



NEW ZEALAND  
AGRICULTURAL GREENHOUSE GAS  
Research Centre

# 2020-2021 Annual Highlights







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# Chair's Report

What a year this has been. The world about us has seen a greater focus on climate change. This increase in action has happened in New Zealand too and has led to a doubling of funding for work of the NZAGRC.

Our research has become more urgent, but our central remit remains the same – to develop the tools and knowledge to substantially reduce New Zealand's agricultural methane and nitrous oxide emissions, and to do this as quickly as possible. We have seen steady developments in the work on a vaccine against methane, inhibitors in the feed which reduce methane, pasture-applied inhibitors to reduce nitrous oxide, and breeding for low-emitting animals.

This year, we also established the NZAGRC Innovation Fund. This competitive fund is targeting new approaches and research avenues that show major promise for bringing practical, farm-level solutions for greenhouse gas emissions closer to implementation.

Our thanks go to NZAGRC Director, Dr Harry Clark, and his team for their unerring leadership in a year of momentous change.

**Dr Steve Thompson**  
**Chair of NZAGRC Governance Group**  
**November 2021**





# Director's Report

With a doubling of our funding, the next phase for the NZAGRC is underway. We have a new strategic framework and science plan in place, alongside strengthened governance and advisory structures. The Government's funding for our work now comes not only from the Ministry for Primary Industries (MPI) but also the Ministry of Business, Innovation and Employment (MBIE).

In the last 12 months, and in partnership with the Pastoral Greenhouse Gas Research Consortium (PGgRC), we have made significant advancements in the development of a novel nitrous oxide emissions inhibitor, started work on promising new approaches to inhibiting methane from the rumen, made progress in the search for an anti-methanogen vaccine and initiated a new low-emissions dairy cattle breeding programme. The launch of the NZAGRC Innovation Fund has created a competitive process to identify new and emerging ideas.

We have also continued our role in informing policy, with NZAGRC staff contributing to workstreams set up under He Waka Eke Noa, the Primary Sector Climate Action Partnership. A great deal of work has also gone into outreach, helping prepare farmers, growers and rural professionals get to grips with climate change.

**Dr Harry Clark**  
**NZAGRC Director, November 2021**

# About the NZAGRC

The NZAGRC was established in 2009 and is focussed on the discovery and development of products, tools and knowledge for New Zealand farmers and growers that enable the practical and cost-effective reduction of agricultural greenhouse gas emissions.

It receives funding from the Government for investment in research programmes focussed on reducing biogenic methane and nitrous oxide emissions and maintaining/increasing carbon sequestration in New Zealand soils. It is a partnership between New Zealand's leading research providers working on agricultural greenhouse gas emissions and the Pastoral Greenhouse Gas Research Consortium (PGgRc). The NZAGRC is hosted by AgResearch.

In addition to its role as a science funder, the NZAGRC ensures strategic research coordination and capacity building. It also leads New Zealand's scientific input into international initiatives, in particular the Global Research Alliance on Agricultural Greenhouse Gases (GRA).

The NZAGRC's principal focus is on the development and testing of mitigation solutions, in line with the Government's:

- Legislation of long-term greenhouse gas reduction targets, including for agricultural emissions
- Intent to price agricultural emissions at the farm level from 2025, the mechanism for which is being developed through He Waka Eke Noa, the three-way Government/industry/Māori partnership on climate change

Currently, the main mitigation options available to New Zealand farmers and growers are based around improvements in efficiency. New technologies and approaches are urgently needed for the sector to achieve the reductions required by the Government's long-term targets. This need has been recognised by the Government, which has substantially increased funding for research in this area both in 2019/20 (committing \$48.5 million for the NZAGRC out to 30 June 2025) and in 2020/21 (confirming an additional \$24 million out to June 2025).

Where once the NZAGRC was solely funded by MPI, it is now a 50:50 arrangement between MPI and MBIE's Strategic Science Investment Fund (SSIF).

From 1 July 2020, new governance and advisory structures were established, replacing the NZAGRC's Steering Group<sup>1</sup> that had served for the previous decade. Governance and oversight of decision-making has been devolved by the AgResearch Board to a new NZAGRC Governance Group, supported by Toihau and Stakeholder and Science Programme Advisory Groups.

For more on the NZAGRC, see: [www.nzagrc.org.nz/about/](http://www.nzagrc.org.nz/about/)

<sup>1</sup>Comprising a representative of each NZAGRC partner organisation

# NZAGRC's Strategic Objectives

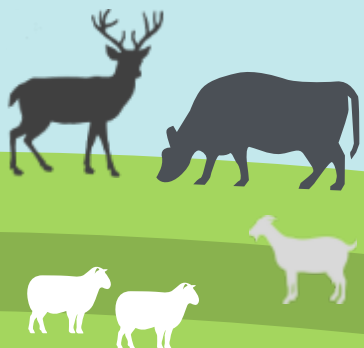
Eight objectives drive the NZAGRC's work:

