NEW ZEALAND
AGRICULTURAL GREENHOUSE GAS
Research Centre

HIGHLIGHTS 2016

WORKING TOGETHER TO DEVELOP NEW MITIGATION OPTIONS

New technologies will be required in order to achieve the long-term global goal of limiting warming from climate change to below 2ºC above pre-industrial levels.

More than 100 countries pledged to reduce agricultural greenhouse gas (GHG) emissions in the 2015 Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC). The agreement seeks to limit the rise in global average temperatures to well below 2ºC above pre-industrial levels, which will require engagement from all sectors. However, at the present time, few countries have a clear plan for how to reduce emissions from agriculture or how big a reduction they can realise.

Increasing productivity and the adoption of best practices for efficient and productive farm systems is a key element of reducing GHG emissions, but these alone are not enough. Detailed global analysis has revealed a major gap between the existing mitigation options for the agricultural sector and the reductions needed: currently and readily available interventions would only deliver 21-40% of the mitigation required to meet the goals of the Paris Agreement. Coordinated efforts between national and global institutions concerned with agriculture and food security will be needed to make the necessary progress.

These findings strongly support New Zealand's approach to tackling agricultural GHG emissions. The government-funded New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) is working in partnership with the industry-government joint venture, the Pastoral Greenhouse Gas Research Consortium (PGgRc), to develop additional ways for farmers to reduce GHGs from livestock. The Global Research Alliance on Agricultural Greenhouse Gases (GRA), a voluntary international initiative instigated by New Zealand, is seeking to accelerate this research further and build capability of developing countries to unlock synergies between GHG mitigation and food security.

Given the increasing global population and associated demand for food, Government, industry and researchers are working together to address this issue. New Zealand is at the forefront of developing new technologies. If successfully developed and implemented, these technologies will have global, as well as local, impacts and would make the type of contribution needed for the world to achieve the goals agreed in Paris.

NEW ZEALAND AGRICULTURAL GREENHOUSE GAS Research Centre

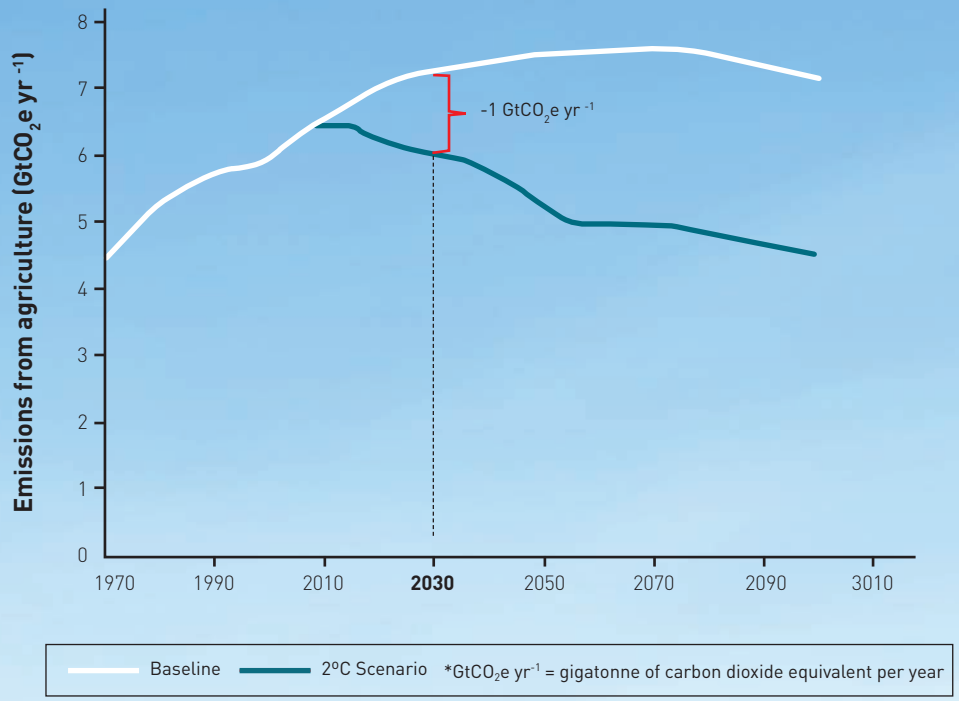
PGgRc PASTORAL GREENHOUSE GAS RESEARCH CONSORTIUM

WORKING TOGETHER

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

Ministry for Primary Industries
Manatū Ahu Matua

New Zealand Government



Graph shows projected emissions from agriculture under business-as-usual (Baseline), and the trajectory with the adoption of technically feasible emission reductions that would support achieving the goal of limiting warming to 2°C (2°C scenario). The difference (red bracket) is the reduction necessary per year for agriculture to contribute to the global effort to get below 2°C.

