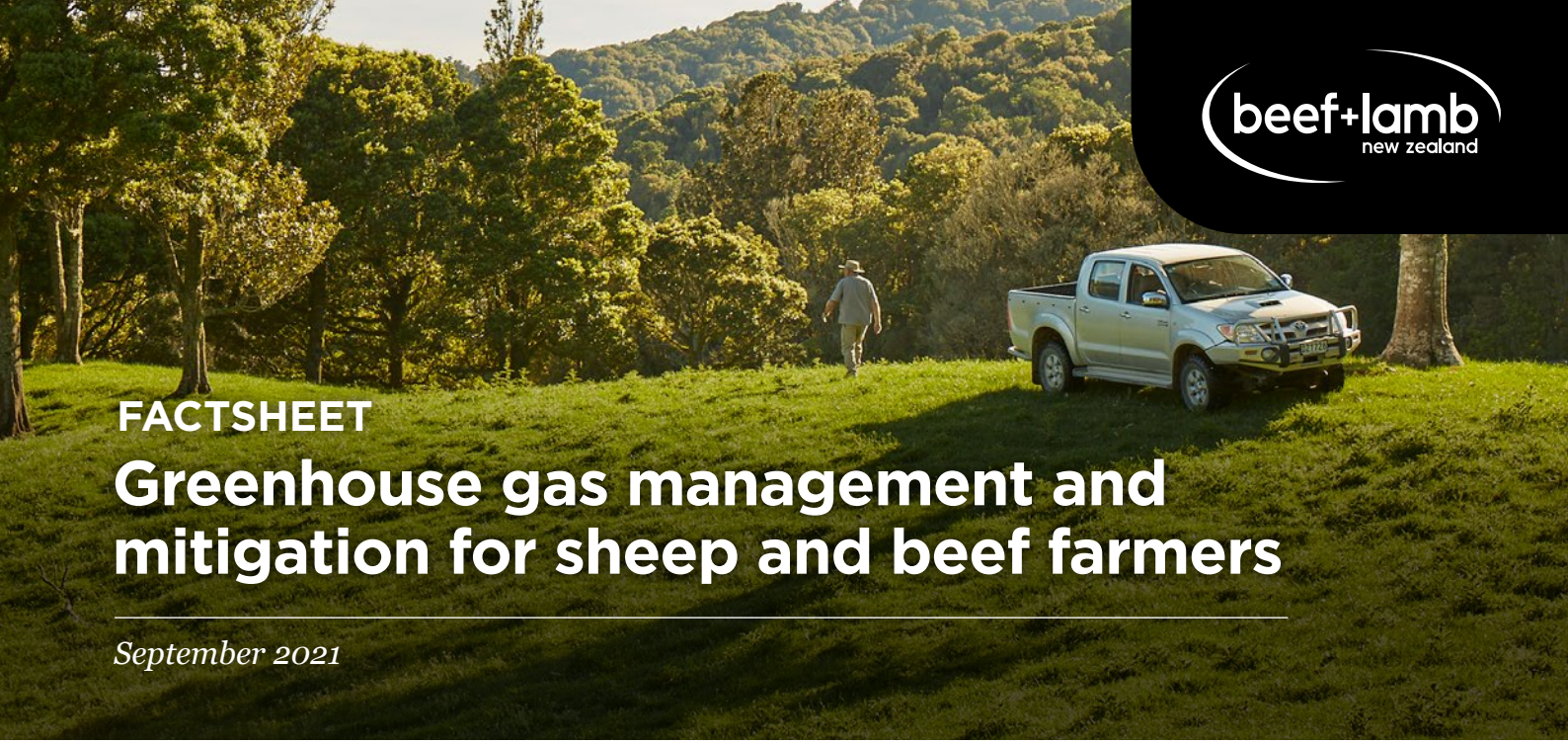

FACTSHEET

Greenhouse gas management and mitigation for sheep and beef farmers

September 2021

New Zealand's agricultural sector has a role to play to contribute to meeting specific greenhouse gas emission reduction targets, as part of international commitments on climate change and in the Zero Carbon Act.