- 1** Develop practices and technologies, and the knowledge and understanding to support future developments, that will contribute to New Zealand's 2030 and 2050 reduction targets for agricultural greenhouse gases
- 2** Quantify and increase the understanding of how to influence soil carbon sequestration in New Zealand's agricultural soils
- 3** Contribute to Iwi/Māori aspirations to play a leading role in the transition to a low-carbon economy
- 4** Be a trusted knowledge source and broker, facilitating the alignment of industry and Government funding, and securing additional resources both nationally and internationally
- 5** Enhance New Zealand's international reputation as a leader in agricultural greenhouse gas research by funding an innovative research programme of international quality and leading New Zealand's science input to the GRA
- 6** Ensure that national greenhouse gas research, development and extension activities are well-coordinated, developed with sector/stakeholder input and that progress in developing solutions is effectively communicated to the primary sector, Government and public
- 7** Enhance national capability and capacity, both human and infrastructure, to undertake agricultural greenhouse gas research, development and extension
- 8** Strengthen existing and build new collaborations with national and international organisations to increase the effectiveness of the NZAGRC's science programmes, Government investments in agricultural greenhouse gas mitigation, including the GRA programme, and Government-industry initiatives such as the PGgRc and He Waka Eke Noa

# 2020/21 Science Highlights

Since its inception in 2009, the NZAGRC has funded and coordinated research under five major themes: methane, nitrous oxide, soil carbon, farm systems, and Māori-focussed research.

The following pages provide a high-level summary of progress achieved within each programme during 2020/21. Figure 1 highlights the status of the different mitigation technologies and approaches being researched, as of 30 June 2021. This shows when they might be available for implementation on farms.



## Discovery

A scientifically-viable concept has been proposed but lacks scientific data on efficacy

Idea → Limited proof of efficacy in small-scale lab experiments

## Proof of Concept

Robust scientific evidence obtained which demonstrates efficacy

In-vitros → Limited In vivo/field experiments

Proof of concept → Proof of function

## Pilot studies

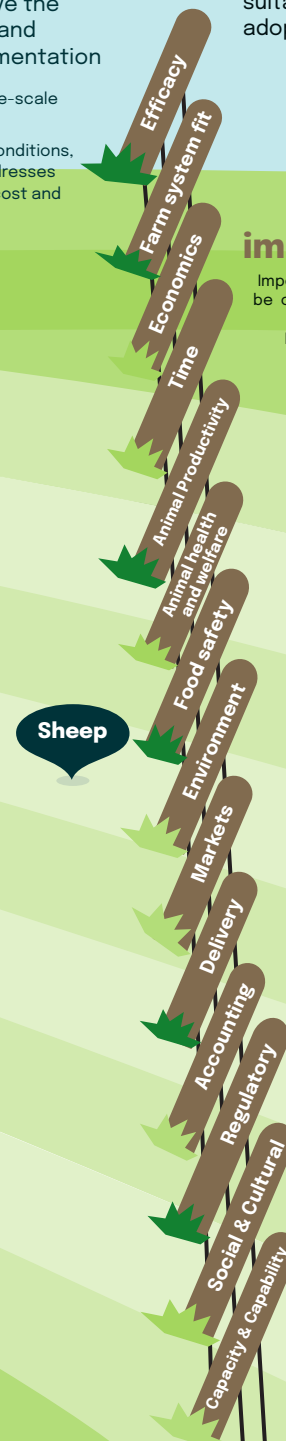
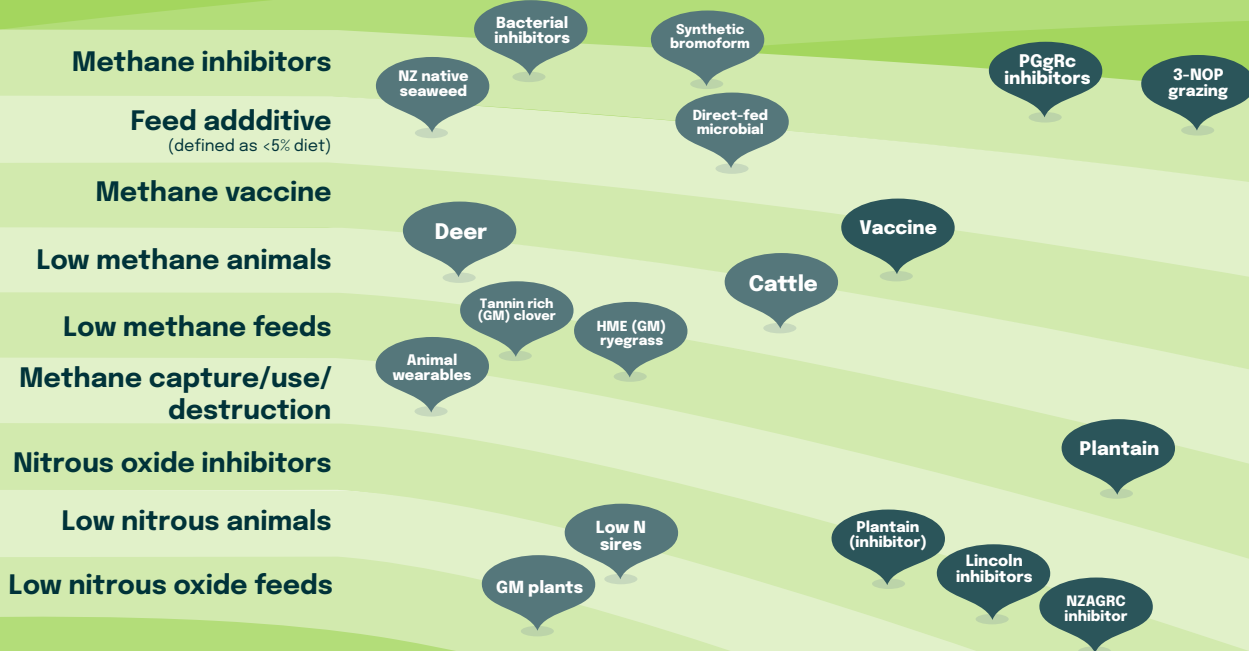
Concept trialed in large-scale systems designed to prove the viability of the mitigation and address hurdles to implementation