Source: Infographic from CCAFS, data from 'Reducing emissions from agriculture to meet the 2ºC target' doi:10.111/gcb.13340

THE NZAGRC

The NZAGRC building in Palmerston North

The NZAGRC is a core component of the New Zealand Government's approach for addressing GHG emissions from agriculture.

This includes New Zealand becoming a world leader in agricultural GHG mitigation research and in international collaborative initiatives. The initiatives will advance the search for, and implementation of, mitigation solutions for agriculture that are consistent with countries' economic, social and environmental aspirations.

The Centre is primarily a science funder, with additional responsibilities for strategic research coordination, capacity building and leading New Zealand's science input into international research activities in the agricultural GHG area.

OUR MISSION

To be an internationally renowned centre for research and development into agricultural greenhouse gas mitigation solutions.

OUR VISION

To provide knowledge, technologies and practices which grow agriculture's ability to create wealth for New Zealand in a carbon-constrained world.

OUR RESEARCH PROGRAMMES

MITIGATING METHANE EMISSIONS

(Joint programme with the PGgRc)

- Breeding low GHG animals
- Low methane feeds
- Vaccines
- Inhibitors
- Capture & mitigation by soil

MITIGATING NITROUS OXIDE EMISSIONS

- Plant effects on N_2O emissions
- Manipulating denitrification processes
- Feed management options
- Management effects on emission factors
- Urine patch detector development
- Potential inhibitor effects on N_2O emissions

INCREASING SOIL CARBON CONTENT

- Manipulating carbon inputs to stabilise and enhance stocks
- Tools to quantify soil carbon content
- Modelling management manipulations

INTEGRATED FARM SYSTEMS

- Demonstrating profitable, practical and low GHG emitting sheep, beef and dairy farm systems

MĀORI-FOCUSSED RESEARCH

(Aligned with Integrated Farm Systems)

- Assisting the Māori pastoral sector to improve its capacity to increase resource efficiency and farm productivity whilst lowering GHGs

OUR GOALS

01

ADVANCE KNOWLEDGE AND UNDERSTANDING

Progress in 2015/2016:

- 17 journal articles
- 46 conference papers
- Four core science programmes supported

02

ENHANCE AWARENESS AMONG SHAREHOLDERS

Progress in 2015/2016:

- Alignment with industry via PGgRc
- Range of knowledge transfer activities
- Dedicated Māori GHG research programme underway

03

CONTRIBUTE TO POLICY

Progress in 2015/2016:

- On-going input into IPCC
- Leadership role in Global Research Alliance
- National & international advisory roles

04

DEVELOP SCIENCE CAPABILITY

Progress in 2015/2016:

- 32 undergraduate student placements supported
- 15 PhD students studying & graduated
- 6 Post-doctoral researchers funded to date
- 8 Masters and Masters project students funded to date

05

DEVELOP SCIENCE AND COMMERCIAL PARTNERSHIPS

Progress in 2015/2016:

- Proactive input into Global Research Alliance
- 6 international scientist exchanges funded
- Commercialisation support to MPI and PGgRc

2015/16 AT A GLANCE

SCIENCE

Progress towards solutions

- Four inhibitors identified that reduce methane *in vivo* for an extended period, which have potential for further development
- Confirmation that low methane sheep maintain differences under grazing conditions and indication of positive economic benefits
- Animal trials show prototype vaccinations can produce high levels of methanogen-specific antibody in the saliva entering the rumen
- Naturally occurring compounds identified that can reduce nitrification and lower nitrous oxide emissions
- Field testing of machinery that allows farmers to better target their use of mitigation technologies
- Improved modelling gives confidence that there is potential to increase the amount of carbon stored in New Zealand's agricultural soils
- On farm mitigation options/practices have been identified and evaluated using farm systems models on two sheep and feed monitor farms
- Modelling on four Māori case study farms has identified mitigation options that can result in modest reductions at no cost.

