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Carbon Farming Extension and Outreach:

Case Studies for Farmers and Land Managers

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Australia's Independent
Farm Policy Research Institute

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Executive Summary

The Australian Government provided grant funding to the Australian Farm Institute (AFI) to develop decision support tools to support participation in carbon farming activities. The decision support tool development project included video production, case study analysis, training presentation materials and an online question and answer portal. The aim of the case study analysis was to support key messages from the video and extension materials. Additionally, the case studies were to provide a step-by-step decision support tool which covered sheep, beef and grains enterprises. The four carbon farming case studies were to be suitable for use with farmers and land managers, and be made available to relevant advisors, Australian Government program communication networks and extension officers as informative resource materials.

The development of four carbon farming case studies involved gathering information from farms with different enterprises in different locations, including;

- Farm-1: Beef cattle breeding and sheep farm in North East Victoria
- Farm-2: Cropping and sheep farm in Central Southern New South Wales
- Farm-3: Sheep farm in the Southern Tablelands of New South Wales
- Farm-4: Beef cattle breeding and store cattle farm in the Central Highlands Northern region of Queensland

The carbon farming case study analysis was conducted using the Australian Farm Institute's FarmGAS Calculator, an online tool which estimates greenhouse gas (GHG) emissions output for farm scenarios. The FarmGAS Calculator provided estimates of GHG emissions based on the accounting method used by the Australian Government Department of the Environment's National Greenhouse Gas Inventory reporting requirements. The carbon farming case study analysis involved estimating each farm's GHG emissions and conducting hypothetical scenario modelling by using the FarmGAS Calculators Scenario Comparison Tool.

The carbon farming case study analysis identified three potential GHG emissions reductions for each farm (see Table 1). The hypothetical scenarios which provided the largest amount of GHG emission abatement for each farm, were as follows;

- Farm-1: Switch from a dominant beef cattle farm business to a dominant sheep meat-breeding farm business; resulting in 80% sheep and 20% cattle at constant levels of dry sheep equivalent (dse) based on existing farm and livestock production factors.
- Farm-2: Planting trees on 20% of grazing land and maintaining the trees for 100 years.
- Farm-3: Planting trees on 10% of grazing land and maintaining the trees for 100 years.
- Farm-4: Applying a dietary supplement to cattle feed that reduces methane emissions.

The main objective in developing carbon farming decision support tools was to inform farm businesses managers about ways to reduce GHG emissions through carbon farming activities. However, for a carbon farming activity to include a project methodology (emissions reduction scenario) which is approved by the Australian Government under the current policy, the project

methodology needs to formally demonstrate that it will reduce overall GHG emissions and be additional to the business as usual farming activities. Carbon farming project approvals are administered by the Australian Government's Clean Energy Regulator. The case study analyses presented in this report showed that numerous hypothetical scenarios would reduce GHG emissions output. However, the challenge remains to develop an approved carbon farming project methodology for an emissions reduction activity that is applicable for the sheep, beef cattle and grains farm businesses that were involved in these case studies.

Table 1: Greenhouse gas emissions reductions scenario comparisons for case study farms

Farm case study	Description of farm GHG emissions abatement scenarios	Percentage annual change from current farm GHG emissions
Farm-1	Dietary supplement used in cattle feed which reduced methane emissions from the beef cattle herd by 20%.	-16%
	Switch from a dominant beef cattle farm business to a dominant sheep meat-breed farm business.	-25%
	Planted an environmental tree lot; 400 ha or 10% of total farm area.	-7%
Farm-2	Application of a nitrogen fertiliser inhibitor which reduced nitrogen volatilisation from fertiliser by 90%.	-1%
	Switched from lambing in autumn to lambing in spring and lambs were weaned two months earlier.	-3%
	Planted a portion of grazing land to an environmental tree lot; 74.4 ha or 20% of total grazing area.	-7%
Farm-3	Increased lambing percentage by 5%, weaned lambs at two months and sold young sheep earlier at 10 months of age.	-1%
	Reduced the time period for trading wethers on farm from 12 months to nine months.	-5%
	Planted an environmental tree lot; 53 ha or 10% of total farm area.	-16%
Farm-4	Dietary supplement used in cattle feed which reduced methane emissions from the beef cattle herd by 20%.	-19%
	Improved beef cattle breeding genetics to reduce methane emissions by 15%.	-3%
	Restricted the time period for carrying store cattle on-farm to nine months.	-1%

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Background

The Carbon Farming Initiative (CFI) was established by the Australian Government in 2011 to allow farmers and land managers to voluntarily participate in carbon markets through earning carbon credits by storing carbon or reducing GHG emissions on the land [1]. The CFI also encouraged carbon farming activities that provided environmental benefits such as sustainable farming practices.

The CFI was amongst a number of measures introduced by the Australian Government to assist with meeting Australia's GHG emissions reduction obligations under the Kyoto Protocol, which is an agreement established under the United Nations Framework Convention on Climate Change (UNFCCC), whereby signatory nations have committed to reduce national GHG emissions through to 2020.

In November 2012, the Australian Government made available Extension and Outreach grant funding from 2011–12 to 2016–17 to support increased participation in carbon farming activities. The Extension and Outreach program aims to deliver information that is clear, consistent and current to farmers, land managers and their key influencers using a mix of traditional and new extension methods[2].

