NEW ZEALAND
AGRICULTURAL GREENHOUSE GAS
Research Centre

Highlights 2011

Chairman's Report

"The success of agricultural production in New Zealand relies on its ability to produce high quality goods at lower costs as well as higher standards than other countries. Those standards include a perception, and must reflect a reality, that the goods produced by New Zealand do not come at a high price to the local or the global environment."
Peter Benfell

The New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) was founded to help New Zealand meet its international greenhouse gas emission obligations without reducing agricultural output. The NZAGRC aims to deliver economic, environmental and social benefits to New Zealand, as well as setting an example globally.

During the first full year of operation the NZAGRC has achieved a number of important milestones. The NZAGRC has commenced its full programme of research, with the first annual conference showcasing this work and demonstrating the high regard in which the NZAGRC and the scientists carrying out its research programme are held internationally. The opening of two major measurement facilities this year will further boost the capacity of our research teams to conduct high quality and timely research. The NZAGRC's Steering Group has established itself as a collegial and effective team that ensures the NZAGRC's strategic direction and decisions made by its Director carry the full support of the NZAGRC's nine partners.

An important addition to the many roles of the NZAGRC is the emergence of the Global Research Alliance on Agricultural Greenhouse Gases. An expanded NZAGRC team supports the Alliance's Livestock Research Group and provides advice to the New Zealand Ministry of Agriculture and Forestry (MAF) on the development of the Alliance as a collaborative global research initiative. This work also promotes a seamless connection between our domestic research efforts and the broader, but crucial, international context.

Peter Benfell
Immediate past Chair of NZAGRC Steering Group (to 30 June 2011)

Professor Warren McNabb
Incoming Chair of NZAGRC Steering Group (from 1 July 2011)

August 2011

Director's Report

In January we finalised contracts for the first 18 science programmes to receive long term funding from the NZAGRC and research is now well underway. The profile of the NZAGRC and our work is growing rapidly via implementation of our communication strategy and engagement with the wider scientific community.

Aside from our science programme, a key goal of the NZAGRC is building and developing research scientist capability in the agricultural greenhouse gas area. During this financial year we have proudly provided support for 20 young scientists to work alongside Senior Scientists within our research programmes.

The governance arrangements of the NZAGRC have become well established this year and work very effectively. The February conference provided a great opportunity for the Steering Group and the Stakeholder and International Science Advisory Groups to become more familiar with the science programmes and to feed back their comments directly to our lead scientists. In particular I would like to express my thanks to the members of the Steering Group for their enthusiastic approach to their role and for the sound advice they have provided throughout the year. Their solid contribution has been a big factor in establishing the NZAGRC as a truly collaborative venture.

The NZAGRC's input into the Global Research Alliance gathered momentum as the year progressed. In addition to representing New Zealand at Alliance meetings in Canada and France, we have provided MAF with scientific and administrative support for a range of initiatives being funded by the New Zealand government. Two new NZAGRC appointments, Dr Andy Reisinger and Dr Victoria Hatton, have strengthened our ability to help make this New Zealand inspired global initiative a success.

I look forward to a productive and successful 2011/12.

Dr Harry Clark
NZAGRC Director
August 2011

"I would like to thank all scientists and support staff that have enabled the NZAGRC to make an efficient and effective start to its long term science programme. It is very rewarding to see the significant number of NZAGRC related outputs that have already been generated."
Dr Harry Clark

The New Zealand Agricultural Greenhouse Gas Research Centre

The NZAGRC is a partnership between the leading New Zealand research providers working on agricultural greenhouse gases and the Pastoral Greenhouse Gas Research Consortium (PGgRc). It is 100% government funded and about NZ$48.5 million will be invested by the NZAGRC into research and development activities over ten years. The NZAGRC is a "virtual" Centre: the research that it funds is carried out by researchers working in their own organisations. The NZAGRC administrative headquarters are on the AgResearch Grasslands campus in Palmerston North.

