Carbon Farming

Climate Change and Carbon Economy Extension in SA Arid Lands

Project Background

As Australia seeks ways to reduce Greenhouse Gas (GHG) emissions there are potential opportunities for businesses and landholders to participate in the Australian and global carbon market place. There are a range of environmental and pastoral production co-benefits that can flow on from Carbon Farming activities.

The SA Arid Lands Carbon Farming Project

As part of a broader on-property diversification theme, the Climate Change and Carbon Economy Extension in the SA Arid Lands project (the SA Arid Lands Carbon Farming Project) was funded by the Australian Government to explore the potential for carbon farming in the arid rangelands of South Australia.

The project focused on four broad objectives:

1. Provision of a decision support tool.
2. Increase understanding of the Carbon Farming Initiative (CFI) and participation in Emission Reduction Fund (ERF) projects by landholders through feasibility and case studies.
3. Increase the capacity of regional networks in the pastoral regions of SA.
4. Removal of barriers to participation in the ERF.

What is carbon farming?

Carbon farming is any change to agricultural or land management practices that can reduce greenhouse gas emissions such as nitrous oxide and methane, or store additional carbon in vegetation and soils.

These changes in practices can provide benefits to landholders including the earning of Australian Carbon Credit Units (ACCUs), through the ERF – which can be sold and provide another income stream to landholder – as well as increased profitability, production and biodiversity.

Decision Support Tool

The *Rangelands Enterprise Diversification Decision Support* tool (REDDS) was developed to enable comparative analysis of pastoral enterprises. In 2016 twelve SA Arid Lands pastoral properties used the tool to explore the viability of carbon farming on their properties. Feasibility studies were undertaken on properties representing beef, meat sheep or wool sheep herds in each of the main land systems.

Carbon Farming Scenarios

For each enterprise "business as usual" (BaU) was established in REDDS to accurately reflect what was occurring at the time of the feasibility study workshop. BaU represented an analysis of the current pastoral enterprise parameters. Tables were produced for each year, resulting in a cost of production for each kilogram of meat or wool grown. This information was then used to model future scenarios for the selected enterprise operating on that property and make comparisons between enterprises such as beef vs sheep or wool production vs carbon farming activities.

For modeling and comparison purposes, information from each enterprise was standardised with the same seasonal sequence and commodity prices applied to each scenario and run over 10 years.

Carbon sequestration and emissions reduction projects were modelled for each enterprise with standard settings for land area, setup and running costs. Scenarios took into consideration carbon uptake rates according to the land system in use, applying CENTURY modelling, Farm-GAF and Sheep-GAF modelling as well as the seasonal and stocking variations.

Data from these scenarios was then reduced to kg/CO_2^e/hectare or $ per hectare for the purposes of comparison with sheep or beef production.

A carbon price of $10 and $40/tonne of Carbon Dioxide equivalent (CO_2^e) was modeled and results from the studies were averaged and grouped into five types of pastoral operations:

- Large beef cattle enterprises >150,000ha
- Small beef cattle enterprises <20,000ha
- Small wool enterprises <50,000ha
- Large wool enterprises >150,000ha
- Meat sheep

Sequestration of carbon

Occurs on farming land when vegetation, normally trees, is allowed to grow thus removing CO_2 from the atmosphere. For every tonne of wood produced 3.67 tonnes of CO_2 are taken out of the atmosphere.

Herd emissions reduction

Sheep and cattle emissions include a range of Green House Gasses (GHG), the major one being methane. These can be reduced through management actions and the resultant decrease in emissions used to earn Australian Carbon Credits (ACCUs)

Study Assumptions

- That carbon sequestered will be allowed under the *Pastoral Land Management and Conservation Act 1989* and owned by the lessee.
- That suitable methods for carbon sequestration will exist for use in regions of rainfall of less than 200mm.
- That herd emission reduction methods will be available for sheep enterprises in arid regions.
- Pastoral production remains the primary business of each property
- Carbon sequestration rates were adjusted over the base rate of the bio-regions to reflect management actions on the part of the landholder:
  - High Stocking rate: nil/ha/yr
  - Medium (50% destocked): 0.128t/ha/yr
  - Destocked (100%): 0.275t/ha/yr
  - Destocked + environmental works (e.g. soil rehydration programs): 0.366t/ha/yr
- Our modelling took into consideration loss of productivity from destocking.

Study Standards:

Except for two very small properties, all sequestration models were run over 10 years using a paddock size of 17,000 ha that is sub-divided into:

- o 10,000 ha 100% destocked
- o 6,000 ha 50% destocked
- o 1,000 ha 50% destocked with environmental works (e.g. soil rehydration programs)

A standard setup cost of $344,000 was applied to all scenarios for fencing the 17,000ha sequestration area. This cost was spread over 25 years. Running costs, including management, audit and reporting of $40,000 were applied to each sequestration project at each year of issuance of ACCUs.

