needed. 'This was encouraging, as I had always thought our use of chemicals would be affecting biodiversity more. However I certainly recognise that this is only a small sample of what's in our paddocks and we will be killing some beneficial creatures by our actions.

'What I'd like to get out of BiGG is a better understanding of beneficial insects, to try and nurture them so we don't have to spray as much. I see spraying insecticides as one of the worst things to do on a farm.

'It's been very thought provoking. To be honest I'd never really looked to see what was there in our remnant vegetation. To have someone collect microbes and insects and tell us what is there has been great. Now I'd like to find out a bit more about how they all fit in together.'

A family tradition of nurturing country

Chris Lott



The recent run of dry years on his property 'Caringal' has brought into focus the advantages of native vegetation, according to third generation mixed farmer Chris Lott.

Chris, one of the collaborating farmers in the BiGG project, says that initially he was reserved in his opinion of what the study could provide. However, after attending the BiGG forum and hearing some of the results of the information collected from his and the other 46 properties involved in the program, he can see its worth.

'Caringal', Narrandera, New South Wales
Murrumbidgee Grain & Graze region
450 mm average rainfall
4800 hectares
Sheep, beef and irrigated crops

'After only two years of gathering information the results aren't concrete yet,' says Chris. 'I think they need another couple of years, but I can see it's probably worthwhile in what the project is moving towards.

'It's helped me to consolidate my thoughts about where I'm going with rotational grazing, improved fencing, small paddocks and basically getting more value out of my remnant vegetation and native grasses.'

Chris runs a flock of 5000 medium wool merinos, based around wonga bloodlines. He previously agisted cattle, but with the drought he has taken the opportunity of buying angus heifers which have been joined and will form the nucleus of a self replacing herd.

With the advent of a soft commodity boom, Chris also plans to make cropping of greater importance in the enterprise, sowing both oats and barley on the majority of the 1200 hectares used for cropping. He intends to stop growing rice and concentrate his irrigation water resources on growing forage crops and lucerne, which will then be used in his livestock business for grazing.

Generations of nurturing

About one-third of Caringal's 4800 hectares consists of undeveloped native grasses and wooded vegetation, thanks to the farming practices of previous generations of Chris's family.

'My grandfather disliked ploughing up the country,' says Chris. 'He nurtured a lot of the country and we've continued with that. We haven't overstocked or pushed the country. Maybe I should have pushed it harder, but I didn't and it's held us in good stead.'

Far left: Chris amongst white Cyprus Pine. Photo by Nicola James

Below: Showy Foxtails (known as pussy tails) - a perennial herb. Photo by Sheila Lee

Right: Black Box within a Lignin Swamp. Photo by Chris Lott

'It's the ongoing management of the land that produces the outcomes. A healthy landscape leads to good biodiversity outcomes.'

The main advantage of this stock of undeveloped native vegetation is that during the drought the Riverine summer grasses provide feed for cattle.

'Late last year and earlier this year the native grass and herbages, which consist of spear grass, windmill grass and herbages such as tar vine, were producing green shoots,' says Chris. 'With the native green grass coming out it supported quite a good herd of angus cattle. They were fat, even in the drought.'

Chris's involvement in BiGG has helped him see the potential for extra value from his summer grasses. He values his native pastures and would like to lift stocking rates if possible. As a consequence, Chris is experimenting to see what opportunities there are to increase production from these sites without negatively impacting on this natural resource.

Chris has also undertaken a NSW Department of Primary Industries Prograze course. He says that the ideas he learned in the course will form the foundation for his rotational grazing program. His first step is to begin improving the fencing of smaller paddocks.

'With the native green grass coming out it supported quite a good herd of angus cattle. They were fat, even in the drought.'

'The mix of native vegetation I've got needs grazing management,' says Chris. 'I've moved away from a set stocking scenario. Now I'm allowing it to move forward and seed before I put the stock in to graze.'

Chris has found that the spatial analysis conducted as part of BiGG is pointing towards a number of tangible benefits from remnant vegetation. He plans to explore these further and develop his existing remnants by creating wildlife corridors and small saltbush paddocks for drought reserves.

He is adamant that the work of nurturing the landscape is an ongoing one – he cannot afford to rest on his grandfather's laurels.

'Generational nurturing alone wouldn't have produced what is here today,' Chris says. 'It's the ongoing management of the land that produces the outcomes. A healthy landscape leads to good biodiversity outcomes.