The Vision

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

During 2010/11 the NZAGRC has taken a number of significant steps towards realising the vision of the Centre. A total of 18 initial research objectives have been contracted and support systems to increase science capability in New Zealand have been established. The NZAGRC has developed a communication strategy and plan and has been actively promoting its role, research and achievements during 2010/11. NZAGRC staff and key NZAGRC funded researchers have also been working alongside MAF to establish the Global Research Alliance and promote New Zealand's leadership in this area on the international stage.

NZAGRC Staff

1 ***Dr Harry Clark***, *Director*
2 ***Dr Andy Reisinger***, *Deputy Director (International)*
3 *(L-R)* ***Dr Victoria Hatton***, *Operations Manager (International)*
Kate Parlane, *Administrator*
Dr Heather Went, *Operations Manager*

The Mission

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

The NZAGRC is working with its partner organisations, particularly the PGgRc as a joint venture of industry and government, to deliver science that is innovative, practical, credible and able to stand up to international peer review. The NZAGRC strives to ensure that its activities are transparent and effectively communicated to its stakeholders.

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 (SG).

AgResearch
Farming, Food and Health. First™
Te Ahuwhenua, Te Kai me te Whai Ora. Tuatahi

Lead role in methane and nitrous oxide emission research and contributes to research in increasing soil carbon sinks. AgResearch also hosts the NZAGRC.
SG Chair: Professor Warren McNabb

DairyNZ

Lead role in integrating research outcomes for the dairy industry, applying those outcomes in dairy farming systems and in stimulating uptake of new knowledge within the dairy industry.
SG Rep: Dr David Johns

Landcare Research
Manaaki Whenua

Coordinates research in emission measurement and soil carbon and contributes to the nitrous oxide research programme.
SG Rep: Dr Richard Gordon

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

Leads research in nitrous oxide emission mitigation and facilitates a programme to develop new capability and capacity in GHG mitigations research.
SG Rep: Dr Peter John

MASSEY UNIVERSITY

Leads research into biochar and innovative management practices that reduce GHG emissions and facilitates a programme to develop capability and capacity in GHG mitigation research.
SG Rep: Professor Mike Hedley

NIWA
Taihoro Nukurangi

Lead role in assessing the effectiveness of mitigation outcomes on climate change impacts in New Zealand, and contributes to emission measurements.
SG Rep: Dr Murray Poulter

PGgRc
PASTORAL GREENHOUSE GAS RESEARCH CONSORTIUM

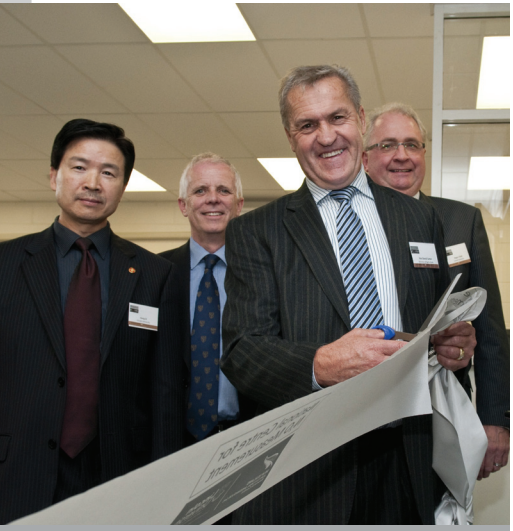
Key conduit for industry guidance to ensure applicability of NZAGRC's research to the agriculture sector, and will be an important pathway for commercialisation and practice change.
SG Rep: Mark Aspin

Plant & Food RESEARCH
RANGAHAU AHUMARA KAI

Leads research on soil carbon mitigation, stocks and rates of change and nitrous oxide mitigation.
SG Rep: Warrick Nelson

SCION
Next generation biomaterials

Contributes to research on soil carbon.
SG Rep: Dr Trevor Stuthridge



Hon. David Carter opening the NCN_2OM at Lincoln University

The NZRMMC at AgResearch, Palmerston North

Infrastructure Update

In the 2009/10 financial year, $2.3 million was allocated to infrastructure spending by the NZAGRC to ensure research facilities are adequate for the ambition of our science plan. The two largest contracts were for buildings and facilities to increase the capacity to measure emissions, as these were areas deemed to be constraining the current research effort. These projects were completed in the 2010/11 financial year.