According to the Australian Government Department of Agriculture, the Extension and Outreach activities that were supported by the program included;

- providing technical information and support about integrating carbon management into whole farm planning and farm performance
- sharing new research and farm techniques for the property and farm business
- increasing communication resources and channels available
- creating tools and information systems to improve knowledge of land sector emissions
- enhancing productivity and environmental sustainability.

The current Australian Government, which was elected in September 2013, has announced it will merge the CFI with the Emissions Reduction Fund (ERF). The ERF is a central component of the Government's Direct Action Plan climate policy. Essentially, the ERF will be an incentive-based approach aimed at supporting Australian businesses in lowering their energy costs and increasing their productivity, while at the same time reducing Australia's GHG emissions.

[1] Australian Government Department of the Environment, *Carbon Farm Initiative*, accessed 28 March 2014, available at http://www.climatechange.gov.au/reducing-carbon/carbon-farming-initiative
[2] Australian Government Department of Agriculture, *Extension and Outreach*, accessed 28 March 2014, available at http://www.daff.gov.au/climatechange/carbonfarmingfutures/extensionandoutreach

Project objective

The primary objective of this extension project was to develop decision support tools to help inform farmers about participation in carbon farming activities. This project was to deliver a series of extension resources to inform and educate farmers, land managers and their influencers about GHG emissions, carbon policy, on-farm emissions reduction opportunities and participation in carbon farming. As part of this project, the Australian Farm Institute was required to collect industry (farm related) data to create step-by-step case studies which align with key messages in other extension materials such as videos and training presentations.

Report structure

The remainder of this case study report is structured as follows:

Project methodology – details the case study farm business identification process, data analysis and scenario modelling that was adopted in this assessment. The project methodology also provides information about the Australian Farm Institutes FarmGAS Calculator.

Farm business case studies – provides an overview of the individual farm, the current farm emissions output estimates and potential GHG emissions reduction options for each farm. The farm case study section also details each farmer's feedback on the GHG emissions reduction scenario modelling.

Project methodology

The research initially involved the identification of a number of case study farm businesses. The aim was to identify four farms covering sheep, beef and grains enterprises throughout eastern Australia. The Australian Farm Institute identified farm case study locations based on the regions that would offer efficient and effective video production opportunities. In consultation with a video production company, it was decided that a northern Victoria to Southern and Central New South Wales road trip would encompass all three enterprise requirements with the potential to interview decision-makers for three individual farm businesses. It was then decided that the geography of the case study interviews could be broadened by including northern Queensland as a fourth farm case study region.

The Australian Farm Institute then contacted industry representatives in those regions, and after some discussion on likely candidates four farm businesses were identified:

- Farm-1: Beef cattle breeding and sheep farm in North East Victoria
- Farm-2: Cropping and sheep farm in Central Southern New South Wales
- Farm-3: Sheep farm in the Southern Tablelands of New South Wales
- Farm-4: Beef cattle breeding and store cattle farm in the Central Highlands Northern region of Queensland

Phone and/or email contact was made with each farmer to outline the case study objectives, confirm their participation and detail the level of commitment required. General farm information and production data was then obtained for each participating farm and GHG emissions reduction scenarios were discussed. Subsequently, the Australian Farm Institute determined three hypothetical GHG emissions reduction scenarios for each farm that included different types of farm practice changes, capital development projects and technology investment.

The development of four carbon farming case studies was accomplished by using the FarmGAS Calculator for estimating GHG emissions output. The FarmGAS Calculator's Scenario Comparison Tool was used to evaluate the selected case studies GHG emissions output estimates for the current farm and GHG emissions reduction scenarios. The FarmGAS Calculator is an online tool developed by the Australian Farm Institute for estimating GHG emissions from agricultural enterprises.

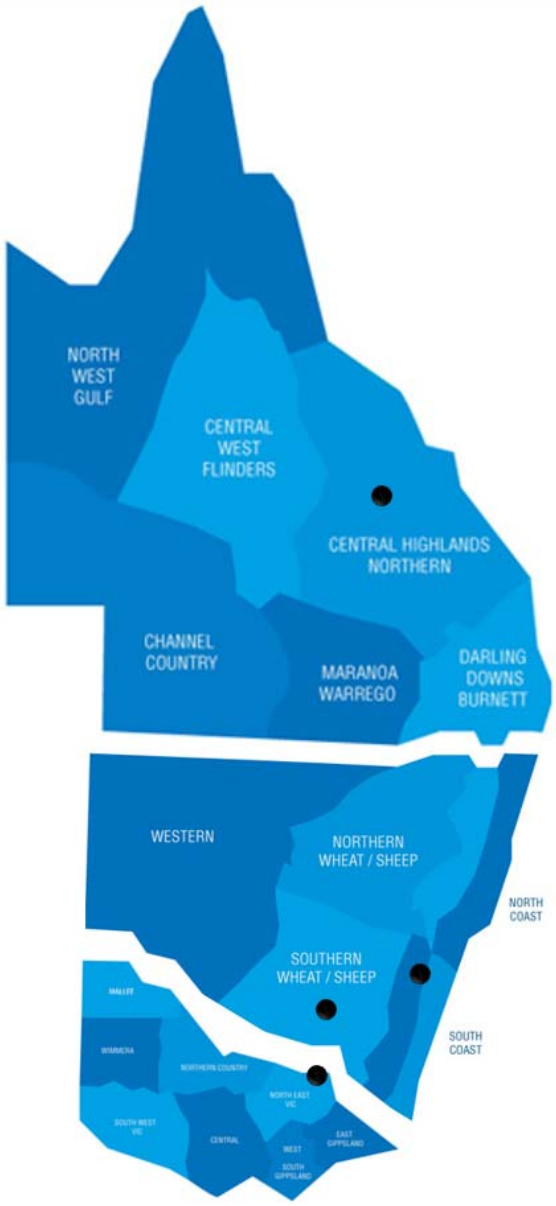
FarmGAS Calculator emissions output estimates are based on the internationally accepted GHG accounting methodologies that are used by the Australian Government Department of the Environment to estimate emissions from the agricultural sector at the national level. The details of the emissions calculation methodology are provided on the following website: http://www.climatechange.gov.au/climate-change/greenhouse-gas-measurement/national-greenhouse-and-energy-reporting. The FarmGAS Calculator modifies this methodology to facilitate GHG estimates at a specific farm level. The FarmGAS Calculator is described in detail on the following website: http://www.farminstitute.org.au/calculators/farm-gas-calculator.