ENGAGEMENT

The NZAGRC has developed a strong media profile through regular appearances in print, radio and TV, issuing several press releases and initiating a social media presence.

The NZAGRC continues to provide science leadership in New Zealand's engagement in the Global Research Alliance on Agricultural Greenhouse Gases; work undertaken serves to extend the domestic research programme, develop internationally relevant solutions, and increase the capability of other countries to engage with agricultural greenhouse gases.

The NZAGRC continues to work closely with the PGgRc. The PGgRc is a key funding partner and provides an important pathway for the NZAGRC to interact with industry stakeholders, assist MPI to manage IP and enable knowledge transfer through commercialisation of new tools, technologies and practices.

Key joint initiatives in 2015/16 with the PGgRc included:

- Evaluation of the joint methane research programme and establishment of updated work plans
- Continued implementation of a joint communications strategy and plan
- NZAGRC support for PGgRc-led engagement to build relationships with commercialisation partners.

CHAIR & DIRECTOR REPORTS

CHAIR'S REPORT 2016

History was made on 12 December 2015, when the gavel went down on a new global climate change agreement at the 21st UN climate change conference (COP 21) in Paris. For the first time in the UN Framework Convention on Climate Change (UNFCCC) two-decade history, all governments at the meeting agreed to act on climate change, and all will transition to a lower carbon economy over the course of this century.

Agriculture is neither treated differently from other sectors, nor excluded from the Paris Agreement. It is now important to develop strategies, both short and long term, to achieve the duel objectives of reducing GHG emissions and maintaining food production levels.

The New Zealand government has set a target to reduce GHG emissions to 30 per cent below 2005 levels by 2030. It has also committed an additional $20m in support of the Global Research Alliance on Agricultural Greenhouse Gases (GRA). This reflects the importance of developing domestic solutions as well as fostering international collaboration to address a globally significant problem.

Practical and cost-effective new and enhanced approaches to reducing agricultural GHG emissions are required to help meet environmental, social and international aspirations and obligations, as well as economic growth targets. This is the role of the NZAGRC alongside the jointly industry/government-backed PGgRc. Our efforts are a prime example of Government, industry and researchers working together, combining resources to identify and develop additional interventions.

A number of key science results in 2015/16 demonstrate that the science teams are getting closer to viable solutions to reduce agricultural GHGs. There is now a strong drive towards engaging commercial partners for new methane mitigation technologies, which the PGgRc is leading.

Through its national and international roles and responsibilities, particularly through its active involvement in the GRA, the Centre continues to build on its reputation as an important source of clear and unbiased advice on the science behind agricultural greenhouse gases and their mitigation options.

Professor Warren McNabb
Chair, NZAGRC Steering Group

DIRECTOR'S REPORT 2016

Over the past year, the Paris agreement has led to increased momentum and growing interest in the climate change space. It is an exciting time to be involved in this area.

Working alongside MPI and the PGgRc, usable results, outputs and publications continue to emerge from our research. We keep a close eye on ensuring that the outcomes of our funding can be translated into practical solutions; in some areas, notably the animal breeding and inhibitor space, discussions with potential commercial partners are underway. These are being led by the PGgRc in line with agreed commercialisation strategies.
In addition to experimental work, NZAGRC-funded scientists have increased their engagement with farmers over the past year. In the Integrated Farm Systems and Māori programmes, a number of meetings and huis have been held. Capability building has been a feature of the NZAGRC since its inception in 2009 and we are continuing to invest in this area. Our on-going scholarship programme with Massey, Lincoln and Waikato Universities has been very successful to date and has provided opportunities to a wide range of young researchers.

Highlights for the Centre staff this year include the coordination of a collaborative project with the Food and Agricultural Organisation of the United Nations (FAO). Our international work also involved working with FAO and CCAFS (the CGIAR Research Program on Climate Change, Agriculture and Food Security) and S.E. Asian countries involved in the GRA to help them develop more rigorous GHG accounting methodologies.