In February 2011, the New Zealand Ruminant Methane Measurement Centre (NZRMMC), at the AgResearch Grasslands campus in Palmerston North, was opened by the Minister of Agriculture, David Carter. This facility allows scientists to measure methane from 24 sheep and 4 cattle in enclosed chambers in a purpose designed facility that is the largest of its type in the world.

In April 2011, the National Centre for N_2O Measurement (NCN_2OM), situated at Lincoln University, was also opened by Minister Carter. This facility, thankfully, came through the two major earthquakes intact. The facility has, along with investment at Landcare Research in Palmerston North, more than doubled the New Zealand nitrous oxide measurement capacity and removed a critical bottleneck for a wide range of research programmes that rely on routine and rapid high quality emissions measurements.

For further details contact:

New Zealand Ruminant Methane Measurement Centre
Dr David Pacheco
david.pacheco@agresearch.co.nz

National Centre for N_2O Measurement
Professor Hong Di
Hong.Di@lincoln.ac.nz

Capability Building

Increasing the pool of researchers with skills in the agricultural greenhouse gas mitigation area is a major objective for the NZAGRC, due to an aging science population and the need to increase our science capacity and capability.

To achieve this objective the NZAGRC funds promising students and early career researchers to build capability for the future. Some of this funding is embedded within the funding of the core science programme, with additional funding being available when high quality students are identified. In the 2010/11 financial year this additional funding totalled $245,000. The funding plan has three elements:

1. Short term scholarships to encourage promising undergraduate students to undertake postgraduate studies;
2. Well funded PhD stipends for high quality students; and
3. Fellowships for top post doctoral and early career scientists on 2-3 year contracts.

In 2010/11, two pilot undergraduate "pipeline" scholarship schemes were established with Massey and Lincoln Universities to promote continued study. These are scheduled to initially run for three years and will then be reviewed, including their possible extension to other universities in following years. Additionally, new NZAGRC PhD and post doctoral fellow positions in the core NZAGRC funded research programme were advertised nationally and internationally.

The NZAGRC is now a major funder of PhD students in New Zealand in scientific research related to nutrition, animal and plant performance and greenhouse gas emissions.

(L-R) Anne-Maree Hill (Summer student), Aimee Robinson (Masters), Bianca Dias (Honours student) at Lincoln University

Helen Walker (PhD student, Massey University)

Dr Nicole Schon (Post doctoral fellow, AgResearch)

Cameron Shaw, Samantha Edgar (Summer students, Massey University)

Sam McNally (PhD student, Waikato University)

Type of Capability Development	# funded in 2010/11
Undergraduate - Summer student	4
Undergraduate - Honours student	1
Masters	2
PhD	9
Post doctoral fellow	3
Early career scientist	1

Science Programme
Methane

Principal Investigators: Dr Graeme Atwood and Dr Peter Janssen

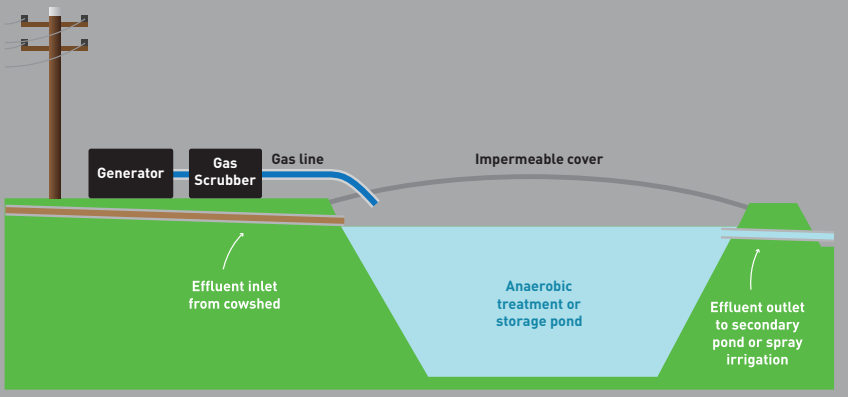
The NZAGRC methane programme follows a three pronged approach to reduce ruminant methane emissions. One approach seeks to directly impair the ability of methanogens to produce methane through small molecule inhibitors or vaccines. The other two approaches seek to indirectly manipulate methane production through (a) identifying possible changes in animal feed and (b) identifying and selecting low emitting animals. NZAGRC investment in these areas aligns with existing programmes funded by the PGgRc and MAF.