You can find out more about regulations and policies around climate change, how they affect farmers and how Beef + Lamb New Zealand (B+LNZ) is helping you navigate them on the B+LNZ website www.beeflambnz.com/your-levies-at-work/he-waka-eke-noa

Step 1: Know your numbers – the measure part

Knowing your greenhouse gas numbers (principally methane [CH_4] and nitrous oxide [N_2O]) and any sequestration offsets you may have is the first thing you need to start to understand the agricultural greenhouse gas (GHG) emissions from your farm and then the options you have to manage them.

The B+LNZ GHG Calculator is a free tool for sheep, beef and deer (and dairy rearing/grazing) farmers to easily measure and manage on-farm GHG emissions and sequestration.

For more information check out the B+LNZ GHG calculator www.beeflambnz.com/ghg-calculator-info

OverseerFM and/or Farmax8 will also give you your GHG emission and sequestration numbers.

Why do different tools give me different numbers?

Getting a different number in different tools can be confusing, and is usually due to the amount of information included. The important thing for now is to know your numbers using one of the approved tools and understand where emissions are coming from on your farm.

B+LNZ are working with our partners in He Waka Eke Noa (HWEN, the Primary Sector Climate Action Partnership), on standardising the calculation that sits behind the tools – meaning you choose the tool that works for your business but your numbers will be consistent.

Find out more about the different tools on the HWEN website www.hewakaekenoa.nz/tools/

Step 2: Create an action plan within your farm plan to manage your GHG emissions

Now that you know your numbers (your farm's emissions profile), you can look at what options you have in your toolbox to manage them.

B+LNZ Farm Plan: Environment Module has a 'Responding to a changing climate' chapter along with different mitigation options. As the Farm Plan is holistic you can look your whole farm system – you may even find that you have done or are already doing activities that reduce or off-set your GHG emissions.

Find out more about B+LNZ's Farm Plan: Environment Module at www.beeflambnz.com/farmplan

Overseer and/or Farmax allow you to investigate the implications of different farm management strategies on your emissions.

Managing methane – what options do you have?

See B+LNZ Factsheet 286 'Biogenic methane from ruminant animals and nitrous oxide from agricultural soils' to learn more about the production of methane in ruminants. You can find it on the B+LNZ Knowledge Hub: www.knowledgehub.co.nz

The primary source of methane on sheep and beef farms is from ruminant animals. Other sources include wetlands and effluent storage, however these are very small compared to the biogenic methane produced by ruminants.

Let's be clear from the start – for extensive sheep and beef farmers there are very few options to significantly reduce methane without reducing an already low stocking rate.

A continued focus on capturing efficiencies in the farm system ensures feed eaten is used as efficiently as possible to contribute to the production of meat, milk and wool on farm. The following areas (see Table 1) can impact productivity and therefore may offer scope for increased on-farm efficiency – enabling more production from the current feed supply, or maintaining production from a smaller feed supply.

This is sometimes termed eco-efficiencies which basically means "achieving more with less". More agricultural outputs (in terms of quantity and quality) for less input of land, water and nutrients. This is maximising the production from the farm **WITHOUT** increasing total GHG emissions or total losses of contaminant to water. In terms of GHG emissions it comes down to maximising the amount of product produced from the feed consumed and minimising the time the animal is on the farm. This means reducing losses (animal losses, early pregnancy losses, pasture losses), retiring less productive land (where applicable) and potentially increasing carrying capacity of higher producing areas of the farm in response to maintain farm stocking rates.

It is important that any potential mitigation and management options are carefully considered within the context of the whole farm system. While some strategies may reduce emissions in one area of the farm system, they have the potential to increase emissions overall depending on the farm management response. The impacts of changes to farm management practices must also be considered in the context of impacts on nutrient losses to water, soil health and biodiversity.

