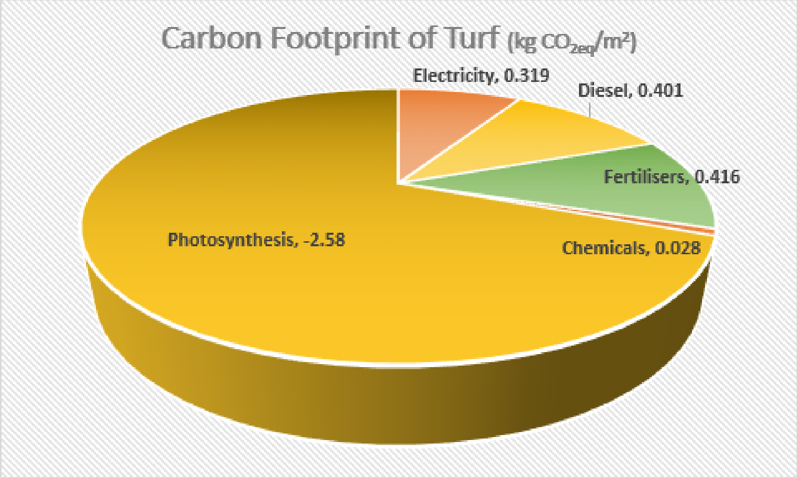
The Carbon Footprint of Turf

All farming relies on the sun to generate plant growth through photosynthesis. Photosynthesis is a plant's way of converting atmospheric carbon dioxide into plant material, using the sun's energy in the process. Turf farms are reasonably efficient at harvesting the sun's energy and sequestering carbon dioxide in the harvested turf.

A study of turf growing sites in 2017-18 for Hort. Innovation project TU 16000- *An Environmental Assessment of the Australian Turf Growing Industry*, demonstrated a strong net sequestration of carbon dioxide from the atmosphere for all the participating turf growers. This had a median value of 1.63 ±0.54 kg CO2eq/m2 of turf harvested with the stronger performers around 2 to 2.5 kg CO2eq/m2. There is a direct relationship between energy and fertiliser efficiency and carbon sequestration rates. One certain way of improving the carbon footprint of the product is by using less energy and fertiliser.

Key findings:

- **Natural turf extracts carbon dioxide from the atmosphere**
- **An average of 2.5 kg/CO2 is extracted per square meter of turf**
- **On farm energy use puts CO2 back into the atmosphere**
- **Fertiliser use also puts CO2 back into the atmosphere**
- **Turf farmers are still about 1.6 kg CO2 per m2 ahead on balance**



The average impact of energy and chemical use compared to the carbon in the turf product in 2016-17

The net carbon sequestration in turf varied from one growing site studied to another and from year to year for the same turf grower, but all growers studied managed to sequester more carbon than they emitted from their activities.

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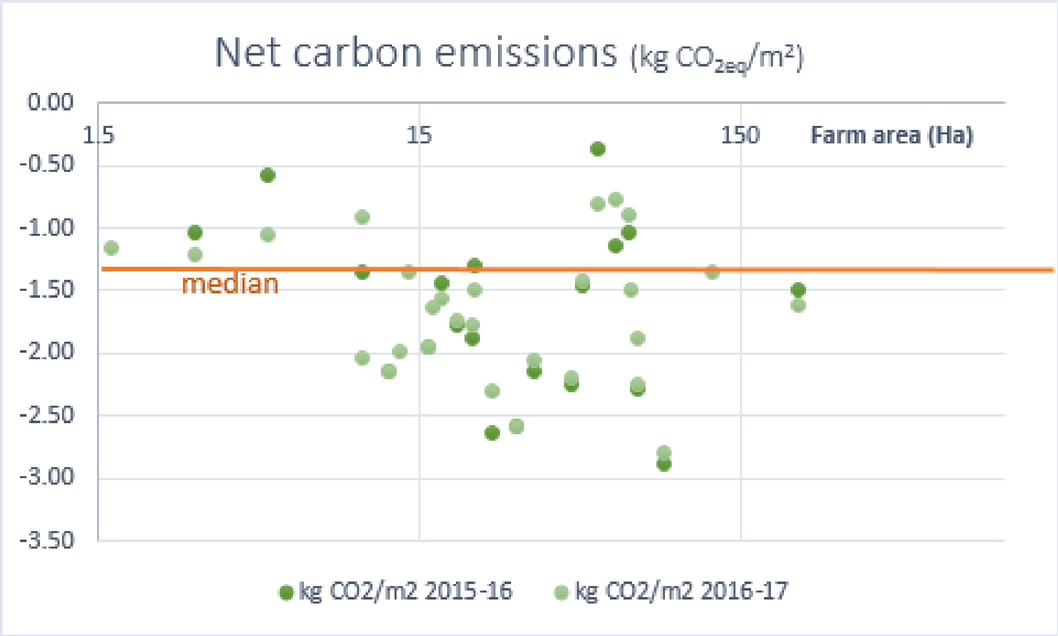

Net emissions from harvested turf for 28 turf growers

(This analysis does not allow for farm infrastructure and plant nor for carbon sequestered in the soil.)