Small-scale → Large-scale

Trialed across multiple systems, geographical location, multiple conditions, long term effect established. Addresses product quality, path to market, cost and ability to report impact.

## Adoptable

Available as a mitigation suitable for widespread adoption



## Hurdles to implementation

Important criteria that should not be overlooked when considering a mitigation approach for New Zealand farm systems

June 2021

Research currently funded in New Zealand and its progress status

Plantain

Maize silage



# Methane

The NZAGRC's methane mitigation programme aims to reduce emissions in two ways:

1. Directly, by targeting methane-producing microbes found in the digestive systems of ruminant animals through the discovery of small molecule inhibitors and vaccines
2. Indirectly, through different animal feeds and through changes in animal phenotype (breeding low-emitting livestock).

The programme is planned and funded in partnership with the PgGRc and aligns with other work funded by MPI, including through the GRA.

In 2020/21, the sheep-breeding programme made research breeding values for low-methane emissions available to selected ram breeders through Beef+Lamb Genetics supported by the PGgRc. This provided 2,040 measurements from commercial breeding flocks.

As breeders and producers consider incorporating methane-breeding values into their own breeding programmes, the selection lines continue to provide a vital demonstration that this is a safe and practical mitigation strategy. All selection line lambs are measured for methane. Milk compositions from selection line ewes at four and six weeks after lambing have shown differences between the methane selection lines for individual milk and rumen fatty acid profiles. Rumen microbial profiles also differed, consistent with different fermentation characteristics of the rumens in the two groups.

A very successful collaboration has been with the GPLER<sup>2</sup>-funded programme “*Microbes to Predict Methane*”. This project used samples collected early in this research programme. Results show promise for the estimation of methane-breeding values in ruminant livestock.

2020/21 saw an acceleration in the dairy cattle breeding research programme. A successful small-scale pilot trial confirmed that automated Greenfeed methane measurement units could successfully identify young dairy bulls with contrasting methane emissions. Equipment needed to move to a full-scale trial was purchased and assembled, installed and commissioned.

Work on identifying low-emitting feeds concluded in 2020/21. Previous studies have shown conclusively that sheep and cattle fed diets comprising 100% forage rape have approximately 30% lower emissions than those fed standard grass-clover pasture. However, little evidence is available on whether this mitigation effect is still evident when diets comprise less than 100% forage rape. A trial suggests that the size of the effect is highly dependent upon the feeding situation.

Plantain is being extensively studied, particularly in dairy cattle, for its ability to decrease nitrogen leaching losses, nitrous oxide emissions and impact on soil carbon storage. A trial was performed to determine the effect of feeding plantain or ryegrass as a sole diet to non-lactating cows.

Methane yield was less in cows fed plantain compared to cows fed ryegrass. The PGgRc also supported work at DairyNZ to estimate methane emissions from cattle fed different proportions of plantain in the diet. Results are pending.

In the final quarter of 2020/21, work began on examining the potential of the direct feeding of bromoform to mitigate methane emissions. Bromoform has been identified as the principal active ingredient responsible for reducing methane emissions in animals fed *Asparagopsis* species seaweed.

For more on methane: [www.nzagrc.org.nz/domestic/methane-research-programme/](http://www.nzagrc.org.nz/domestic/methane-research-programme/)

<sup>2</sup>Global Partnerships in Livestock Emissions Research – a fund initiated by New Zealand in support of the work of the GRA’s Livestock Research Group





## Showcasing science impact: Breeding climate-friendly cows in partnership with LIC and CRV Ambreed

2020/21 saw significant acceleration of the programme to identify low methane-emitting dairy cattle. A pilot trial by breeding companies LIC and CRV Ambreed, with funding from the NZAGRC, measured feed intake and methane emissions from 20 young bulls destined to father the next generation of New Zealand's dairy cows.

The trial looked at whether automated Greenfeed measurement units could identify young bulls with contrasting methane emissions. This was a success and paved the way for a bull testing trial to begin.

Equipment needed for that full trial – seven new Greenfeed units and associated smart intake feeders – was purchased by the NZAGRC and assembled in a purpose-built barn provided by the LIC. The trial began in April 2021 and was launched by Agriculture Minister Damien O'Connor at LIC's farm near Hamilton. By 30 June 2021, methane measurements had been completed on 140 young bulls.

The full-scale trial is being undertaken as part of existing LIC and CRV Ambreed sire-proving schemes and will see measurements taken from approximately 300 young bulls annually.



