CLIMATE CHANGE 101

Climate change affects everybody and farmers are some of the first to be affected. Everybody has their part to play.

The earlier farmers understand the drivers of climate change and what is contributing to it, the sooner they can adapt and make changes to their farm systems.

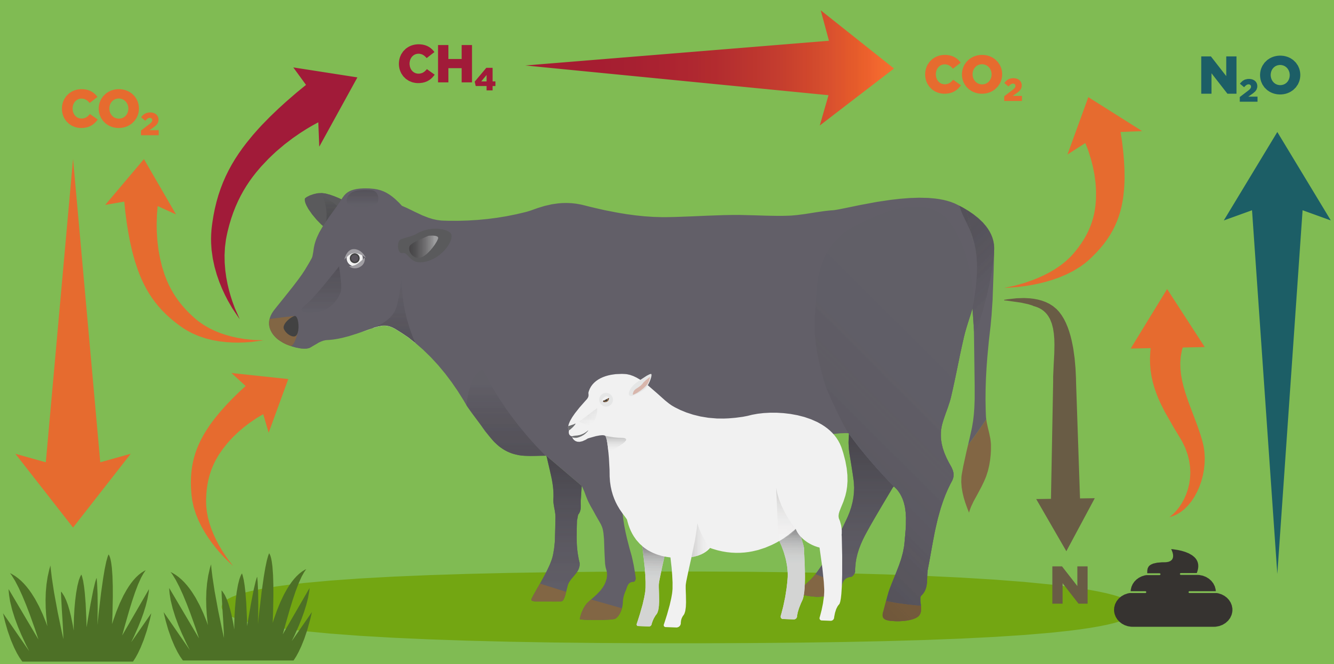
UNDERSTANDING THE BASICS

Livestock are neither a source nor a sink for carbon dioxide (CO_2)

Livestock are a source of methane (CH_4) which eventually decays back into CO_2

Livestock are a source of nitrous oxide (N_2O)

CO_2 from fossil fuels is the main (but not the only) driver of climate change, as it releases CO_2 from plants and animals that lived millions of years ago



How it works

Carbon dioxide as the most common Greenhouse Gas (GHG) and is the gas that others are compared to. It is a long lived gas because it stays in the atmosphere for millennia.

For livestock, the damage is done when the carbon from the grass is digested in the rumen, and burped out as methane.

