BASS COAST
Landcare Network

Case Study
Adapting to Climate Change

Anne & Bob Davie, Beef Producers

Areas of concern

- methane emissions
- nitrous oxide emissions
- energy consumption
- water security & quality
- waste to landfill

Action Taken

- energy, waste & water audit
- breeding & culling for feed conversion efficiency
- trial dietary oils in feed
- rotational grazing
- trial variety of pasture species
- smudging after grazing
- recycle silage wrap
- water siphoning
- wind & solar power
- careful fuel use
- mix saline water from aquifer to extend dam water
- silicon film to cut evaporation
- continued tree planting

Benefits

- more productive stock
- more secure water supply
- reduced carbon footprint
- assisting researchers to develop best practices for Australian agriculture

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Who:	Anne and Bob Davie
Where:	"Bimbadeen", Ventnor, Phillip Island
Size:	188ha (144ha pasture, 24ha vegetation, laneways, buildings, dams)
Enterprise:	Beef (Angus & Brangus breeding stud, & Enviromeat suppliers). Currently 266 head
Soil:	Three main soil types: red volcanic, heavy black and loam/clay
Aspect:	Low & undulating, with a northerly aspect from the house. Around 40 ha on the lower slopes are salt affected as a result of clearing in the middle of last century

Anne and Bob Davie are preparing themselves for a future where farmers will be required to audit their on-farm activities, and account for their impacts on the environment.

They have already implemented an ISO 14001 complaint environmental management system (EMS) to identify and manage their business's environmental impacts.

They are also enthusiastic participants in the Western Port Greenhouse Action and Resource Efficiency Project. They have undertaken a comprehensive audit of their on-farm activities, and are striving to reduce their greenhouse gas emissions (GGEs) and waste to landfill, and improve water efficiency.

As part of the Project, Anne and Bob are trialling a variety of different strategies for reducing methane emissions from stock, and nitrous oxide emissions from soils.

They are collaborating with scientists and other researchers so that data from the trials can be collected and evaluated. This information will form the basis of future recommendations to help farmers reduce their carbon footprint, and improve production and profitability.

Already, Anne and Bob have reported significant gains through breeding for feed efficiency and good pasture management.

They've also reduced their reliance on mains water for stock, by using a bore, and reducing evaporation by using a protective silicon film on their dams.

Finally, they have taken a series of simple steps to reduce their fuel and energy consumption which is saving money as well as reducing their carbon footprint.

Photo: Jenny O'Sullivan

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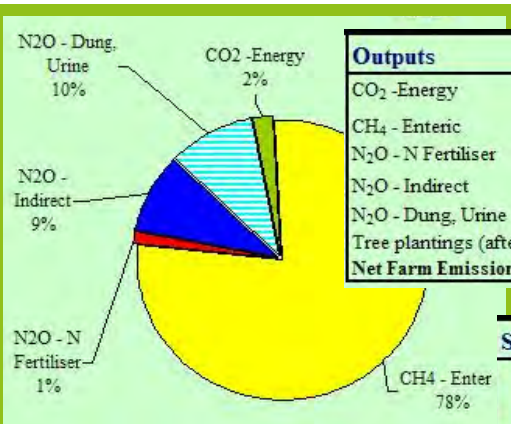
On-farm greenhouse gas emissions

Enteric methane (methane emitted from the intestine) (CH_4) accounts for most of Australia's agricultural greenhouse gas emissions, followed by nitrous oxide (N_2O) lost from fertilisers, animal excreta and soils.

Methane and nitrous oxide are potent greenhouse gases, having significantly more global warming propensity than carbon dioxide (CO_2).

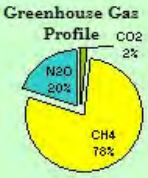
They also represent losses of energy – and therefore productivity – from the farming system. Methane in particular represents a significant loss of dietary energy that could be converted into milk production or weight gain. The loss of nitrogen as N_2O represents a loss of a valuable nutrient.

Typically, enteric methane represents between 70-80% of the total greenhouse gas emissions (measured as CO_2 equivalent) produced by a beef or dairy enterprise. Methane is produced by microbes in the rumen utilizing surplus hydrogen (H) and is lost to the atmosphere via belching and flatulence.