# Nitrous oxide

In New Zealand, most nitrous oxide is produced by microbes acting on nitrogen introduced to the soil via livestock urine or synthetic fertilisers. The NZAGRC's nitrous oxide programme has been focused on developing effective and safe inhibitory compounds that influence the rates that nitrous oxide is converted from those processes in the soil. This has led to the identification of a novel inhibitor that has shown promise in both field and laboratory trials. A preliminary patent has been lodged.

NZAGRC-funded research, in association with industry-led research, has also been exploring different forages that could assist to reduce the quantity of nitrogen excreted by livestock and/or influence microbial processes in the soil that cause nitrous oxide emissions.

Two strands of work were pursued in 2020/21:

- The development of a recently-identified nitrous oxide inhibitor
- Further evaluation of the ability of plantain to reduce nitrous oxide

In 2019/20 a compound was identified that reduces nitrous oxide emissions in a similar manner to DCD (dicyandiamide) is a well-proven well-proven inhibitor that is not currently available in New Zealand. In 2020/21, further work confirmed the promise shown by the new compound in early trials, including some preliminary information that it also reduced nitrogen leaching losses. Evidence to support a provisional patent was assembled and the patent lodged in December 2020. This patent covered ground application and use as a fertiliser coating. Work in 2021 focussed on confirming efficacy, optimising dose

rates and to better understand how it works. Analytical techniques to identify residues are being developed, to help provide critical information needed by regulatory bodies. MPI, who own the patent, have commenced discussions with potential commercial partners.

A review of current knowledge was commissioned to identify the potential effect of plantain to reduce nitrous oxide emissions in urine patches and to improve the understanding of the main drivers that influence its effectiveness. Data were collated from eight published and two unpublished plantain studies conducted in New Zealand. Region, season, sward, urine type and urine nitrogen loading data for each study were assembled and, where available, key soil and climatic variables.

In the majority of studies, the presence of plantain reduced nitrous oxide emissions from cattle urine patches, but some showed no effect or even an increase in emissions. There seems to be a seasonal effect on plantain effectiveness. Winter studies generally showed very low nitrous oxide emissions, with no significant differences in emission from plantain swards.

The number of studies for which we had key soil and climatic variables was limited. The information obtained has been used to guide further work on plantain and nitrous oxide emissions, commencing in spring 2021.

For more on nitrous oxide: [www.nzagrc.org.nz/domestic/nitrous-oxide-research-programme/](http://www.nzagrc.org.nz/domestic/nitrous-oxide-research-programme/)

# Showcasing science impact:

## Major mitigation for nitrous oxide emissions on the horizon

With funding from the NZAGRC, work led by AgResearch scientists is showing great promise for reducing nitrous oxide emissions from cattle urine patches.

Nitrification inhibitors can be added to fertiliser or deposited directly onto grazed pasture. They work by suppressing the action of microbes in the soil that convert nitrogen into nitrate – of which nitrous oxide emissions are a by-product.

In 2019/20, Paul Newton and his team in Palmerston North discovered and tested a compound in laboratory and field studies that reduced nitrous oxide emissions in a similar manner to DCD.

In 2020/21, further work by the team confirmed the promise shown in the earlier trials, including some preliminary information that it also reduced nitrogen leaching losses. The evidence of efficacy was assembled to support a provisional patent application, which was then lodged in December 2020.

This patent covered ground application of the inhibitor and its use as a fertiliser coating. A new programme of work is now underway to support the granting of a full patent. This includes further laboratory and field trials to confirm efficacy and optimise dose rates, along with work to better understand the inhibitor's mode of action. MPI has also commenced discussions with a potential commercial partner. It is early days and much more work is needed to confirm efficacy, but it is an exciting development.