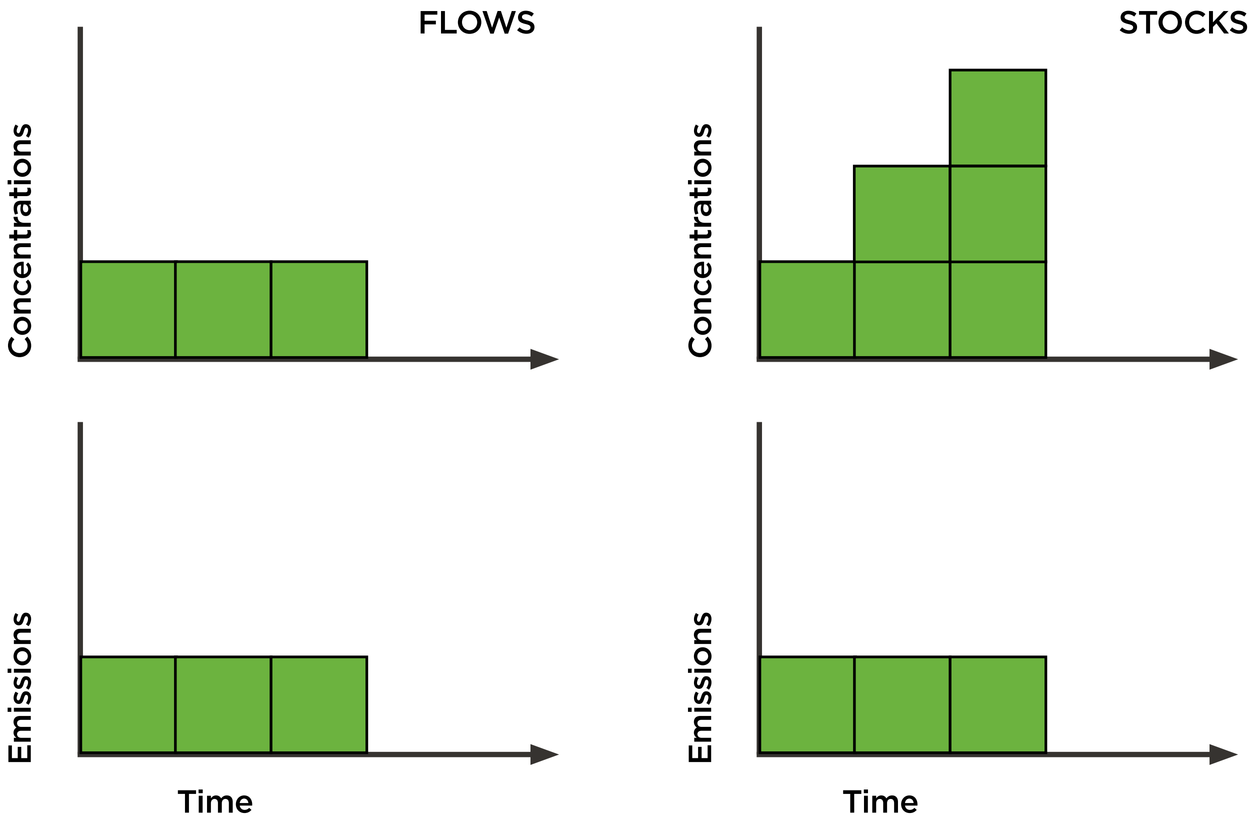
Methane warms the atmosphere much more than carbon dioxide—about 28 times more.

Methane lasts in the atmosphere for around 12 years when it starts to convert into carbon dioxide, but it has a much greater impact while it is in the atmosphere, and those impacts (warming) last for a lot longer than the methane itself. Methane is known as a short-lived gas.

Nitrous oxide has a much greater warming effect than carbon dioxide—about 265 times more than carbon dioxide, and lasts for hundreds of years.

Short lived and long-lived gases—the differences

Short-lived gases are ‘Flows’ while long-lived gases are ‘Stocks’.



Flows enter and leave the atmosphere after a relatively short period—for CH_4 they start to leave after about 12 years. If the amount of CH_4 being emitted to the atmosphere remains constant, then over an extended time the amount entering and the amount leaving will balance out.

Stocks are gases that accumulate over time, such as CO_2 and N_2O. Each addition of CO_2 or N_2O adds to the total in the atmosphere.

What the world is aiming to do – limiting additional warming to no more than 1.5°C

CO_2 is the main driver of peak warming. To keep below 1.5°C net CO_2 emissions must go to net zero now.

N_2O also has to go to net zero now, although the global impact of N_2O is much lower because there is less N_2O being emitted.

Methane (CH_4) emissions affect the trajectory towards peak warming and can help reduce peak warming, but when it is reduced does not matter. Methane does not have to go to zero to limit warming to below 1.5°C! Reducing CH_4 by 10–22% (or about 0.3% per year) will not add any additional warming above 1.5°C.

If the world wants to cool the climate then CO_2 and N_2O must reduce below net zero, and CH_4 must reduce more.

What does 'net' mean?

'Net' is where CO_2 is removed from the atmosphere to off-set emissions of GHGs. The amount of CO_2 that needs to be removed depends on the gas, so CH_4 needs to remove 28 times as much CO_2 per unit of gas, and N_2O has to remove 265 times as much CO_2. (These exchange rates are known as Global Warming Potentials of GWPs).

How can CO_2 be removed from the atmosphere?

Currently the only readily available and reliable way of removing or sequestering CO_2 is by growing trees.

Trees store carbon as they grow. Once they stop growing, they stop adding carbon. When trees die they start to break down and decay and release the carbon back into the atmosphere as CO_2. Trees can be used as timber for building and making things, but once it starts to decay, it releases the CO_2 back into the atmosphere as well.

There is a lot of research into other ways to remove CO_2 from the atmosphere.

What about soil carbon?

We know soil can store quite a lot of carbon, but....

- It is really hard to measure at farm scale:
  - Soil samples only measure a small part of the soil and it is too expensive to take enough samples over a whole farm. Scientists are working on new tools
  - There are still big gaps in knowledge about how soil carbon behaves.
- It can be lost very quickly for reasons beyond a farmer's control such as during a drought.
- There are lots of things that affect soil carbon such as underlying soil types.
- New Zealand soils are very young and most still have very high soil carbon levels, with the exception of some heavily cropped soils. Other countries that have been cultivating their soils for hundreds of years may have very low soil carbon levels, and can add more carbon to the soil.

But—there are things that can be done to protect soils and soil carbon as much as possible as well as helping to build soil carbon.

- No-till cultivation and other carbon building actions.
- Avoiding compaction and soil damage through pugging wet soils or heavy machinery.
- Avoiding soil losses through erosion, keeping soils in place.