Outputs	t CO2e/farm
CO_2 -Energy	6
CH_4 - Enteric	214
N_2O - N Fertiliser	4
N_2O - Indirect	25
N_2O - Dung, Urine	27
Tree plantings (after 1990)	-70
Net Farm Emissions	**206**

Summary	t CO2e/farm
CO_2	6
CH_4	214
N_2O	56



Anne and Bob's farm emissions totalled 206 tCO2e (tonnes per CO2 equivalent), after the carbon savings from tree plantings since 1990 were taken into account. The breakdown of emissions was typical for a beef enterprise.

"Cattle that produce less methane put on weight quickly, and with less feed. The faster the weight gain, the quicker we can turn them over. That means less overheads for each kilogram of meat that we sell."

N_2O accounts for between 15- 20% of the typical beef or dairy enterprise's GGEs. N_2O is lost from soils as a result of animal excreta (particularly urine), fertiliser use and cultivation. Key factors affecting N_2O losses in grazing systems are high nitrate (NO_3) levels, and poor soil aeration (particularly waterlogged soils).

Carbon dioxide from fuel and energy use accounts for the remainder of emissions in a livestock enterprise. Dairy enterprises typically have greater CO_2 emissions than a beef enterprise, due to energy use in the dairy shed.

Breeding to reduce GGEs

Research indicates that highly productive animals are generally low emitters of methane, suggesting that breeding and culling for feed conversion efficiency is a worthwhile strategy for reducing methane.

Anne and Bob use high-Breedplan bulls and take advantage of GeneStar DNA testing on their AI bulls to maximize feed efficiency & tenderness.

This means that cattle reach slaughter weights earlier, resulting in reduced lifetime emissions per animal and proportionately less animals producing methane and excreting nitrogen. This should also lead to animals that are able to use more of their feed intake for production, and less to nitrogen excretion, which will reduce N_2O emissions.

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Feeding to reduce GGEs

Diet is believed to play an important role part in reducing methane and nitrous oxide losses. Methane producing microbes thrive on high fibre-low digestibility diets (eg poor summer pasture), while nitrogen losses are greatest when diets are high in protein but low in energy (eg lush spring pasture).

Higher quality forage is more easily digested and spends less time in the rumen. It also encourages higher performance allowing farmers to finish off stock more quickly or achieve greater milk production over an extended lactation period. Similarly, providing feed with a higher energy to protein ratio results in less nitrogen being excreted in the urine.

Anne and Bob are adding vegetable oils to the diet of an experimental mob of eight steers and three bulls as part of a feed efficiency trial.

Anne and Bob use homegrown silage through summer to provide higher quality feed to their cattle and feed molasses to improve digestibility.

They have also begun trials of two supplements, Grape Marc©, which is a by-product of the wine industry, and vegetable oil. Both products are high in dietary oils which have been shown to reduce methane emissions and increase milk production in dairy cows.

Grape Marc is also high in tannins which have been shown to reduce both methane production and urinary nitrogen excretion in dairy cows.

Feed tests are being carried to determine how much supplement will be needed at various times of the year to increase the total dietary oils to the recommended level of 6%.

Researchers will be testing new pasture species for their ability to utilise nitrogen, and their protein-to-energy ratio.

The supplements are being added to the feed of an experimental mob of eight steers and three bulls, which have been matched to a control mob of nine steers and three bulls of corresponding weight and sires. Both mobs will be weighed at intervals to establish the cost benefit ratio of using the supplements*.

Managing pasture to reduce GGEs

Improving pasture quality can help improve digestibility and therefore reduce enteric methane.

This can be achieved through better plant selection, and good pasture management. Anne and Bob are trialling a new pasture mix (Triple Octane©) which comprises three ryegrass varieties (crusader, barbaria and ohau) for improved feed utilization.

The mix should last for three to four years resulting in less N_2O losses via cultivation (the Davies avoid tillage, preferring to direct sow into pasture wherever possible). Researchers will test the mix for its ability to utilize nitrogen, and its protein-to-energy ratio, to determine whether it can help reduce nitrous oxide emissions.

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The Davies have also been increasing the variety of species in their pasture. This promotes thicker pasture cover, and increases organic matter which boosts soil fertility.