Rumen methanogens are micro-organisms responsible for the production of methane in the digestive tract of ruminants. NZAGRC supports and builds on existing PGgRc and MAF programmes to find ways of directly inhibiting methanogen activity. NZAGRC funding has allowed two more methanogen genomes to be sequenced and detailed study of 10 enzymes produced by methanogens. This information will be used to identify more/better targets for vaccines and to 'design' or identify chemical compounds that could suppress methanogen growth. Both programmes are still at the stage where testing is in the laboratory not the animal.

Existing PGgRc and MAF programmes have shown that some animals are naturally lower emitters of methane than others. NZAGRC funding has enabled these animals to be genotyped to screen for genetic markers that could help rapidly identify low emitting animals. Preliminary results indicate emissions intensity in the sheep sector could be reduced using traditional animal breeding approaches with almost no loss of productivity. However, rapid and cheap measurement of methane emissions, along with productivity and food intake, for individual animals is an essential pre-requisite if animal breeding approaches are to be pursued. Analysis of existing methane emissions data has revealed that it may be possible to identify low emitting animals from repeated one hour measurements, but further work will check whether such short-term measurements are sufficiently accurate when animals are taken directly from the field with no pre-conditioning.

Two additional programmes in the methane area are profiled on the opposite page.

Economics of biogas production from animal waste



Covering anaerobic ponds and capturing the biogas produced can recover energy in the form of electricity and/or heat.

Installing on-farm infrastructure to capture biogas can be costly, however the energy recovered can be used to reduce farm energy consumption. A small programme has concentrated on the development of a model to estimate the economics of installing methane bio-digesters for anaerobic animal waste ponds. Initial findings suggest that the installation of bio-digesters can be economic even on farms having as few as 400 cows, with a payback period on the investment of 3-5 years. Further work is now being undertaken using MAF funding to confirm these initial findings prior to the model being finalised, promoted and released to farmers around New Zealand.

Algal Additives

A novel approach to the mitigation of methane is to feed algal species which are high in lipid content to ruminants. This should, theoretically, suppress methanogen activity. Scientists harvested algal species from NZ-based wastewater treatment ponds and conducted *in vitro* studies to assess their potential as methane mitigating animal feed supplements. Results showed that the algal species tested had insufficient lipid levels to reduce methane effectively. However, algal species from other sources have been collected and initial laboratory level studies are looking promising.

Algal species from wastewater treatment high rate algal ponds

Science Programme
Nitrous Oxide

Principal Investigators: Dr Cecile de Klein and Professor Hong Di

The NZAGRC nitrous oxide programme seeks to reduce nitrous oxide emissions from agriculture and explore possible management options for these emissions.

Nitrification inhibitors are known to reduce nitrous oxide emissions but their performance is uneven across the country and also varies with season. A principal component of the NZAGRC's programme of work is therefore aimed at finding ways of improving the efficacy of nitrification inhibitors. Another research project aims to better quantify how soil water content and soil physical conditions influence nitrous oxide emissions, to inform animal management. Some work has been delayed due to the Canterbury earthquakes, but some laboratory studies have been undertaken and several field trials have been established. These programmes provide crucial experimental data needed by farm systems modellers to validate their model predictions.

Three additional programmes look at much more fundamental issues:

Animals generally eat more nitrogen than they require for their own growth and thus excrete much of the nitrogen, which turns into nitrous oxide. Unfortunately, most highly productive grasses also have a high nitrogen content. A NZAGRC programme explores whether the link between nitrogen and grass growth could be broken. Early results indicate that a group of plant hormones called gibberelins regulate grass growth independently of nitrogen supply.