This case study report was then prepared to assist with informing and educating farmers, land managers and their influencers about on-farm emissions reduction opportunities.

Farm business case studies

The four case study farm businesses that were involved in this analysis were located in eastern Australia. The specific location for these farms included one farm in the border region of Victoria and New South Wales (NSW), one farm in the southern wheat sheep region of NSW, one farm on the southern tablelands of NSW and one farm in the central highlands northern region of Queensland (*see Figure 1*). These farm businesses combined provided a diversity of farm enterprises including beef cattle, sheep and grains.

*Figure 1: Farm business case study locations across eastern Australia**



* The black dots indicate farm business case study locations. Note: map is not drawn to scale.

Farm-1 case study: Beef cattle and sheep farm in north east Victoria

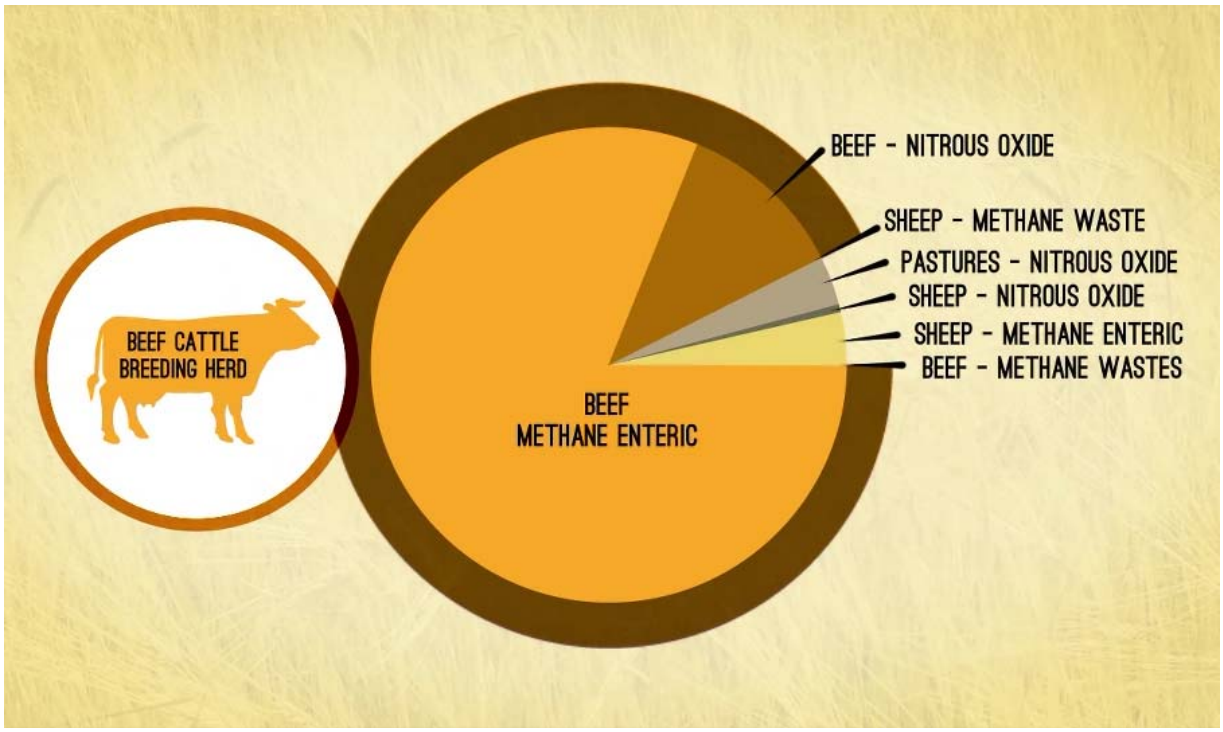
Summary

Farm-1 is 4,166 hectares and consists of mainly alluvial river flats and mountain grazing land on the eastern border region of Victoria and NSW.

The farm enterprises include a beef cattle breeding herd of more than 1,500 cows and a flock of 600 breeding ewes.

The FarmGAS Calculator estimated that the total annual GHG emissions from Farm-1 were 6,162.43 tonnes of carbon dioxide equivalents (CO_2-e). The FarmGAS Calculator estimated that the majority of GHG emissions output from Farm-1 was enteric methane from the beef cattle breeding enterprise (*see Figure 2*).