Anne and Bob rotationally graze over short intervals (usually a couple of days per paddock) to maintain good pasture cover. Trials will also be conducted to determine the effect that longer pasture rotations have on pasture quality and digestibility.

Bob favours adding minerals and supplements (like copper, cobalt and selenium) to the stock's drinking water.

Managing nutrients to reduce GGEs

Anne and Bob soil test regularly, and apply trace elements to correct deficiencies rather than synthetic fertilisers. Bob adds minerals and supplements to water troughs wherever possible, and also favours the use of licks.

This reduces handling and stress on the animals to maximize meat quality (as Enviromeat suppliers, it is critical that the Davies' carcasses achieve strict Meat Standards of Australia (MSA) grading). It also increases the likelihood of intake by the animals.

The Davies minimize nitrogen use by taking advantage of the nutrients contained in the cattle's dung and urine. They calculate the nutrient value of the manure on volume, based on stock numbers and grazing intervals.

After grazing, Bob smudges each paddock to put the nitrogen back into the soil and encourage even pasture growth.

Anne and Bob avoid grazing seasonally wet paddocks as hoof impaction on waterlogged soils creates the anaerobic conditions that encourage N_2O emissions.

The introduction of dung beetles also helps cycle nitrogen through the soil-plant- animal system and reduce N_2O emissions.

Smudging after grazing with a mat made of tyres chained together is an effective way of spreading the effluent - and therefore the nitrogen—evenly around the paddock.

Reducing energy consumption

Emissions from fuel and electricity use comprise only a fraction of Ann and Bob's total GGEs. Nevertheless, they have taken several steps to reduce their energy consumption which has reduced their carbon footprint, and also saved them money.

They have begun siphoning water from their dams rather than pumping, have installed a Quantum© heat pump for domestic use and have re-insulated their house.

They use one windmill and are looking into installing solar pumps. They are also careful with their fuel use, and use the smaller tractor or the four-wheeler wherever practical.

"They're fairly simple things, yet they've all made a difference," says Bob.

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Tree Planting to offset GGEs

Anne and Bob were able to offset 70 tCO2e through the thousands of trees they have planted over the past nineteen years. Their target has been a minimum of 2500 trees with ground cover per year.

Photo: Jenny O'Sullivan

Tree planting plays an important role in the Davies' whole farm management. The trees will also be valuable as an offset if a carbon emissions tax is imposed on agriculture.

The trees are an important business asset, providing shade and shelter for stock. This means that the cattle require less water in summer, and less feed in winter. The trees have also helped lower the water table and counter the salinity problems affecting the property.

Saving Water

Anne and Bob have reduced their reliance on mains water for stock by using a bore, and have been experimenting with mixing dam water with saline water from an aquifer on Bimbadeen.

All but three troughs can be supplied by the siphon for nine months of the year. Copper, cobalt and selenium are added to the supply for animal health.

They have also begun using Aquatain©, a protective silicon film, on their dams to reduce evaporation. While it's difficult to quantify the savings (the manufacturers claim that it can reduce evaporation by up to 50%), Bob believes they have been considerable.

Conclusion

Anne and Bob are taking positive steps to prepare their business for the impacts of climate change, and any future tax on emissions. Their goal is to reach carbon neutrality, which may also have marketing advantages for their meat.

They are also taking a leading role in helping researchers develop best management practices to help other farmers create more sustainable businesses.

Importantly, Anne and Bob have shown that strategies to reduce emissions and improve water efficiency can bring real productivity gains to any faming business.

**All supplements are carefully checked to ensure that they do not contain contaminants or prohibited substances, and do not breach the Restricted Animal Health regulations.*

Resources & links to other information

- *BCLN Fact sheet 5 (methane)*
- *BCLN Fact sheet 6 (nitrous oxide)*
- *BCLN Fact sheet 3 (Evaporation & seepage control)*
- *BCLN case study: Thomas (water wise farming (dairy)*
- *Greenhouse calculators and additional information available:*
  - *www.greenhouse.unimelb.edu.au*
  - *www.dairyingfortomorrow.com*
  - *www.farminstitute.org.au*
- *www.bimbadeenbrangus.com.au*
- *www.enviromeat.com.au*
- *www.bullsemen.com.au*

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