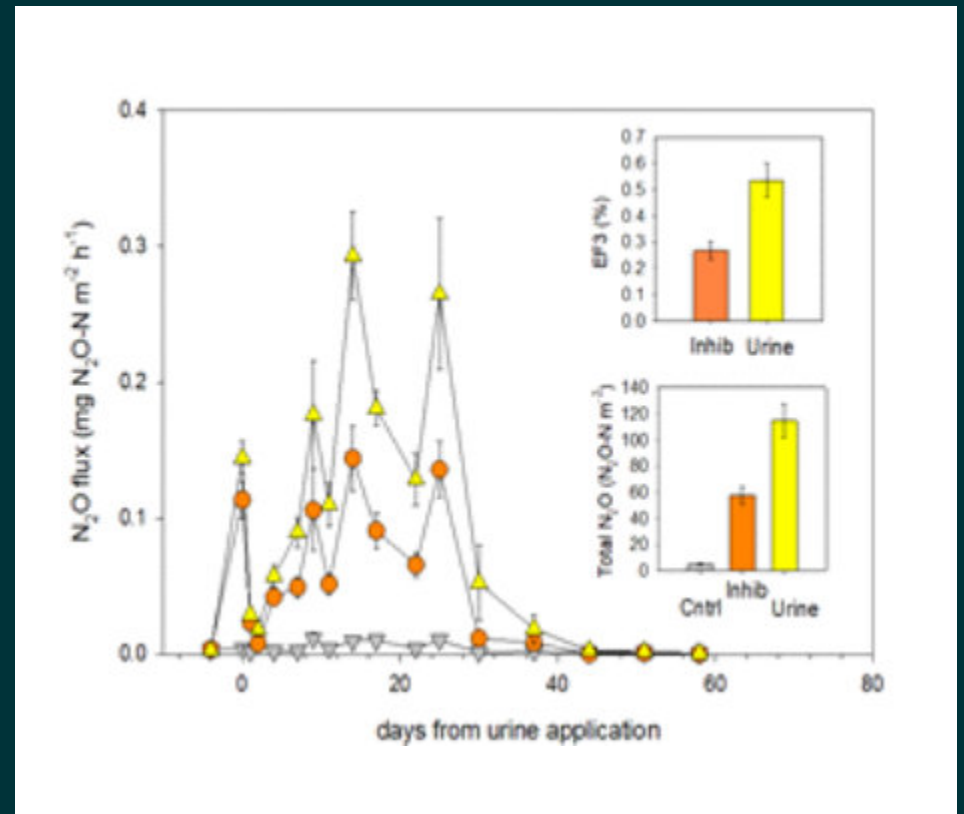


Image (above) : Nitrous oxide emissions from urine patches treated with a novel inhibitor compared with an untreated control

Image (right): Mesocosms used for measuring nitrous oxide emissions after the application of urine and potential inhibitory compounds



# NZAGRC Innovation Fund

In 2020, the NZAGRC created an Innovation Fund – a mechanism by which new and emerging research ideas can be progressed.

Two funding rounds were held during the year (July 2020 and March 2021) and the Fund is already showing its worth in promoting new thinking in the search for solutions and in leveraging co-funding.

Both rounds sought proposals for projects focussed on reducing methane emissions from enteric fermentation in grazing ruminants or on reducing nitrous oxide emissions from ruminant animal-deposited urine patches.

Proposals were invited from New Zealand-based research providers, organisations and companies. Fundamental to applied projects were considered, but proposals had to significantly strengthen current research avenues and/or develop novel approaches that show major promise for bringing practical, farm-level solutions closer to on-farm implementation.

More than 50 applications were received across the two funding rounds, with eight put forward by the Fund's Technical Advisory Panel for contracting. By the end of June 2021, four of those had been contracted and the remaining four were in negotiations. This will see just under \$5 million of new work underway that has also attracted nearly \$2 million in co-funding from research partners.

For more, see: <https://www.nzagrc.org.nz/about/funding/innovation-fund/>

Photo credit (right): Dave Allen Photography





# Soil carbon

In 2019, the NZAGRC initiated a national, long-term soil carbon monitoring programme that will see the sampling of 500 sites across broad land use categories. Measurements over the next decade will determine, for the first time, whether New Zealand agricultural soils are gaining or losing carbon. As of 30 June 2021, total of 170 sites had been sampled. The target is to complete the benchmarking phase by June 2023.

In 2020/21, an initial analysis of data collected to date revealed lower soil carbon stocks in the topsoils of croplands, which is consistent with expectations. Results also suggested that soils under dairy farms had higher soil carbon than other land uses, although this appears to be largely due to a higher proportion of dairy sites occurring on Allophanic soils, which have naturally-high carbon stocks.

Advances in measurement technology have increased the ability to measure carbon and nitrous oxide balances at the paddock scale. Paddock-scale measurements of nitrous oxide and carbon balances comparing ryegrass/clover mix to swards including plantain got underway in the Waikato and Canterbury during 2020/21. This research will determine approaches for establishing plantain with minimal carbon loss during transition while reducing nitrous oxide emissions.

Maize is an important component of dairy cattle diets in some regions and previous NZAGRC-funded work demonstrated that large losses of carbon can occur both prior to and post-maize production. Three years after converting maize back to pasture, there has been no evidence of a recovery in soil carbon stocks. Future measurements

will track when carbon starts to accumulate again to identify safe return periods between maize-pasture rotations.

Detailed modelling of nitrous oxide emissions alongside carbon dioxide exchange from the Troughton Farm in the Waikato started in 2020/21. The modelling will be further refined with observations from Ashley Dene Farm Lincoln (irrigated). It will then be used to provide scenarios of the annual and seasonal impacts of incorporating plantain into pasture swards. Simultaneous predictions will enable the evaluation of trade-offs between different greenhouse gases and production.

The NZAGRC has also launched a new programme aimed at understanding how climate change itself (temperature, water supply and atmospheric carbon dioxide) is likely to influence soil carbon stocks. This piece of work utilises the New Zealand Free Air Carbon Enrichment (FACE) system in the Rangitikei – the world's longest running experiment site examining the influence of elevated carbon dioxide levels on grassland ecosystems (set up by AgResearch in the late 1990s).

Initial results indicate that 23 years of exposure of pasture to elevated carbon dioxide at the FACE site appears to have had minimal impact on soil physical properties and soil carbon stocks. In contrast, sheep grazing behaviour had a significant impact, with higher carbon stocks in the middle of the rings where grazing and excreta deposition occurred than on the edges where grazing occurred, but excreta was not deposited.