Table 1 Options for eco efficiency benefits

Areas for consideration	Some suggested actions on-farm to achieve the list on the left. These are not exhaustive and are for guidance only
Genetics	• Selection for low methane sheep (and in the future cattle and potentially deer) • Genetic improvement of stock for lamb/calf survival and maternal ability • Improved pastures – careful selection of pasture mixes for pasture renewal (select those appropriate for the region taking in to account future changes in climate) • Terminal sires to increase young stock growth rates (effectively allow more production per unit of feed)
Animal health	• Prepare and follow a comprehensive animal health plan in consultation with a vet or other expert • Reduction of drench resistance/failure • Adequate shelter and shade to reduce animal stress in winter and peak summer (region dependent) • Identification and treatment of subclinical disease
Improved lambing, calving and fawning percentages	• Ensure animals are at optimal mating weight/condition score • Adequate and appropriate shelter on lambing, calving and fawning paddocks • Checking rams/stags/bulls for reproductive fitness (improved pregnancy rates) • Flushing ewes
Improved growth rates and reduced time to slaughter	• Pregnancy scanning and preferential treatment of multiples • Adequate and appropriate shelter on lambing paddocks • Routine lambing beats to increase lamb survival
Pasture and soil management	• In conjunction with agrichemical and seed suppliers create a pasture renewal programme • Liaise with a qualified fertiliser specialist to prepare a fertiliser plan in combination with a soil nutrient budget • Pasture and soil management to optimise utilisation • Reticulated water and improved subdivision (smaller paddocks) to improve pasture efficiency and stock management • Early identification and management of soil, pasture and crop pests • Utilise tools and expertise to create a feed budget, with regular reviews and refinements

Methane

Mitigations to reduce methane include reducing nitrogen fertiliser, reducing supplementary feed bought on (which have the outcome of reducing the dry matter available for animals and thus the animal numbers are reduced accordingly), and reducing stocking rate. In those high-input systems this is simply moving closer to farming to natural feed production sustained on the property. It may be practical to reduce stocking rates, run slightly fewer animals but focus on increasing production per head (productivity). Other options to reduce stocking rates include considering land-use change; integrate trees into less productive land, or diversification into cropping or horticulture.

Current options to reduce the methane produced by an animal include genetic selection for low methane emitting sheep and also low emission feeds such as rape and fodder beet.

However – in order to make significant reduction in methane production, without a significant reduction in animal numbers, we require an innovative technology. For example, a feed additive that restricts methane production (this may only useful in a feedlot or dairy shed scenario), or a methane inhibitor in the form of a vaccine or bolus. These are still some time away.

See B+LNZ Factsheet 'Biogenic methane from ruminants and nitrous oxide from agricultural soils' for more information on how methane (and nitrous oxide) are produced.

Table 2 Options to manage methane production

Areas for consideration	Some suggested actions on-farm to achieve the list on the left. These are not exhaustive and are for guidance only
Genetics	• Select rams for low methane production
Low emission feeds	• Forage rape (30% less methane per kg DMI when fed as a sole feed). • Fodder beet (needs to be more than approx. 75% of the diet which may cause animal health concerns)
Options for high input systems	• Better manage nitrogen fertiliser • Reduce bought in supplementary feed and/or analyse efficiency of alternative supplementary feeds • Improved effluent storage management • Farm to the grass curve/grazed forage supply and optimise feed efficiency
Changes to the stock ratio	• Optimise stock policy to pasture growth curve • Improve productivity of beef cattle
Future options	• Vaccine • Bolus • Drench • Feed additives (compounds that reduce methane production in the rumen) • Genetic selection for low methane emitting animals of other livestock species

Nitrous oxide

Nitrous oxide is formed by soil microbes. Sources of increased nitrogen such as animal urine and nitrogen fertiliser can result in more emissions. See B+LNZ Factsheet 286 'Biogenic methane from ruminant animals and nitrous oxide from agricultural soils' for more information.

One key method to reduce nitrous oxide emissions is to reduce the amount of nitrogen in the system, which can be very difficult to achieve in New Zealand grazing systems that provide high protein pastures, typically more protein than the ruminant requires. Two possible options are reducing the number of animals urinating or by reducing the amount of nitrogen in the urine. There are some plants that have a lower nitrogen content and reduce the nitrogen the urine, however, care needs to be taken that low N feeds do not require an increased level of feed intake which eliminates the benefit of the lower N per unit of feed as more feed is required.