Letting the grass – and the microbes – grow under their feet

Craig and Donelle Forsyth

Craig says the decision to get out of cropping altogether was the turning point for biodiversity on 'Avoca', his 3600 hectare farm in Dongara WA.

Around the turn of the century, Craig and Donelle realised they needed to make some changes at Avoca. Their soils – gravel sands, deep poor sands and sand over clay – were not sustaining healthy crops. The couple was battling herbicide resistance, water logging and disease – particularly in lupins, which were an important part of the cropping enterprise and provided a break between wheat crops.

'Avoca', Dongara, Western Australia
Northern Agricultural Grain & Graze region
450 mm average rainfall
3600 hectares
Cattle and perennial pastures

'We believe that healthy soils breed healthy people and with healthy people you have healthy communities.'

In Craig and Donelle's favour was the fact that Craig had planted rows of the tree legume tagasaste in the 1980s and 90s. In the late 1990s he had added perennial summer grasses to the pasture mix. Craig believed he could establish a grazing enterprise that drew on perennial grass paddocks, annual pasture and tagasaste, with stock rotating between the three feed sources.

'Our perennial grasses were the catalyst for getting involved in BiGG,' says Craig. 'It was a natural progression to move from perennial grasses to finding out more about biodiversity. I'd always been interested in microbial activity in the soil and BiGG was a chance to learn more about it.

'Initially there was a "tree-hugging" aspect to getting involved in BiGG. It was something we felt good about. But once we become involved, we realised how much we didn't know. We were ignorant about what's happening below the surface.'

Getting the right balance

The Forsyths' decision to become a collaborating farm with BiGG has reinforced their decisions to change the direction of their business.

'The biggest surprise was the number of invertebrates we've got,' says Craig. 'The monitoring found lots of spiders on the farm. We're told that spider populations are the basis of a healthy environment.

'When we start working out which species of trees harbour the predators better and things like that then we can go another step and use that knowledge for integrated pest management.

'We are realising the importance of every bit of living matter that's in the ground. We like the thought of microbial activity below the soles of our shoes.'

Far left: Craig Forsyth

Left: Carnaby cockatoos enjoy their daily lunchtime perch in the trees near the Forsyth's house

Below: Cattle grazing a perennial grass paddock sown in Spring 2007. Carnaby cockatoos in background

'We've always been talking about sustainability but I think we've got to go one step further than sustainability and talk about regeneration.'

Perennial grasses as the basis of the new farm system

Committing 100 per cent of the enterprise to grazing wasn't an easy decision to make. The Forsyths tackled the problem of raising large amounts of capital by entering into a share profit alliance with several other pastoralists. Craig and Donelle's profit is calculated by the amount of weight gained by the pastoral cattle that they finish for export between April and October.

This has given them a strong incentive for maximising the amount of feed on the property. They set up a wagon-wheel cell grazing system that criss-crosses 2800 arable hectares, providing 54 paddocks, each with access to one of eight watering hubs. Each wagon wheel paddock has a combination of perennial grass paddocks, annual pasture and tagasaste.
They currently turn off around 1500 cattle.

Craig sowed the first subtropical perennial grass pasture in 2001. He has now established about 700 hectares of subtropical perennial grasses including gatton panic, signal grass and fine cut rhodes grass. Most of the perennial grass sowings have been successful, with those paddocks showing good species diversity and high levels of ground cover. Eventually Craig and Donnelle would like to see their whole farm under perennial grasses.

'We are realising the importance of every bit of living matter that's in the ground.'

The increase of ground cover has increased the number of dry sheep equivalents (DSE) carried during the summer. A decade ago some paddocks on Avoca were lucky to run 1.5 to two DSE per hectare. Now they can carry five DSE per hectare.

'The beauty of the perennial grasses is that they also improve annual grass production,' says Craig. 'There is a symbiotic relationship occurring. The perennials improve species diversity and microbial activity because they provide increased ground cover over summer, which keeps the soil cooler, and capillary action which moves moisture closer to the surface.

'As long as you've got green matter in the soil you've got moisture coming towards the surface. I believe that's why we've got an improvement in the microbial and microfauna aspects.'

The great unknown

BiGG has provided Craig and Donelle with greater motivation to improve their farm management.

'After BiGG, one of the main things is I'm trying is improving my grazing management,' says Craig. 'Really I'm trying to improve in every area – ground cover, wildlife flora and fauna corridors, linkages between remnant veg and so on. We are making sure we keep a cover on the soil and keep and area set aside for our endangered species.