Even though most nitrous oxide emissions come from soil, in some circumstances emissions seem to come from plants themselves. A novel programme looks at whether this is indeed an important emissions pathway. The project initially focused on developing equipment that allows emissions from plants to be measured.

A third programme addresses the issue of nitrous oxide emissions from denitrification (reduction of nitrate). Can this process be manipulated? Initial studies show that denitrification rates vary substantially in both space and time, and research seeks to better understand the processes responsible for this variability.

Further information about selected research work carried out this financial year is shown on the opposite page.

Field studies of nitrification inhibitors

Tests of the efficacy of nitrification inhibitors have focused on the timing of application and the implications of soil pore space and animal trampling. Initial results from this first year of field studies indicate that high efficacy could potentially be obtained with a single, winter application regime. These interim results will be studied further in following years. Animal trampling was found to have a critical impact on the absolute quantity of nitrous oxide emitted but nitrification inhibitors were found to work equally well on trampled and non-trampled soils.

The eco-n ™ technology was developed on the basis of more than 10 years of rigorous fundamental and applied research, funded by the Foundation for Research, Science and Technology (FRST), Ravensdown Fertiliser Co-operative Ltd, the PGgRc, the Pasture 21 Industry/FRST Research Consortium, and MAF.

Measuring the impact of nitrogen concentration

Most nitrous oxide emissions in New Zealand come from urine patches excreted onto soil. One project looked at whether diluting the concentration of nitrogen in animal urine (e.g. by feeding a diuretic) could reduce emissions. Early results suggest that varying the concentration of nitrogen in animal urine over a normal range does not affect nitrous oxide emissions. In other words, nitrous oxide emissions depend on the total amount of nitrogen excreted by an animal, not on how much water it is associated with the nitrogen.

Science Programme
Soil Carbon

Principal Investigators: Professor Frank Kelliher and Dr David Whitehead

Increasing the quantity of carbon stored in agricultural soils has the potential to offset emissions of other greenhouse gases to the atmosphere. However, realising this potential is challenging, in part because soil carbon stocks are already high in New Zealand. The NZAGRC science programme has three distinct components: (1) assessing the maximum carbon storage potential; (2) devising management practises to sustainably increase soil carbon storage; and (3) methods for verifying changes in soil carbon.

Data mining and modelling are used to quantify current levels of soil carbon and to determine the maximum amount that could be stored. An exhaustive literature review suggests that the maximum storage potential depends on climate and soil characteristics and hence varies significantly across New Zealand.

Devising management practices to increase soil carbon storage requires both modelling and experimental approaches. The first year of the programme concentrated on developing two models to predict the consequences of management actions, in particular the role of nitrogen supply and stocking rate. Experimental work focused on three high priority areas: the replacement of conventional grassland with deep-rooting species; the introduction of earthworms; and the production and addition of biochar. Three long term experimental projects to test these options have been set up and measurements of the effects are underway.

The final focus area is to develop improved methods to verify changes in soil carbon storage and to develop appropriate accounting rules. The initial focus has been on interpreting data of long term changes at an irrigated grassland site, including how to obtain robust estimates based on limited soil samples. A method to integrate changes in the vertical profile of soil carbon from soil samples collected from field sites at different times has been developed and tested. This method has been used to study the impact of irrigation on soil carbon.

Dr Nicole Schon (AgResearch) has established soil carbon field trials investigating the effects of introducing earthworms

Associate Professor Louis Schipper (Waikato University) adjusting eddy covariance equipment in the field

Management impacts on soil carbon storage in dairy systems

Accounting for soil carbon requires the ability to predict and monitor the impact of farm management without having to wait decades for results. An NZAGRC project will measure carbon dioxide exchange over dairy pastures and derive the amount of carbon stored in soil from the balance of all carbon inputs and losses from the soil. Measurements of photosynthesis and respiration by plants and soil microorganisms will be coupled to measurements of other carbon losses and gains including milk production, dry matter imports and exports, and methane production. This will permit the testing of the effect of alternative management options on soil carbon at hectare and annual scales.