I would like to express my thanks to all of our Advisory Groups. The Steering Group continue to be exceptionally dedicated to the Centre and have provided valuable and knowledgeable advice throughout the last year.

Dr Harry Clark MNZM
NZAGRC Director

MITIGATING METHANE EMISSIONS

PRINCIPAL INVESTIGATORS:
DR GRAEME ATTWOOD (AGRESEARCH)
DR PETER JANSSEN (AGRESEARCH)

The majority of the NZAGRC methane programme is jointly funded with the PGgRc and aligns with existing MPI programmes. It aims to reduce emissions by directly targeting the methane-producing methanogens through small molecule inhibitors and vaccines and indirectly through feeding and breeding naturally lower-emitting animals. In addition, the NZAGRC is solely funding a feasibility study into capturing methane from housed cattle and stored animal waste and injecting it in to soil for oxidation by methanotrophs.

BREEDING PROGRAMME EXTENDING INTO CATTLE

The low and high emitting sheep selection lines continue to diverge, with the differences now about 10%. Portable accumulation chambers (PAC) have been demonstrated to be a low cost and rapid tool to aid breeding for the low methane trait. Preliminary economic analysis shows the low methane sheep could lead to higher profits, primarily due to higher growth rates, a greater proportion of meat, and increased wool production. A cattle screening programme commenced at the end of 2015/16. The first goal of this work is to validate a rapid, low cost system for measuring both methane and feed intake for individual cows in real-time.

MOST PROMISING PROTOTYPE VACCINES TRIALLED IN SHEEP

The vaccine programme has progressed significantly in the past year. Bioinformatic analysis of genome sequences generated in the methane programme identified and ranked other potential vaccine antigens for testing, greatly increasing the scope for effective vaccine development. Systematic screening of these ranked antigen has commenced. Antigens that induced antibodies that inhibited methanogens in in vitro assays, or resulted in apparent rumen microbial community changes are being evaluated further. Animal trials show that prototype vaccinations can produce high levels of methanogen-specific antibody in the saliva that enter the rumen.

LEAD INHIBITOR COMPOUNDS WARRANT FURTHER DEVELOPMENT

The inhibitor programme conducted seven animal trials this year. These tested the effects of 9 different compounds to reduce methane emissions. These were conducted in 2 day sheep trials, 16 day sheep trials, and/or 2 day trials in cattle. Eight of these compounds resulted in methane inhibition, and four inhibitor classes have been selected for further development and investigation. These classes need to be shown to be highly potent and have the potential for market acceptability for them to progress further.

POTENTIAL TO CAPTURE METHANE USING SOIL

A feasibility study is underway to test the practicality of capturing methane emitted from housed cattle and stored animal waste and injecting it in the soil for oxidation by methanotrophs. To date, results from the field trial have established that feeding methane at low concentrations (<120 ppm) for a short-period (6 weeks) does not achieve the methanotroph activity to enhance methane oxidation efficiency. However, feeding methane at high concentration (3600 ppm) for 8 weeks removed more than 95% of methane from the pasture soil.

MITIGATING NITROUS OXIDE EMISSIONS

PRINCIPAL INVESTIGATORS:
DR CECILE DE KLEIN (AGRESEARCH)
PROFESSOR HONG DI (LINCOLN UNIVERSITY)

The current focus of the NZAGRC's nitrous oxide (N_2O) research programme is on measuring the effects pasture plants and pasture plant communities have on N_2O emissions. This work is closely aligned to the MBIE P21 and Forages for Nitrate Leaching programmes (FRNL). In addition, an investigative project on a technology to locate and treat urine patches was completed in 2015/16.

POTENTIAL TO REDUCE N_2O EMISSIONS FROM URINE PATCHES

Trials aligned with the FRNL programme have demonstrated the potential of feed management options and plant species to reduce N_2O emissions from urine patches during 2015/16. Monoculture trials have shown that plantain and lucerne had around 35-70% lower emissions than perennial or Italian ryegrass and white clover at the same level of nitrogen (N) supply. Linking in with a P21 trial using winter forage crops and crop-specific urine, showed that, at the same rate of urine-N returned, N_2O emissions from fodder beet were about 40% lower than from a kale crop.