Figure 2: Greenhouse gas emissions breakdown by enterprise and by type of emissions for Farm-1.



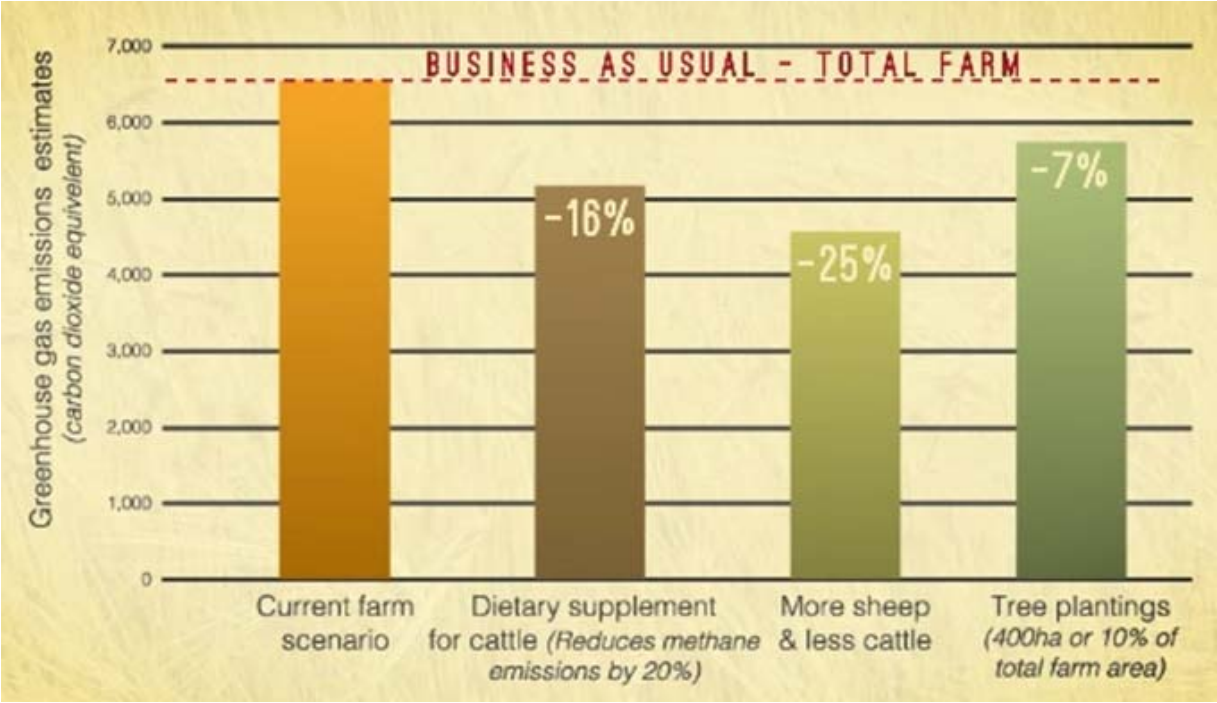
Scenario modelling for Farm-1

The FarmGAS Calculator was used to compare three hypothetical project scenarios to the current farm operation (whole farm comparisons). The assumptions for these scenarios were as follows;

1) Application of a dietary supplement which reduced methane emissions from the beef cattle herd by 20%
2) Switch from a dominant beef cattle farm business to a dominant sheep meat-breeding farm business; 80% sheep and 20% cattle at constant levels of dse
3) Plant trees on a portion of grazing land; 400 ha or 10% of total farm area.

The GHG emissions reduction modelling which included three different scenarios estimated that an enterprise change to running more sheep and less cattle provided the largest amount of GHG abatement (*see Figure 3*). This scenario was also based on existing livestock and production factors for Farm-1.

Figure 3: Greenhouse gas emissions reduction modelling of hypothetical scenarios for Farm-1



Farmers feedback on scenario modelling for Farm-1

The decision-makers for Farm-1 provided feedback on each scenario as follows;

1) Dietary supplement for beef cattle:

- This technology sounded exciting to the farmer but would require a thorough cost analysis on this specific farm before implementation
- There would also need to be a clear understanding as to how beef consumers would feel about this technology before implementation

2) Changing enterprise structure in order to run more sheep and less cattle:
- The farmer was interested in hearing about how these types of changes can reduce GHG emissions output. The farmer also understood that this scenario is a general farm management decision and is not likely to be a carbon farming project that could generate credits under a carbon crediting scheme
- Due to a wild dog problem in the local area this scenario would require significant investment in wild dog management before it could be implemented

3) Tree plantings:
- Some tree plantings have already occurred on this farm and the farmer sees a lot of benefits not only for carbon farming but for biodiversity and soil erosion control
- Tree plantings on this farm however are costly to implement due to the amount of manual labour required in the establishment phase. For further tree plantings on this farm, there would need to be more incentives that could offset upfront costs.