Biochar pyrolysis machine built by scientists based at Massey University

Studying the impacts of biochar addition to pastures

Biochar is charcoal created by the pyrolysis of biomass under carefully controlled conditions. It is intended to be added to soils to improve soil functions and to reduce emissions from the organic material that would otherwise naturally degrade to carbon dioxide. NZAGRC research focuses on the use of biochar in pasture soils to promote deep root growth and on the development of robust methodologies for monitoring its impacts on soil carbon and organic matter. Initial biochar samples have been prepared from pine forest waste; additional options for biochar production are being explored using biosolids and municipal green waste as raw material.

Biochar being tested under different soil/pasture types

Science Programme
Integrated Systems

Principal Investigators: Mr Dave Clark and Dr Robyn Dynes

This work area aims to develop profitable, practical low emitting farming systems and aligns with MAF's Sustainable Land Management and Climate Change (SLMACC) funded work. NZAGRC research focuses on developing better quantitative tools to predict enteric methane emissions and nitrous oxide emissions from soils. These can be incorporated into simple farm system models and used by farmers to identify and support mitigation options.

The prediction of volatile fatty acid (VFA) concentration is a key component in accurately modelling methane production in ruminants. Using a large database of New Zealand data and reviewing relevant literature, scientists have evaluated two models and have found deficiencies in predicted VFA concentrations in forage fed sheep. Further work will now concentrate on better estimation of the processes and substrate concentrations and flow of material in the rumen, which is expected to improve the ability of models to predict methane emissions from animals under different conditions.

In order to identify and/or develop an improved model for predicting nitrous oxide production for New Zealand's pastoral systems a review of suitable publicly available models has been completed. Key criteria needed in an improved model are that it should be:

- publicly available;
- mechanistically sensible;
- able to be tested with a New Zealand dataset;
- able to adequately describe New Zealand farming systems; and
- able to be used to evaluate the effect of relevant mitigation options across the whole farm system.

Our approach is that selected components of existing models have been integrated into the Agricultural Production Systems Simulator (APSIM) modelling framework and are being tested for their ability to reproduce field data relating to the cycling of nitrogen in soils, which is essential for accurate predictions of nitrous oxide emissions.

Improving methane models

The reactions leading to the production of methane in the rumen have been more or less adequately characterised in models for dairy cattle only, but not for other ruminant animals. In addition, such models have been parameterised using diets that are untypical of the forage dominant diets consumed by New Zealand animals. A key finding from a literature review was that although methane production can be described using thermodynamic principles, accurate description requires a better understanding of the flows of solid and liquid material out of the rumen. These findings now provide a clear focus for developing better models suited to New Zealand conditions.

Mr Dave Clark, Dr Pierre Beukes, Dr Pablo Gregorini and Dr Alvaro Romera (DairyNZ)

Dr Frank Li, Dr Iris Vogeler (AgResearch) and Dr Donna Giltrap (Landcare Research)

Accurately predicting nitrous oxide emissions

A major collaborative effort between scientists funded under NZAGRC and SLMACC programmes has seen the compilation of a New Zealand wide database of nitrous oxide emissions datasets and other relevant data for the development and testing of improved models of nitrous oxide production. The database contains a total of 150 different combinations of measurements from a range of NZ climates, soils and soil drainage classes, periods, from dairying and sheep and beef on flat and hill country. The database will regularly be updated to include new data when available. This database is proving to be invaluable as a comprehensive resource for the modellers.

Stakeholder Engagement

The NZAGRC is advised by an International Science Advisory Group (ISAG) and a Stakeholder Advisory Group (SAG). The ISAG ensures that NZAGRC research is internationally excellent, while the SAG aims to ensure that research remains connected with practical realities of farming in New Zealand.

Engagement of the SAG allows domestic stakeholders to communicate NZAGRC's research plan to their diverse constituents while at the same time providing an input to NZAGRC's future direction of research.

A major highlight of the past year was the first annual conference of the NZAGRC in February 2011. This three day meeting brought lead NZAGRC researchers together with stakeholders from policy and industry, including the ISAG and SAG. Plenary presentations showcased work to more than 150 delegates, followed by two days of science workshops to promote in-depth discussion of progress and research opportunities.