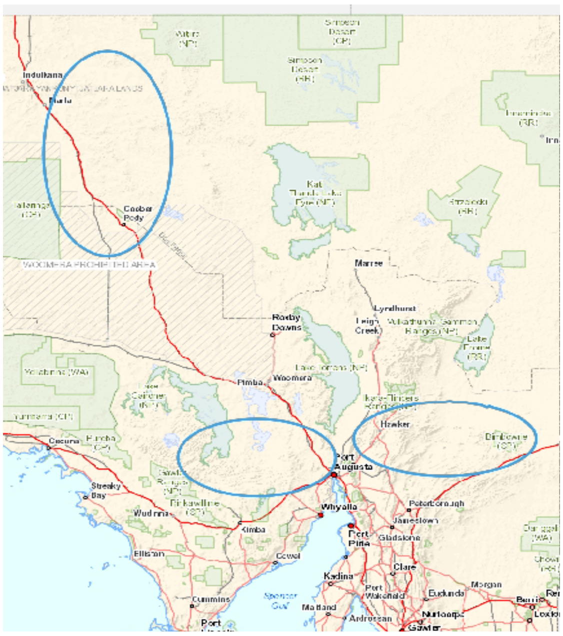
Herd emissions reduction modelling was run for 10 years with annual management and auditing costs of $2,000 applied. Note this was our best estimation based on the likely size of a project in this region. Many carbon companies will work on a percentage of the income or a dollar per tonne of CO_2^e to manage an emissions reduction project.

The stock weights used were those provided by the landholder for good, fair, poor and bad years of production.

Enteric and manure methane emissions were included in the modelling.

Seasons were defined as good, bad, or fair by the landholder and did not always refer to total rainfall. For example, a bad year might be when rain arrived at the wrong time, not when the rainfall was low.

The same sequence of good, fair and bad years were modelled over 10 years for all properties.



Regions where carbon feasibility studies were undertaken

Summary

The Studies

Workshops were held on pastoral properties over two days, using the Rangelands Enterprise Diversification Decision Support (REDDS) tool.

Day one concentrated on the use of REDDS and entering all the property's stock and financial information. At the end of the day a "business-as-usual" or base file was produced which provided a snapshot of the business economics and the base information for future "what if" scenarios in the REDDS modelling. A key element of the first day was to get REDDS to produce Key Performance Indicators (KPIs) around the cost of production for each property. At the end of the day an anonymous copy of the base file was made for use in this study.

Day two included carbon farming training, before running "what if" scenarios. These scenarios included different stocking arrangements such as sheep vs cattle, opening or closing sections of the property, developing water points or tourism enterprises. The carbon sequestration or emissions reduction elements of REDDS were then turned on to see what potential these offered the landholder. Carbon farming activities were treated as another enterprise within REDDS. This enabled comparison between production of wool or meat with carbon farming.

Case study scenarios were then produced using the base files from the participating properties. Each enterprise file was standardised with the same seasonal sequence of good, bad and fair years, the cost of carbon activities and areas of land under carbon farming.

The enterprise details, rainfall, land systems, stocking rates, cost of production and figures from the landholders input were not changed, except to ensure anonymity. The REDDS program was then run over 10 years with a carbon price of $10 and $40 / t CO_2^e. Outcomes were then averaged between several similar types of properties.

Sequestration of Carbon

A standard "paddock" of 17,000ha was modelled for sequestration using a natural regrowth method. The same costs were applied to all properties. Some smaller properties had to have the project area scaled to allow for pastoral production to continue. The same annual seasonal sequence was run for all properties. Resulting numbers are indicative only as wide variations were noted depending on factors such as the local micro climate and the local carbon base line.

It was found that carbon sequestration results could be "manipulated" in our modelling if landholders applied a sequence of poor years as a base line. This suggests that a sequestration project becomes more viable if landholders enter the market after a run of poor years.

Modelling of the income from carbon sequestration resulted in large variations between properties, ranging from losing money per year after costs, to as much as $19,300 (at $10/t CO_2^e).

Fencing remains the greatest setup cost for sequestration projects in this landscape. The large areas required to gain a small return on carbon meant we had to factor into our model 52kms of fencing to keep out cattle, sheep, and camels for each project.

Sequestration positives

- A lot of land is available, and some properties have areas that are rarely grazed due to lack of suitable water for stock.
- Rapid responses of native vegetation to good rainfall years is possible.
- If land chosen for a sequestration project has suffered historical over-grazing, a recent fire or run of poor years, it will have a low carbon baseline making for better returns than we modelled.