Farm-2 case study: Cropping and sheep farm in central southern New South Wales

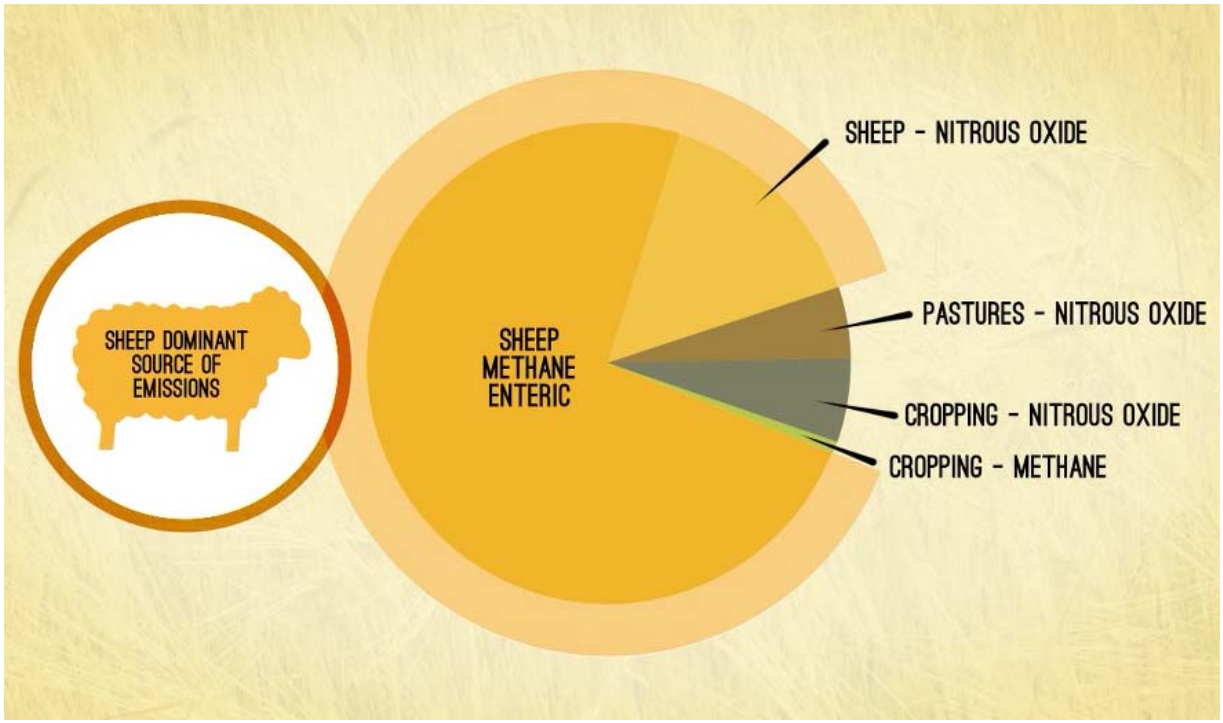
Summary

Farm-2 is an aggregation of farming properties that covers an area of 1,488 hectares and consists of mainly undulating cropping land in central southern New South Wales.

The farm enterprises include a winter cropping rotation that plants 1,100 hectares of crop each year (including grain crops) and a flock of merino sheep with more than 2,800 ewes.

The FarmGAS Calculator estimated that the total annual GHG emissions from Farm-2 were 1,283.43 tonnes of CO_2-e. The FarmGAS Calculator estimated that the majority of GHG emissions output from Farm-2 was enteric methane from the sheep enterprise (*see Figure 4*).

Figure 4: Greenhouse gas emissions breakdown by enterprise and by type of emissions for Farm-2.



Scenario modelling for Farm-2

The FarmGAS Calculator was used to compare three hypothetical project scenarios to the current farm operation (whole farm comparisons). The assumptions for these scenarios were as follows;

1) Application of a nitrogen fertiliser inhibitor which reduced nitrogen volatilisation from fertiliser by 90%
2) Switched from lambing in autumn to lambing in spring with lambs being weaned two months earlier than usual
3) Planted trees on a portion of grazing land; 74.4 ha or 20% of total grazing area.

The GHG emissions reduction modelling estimated that planting trees on 20% of the grazing land provided the largest amount of GHG emissions abatement compared with other the hypothetical scenarios that were evaluated (*see Figure 5*).

Figure 5: Greenhouse gas emissions reduction modelling of hypothetical scenarios for Farm-2.

Farmers feedback on scenario modelling for Farm-2

The decision-makers for Farm-2 provided feedback on each scenario as follows;

1) Switch from autumn to spring lambing and wean lambs at two months:
- The farmer was interested in hearing about how these types of changes can reduce GHG emissions output. The farmer also understood that this scenario is a general farm management decision and is not likely to be a carbon farming project that could generate credits under a carbon crediting scheme
- The farmer preferred that lambing occurred in autumn as this timing fitted in with cropping activities from a labour and pasture availability perspective

2) Tree plantings:
- The farmer could see benefits with tree plantings and this scenario would be considered if permanence obligations were less than 50 years
- The farmer was concerned about the permanence obligations for sequestration projects as international scientific standards require a 100 year commitment to achieve carbon sequestration

3) Nitrogen fertiliser inhibitor:

- Although the nitrogen fertiliser inhibitor only reduced whole farm emissions by 1%, the fertiliser inhibitor technology did reduce the cropping enterprise GHG emissions by 11%
- However, the farmer had concerns that the potential cost of the manufactured fertiliser technology may outweigh the benefits on this specific farm.