During 2010/11, the NZAGRC had a regular profile in the media and with the wider scientific community and the general public. Dr Harry Clark also supported policy processes through his membership on the Agricultural Emissions Trading Scheme Advisory Committee. The NZAGRC additionally communicated its activities through its website (www.nzagrc.org.nz) and the initiation of a regular newsletter 'Release' received by more than 400 recipients domestically and internationally. To join the NZAGRC's news and information mailing list, email enquiry@nzagrc.org.nz.

International Dimensions

The Global Research Alliance on Agricultural Greenhouse Gases (Alliance) is a major international initiative to increase collaboration and development of solutions to reduce agricultural greenhouse gas emissions globally while meeting growing food demand.

It was initiated by the New Zealand Government in 2009 and now has 32 member countries[1]. The New Zealand government set aside $45 million to support involvement in the Alliance, in particular research into pastoral livestock emissions. This budget is administered by MAF and a close partnership has been developed with the NZAGRC.

New Zealand currently hosts the Secretariat and the NZAGRC Director co-chairs together with the Netherlands the Livestock Research Group of the Alliance, and co-leads the sub-group on ruminant animals within this Research Group together with Uruguay. NZAGRC has been contracted by MAF to provide leadership for the Livestock Research Group including developing and overseeing a work plan and a series of research-related activities in support of the goals of the group and the Alliance as a whole.

The NZAGRC also provides assistance to MAF on a range of other initiatives associated with the Alliance. This includes administering science fellowship programmes for scientists from developing countries to visit New Zealand (LEARN)[2] and senior New Zealand scientists working with counterparts in other Alliance member countries (GRASS), providing advice on options for funding targeted and strategic research in support of the Alliance, and the development of scientific networks, databases and guidelines.

NZAGRC also ensures consistent science representation from New Zealand in the various other Research and Cross-Cutting Groups set up under the Alliance and in regional capacity building initiatives such as the FONTAGRO project in Latin America, which is jointly funded by the Interamerican Development Bank and New Zealand.

[1] See www.globalresearchalliance.org
[2] See www.livestockemissions.net

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Heads of Delegations at the Alliance Ministerial Summit (reproduced by permission from the Alliance)

Financial Summary and Outputs

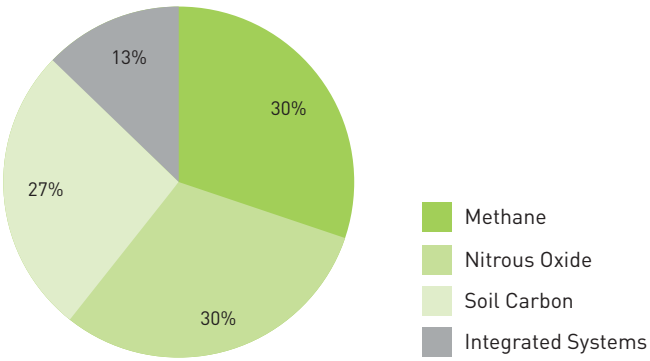
FINANCES[1]

Spending in 2010/11 has been across four key areas: Core Research ($3.79 million); Other Research (including fellowships and short term projects) ($0.46 million); Administration ($0.48 million); and Other Expenditure (including strategy development and IT) ($0.13 million).

Science has been funded across four research areas, in accordance with the NZAGRC's approved domestic science plan: Methane, Nitrous Oxide, Soil Carbon and Integrated Systems.

In addition to the investment made in science, money has also been spent on holding the NZAGRC conference, providing workshop and conference support and developing Maori and Communication Strategies.

