

Blame it on the worms

Words by: **Karen Trebilcock**

The more fertile your soil is, the more worms you have and other microorganisms living underground. And they all breathe in oxygen and breathe out carbon dioxide, in the case of worms, through their skin.

And it's because of this, the country's 13 million hectares of pastoral farming which is continually building humus and soil through plant photosynthesis and the breakdown of animal dung is not necessarily building carbon, Landcare Research soil scientist Paul Mudge says.

The researcher says popular belief is rich, fertile top soils with high amounts of organic matter are full of carbon but it isn't always true.

"The generally accepted definition or approach is soil carbon is quantified on material that will pass through a 2mm sieve. Large roots and worms will be excluded. Soil is generally air-dried and then sieved."

However, if soil organic matter such as worms and grass roots are included, which are more than 50% carbon, it would add less than 5% to soil carbon levels in New Zealand.



Landcare Research soil scientist Paul Mudge: land under irrigation in NZ is not building carbon but losing it.

And that goes for adding the life above the ground as well, such as cows.

"Globally, New Zealand has good soil carbon levels because we have a temperate climate and good rainfall and well-managed perennial pastures."

So building soil carbon, by increasing soil organic matter, is a tough if not impossible task because on a percentage basis, it hardly measures against what we already have.

Also, soil organic matter is often not considered carbon sequestration as the carbon is in flux. Even the worms will die, their bodies decompose and so release more carbon dioxide into the air.



"We know that if you take pastoral farming land and change it to horticulture you lose carbon, but then you don't have animals emitting carbon dioxide above the ground."

'Globally, New Zealand has good soil carbon levels because we have a temperate climate and good rainfall and well-managed perennial pastures.'

"We're doing a lot of work trying to identify ways to increase soil carbon but at this stage we don't have any concrete evidence of how to do it by pastoral farming," he says.

Corporate and smaller farms are contacting him about how to measure carbon in their soils as they want to promote their produce as carbon neutral.

"At the bare minimum you must measure to a depth of 30cm and then you're looking at the percentage of carbon, or the concentration of carbon in the soil sample, and the total mass of carbon.

"So far the available data shows we're not losing it but we're also not gaining it. It's in a steady state.

"And if you plant trees the ground underneath the trees loses carbon but there is the huge carbon biomass above the ground."

Land under irrigation in NZ is not building carbon but losing it.

"In Canterbury on what was dry, stony pastures carrying a few sheep and are now dairy farms with green grass and soil, there is actually less carbon there now.

"Under irrigation, the roots of the pasture are shorter and because it's warm and there is plentiful moisture there are a lot of worms and other soil organism activity and they're all expiring carbon into the atmosphere.

"Just because you have biomass that doesn't mean you have carbon," Paul says.



Otago Next Level Grazing coach Siobhan Griffin.

“High fertility and low fertility soils can have the same amount.”

Otago Next Level Grazing coach Siobhan Griffin agrees, saying 10 years of ryegrass and white clover rotational grazing has done little to increase the soil organic matter on her dairy farm in the United States.

“Once I shifted my management to enhance diversity in my dairy pastoral system and incorporated mob grazing, my soil organic matter went up steadily over 10 years and did not get to the point of levelling off.

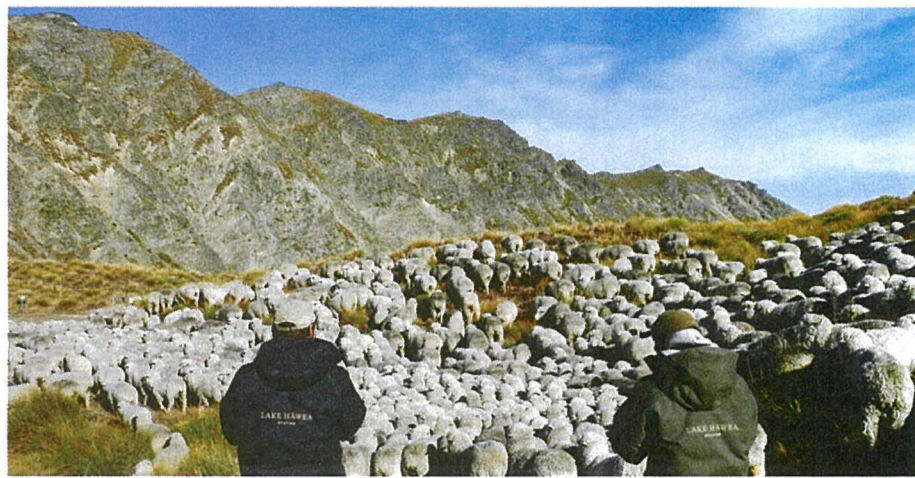
“My topsoil A horizon depth went from 300mm to 800mm. Exactly how much carbon was drawn down into the soil in scenarios like mine and how long it will stay there will take a lot of science but that will all come rapidly as a higher price gets put on carbon.”

She is not surprised dairy farms under pivot irrigation in Canterbury are losing carbon.

“High rates of urea fertiliser oxidise the carbon and short roots in pasture are not conducive to building a carbon sponge. Nor do they capture nitrates well so nitrous oxide leaks out into the air and nitrates leak down into the soil.”

It was why regenerative grazing was such a win-win for the climate and for the environment.

“It allows farmers to grow more pasture per unit of fertiliser and grow deeper-rooted pasture to retain soil, moisture and nutrients so they don’t run rapidly into waterways.”



Lake Hawea Station in the South Island high country sequesters more carbon than it emits.

The first farm to show it sequesters more carbon than it emits is Lake Hawea Station in the South Island high country which sequesters annually 5131 tonnes of carbon from growing trees and emits 2538t.

The 6505-hectare station runs Merinos and Angus cattle as well as a tourism business bringing people on to the farm.

The station gained farm carbon certification in April this year from Toitu Envirocare which is a wholly owned subsidiary of Manaaki Whenua – Landcare Research, a government-owned Crown Research Institute.

Toitu uses OverseerFM plus its own software to assess a farm’s carbon footprint which is verified by Asure Quality.

Station owner Geoff Ross says NZ Merino was the catalyst for getting Toitu certification.

“Carbon modelling of sequestration in this country only allows large vegetation — trees,” he says.

“Whilst we would love to use soil, tussock and in fact wool itself, which is 50% carbon, as yet these do not qualify to be included into a carbon budget.

“In my mind they should, however, be part of a farm’s net number. Soil is a great sequester of carbon, although building soil carbon is a little different to growing a tree.

“A tree will sequester carbon for say 100 years. Building carbon into your soil will cap out at some point much earlier. You can’t keep adding carbon into soil forever as the byproduct of

high carbon and high organic matter soils is they also produce more.”

As well as growing trees, Lake Hawea Station is also using regenerative farming practices and investigating ways to lessen methane from ruminants.

“Healthy animals with clean bums are likely to be emitting less methane so understanding parasite loads is important. We have recently bought on the Techion Fecpak as a tool to help with this.

“Multi species crops are also thought to create healthy ruminants, and this is likely to create less methane.

“Asparagopsis seaweed is being trialled in Australia with huge results. We would love to try it here.”