Farm-3 case study: Sheep farm in the southern tablelands of New South Wales

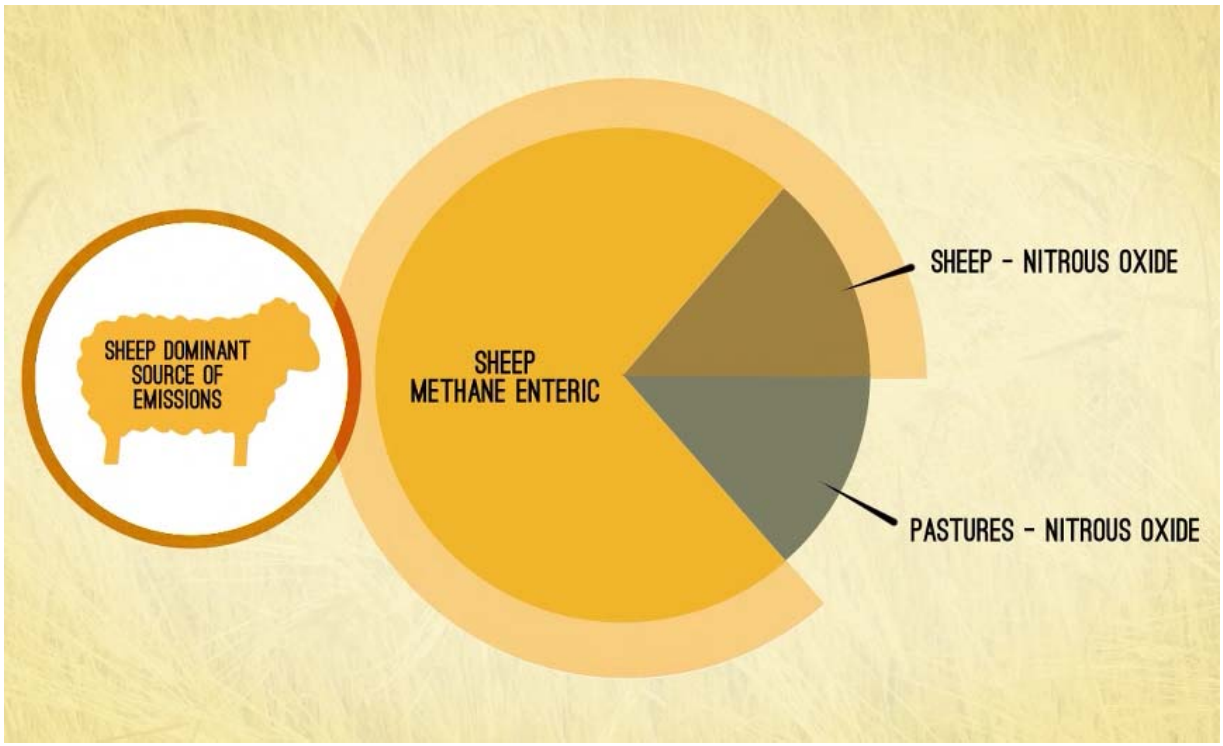
Summary

Farm-3 is 530 hectares and consists of grazing land in the southern tablelands region of New South Wales.

The farm enterprises include a merino breeding flock of more than 1,200 ewes.

The FarmGAS Calculator estimated that the total annual GHG emissions from Farm-3 were 362.84 tonnes of CO_2-e. The majority of GHG emissions output from Farm-3 was enteric methane from the sheep enterprise (*see Figure 6*).

Figure 6: Greenhouse gas emissions breakdown by enterprise and by type of emissions for Farm-3.