For more on soil carbon: [www.nzagrc.org.nz/domestic/soil-carbon-research-programme/](https://www.nzagrc.org.nz/domestic/soil-carbon-research-programme/)





# Farm systems

The sheep, beef and dairy components of the NZAGRC's original farm systems research programme were completed in 2019/20. In 2020/21, a summary of the dairy work was undertaken to highlight the connections with wider dairy industry initiatives.

A highlight has been the ongoing impact each of the work programmes has had through both Government and industries. Of note, is the contribution of this programme to DairyNZ's Step Change project, designed to help dairy farmers achieve financial gains while making progress towards environmental goals and adapting to pending regulations.

Since the close of that work, the NZAGRC has refocussed its farm systems programme towards the future of farming in New Zealand. A small steering group comprising experienced farm systems experts and senior representatives from key industry organisations was established in March 2021. This group identified an opportunity for the NZAGRC to shift its research focus to exploring more radical system changes that could be implemented to meet the Government's 2050 climate targets. Discussions were held with the NZAGRC's Toihau and Stakeholder Advisory Group, who agreed and requested a stocktake of existing farm systems research to inform the development of any future programme.

The NZAGRC worked with Phil Journeaux (AgFirst) to complete this stocktake in mid-2021. Its findings were then used by the steering group, Toihau and the Stakeholder Advisory Group to identify new investment opportunities. A sub-group of the steering group has been tasked with providing a detailed proposal for consideration early in 2021/22.

For more on farm systems, see: [www.nzagrc.org.nz/domestic/integrated-solutions/](http://www.nzagrc.org.nz/domestic/integrated-solutions/)



# Māori-focussed research

The NZAGRC's Māori-focussed research programme moved into a new phase in 2020/21. In the six years, ending 30 June 2020, work focussed on modelling individual Māori-owned dairy and livestock farms to develop mitigation and land-use change scenarios to reduce greenhouse gas emissions while minimising the economic impact.

Efforts during 2020/21 focussed on scoping a new project that will utilise knowledge gained in that previous work and apply it to Collectives. The new project (which was submitted for funding approval in July 2021) will focus on three areas:

1. Demonstrating the application of the 10-point methodology developed in the previous three stages of the programme to Māori Collectives.
2. Develop a communication and extension framework where the methodology can be demonstrated on individual Māori farms and Māori Collectives to encourage the exploration and adoption of methodology to reduce on-farm agricultural greenhouse gases through changes in farm systems design and land use diversification.
3. Building the capacity of the Collectives and entities to develop a greenhouse gas mitigation framework that will enable Māori farmers and landowners to respond to environmental policy restrictions while also meeting the expectations of their owner communities.

Three Collectives have agreed to take part in the programme: Te Arawa Arataua (Te Arawa Primary Sector Group); Tuwharetoa Farming Collective; and Whangara Partnership. Additionally, two other Collectives have been involved in the discussions and (to be confirmed) have agreed to be observers of the programme. They will be invited into the programme in Year 3 to test the framework. Each Collective has confirmed six farms within their Collective which will be modelled for farm systems and land-use changes.

In addition to this project, in late 2020/21, the NZAGRC began exploring an opportunity to support a scoping study with a group of marae on the East Coast of the North Island. The information from this scoping study will be used to develop a proposal for a larger, community-led research project aimed at using Mātauranga Māori and traditional environmental knowledge to shape a climate-ready future for this remote, rural community.

For more on Māori-focused research, see: [www.nzagrc.org.nz/domestic/maori-research/](http://www.nzagrc.org.nz/domestic/maori-research/)

# Building Science Capability and Capacity

The NZAGRC continues to be a major source of new research capability in the field of agricultural greenhouse gas mitigation. Increasing the pool of researchers with skills in this field is a key focus. In 2020/21, dedicated funding provided to Massey, Lincoln and Waikato Universities enabled short-term scholarships to promising undergraduate students with the aim of encouraging them to undertake postgraduate studies, topping up existing postgraduate stipends and embedding funding for postgraduates and early-career scientists within the NZAGRC's core science programmes.