'We've had it in the back of our minds to do these things but BiGG has reinforced that and proved it can be done without affecting productivity.

'Like anything in life there needs to be a balance. But we do believe that healthy soils breed healthy people and with healthy people you have healthy communities,' Craig says.

'We've always been talking about sustainability but I think we've got to go one step further than sustainability and talk about regeneration.'

thank you

The research team would like to take this opportunity to thank all the BiGG farmers listed for your contribution to the Biodiversity in Grain & Graze project. Over the past two years you have very generously allowed us free access to your properties to undertake surveys for various plants and animals. We hope that the information that we can provide back to you is of value, and that the links that have been developed through this project are maintained.

We appreciate your support for the project and have been overwhelmed with the level of interest you have shown, particularly at the forum in Hobart in January 2008. We feel that BiGG has created its own Australia-wide community, a strong mixture of farmers, regional catchment management officers and researchers. The combined knowledge of this community has enhanced the project beyond that which any single group could have achieved alone. For this contribution we thank you and we hope that further collaborations will be possible in the future.

This booklet is a celebration of your important role as land managers in BiGG.

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Maranoa Balonne, Qld
Charles & Sarah Nason
John & Elizabeth, Shaun & Amanda Nolan
Ken & Lyn Rigney
David & Liz Hill
Andy & Roz Arthur

Photo by Craig White

Think... BiGG

by Roma Parker, BiGG farmer

The date it was set for Grain and for Graze
To gather together for three busy days
For Hobart is – a joy for us all
To head and to gather and answer the call

To all Project Officers – for some, a long way
The emails with info were sent – no delay
With timetables and housing were all to be found
The details for the Conference was passed on around

Professor Ted gave us an overall view
Of the project, the data in a pyramid stew
Kerry and Peter outlined the task further
With obvious points, delivered with fervour

It was soon discovered by introducing ourselves
That we're like minded farmers – and not off the shelves!
Our passions and worries for each of our farms
The stories we could each tell to the length of our arms

From grasses to cattle and crops in the ground
And sheep and trees, the birds and the hounds
But the underlying factor for all of us here
Was the droughted conditions for many a year

Richard's explanation of the things to be done
Was clear and specific and questions were none
We compared and we shared the meaningful stuff
'Til he did say – "enough is enough!"

So, after a cuppa we broke from the ranks
And learnt 'bout info from many data banks
The mites on the cotton strips tested and strained
While data of bird species were collated and named

The soils and aerial maps were dutifully plotted
With every "T" crossed, and "I" 's were all dotted
The bugs and the spiders were viewed through the scope
While Margy enlightened with many a joke

Richard he gave us a list of the questions
That we were to discuss and have meaningful sessions
So laden with paper and pen we adjourned
To the grasses, the steps and wherever we turned

The groups were all solid in areas nearby
Giving opinions and thoughts to the appointed young scribe
How quickly the time as it flew to the sky
As the members discussed the solutions and why

At six we all gathered to go on a bus
To the top of the mount and be there before dusk
Our dinner and the Cascades – a tidy clean brew
Set us up for the pace, and a joke or a few

Up early the next day we were ready for Curringa Farm
Where we were treated very well and came to no harm
Their thoughts and their actions gave us plenty of thought
As the temptations to eat more was poorly unfought

Now Nigel used questions to probe our ideas
And consider the options and not just the fears
To work out the strats when applied to our land
From the dream to the hope to the overall plan

Our trip to the east coast was a quiet affair
With many a-nodding and dreams to compare
With acres of grasses and lots of tall trees
Including a beach and a whole lot of bees

We heard of Tom's dreams and Cynthia's passion
And many decisions in future – need thrashin'
Our hearts go to them as they work for their place
And hope to survive and wear a brave face

At night for the dinner we were treated like kings
As we sat and discussed some in depth things
The BiGG project was first on our minds
As we nibbled and chatted and checked out the vines /
(sucked on the wines)

The information given and gathered within
Our minds and agendas for future decisions
The proof of its worth and meaningful gain
For all of us here as we return on the plane

The time in Hobart has drawn to an end
As we pack all our cases and 'round the last bend
Our appreciative thanks we offer this team
We consider their abilities – ***the sciences' cream***

Grain & Graze
Profit through knowledge

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