NZAGRC Core Research Spending 2010/2011



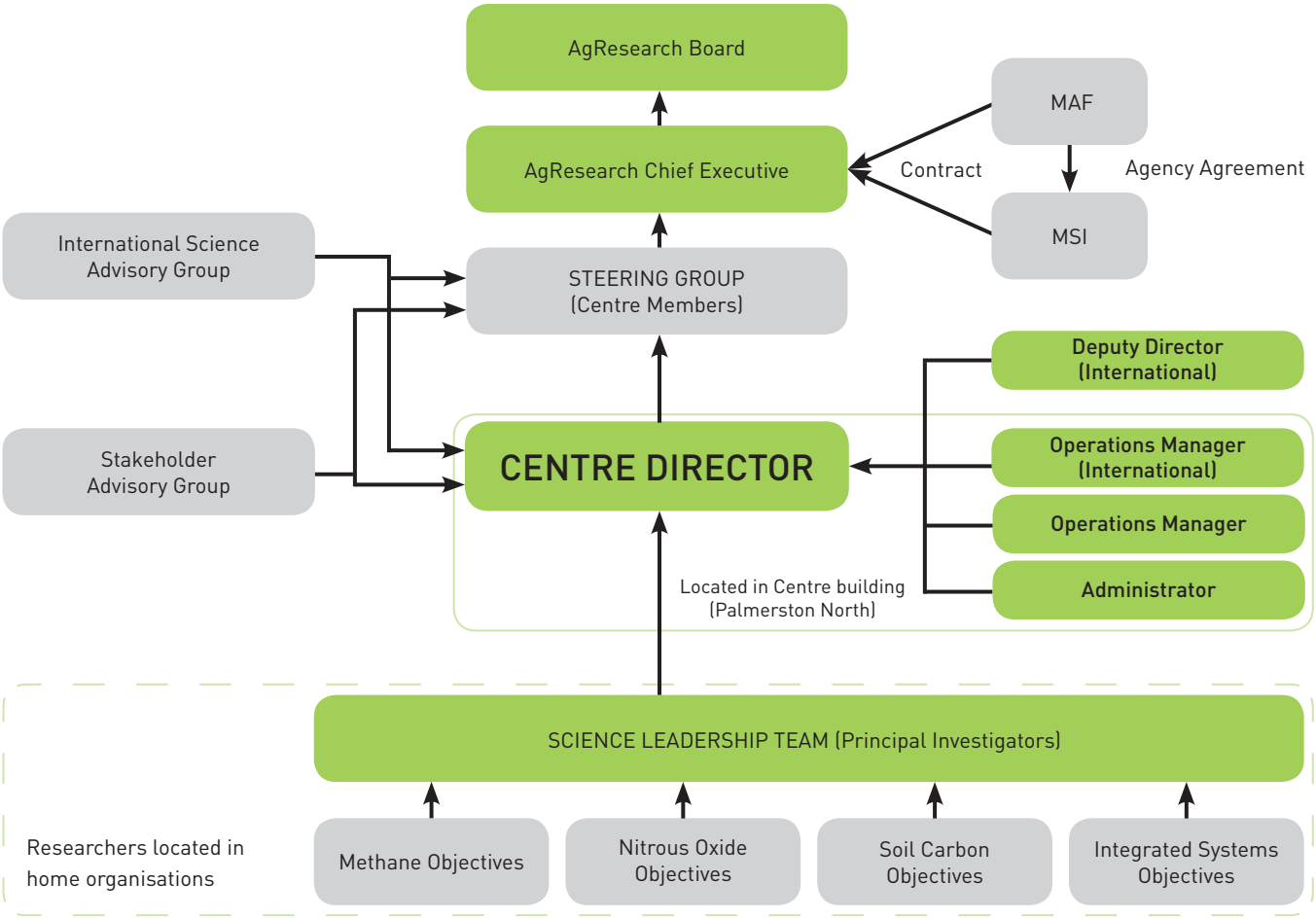
OUTPUTS

During 2010/11 the NZAGRC has both hosted and attended a significant number of meetings and presentations with a diverse group of external parties, both in New Zealand and internationally. The NZAGRC has also actively promoted itself and its role in the media and to a scientific audience via conference papers and peer-reviewed publications.

Type of Interaction/Output	# in 2010/11
Meetings and Presentations (New Zealand)	63
Meetings and Presentations (International)	12
International Visitors and Groups	17
Global Research Alliance related interactions	15
Media interactions	11
Conference presentations	18
Journal articles in press	9
Journal articles published	15
Other interactions/publications	4

[1] Research investments and advice to MAF related to the Global Research Alliance are not included in these figures

Governance Structure



Leading Partners in Science

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