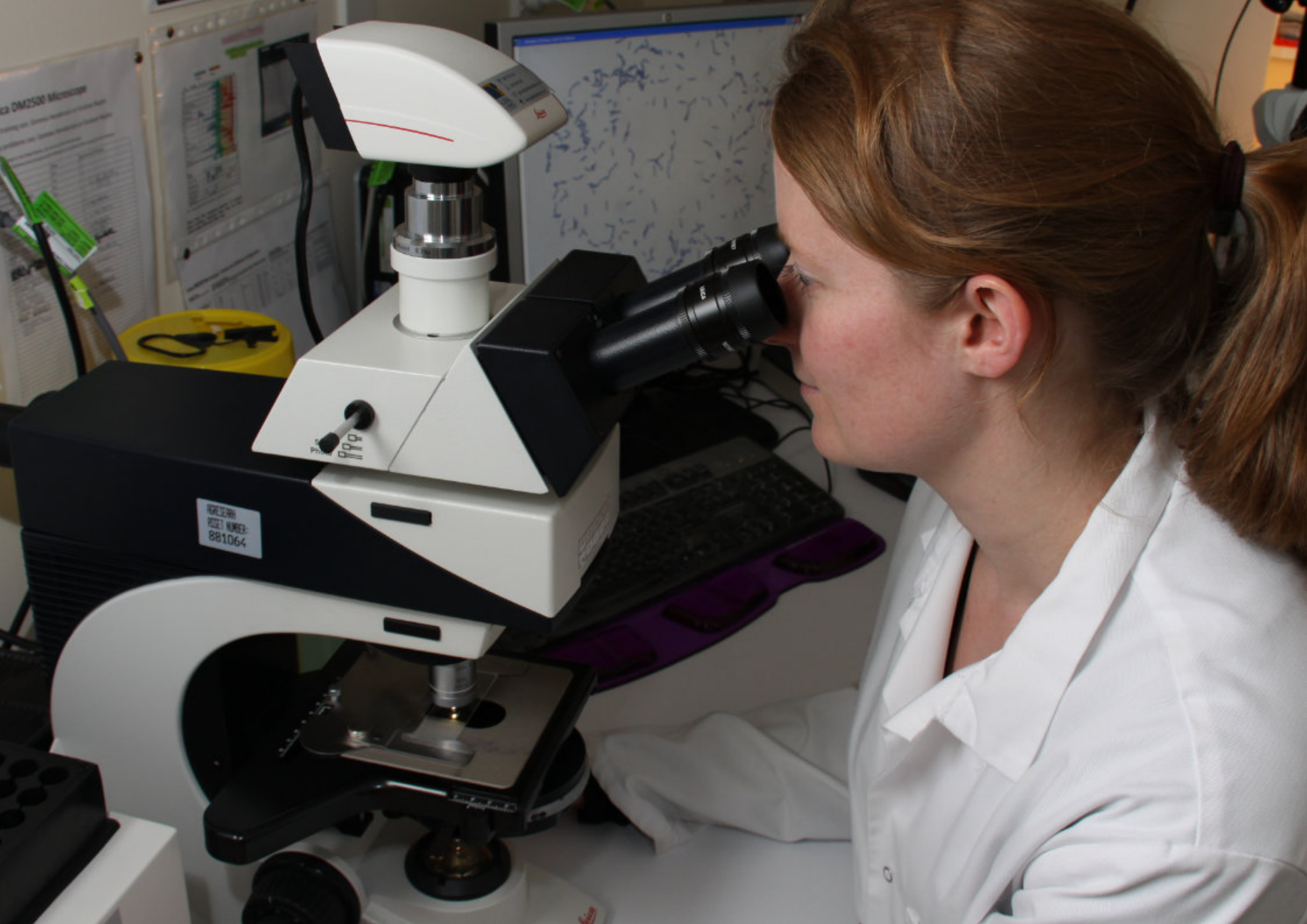
New Zealand's GRA budget, administered by MPI, also provides opportunities for international researchers to receive training in NZAGRC programmes of work.

In 2020/21, two PhD students graduated, one with NZAGRC funding and the other with funding from New Zealand's GRA budget. Two undergraduates, two Masters and two PhD students were supported in their studies during the year with NZAGRC funding/supervision.

Two NZAGRC-funded postdoctoral researchers in the vaccine programme completed their projects and moved into permanent positions with AgResearch. Two postdoctoral researchers funded from New Zealand's GRA budget and supervised by an NZAGRC associate researcher also completed their projects. A fifth postdoctoral researcher, also funded from New Zealand's GRA budget and working under the supervision of the NZAGRC Director, completed his project and took up a three-year contract with AgResearch.

The NZAGRC continued its involvement with House of Science – a scientific literacy resource provider to primary schools around New Zealand. With NZAGRC funding, House of Science has developed and now maintains a number of climate change resource kits for Year 1-8 students.

In addition to investing in human capability, the NZAGRC invested \$1.353m in essential methane measurement equipment in 2020/21 from the MPI portion of its funds. Seven Greenfeed methane measurement units and associated smart intake feeders for use in the low-emissions dairy cattle breeding programme were purchased and commissioned.



# Outreach and Policy Support

As well as its extensive research programme, the NZAGRC has key roles to play in outreach and policy support in line with its strategic objectives (see page 7). This ensures that progress in developing solutions for reducing agricultural greenhouse gas emissions is effectively communicated to the primary sector, Government and public. It also means the sector has access to science-based information about those emissions and how they can be managed and reduced at the farm level.

A wide range of initiatives took place in 2020/21 in support of these objectives.

## Outreach

A major outreach activity for the NZAGRC was the organisation of the New Zealand Agricultural Climate Change Conference from 1-2 June 2021 at Te Papa in Wellington. The two-day conference covered the latest research and policy developments and implementation actions being undertaken to reduce agricultural greenhouse gases in New Zealand. It was attended by more than 300 people and feedback was universally positive. The Ministers of Agriculture and Climate Change and the Director General of MPI attended (and presented), along with other senior leaders from across the primary sector, science and policy communities. Footage of the main presentations can be found on the NZAGRC website events page.