Carbon emissions

Carbon emissions are both direct from the farm and indirect from the processes leading up to the delivery of materials and electricity at the farm. Indirect emissions include emissions from the power stations burning coal to generate electricity, mining operations claiming minerals and factories using energy to produce equipment and chemicals used on the farm.

Direct emissions from farming operations come from burning fossil fuels such as diesel and LPG, as well as emissions of Greenhouse gases such as nitrous oxide from fertilisers. Modelling from this study has nitrous oxide emissions at 0.1 to 2.0 kg/Ha/y using the Greenhouse factor of 298 times CO2, the impact of nitrous oxide is 0.005 to 0.10 kg CO2eq/m2 of turf, insignificant compared to the other factors.

Ammonia emissions can be significantly higher for turf growers using urea and manures, but ammonia is not considered a Greenhouse gas due to its short lived time in the atmosphere (about 24 hours).

Greenhouse gas	Global warming potential	Chemical formula
Carbon dioxide	1.0	CO2
Methane	25	CH4
Nitrous oxide	298	N2O

Fertilisers are the second biggest contributor to turf farm carbon emissions. Most of this is indirect via the manufacturing processes. Direct emissions from fertilisers account for less than 0.1 kg CO2eq/m2 of turf, the indirect emissions are four times that. The general rule of thumb used is the kilos of N applied is multiplied by 5.6 to give the kilos of CO2eq .

Formulated chemical products are more elaborately transformed and consume greater amounts of energy in their manufacture. Lifecycle studies have indicated a factor of 20.7 be used to convert kilos of a formulated agricultural chemical to kilos of CO2eq.

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These factors have been used on data provided by the turf growers to yield the indirect carbon emissions on the turf farms.

The other major indirect carbon emission contributor was electricity, which has a carbon load that varies from state to state depending on how they generate their electricity. Individual growers were allocated a factor relevant to their state (SA 0.49 to Vic 1.08 kg CO2eq/kWh of electricity).

Overall the direct and indirect carbon emissions took back 45% of the carbon sequestered by the growth of turf on average.

How to maximise sequestered carbon in turf

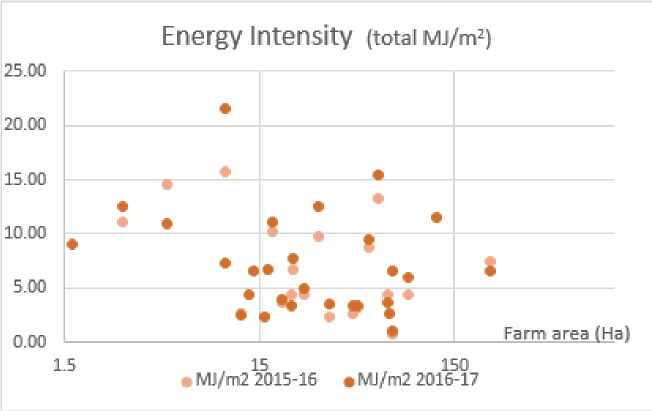
Maximise growth and plant density as the amount of carbon in the plant is the amount of carbon sequestered from the atmosphere. It probably pays to have plenty of sunlight and a good dose of fertiliser to promote growth, but the key aspect is harvesting mature dense turf.

Harvesting turf under ideal conditions

Reduction of turf waste to a minimum will increase yields and sequestered carbon. Wastes will break down and most of the sequestered carbon will be lost by bacterial decomposition. The practice of good turf farming is where a balance is struck between fertiliser use, plant growth and weed management.

Minimising Greenhouse emissions on the farm

Efficient use of energy and all other farm inputs will reduce wastage and minimise the direct and indirect Greenhouse emissions. The first step in energy efficiency is measuring the current usage of electricity by pumps and diesel in tractors. Then farm management can set targets for improvement.



Energy intensity of 30 turf growing sites studied

The variation of the bulk of turf growers is from 3 to 12 MJ/m2 of turf harvested. Most of the growers have a significant opportunity to reduce energy use, get the energy efficiency to a best practice level and improve the net amount of sequestered carbon in the turf product.

For further information contact Dr John Cumming, Infotech Research, on 0418 125 688 or john@infotechresearch.org

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