Lauder Methane offset Calculator

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Understanding the Calculator & its purpose

This calculator is in the very early stages of development. Making it truly rigorous is going to rely on the feedback and suggestions of many people. The people who have helped me develop the calculator, made the comment that nobody has looked at the solution in this way. A comment in the middle of one email, "Probably because it's a new way of looking at the question, I'm having trouble getting my head around whether it is ....."

Methane is a short term greenhouse gas which is broken down into carbon dioxide and water vapour by OH molecules in the atmosphere. Methane has a short atmospheric lifetime so therefore the warming effect of steady state emissions into the atmosphere will reach equilibrium.

The calculator focuses on this equilibrium figure. It tabulates what has to be done to completely offset the warming effect, **in both the short term and the long term**, of the sheep and cattle run on the property. At this stage it is necessary to assume that livestock numbers remain constant over time i.e. steady state emissions.

Starting with steady state calculations is not unrealistic. In Australia, livestock methane emissions have reached a steady state after peaking in the 1970's and now declined slightly. (see the graph on page 3 showing Australia's emissions since European settlement and the corresponding atmospheric burden). Further refinements will have to be made to account for the varying diet of livestock due to rainfall.

This calculator quantifies the changes producers need to make, to allow them to provide food security at no risk to the planet.

HOW IT WORKS: The offset calculator, calculates the amount of carbon dioxide that has to be removed from the atmosphere, to offset the radiative forcing (warming effect) of the equilibrium mass of methane residing permanently in the atmosphere.

Provided the right amount of carbon dioxide is brought down to the landscape permanently, then this has the same effect as removing all the ruminant animals in both the short and long term.

After the volume of carbon dioxide that has to be removed from the atmosphere has been calculated, the next step is to decide what sink is going to be used to store the carbon from this carbon dioxide. The possible sinks are the soil, trees or shrubs.

It is then a case of adding in the methane emissions of your animals, using the best available estimates that current science can provide.

Using the same science that the IPCC relies on, I was surprised to discover that only small changes need to be made to management, to completely remove/offset the ongoing warming effect of methane emitted by sheep and cattle.

I do not have a problem with the science behind the warming effect of methane and have promoted ways of reducing emissions of this greenhouse gas. What I do have a problem with, is focusing too much on methane, when it is a short term gas. This reduces our focus on carbon dioxide, which is a long term gas. If you believe in human induced climate change – then it is the long term gas, carbon dioxide, which will paint us into the corner. Paying more attention to short term gases like methane, will be critical at a later date, as they provide some flexibility when we hit the tipping point.

This concern is why I moved away from the Global Warming Potential figures supplied to governments. Instead, I have looked at the physics of how the atmosphere functions.

LAUDER METHANE OFFSET CALCULATOR

This sample calculation has relied on inputs specific to one location. Methane emissions are influenced by the size of livestock and the quality of their diet. For the relevant soil carbon figure to use, please make enquiries about local soils.		
CO2 Radiative Forcing	0.000014000	watts/m^2/ unit mass (warming effect) **IPCC AR4 report - table 2.14**
CH4 Radiative Forcing	0.000370000	watts/m^2/ unit mass (warming effect) **IPCC AR4 report - table 2.14**
CH4/CO2 forcing ratio	26.42857143	this means the warming effect of methane is 26.4 times greater than carbon dioxide
Ratio emissions/year to atmosphere "equilibrium" CH4 amount	2.05	**from AussieGRASS (approx)** This figure explains that there is just over two years of methane emissions residing permanently in the atmosphere (assuming steady state emissions)
Number of Animals in paddock	10	Is the number of cattle in the paddock
kg Methane/ Animal	100	kg/head/year (this is how much methane each animal releases a year)
Paddock area	100	ha (10ha/beast) (this is the area the 10 head of cattle are grazing)
Paddock total CH4 emissions	1000	kg/paddock (this is the total methane emissions of the 10 head of cattle for a year)
Paddock CH4 emissions in atmosphere	2050	kg in atmosphere on average (the amount of methane permanently residing in the atmosphere from the 10 head of cattle i.e. equilibrium.) Net figure: emissions minus breakdown
Paddock CH4 emissions in atmosphere as CO2 forcing equiv.	54178.57143	KG CO_2 equivalents (of CH_4 in atmosphere, use $CH_4/C0_2$ forcing ratio). This is the amount of carbon dioxide which has the same warming effect as equilibrium methane.
Convert to CO2 to carbon factor	0.272727273	(is 12/44) This is a ratio to show how much carbon would be in the landscape after carbon dioxide is brought down from the atmosphere by photosynthesis.
Carbon equivalents of forcing	14775.97403	kg of carbon (This figure shows how much increased carbon we have to measure in the landscape, to prove that enough CO_2 has been removed to offset the CH_4 equilibrium.
Kg to tonnes	1000	This is just the factor for converting kg to tonnes
Tonnes carbon equivalent	14.77597403	tonnes of carbon required to offset equilibrium CH_4
Carbon in wood	0.5	wood is approx 50% carbon when dried
wood equivalents	29.55194805	tonnes wood required to offset CH_4 (just doubling the figure of carbon required)
Average woodland above ground	60	tonnes/ha (tree basal area about 10 m^2/ha) This figure changes according to average rainfall
Ha of new forest required	0.492532468	Ha trees to plant to offset CH_4 (half a Ha of the 100 Ha would have to be planted to trees)
Soil concentration (0-30 cm)	0.5	% (average sort of rangeland value; happens to be better country capable of growing trees)
Soil C / Ha (0-30 cm)	30	approx tonnes /ha (0-30cm at about 0.5%C) grazing land (note: temp influences carbon levels)
Paddock soil C (0-30 cm)	3000	tonnes soil C to 30cm in paddock (carbon in 100 Ha before management change to offset CH_4)
% increase in soil C mass required	0.492532468	(atmosphere tonnes C equiv / paddock soil C tonnes) This is % increase on 3000 tonnes
New soil carbon concentration required	0.502462662	% (new soil carbon % required to offset CH_4) i.e. going from 0.5% to 0.502462662%
Early suggestions are the carbon offset has to be increased by 25% (to cover the indirect Radiative Forcing of the equilibrium methane e.g. warming effect of water vapour & effect on ozone)		
If Saltbush is planted to supply protein in dry times, or for resting pastures after rain, then it could offset methane as trees do. One assessment at Deniliquin arrived at 5.5 tonnes carbon/Ha		

Australian Emissions since European settlement