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Title: A research-based approach to improvement of the New Zealand national inventory dominated by methane and nitrous oxide emissions from pasture grazed ruminants

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Identification of the sources, extent and modifying factors of methane and nitrous oxide emissions from ruminant animals grazed on pasture, as required for the New Zealand national inventory.

Abstract:

The New Zealand national inventory has a profile dominated (55% of national total) by emissions of methane and nitrous oxide from ruminants grazing pasture. The New Zealand Government has established a research programme to improve emission estimates of these gases. The programme is broadly separated into emissions of methane from grazing animals, and emissions of nitrous oxide from grazed pasturelands. The programme is supported by two expert networks: one for methane (MethaNet) and one for nitrous oxide (N₂Onet). These networks contain experts from both the public and private sector, and meet regularly to assess progress, establish priorities and plan future trials.

Over the last two years, significant progress has been made in identifying the key factors influencing emissions that are relevant to New Zealand.

Nitrous oxide

For nitrous oxide, key IPCC emission factors have been targeted. These include emissions factor EF3: deposition of nitrogen onto pasture as excrement by grazing animals. This is the major source of nitrogen deposition in New Zealand. A series of national trials have been carried out at three locations, each location having trials on two contrasting soil-types; a freely draining and a poor draining soil. Emissions have been measured for extended periods (up to 500 days) at these sites from urine initially deposited in spring, summer and autumn. This work has been extended to include emissions from dung and urine from different animal species (sheep and cattle). The research to date has validated New Zealand's position to adopt a value for EF3 reduced from the default 2% to 1%, and results suggest that further reductions may be justified in the future.

Research to date also indicates that IPCC factor FracLeach might also be too high for New Zealand conditions, based on numerous field studies on leaching under New Zealand grazing conditions. Estimates of nitrogen outputs from grazing animals have also been improved through the use of a nutrient input/output model "OVERSEER".

Future research will concentrate on nitrous oxide emissions from sloping hill pastures which make up approximately 50% of New Zealand's grazed land area, and differences in nitrous oxide emissions from dung and urine from different animal species. Process models, particularly DNDC, as well as up-scaling issues are being assessed and evaluated in parallel.

Methane

A series of field studies assessing methane emissions from grazed sheep, beef, deer and dairy cattle under different field grazing situations, using the SF₆ technique, have been conducted over the last 6 years. This has enabled generalised empirical relationships between animal and forage parameters and methane emissions to be derived. These relationships have been incorporated into generalised animal population and animal energy requirement models to derive the national inventory. Satellite imagery has been evaluated to provide forage quality and protein estimates on a national basis for each month of the year to feed into relevant models. A relational database of emission factors based on the SF₆ studies is being developed to further explore their empirical relationships with feed properties.

The paper will further discuss details of the research programme, the need for a dedicated national co-ordinated programme, and the findings to date.