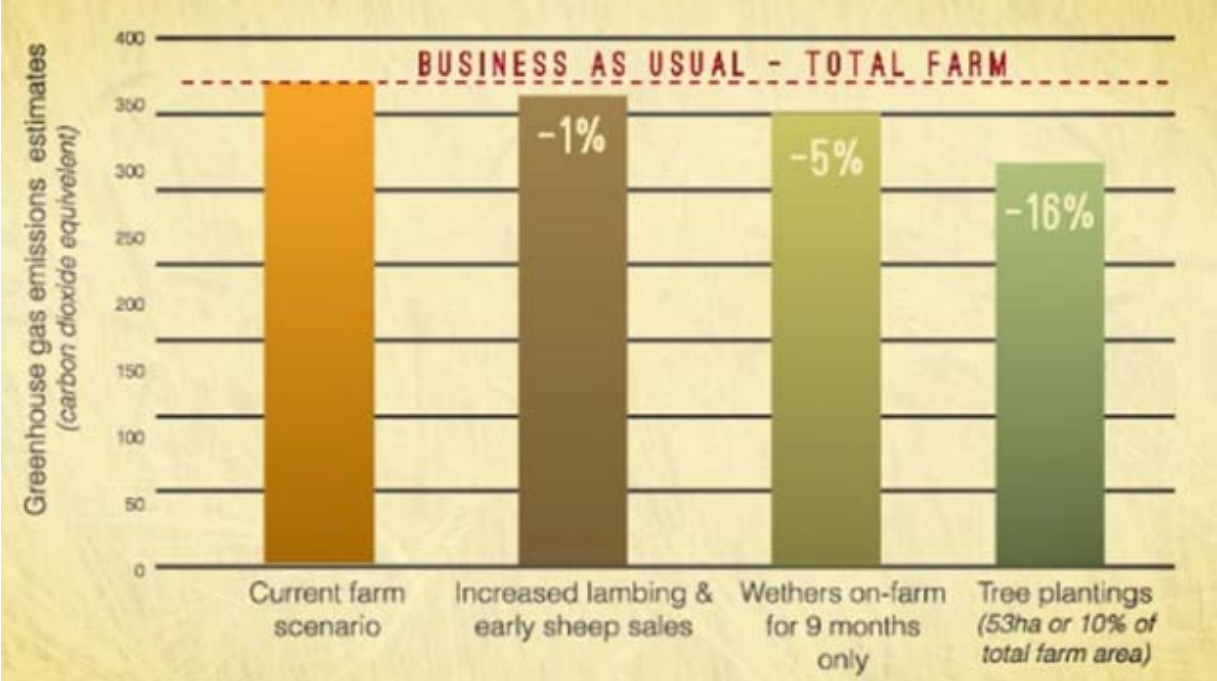
Scenario modelling for Farm-3

The FarmGAS Calculator was used to compare three hypothetical project scenarios to the current farm (whole farm comparisons). The assumptions for these scenarios were as follows;

1) Increased lambing percentage by 5%, weaned lambs at two months and sold young sheep earlier at 10 months of age
2) Reduced the time for trading wethers on farm from 12 months to nine months
3) Planted trees on a portion of grazing land; 53 ha or 10% of total farm area.

The GHG emissions reduction modelling that involved planting trees provided the largest amount of GHG emissions abatement when compared to the other hypothetical scenarios that were evaluated (*see Figure 7*).

Figure 7: Greenhouse gas emissions reduction modelling of hypothetical scenarios for Farm-3.



Farmers feedback on scenario modelling for Farm-3

The decision-makers for Farm-3 provided feedback on each scenario as follows;

1) Switch from autumn to spring lambing, increase lambing and sell sheep earlier:

- The farmer was interested in hearing about how these types of changes can reduce GHG emissions output. The farmer also understood that this scenario is a general farm

management decision and is not likely to be a carbon farming project that could generate credits under a carbon crediting scheme

- The farmer was open to changing lambing/selling practices if these changes provided additional benefits in emissions reductions

2) Change enterprise structure for wethers to be on-farm for nine months only:

- The farmer was interested in this scenario and also understood that this scenario is a general farm management decision and is not likely to be a carbon farming project that could generate credits under a carbon crediting scheme
- The farmer would look at a sheep trading scenario on this farm if it provided additional benefits in emissions reductions

3) Tree plantings:

- The farmer could see benefits with tree plantings and this scenario would be considered if permanence obligations were less than 50 years
- The farmer was concerned about the permanence obligations for sequestration projects as international scientific standards require a 100 year commitment to achieve carbon sequestration.

Farm-4 case study: Beef cattle breeding and store cattle farm in the Central Highlands Northern region of Queensland

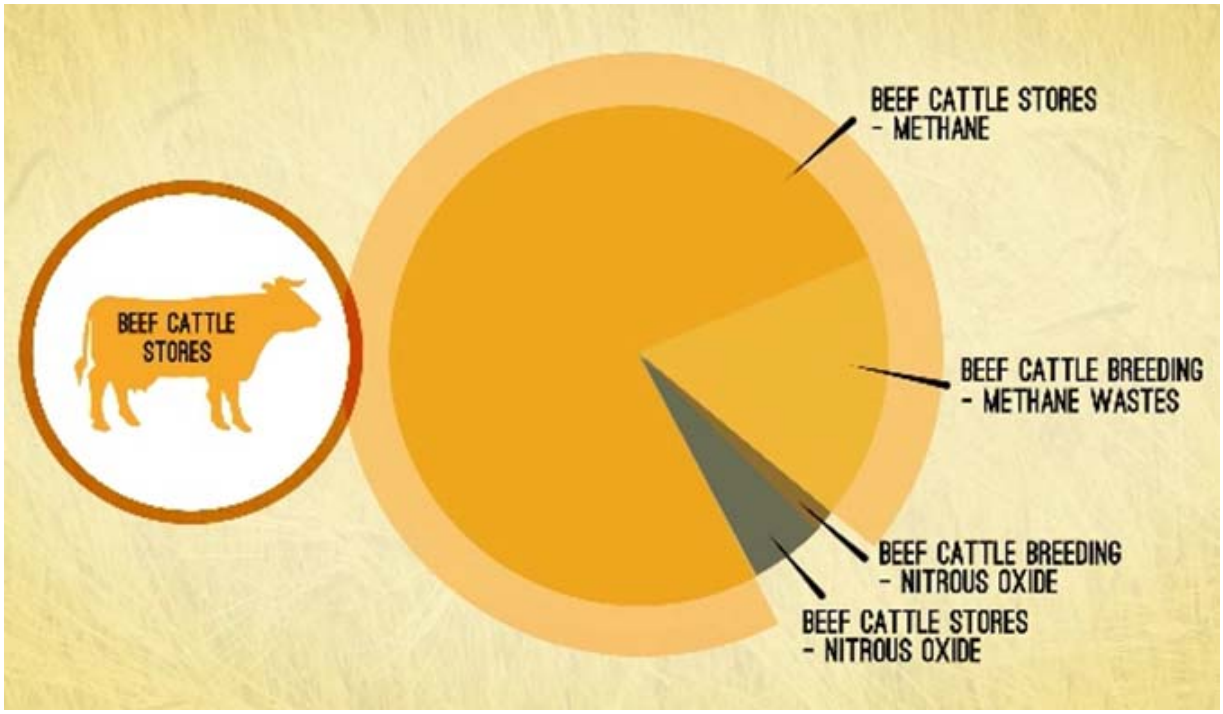
Summary

Farm-4 is 16,119 hectares and consists mainly of sub-tropical grazing land in the central highlands northern region of Queensland.