There is significant research interest in **Plantain**. It appears to reduce nitrous oxide in two ways. Firstly, it has a lower N content than pasture which reduces the N content in urine and thus the amount of N_2O generated, but secondly, research is showing that it may impact soil conditions to reduce the microbial activity that causes nitrous oxide production. While research is continuing, the initial research suggests that Plantain needs to make up at least 30% of the pasture sward to have the effect of reducing nitrous oxide.

New research suggests giving sheep a new break/paddock in the afternoon so that the higher nitrogen excretion occurs at night when the ambient temperature is lower and thus nitrous oxide emissions are less.

Table 3 Options to manage nitrous oxide emissions

Areas for consideration	Some suggested actions on-farm to achieve the list on the left. These are not exhaustive and are for guidance only
Low emission feeds	• Plantain (research continuing but indications are it requires at least 30% of the pasture to be plantain to be effective) • Fodder beet has a lower N content resulting in lower urinary N and thus lower N_2O (although in wet conditions nitrous oxide can increase)
Reduce urinary N lossess - either per animal or in the whole system	• Change to low N feeds to reduce urinary N • Reduce stocking rate to reduce total urine • Use nitrification inhibiters (if/where available)
Fertiliser	• Liaise with a qualified fertiliser specialist to prepare a fertiliser plan in combination with a soil nutrient budget. • Appropriate timing and rate of application • Optimise total N fertiliser inputs • Use of urease inhibitors
Future options	• Widespread use of nitrification inhibitors

Carbon Dioxide

Carbon dioxide emissions make up a small proportion of the overall GHG losses from a farming business however there are some ways that emissions can be managed. These include reducing fuel use and reducing the use of fertilisers and chemicals where carbon dioxide can be emitted during manufacturing, transport and spreading/application.

Table 4 Options to manage carbon dioxide emissions

Areas for consideration	Some suggested actions on-farm to achieve the list on the left. These are not exhaustive and are for guidance only
Electricity use	• 'Green' electricity sources (e.g. solar panels)
Reduce fuel use	• Electric vehicles • Drones • Ensure full truckloads carting produce / livestock • Reduced transportation of animals, feed, fertiliser
Optimise fertiliser use	• Liaise with a qualified fertiliser specialist to prepare a fertiliser plan in combination with a soil nutrient budget. • Appropriate timing of applications • Optimise total N fertiliser inputs • Use of urease inhibitors
Targeted lime use	• Soil test and target lime applications to maximise effectiveness. Excess/ineffective liming adds CO_2 emissions from manufacturing.
Reduce chemical use	• This reduces CO_2 produced in manufacturing, transport and application.
Future options	• Electric tractors, utes, farm bikes and other vehicles.

Identify sequestration opportunities

While you may be able to achieve small emission reductions through some of the changes above, you may also have opportunities to sequester carbon through woody vegetation – exotics or natives, permanent forest or plantation forestry. See **Table 5** for examples. This can also enhance biodiversity outcomes for your farm and depending on the location, can also support healthy freshwater outcomes by reducing erosion risk or providing riparian habitat.

Table 5 Options for increased sequestration

Areas for consideration	Some suggested actions on-farm to achieve the list on the left. These are not exhaustive and are for guidance only
Increased sequestration	• Retiring less productive areas (where applicable) and planting in natives or exotic forestry • Planting shelter belts for improved animal production and sequestration • Collaborate with neighbours and council to form catchment groups for a cohesive catchment approach to planning riparian plantings or other areas such as eco-corridors • Planting of riparian areas and retiring critical source areas for dual sequestration and water quality outcomes • Control pests, diseases, and weeds in planted areas to maximise survival and sequestration of planted areas

Further information can be found here:

B+LNZ GHG Calculator www.beeflambnz.com/ghg-calculator-info

B+LNZ Factsheets: Find these Factsheets on the B+LNZ Knowledge Hub www.knowledgehub.co.nz

- Biogenic methane from ruminant animals and nitrous oxide from agricultural soils
- The Greenhouse Effect, including long and short-lived gases
- Carbon sequestration in woody vegetation
- Contributing to meeting our climate change commitments through He Waka Eke Noa

B+LNZ Farm Plan: Environment Module

- You can download the Farm Plan, with the 'Responding to a changing climate' chapter at www.beeflambnz.com/farmplan

Websites

- www.hewakaekenoa.nz
- www.agmatters.nz