COMPOUNDS IDENTIFIED FOR REDUCING N_2O EMISSIONS

Lab and field trials from the two PhD programmes on the effect of diet-induced urine composition on N_2O emissions, have revealed two potential compounds for reducing N_2O emissions. A comprehensive lab study using glycosinolate hydrolysis products that can be found in brassica crops, has shown that some compounds can reduce nitrification and lower N_2O emissions. Similarly, a lab study using aucubin, a key compound in plantain, showed that aucubin could also lower N_2O emissions.

NEW TECHNOLOGY TO LOCATE AND TREAT URINE PATCHES TESTED

The investigative work on Spikey®, a technology to locate and treat urine patches within a paddock shortly after grazing, has clearly demonstrated its efficacy. The study tested the technology in six soils and under both irrigated and non-irrigated conditions. The collated data base of conductivity readings will be used as a reference data source for the on-going development of the urine patch identification algorithms. A hand-held version of Spikey® has since been developed and will be used in a new project to test the efficacy of targeted application of nitrogen transformation inhibitors (urease and nitrification) and gibberellic acid for reducing ammonia and N_2O emissions and leaching losses of N from cattle urine. This study will also assess the effect of these treatments applied beyond the detectable urine patch to cover the edge effect.

INCREASING SOIL CARBON CONTENT

PRINCIPAL INVESTIGATORS:
PROFESSOR FRANK KELLIHER (AGRESEARCH)
DR DAVID WHITEHEAD (LANDCARE RESEARCH)

Increasing the quantity of carbon stored in agricultural soils has the potential to offset emissions of GHGs to the atmosphere. However, realising this potential is technically challenging when soil carbon stocks are already high as they are in New Zealand, potential changes in soil carbon are small and spatial variability is high. The current NZAGRC programme has three distinct components: (1) testing specific management practices that may increase the long term soil carbon store in field situations (2) developing and using models to predict how a range of management practices may influence long and short term soil carbon storage and (3) identifying those factors that influence the stability of current or newly added soil carbon.

MANAGEMENT PRACTICE IMPACTS ON SOIL CARBON

On-going field trials measuring a range of factors related to carbon measurements have shown that:

- diverse sward has more root biomass and turnover but it is not possible to determine whether this would translate to increased carbon inputs to soil
- large carbon inputs following pasture renewal events that is available for stabilisation
- minimising the period between spraying off pasture, reseeding and pasture re-emergence minimises the immediate loss of carbon particularly when soils are wet.

MORE POTENTIAL THAN PREVIOUSLY THOUGHT FOR INCREASING NZ SOIL CARBON STOCKS

During the past year soil sampling, measurement and statistical analyses have improved a soil carbon stabilisation model. We have confirmed that allophane-rich and non-allophanic soils behave differently with allophane rich (and gley) soils having the potential to store 25% more carbon than non-allophanic soils. We are using this finding to obtain improved estimates of how much more carbon NZ's pastoral soils can potentially store.

MODELLING WORK KEY TO UNDERSTANDING LONG TERM EFFECTS ON SOIL CARBON

Two models, CenW and the Hurley Pasture model, continue to be used in parallel with experimental field work. These provide different, yet complementary, approaches to understanding short and long term effects on soil carbon levels of management techniques and on-farm changes. Our findings include demonstrating that feeding supplements to dairy cows improves efficiency - increasing product produced per hectare while reducing losses of nitrogen, and increasing carbon sequestration per hectare on farm.

Continuous measurements of carbon exchange from pasture and soil using automated chambers. Photo by John Hunt.

INTEGRATED FARM SYSTEMS

PRINCIPAL INVESTIGATOR:
DR ROBYN DYNES (AGRESEARCH)

The overall aim of this programme of work is to identify and demonstrate that management strategies to reduce GHG emissions intensity already exist and that they are practical and cost effective. The programme covers dairy, beef and sheep farms and is closely aligned to the dairy industry's P21 programme and the Beef + Lamb NZ (B+LNZ) environment focused farm programme.

Photo by B+LNZ

SHEEP AND BEEF WORK IDENTIFYING STRATEGIES TO REDUCE GHGS

The NZAGRC team are working with two B+LNZ monitor farms. The farms now have substantial, robust data and baseline farm systems models which demonstrate the extent to which the key management decisions and efficiency drivers impact on current emissions intensity. The farms are at very different points in development cycle, so provide useful perspectives for informing the wider industry.