The NZAGRC's website was comprehensively redeveloped during 2020/21 to provide the latest information on its research programmes and

international activities. The new website now also includes a searchable library enabling access to all publications from NZAGRC-funded work since 2009. See <https://www.nzagrc.org.nz/>

The NZAGRC's continued its work to manage the Ag Matters website – a climate change resource for farmers, growers and rural professionals. New case studies were added (including videos), showcasing different farmers' journeys to finding out their greenhouse gas emission numbers and identifying and implementing mitigation actions on their farms. These case studies have been widely praised and promoted by industry organisations including DairyNZ, Horticulture New Zealand, Beef + Lamb New Zealand and Federated Farmers. They are also being used as part of the extension efforts of He Waka Eke Noa – the primary sector climate action partnership. The NZAGRC also published Ag Matters content in

Farmers Weekly and recorded podcasts with He Waka Eke Noa and the Foundation for Arable Research. See <https://www.agmatters.nz/>

The NZAGRC continued its delivery of climate change training for rural professionals in partnership with AgFirst and the New Zealand Institute of Primary Industry Management (NZIPIM). Two types of events are offered; both are free to attend:

- Education seminars designed to equip rural professionals with a basic understanding of climate change and agricultural greenhouse gas emissions, and what can be done at the farm level – participants also receive a comprehensive booklet to take away as a reference tool for conversations with farming clients
- Advanced training workshops for farm consultants on how to model Farmax and Overseer together to identify mitigation opportunities (and the impact on profitability) at the farm level

Ten seminars and four advanced workshops were delivered nationwide in 2020/21. Since the programme began in 2019, more than 500 rural professionals have attended an event – more than a quarter of the rural professional community. The NZAGRC also delivered several bespoke training sessions for individual agribusiness companies during the year.

Two 'State of Science' webinars were organised during 2020/21:

- **State of Science: The carbon stabilisation of New Zealand grassland soils**, featuring Drs Mike Beare and Sam McNally from Plant & Food Research, 13 October 2021
- **State of Science: Breeding low-emitting cattle**, featuring Dr Lorna McNaughton, LIC and Dr Suzanne Rowe, AgResearch, 25 February 2021



# Policy support

The NZAGRC regularly contributes to relevant forums or working groups to support policy development processes. In 2020/21, this included:

- The Director continued to serve as a member of the Climate Change Commission, which produced a major package of climate change advice for the Government this year.
- Senior NZAGRC staff involvement in He Waka Eke Noa – the primary sector climate action partnership that is developing an alternative farm-level pricing mechanism and an associated package of work on farm planning, reporting, extension and innovation.
- Senior NZAGRC staff involvement in the Biological Emissions Reduction Science Accelerator (BERSA) led by MPI as part of its 'Fit for a Better World – Accelerating our Economic Potential' roadmap. Together with the PGgRc and AgResearch, the NZAGRC led a stocktake exercise for the BERSA to establish the status, including funding, of domestic research into agricultural greenhouse gas emissions. This work will support the development of a national research and development plan in 2021/22.
- Several NZAGRC staff continued to be involved in the work of the Intergovernmental Panel on Climate Change (IPCC), including as Lead and Contributing Authors and Chapter Scientist.

From time to time, the NZAGRC is also asked by MPI to undertake or commission research to inform policy settings. One such request was received in 2020/21 – for a report on the potential use of biochar as a greenhouse gas mitigation. The report confirmed biochar's potential for this purpose, however it also found that there are considerable financial and practical barriers to overcome if it is to provide cost-effective mitigation at scale. The full report can be found at <https://www.nzagrc.org.nz/publications/review-of-evidence-for-the-potential-role-of-biochar-to-reduce-net-ghg-emissions-from-new-zealand-agriculture/>







# International Efforts

The GRA brings countries together to find ways to grow more food without growing greenhouse gas emissions. It was established by New Zealand around the same time the NZAGRC was set up, and now has more than 60 participating countries and 20 international and regional partner organisations.

The NZAGRC has played a lead role in the GRA since it was established and undertakes a wide range of activities on contract to MPI, including strategic advice, capability building, contracting and implementation.

In 2020/21, the NZAGRC continued to co-chair the GRA's Livestock Research Group (LRG) and coordinate its programme of work alongside the other LRG co-chairs from Ireland and the UK. This included organising and co-chairing the annual Livestock Research Group meeting in September 2020 – an online event attended by over 90 people, including from 42 GRA member countries and seven partner organisations. The NZAGRC also represented the LRG at the GRA's online Council meeting in March 2021.

The NZAGRC worked closely with MPI to map out a comprehensive capability building programme in support of the GRA, which included:

- An in-depth assessment of the status of inventory development in Eastern and Southern African countries, which has subsequently led to prioritisation of six countries to support development of Tier 2 greenhouse gas inventories.
- Initiation of work to establish regional agricultural greenhouse gas emissions measurement hubs in the ASEAN region and in Eastern and Southern Africa.
- Ongoing leadership of the GRA's relationship with the Climate and Clean Air Coalition (CCAC), including coordinating funding for a new multi-country project called 'Creating the enabling environment for enhanced climate ambition and climate action through institutional capacity building'.

Two international postdoctoral researchers were engaged to provide greater New Zealand input into the IPCC's Sixth Assessment Report, working with the NZAGRC Director.

The NZAGRC also acts as funding agent for MPI, contracting and monitoring a major science programme from the Government's dedicated GRA support fund. Twenty-two projects were managed during 2020/21.



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