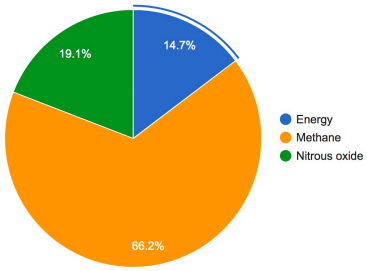
An assessment of the greenhouse gas emissions for Quarantine Island/ Kamau Taurua

Quarantine Island is a 14 hectare island in Otago Harbour. It is owned by the NZ government and designated a recreation reserve. It is administered by the Department of Conservation. Quarantine Island/Kamau Taurua Community Inc (QIKT, quarantineisland.org.nz), a charity, own the buildings and lease the land under them. The Department of Conservation signed a joint management agreement for the whole island with QIKT Inc in 2010. This agreement replaced the expired grazing license, owned privately since 1926. QIKT graze sheep on the island as an interim measure until reforestation occurs. Stock numbers will be reduced as more of the island is returned to native plant cover. QIKT owns and manages a cottage for the resident and a lodge for guests, both with electricity. Access to the island is by boat.

Main Carbon Stores: Soil, Indigenous forest, Exotic Forest, Pasture

Reducing stores: Greenhouse gas (GHG) Emissions
The main sources of emissions
About 40 sheep in 2010, < 30 in 2018 (12 t 30 sheep).
100 l petrol for the boat, mower and weed eater (0.3 t).
14,400 kwh electricity is used in total by the Lodge and Cottage (2 t).



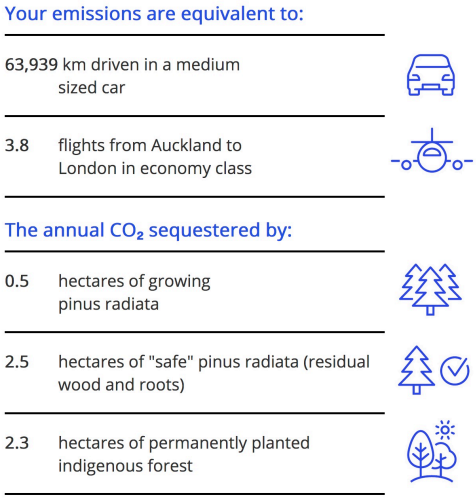
Type	Total kg CO_2 equivalent
Energy	2,170
Fert/Feed	-
Methane	9,772
Nitrous oxide	2,828
Total	**14,770**

Total emissions: 14.770 tonnes (t) of $C0_2$ equivalent (19 t with 40 sheep in 2010).

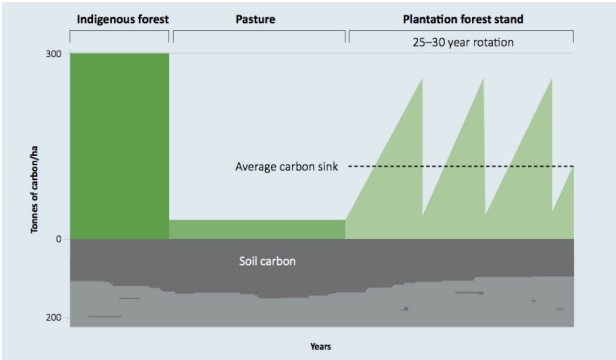
Over 80% of the Island's GHG emissions come from the sheep (0.332 t per sheep) converting pasture to Methane and Nitrous Oxide, and most of the rest from the electricity (Energy) used for the resident and guests.

The fuel is an underestimate as most visitors come on a larger boat with unknown fuel use and 100 l of fuel 'only' produces 0.275 t of GHG (a little less than one sheep). A ten-fold higher value, 1000 l of petrol or diesel, would add about 3 t to these emissions.

So total emissions of 15+ t /year.



Increasing carbon storage. Sequestration



Trees, pasture and soil take $C0_2$ from the atmosphere and sequester it.

14 ha Soil microbes
9.5 ha of Pasture,
4 ha of Low coastal native bush on the island,
0.5 ha of Mature pines, macrocarpas and eucalyptus.

The **pasture** may not sequester much - about 2 t per year. However recent studies from the NZGHC (2018) may indicate a greater potential for farming to increase **soil carbon** storage in pasture soils.

Low coastal bush sequesters up to about 37 t per year, and the Mature exotic trees 9 t per year.

So total sequestration of 48 t per year.

The island is better than carbon neutral (48 vs 15), currently sequestering more than the emissions!

Reducing emissions to 10-20% below 1990 levels by 2020.

Is the Island on track to meet NZ's target for Kyoto?
Sheep are the largest source of emissions. In 1990 there were probably about the same number of sheep as in 2012, perhaps a few more (~40). So, emissions will have reduced if sheep numbers are much less in 2020 (28 in Jan 2019).

Other reductions are the use of an electric mower (Ego) and weedeater for some tasks and use of scheduled ferry (PorttoPort).

Since 1990 there has been considerable planting of native trees, about an extra two hectares, so an increase in sequestration to offset emissions. These forests planted since 1990 count for Kyoto but trees are as yet mainly very small, many but will be sequestering some carbon by 2020 (see notes). Thus, QIKT and is probably on target to reduce greenhouse gas emissions by reducing emissions (sheep) sequestering carbon (plants) by 2020. If the amount of desired offset needs to be greater than the rate of planting emissions could be offset at a cost of ~25 $ /t or ~400 $/year.

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References:

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Soil Carbon Reducing New-Zealands Agricultural Emissions (2015 Factsheet3_Soil Carbon.pdf
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Royal Society Te Apārangi - Emission reduction pathways

Note: This sequestration calculation uses figures for carbon sequestration rates per year from the MPI NZ, for example 18 t CO_2/ha/yr for 'Planted Forests' during rapid growth phases. The carbon calculator provided by Landcare NZ for manuka/kanuka Kyoto afforestation schemes estimates just 1.2 tCO_2/ha/yr at year 2, 8.6 at year 10, peaking at 10.5 at year 15.