Practice-change scenarios have been modelled to predict emissions intensity for Onetai station, a coastal sheep and beef farm in the King country. Scenarios incorporating increased fertiliser use and finishing more stock on farm have predicted a 20 to 38% improvement in emissions intensity is possible.

Scenarios modelled for Highlands (South Canterbury) monitor farm demonstrate the potential for a win-win solution when the area sown in Lucerne and Tall Fescue is increased. This enables more lambs to be finished earlier and results in a large a large effect on lowering emissions intensity. This scenario is assessed as being readily adoptable by farmers.

COLLABORATIVE WORK INVESTIGATING GHG EMISSIONS FROM DAIRY FARMS

During 2015/16, the dairy component of the programme has continued progress towards understanding potential for practical mitigation options to result in lower GHG footprints for dairy farming.

Methane and nitrous oxide measurements on dairy farmlets, testing a range of mitigation options, including high genetic merit cows (Waikato), low N fertiliser input (Waikato) and diverse pastures (Canterbury), have been completed. These data enable mitigation options to be considered within a farming system context.

Methane emissions from cows grazing fodder beet during winter and early lactation can lead to a reduction of 10-20% under some conditions. This is an important result as industry uptake of fodder beet as a winter feed option and as a transition feed used on the milking platform in both late and early lactation is increasing. These findings together with data from the FRNL programme on fodder beet will enable farm systems modelling to understand the wider environmental impacts of increased fodder beet usage.

LOW EMISSION FARM SYSTEMS FOR THE MĀORI FARMING SECTOR

PROGRAMME LEADERS:
DR TANIRA KINGI (SCION)
PHIL JOURNEAUX (AGFIRST)

This programme aims to assist the Māori pastoral sector to improve its collective capacity to increase resource efficiency and farm productivity while lowering greenhouse gas emissions.

Marotiri farm at Tokomaru Bay, one of the project focus farms.

BUILDING RELATIONSHIPS AND SHARING KNOWLEDGE

In the first year of this project 29 Māori farms from around the country were profiled and, from these, four focus farms were selected. During 2015/16, focus farm workshops have been held around the country. This led to the development of practice-change scenarios based on interaction and knowledge sharing between the farmers (including land entities), scientists and industry advisors. A model has been developed to incorporate forestry economics and carbon sequestration, in a spatial framework alongside Farmax and OVERSEER inputs, to incorporate pastoral farming with forestry. This allows the focus farm Trustees and other interested parties to see the holistic impacts of proposed changes.

WIN-WIN SCENARIOS IDENTIFIED THAT DECREASE GHGS AND INCREASE PROFITABILITY

Many of the changes in farm systems modelled to date have resulted in relatively marginal changes in emissions and profitability. Often if emissions decreased so did profitability, and vice versa. Some system changes did give a win-win in that emissions decreased while profitability increased. These included:

- Lowering stocking rates on dairy farms
- Increasing sheep to cattle ratios
- Increasing farm efficiency (e.g. increasing lambing percentages)
- Planting marginal areas in forestry

Planting marginal areas in forestry was marginal on the dairy farms given the small areas available; this mitigation had a much larger impact on the sheep & beef farms. In the absence of any mitigations, the advent of a carbon charge had a significant impact on farm profitability.

NZAGRC INTERNATIONAL DIMENSIONS

The Global Research Alliance on Agricultural Greenhouse Gases (GRA), initiated by the New Zealand Government, remains a key pillar in New Zealand's international science and policy engagement in climate change and agriculture. It also offers significant opportunities for New Zealand to build global research and commercial partnerships and strengthen domestic capability.

GLOBAL LEADERSHIP

NZAGRC is able to maximise these opportunities through its co-leadership of the GRA's Livestock Research Group and its role in providing strategic advice and support to MPI (who administers the GRA Secretariat and the Government's dedicated GRA budget). The NZAGRC Director continues to co-chair GRA's Livestock Research Group (LRG) together with his colleague from Wageningen UR (Netherlands), and the NZAGRC Deputy Director acts as New Zealand's representative on the LRG. The NZAGRC Deputy Director, Operations Manager (International) and Project Analyst, along with external contractors, support the co-chairs in developing and monitoring the LRG's work plan including work with partner organisations.