The farm enterprises include a beef cattle breeding herd of more than 2,000 cows and a store cattle enterprise of up to 4,400 young cattle.

The FarmGAS Calculator estimated that the total annual GHG emissions from Farm-4 were 6,194.95 tonnes of CO_2-e. The FarmGAS Calculator estimated that the majority of GHG emissions output from Farm-4 was enteric methane from the store cattle enterprise (*see Figure 8*)

Figure 8: Greenhouse gas emissions breakdown by enterprise and by type of emissions for Farm-4.



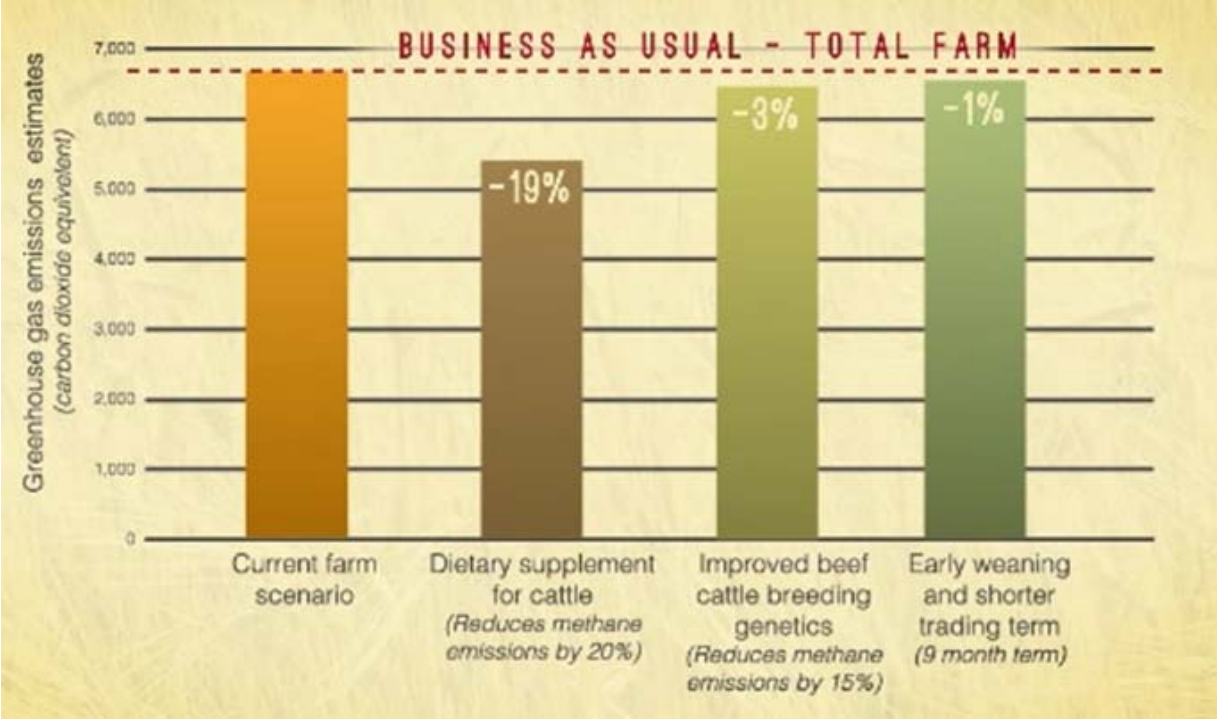
Scenario modelling for Farm-4

The FarmGAS Calculator was used to compare three hypothetical project scenarios to the current farm operation (whole farm comparisons). The assumptions for these scenarios were as follows;

1) Application of a dietary supplement in cattle feed which reduced methane emissions from beef cattle herd by 20%
2) Improved beef cattle breeding genetics that reduced methane emissions output by 15%
3) Restricted the time for trading store cattle on farm to nine months.

The GHG emissions reduction modelling estimated that a dietary supplement in cattle feed provided the largest amount of GHG abatement when compared to the other hypothetical scenarios that were evaluated (*see Figure 9*).

Figure 9: Greenhouse gas emissions reduction modelling of hypothetical scenarios for Farm-4.



Farmers feedback on scenario modelling for Farm-4

The decision-makers for Farm-4 provided feedback on each scenario as follows;

1) Dietary supplement for beef cattle:
   - This technology sounded exciting but would require a thorough cost analysis on this specific farm before implementation
2) Improved beef cattle breeding genetics that lower methane emissions:
   - The farmer was interested in hearing about research being undertaken in cattle breeding for lowering methane emissions output
   - However, the farmer was concerned about the practicality of this scenario as it might impact the productivity developments already achieved with breeding beef cattle on this specific farm
3) Shorter trading period for store cattle herd:
   - The farmer was interested in hearing about how these types of changes can reduce GHG emissions output. The farmer also understood that this scenario is a general farm management decision and is not likely to be a carbon farming project that could generate credits under a carbon crediting scheme