Sequestration limitations

- Managing long fence lines to keep out opportunistic grazers (rabbits, goats, camels, sheep and kangaroos) is expensive.
- Seasonal variations can result in little vegetation growth in some years.
- When fires occur in the arid lands they can be large scale and very difficult to control.
- Currently no sequestration methods have been trialled for these land systems or rainfall regions.
- Planting or cultivating vegetation is not allowed on pastoral properties so natural or human induced regrowth methods are the only ones that could be applied.
- Ownership of the carbon right on Pastoral Leasehold land has not been resolved and currently rests with the Crown, not the pastoral lessee.
- Low returns for carbon farming. In some modelling the annual interest on a loan to set up the carbon sequestration project was almost as much as the income from the carbon credits earned.

Cost of production is the key

While the carbon price influenced the businesses we modelled, it was also clear that focussing on the costs of producing the carbon can make the profit margin higher even if the carbon price is low. For example, one enterprise showed nearly 80% of the income from carbon (at $10/t) would be taken up in the fencing set-up costs and project running costs (audits, paper work and feral animal management). This left a margin of less than 20%. In this case reducing production costs by 20% could result in a doubling of the profit margin.

Our modelling demonstrated that viability of carbon farming will always depend on the structure of the pastoral business (debt levels, over-heads etc.) as well as the relative price of other commodities. For example, if wool prices drop, carbon becomes comparatively more viable. Alternatively, if carbon sequestration costs can be reduced, carbon farming also becomes more viable against other products.

Above all, if landholders want to consider diversification to other products including carbon, they must have a good understanding of their current business, especially their cost of production.

Emissions Reduction

Our modelling of emissions reduction activities on pastoral properties was based on the Beef Herd Management Method and emissions estimations for sheep herds in dry country. It assumed the landholder would undertake management practices to reduce methane output from their herd through improved health of animals, modified grazing practices, improved genetics, controlled breeding, weening programs and reduced lifetime for animals.

The base lines and resulting outputs from the modelling were subject to wide variations depending on the seasons and land systems modelled.

The costs applied to the modelling of emissions reduction activities were the same for all properties as were the seasonal sequencing. The only variables were the land system and the size of the herds.

Emissions reduction positives

- The relatively small herds we examined (<2,000 animals) could produce an average income of up to $4,500 at $10.00 per ACCU.
- Almost all activities resulting in reduction of GHG emission from cattle and sheep mirrors best practice pastoral production and had co-benefits of better animal growth, healthier animals and faster turn off rates, thus increasing the profitability of the business
- The process of analysing the pastoral business to achieve reduced emissions can also result in efficiencies and reduction in cost of production

Emissions reduction limitations

- Access to the Emissions Reduction Fund auction process requires a minimum bid of 2,000t CO_2^e per year. This cannot always be achieved in the SA Arid Lands region due to the size of the herds involved.
- Anecdotal evidence from the carbon industry indicates that herd sizes of over 100,000 cattle are most viable as management/audit costs are absorbed over more animals and larger tonnages of CO_2^e reductions can be offered to the market place Therefore aggregation of smaller holdings and herds will be required in the SA Arid Lands region.
- Lack of accurate herd records including weights for animals in this region will be a hindrance to operating emissions reduction projects.

Glossary

GHG – Green House Gasses. Those emissions from human activity that contribute to warming of the atmosphere by trapping infra-red radiation.

CO_2^e – Carbon dioxide equivalent. There are many different GHG's and their impact in the atmosphere is different. The potential for impact is called their Global Warming Potential. For example, the Global Warming Potential of methane is 25 times that of CO_2 therefore stopping one tonne of Methane getting into the atmosphere has the same effect as stopping 25 tonnes of CO_2. To make trading in GHG possible, all gasses are expressed in terms of a standard Carbon dioxide equivalent. 1 tonne of Methane is equal to 25 t CO_2^e.

ERF – Emissions Reduction Fund. The Emissions Reduction Fund is the Australian Government Program that provides incentives for a range of organisations and individuals to reduce their emissions. Participants in the ERF can earn Australian Carbon Credit Units (ACCUs) for emissions reductions.

ACCUs – Australian Carbon Credit Units. A tradable commodity representing 1 tonne of CO_2^e either removed from the atmosphere (sequestered) or stopped from entering the atmosphere (emissions reduction)

Method – in the context of this document a 'method' is a set of rules that outline how to undertake a carbon project and calculate the emission reductions from activities. Methods are legislated by the Australian Parliament.

DSE – Dry Sheep Equivalent. Is a standard unit used in Australia to compare the feed requirements of different classes of stock or to assess the carrying capacity and potential productivity of a given farm or area of grazing land.

REDDS- Rangelands Enterprise Diversification Decision Support tool. Developed for this project to capture cost of production figures on properties and model variable seasons and management scenarios including carbon

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Government of South Australia
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