Specific activities include facilitating New Zealand involvement in flagship GRA research/capability building activities, monitoring and administering research contracts on behalf of MPI, advising on the further evolution of the GRA, including connecting with key member countries and global partners (e.g. World Bank, FAO), pursuing collaborative funding opportunities and linking research projects with existing international initiatives. NZAGRC also works to raise awareness of LRG activities including via newsletters, a regularly updated website, and presentations at scientific conferences and expert meetings.

GLOBAL COLLABORATION

A key example of the power of collaboration is Global Rumen Census, which concluded successfully in late 2015. This project compared rumen microbial communities in different ruminant species and a variety of diets around the world, and found that only a few rumen methanogen species appear to be responsible for much of the methane produced by ruminants everywhere. This means mitigation strategies that target the few dominant methanogens through inhibitors or vaccines should be applicable globally. The implications for New Zealand's domestic research programme are clear and could only be achieved by countries collaborating around the world.

EFFECTIVE PARTNERSHIPS

The NZAGRC also worked intensively with international partners to identify ways for developing countries to improve the productivity of their livestock systems and thus reduce the emissions inherent in each kg of food they produce for their growing populations, and to help governments account for these improvements through advanced GHG emissions inventories.

NEW OPPORTUNITIES

The opportunities for New Zealand will continue to grow in light of the Government's announcement of an additional $20m in support of the GRA, and also the explicit reference to both the GRA and the NZAGRC in New Zealand's Intended Nationally Determined Contribution (INDC), pledged at the Paris UN Climate Change Conference in December 2015. These commitments reflect the importance of developing domestic solutions as well as fostering international collaboration to address a globally significant problem.

MORE INFORMATION

www.globalresearchalliance.org and www.linkedin.com/company/global-research-alliance

The LRG meeting at the Pullman Albert Hotel in Melbourne, Australia, 19-20 February 2016

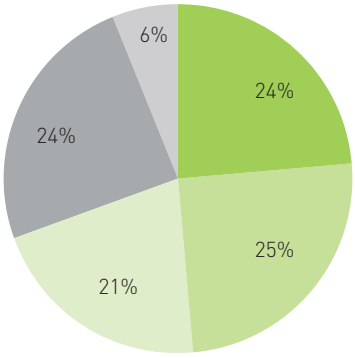
2015/16 IN NUMBERS

FINANCES

Total funding for the Centre in 2015/16 was $5.16m (including carry over from 2014/15). This covers core research programmes, other research (including fellowships and short term projects) and administration.

In addition to the investment made in science, funding has also been used to provide workshop support and to implement a joint communications plan with the PGgRc.

NZAGRC CORE RESEARCH FUNDING SPLIT 2015/16



- Methane
- Nitrous Oxide
- Soil Carbon
- Integrated Farm Systems
- Māori

*Total funded to date including active 15/16 numbers

CAPABILITY DEVELOPMENT

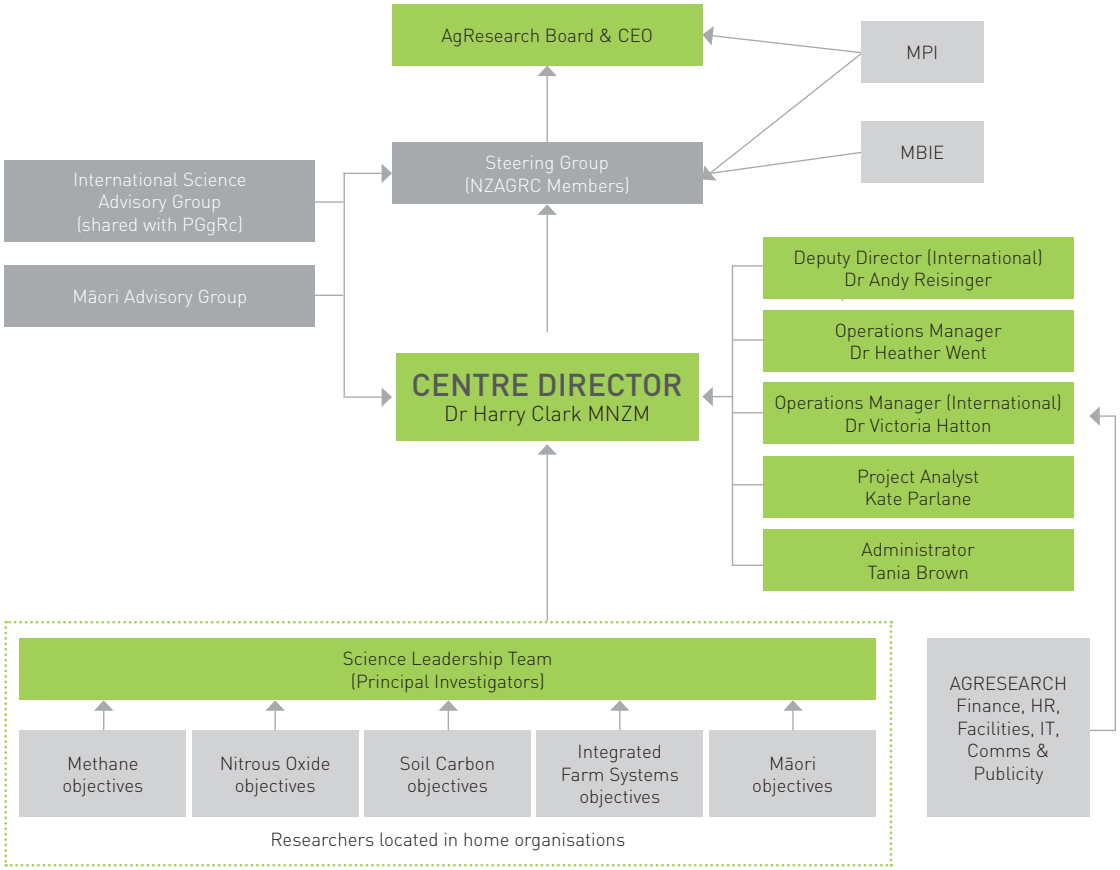
- UNDERGRADUATE SUMMER STUDENTS* — 22
- PHDS* — 15
- UNDERGRADUATE HONOURS STUDENTS* — 08
- POST-DOCTORAL FELLOWS* — 06
- MASTERS* — 05
- MASTERS PROJECTS* — 03
- EARLY CAREER SCIENTIST* UNDERGRADUATE INTERN* — 02

INTERACTIONS AND OUTPUTS IN 2015/16

- 66 — MEETINGS AND PRESENTATIONS (NEW ZEALAND)
- 46 — CONFERENCE PRESENTATIONS
- 28 — GLOBAL RESEARCH ALLIANCE RELATED INTERACTIONS
- 26 — OTHER INTERACTIONS/ PUBLICATIONS
- 24 — MEETINGS AND PRESENTATIONS (INTERNATIONAL)
- 17 — JOURNAL ARTICLES PUBLISHED
- 13 — JOURNAL ARTICLES IN PRESS
- 07 — INTERNATIONAL VISITORS AND GROUPS
- 06 — MEDIA INTERACTIONS

LEADING PARTNERS IN SCIENCE

The NZAGRC has nine members, who between them represent research, development, education and industry. Each member brings unique strengths to the NZAGRC through the specific capabilities and expertise of their science teams and research facilities, and provides one representative to the NZAGRC Steering Group.



STEERING GROUP REPRESENTATIVES

Chair: Professor Warren McNabb

Dr Rick Pridmore

Dr Peter Millard

Dr Stefanie Rixecker / Elizabeth Hopkins

Professor Mike Hedley

Dr Rob Murdoch

Mark Aspin

Warrick Nelson

Dr Tim Payn

LEADING PARTNERS IN SCIENCE

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DairyNZ

Landcare Research
Manaaki Whenua

Lincoln University
Te Whare Wānaka o Aoraki
CHRISTCHURCH-NEW ZEALAND
New Zealand's specialist land-based university

MASSEY UNIVERSITY

NIWA
Taihoro Nukurangi

Plant & Food RESEARCH
RANGAHAU AHUMARA KAI

PGgRc
PASTORAL GREENHOUSE GAS RESEARCH CONSORTIUM

SCION
FORESTS ■ PRODUCTS ■ INNOVATION

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