15 years of developing strategies for adaptation and mitigation to climate change in Latin America and the Caribbean

More than a decade of collaboration to increase farming resilience and sustainability in Latinamerican and the Caribbean agriculture.

IDB

IICA

Te Kāwanatanga o Aotearoa
New Zealand Government

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

FONTAGRO

Códigos JEL: Q16

FONTAGRO (Regional Fund for Agricultural Technology) is a cooperation program administered by the Inter-American Development Bank (IDB), but with its own membership, governance structure, and assets. The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Inter-American Development Bank, FONTAGRO, their Executive Boards, or the countries they represent.

The **Global Research Alliance on Agricultural Greenhouse Gases (GRA)** is a collaborative initiative that addresses the dual challenge of increasing global food production while reducing agriculture's contribution to greenhouse gas emissions. Recognizing the sector's role in food security, poverty reduction, and sustainable development, the GRA facilitates international cooperation by linking research efforts across member countries and partner organizations. By improving the quantification of emissions under different management scenarios and fostering evidence-based research, the GRA accelerates the development of best practices for enhancing agricultural productivity and resilience while mitigating climate change impacts.

The **Ministry for Primary Industries (MPI) of New Zealand** is the government agency responsible for overseeing and supporting the country's primary industries, including agriculture, forestry, fisheries, and biosecurity. MPI plays a crucial role in ensuring the sustainability, productivity, and resilience of these sectors while addressing challenges such as climate change, food security, and market access. Through research, policy development, and collaboration with industry stakeholders, MPI fosters innovation and promotes best practices to enhance New Zealand's global competitiveness. Additionally, the ministry is actively involved in biosecurity measures to protect the country's unique biodiversity and maintain high standards for food safety and trade.

FONTAGRO, and representatives from the Ministry for Primary Industries of New Zealand and the Global Research Alliance on Agricultural Greenhouse Gases collaborated in organizing this publication.

Coordination: Eugenia Saini, Lee Nelson, Martín Oesterheld.
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Contents

Prologue

For over 15 years, FONTAGRO and the Ministry for Primary Industries of New Zealand have been at the forefront of fostering agricultural innovation and climate resilience in Latin America and the Caribbean (LAC). This collaboration has resulted in pioneering efforts to address the urgent challenges posed by climate change and climate variability in the agricultural sector, which is critical to the region's food security and economic stability.

Our joint initiatives have focused on developing and scaling innovative agricultural practices and technologies that mitigate the effects of climate change while enhancing productivity and sustainability. These efforts have included projects aimed at quantifying greenhouse gas emissions from livestock, improving pasture management, integrating sustainable livestock systems, and promoting the use of digital technologies and biological solutions to create more climate-resilient agricultural practices. The outcomes of these projects have not only contributed significantly to scientific knowledge and solutions applicable to New Zealand farming conditions, but have also provided practical tools and methodologies that are being adopted across the LAC region.

The partnership between New Zealand and FONTAGRO exemplifies the power of international collaboration in addressing global challenges. By combining New Zealand's expertise in agricultural science and technology with FONTAGRO's regional focus and network of stakeholders, we have created a model for how countries can work together to drive meaningful change. This publication highlights some of our most impactful projects, showcasing the achievements and lessons learned from our joint efforts to build a more sustainable and resilient agricultural sector in Latin America and the Caribbean.

As we look to the future, we remain committed to expanding our partnership, exploring new avenues for innovation, and continuing to support the development of climate-smart agriculture that benefits farmers, communities, and ecosystems throughout the region.

Acknowledgments

We would like to extend our deepest gratitude to all the individuals and organizations that have contributed to the success of this collaborative effort between the **Ministry for Primary Industries of New Zealand and FONTAGRO**. This publication reflects more than a decade of dedication, research, and partnership aimed at advancing climate-smart agriculture in Latin America and the Caribbean.

First and foremost, we thank the Ministry for Primary Industries of New Zealand for its unwavering support and commitment to fostering agricultural innovation and sustainability in the region. Its vision and leadership have been instrumental in driving forward projects that address the critical challenges posed by climate change in our agricultural systems. We are also profoundly grateful to the **Global Research Alliance on Agricultural Greenhouse Gases (GRA)** for their continued collaboration and support. Its contribution to advancing scientific research and promoting international cooperation has greatly enriched our collective work.

Our appreciation extends to the **FONTAGRO Board of Directors** for their strategic guidance and ongoing support, which have been essential in steering FONTAGRO's mission toward impactful results. Its leadership has enabled FONTAGRO to be a catalyst for agricultural innovation across Latin America and the Caribbean. We would like to acknowledge the invaluable efforts of the scientists and researchers who have been at the heart of our projects. Your dedication to advancing scientific knowledge, developing innovative solutions, and promoting sustainable agricultural practices is the cornerstone of our achievements. We are equally thankful to the FONTAGRO **Technical and Administrative Secretariat** for its diligent work in coordinating and managing the diverse range of activities that make our projects successful. Its commitment and expertise ensure that our collaborative efforts run smoothly and efficiently.

Special thanks are due to the **Inter-American Development Bank (IDB)** for its support. The IDB's commitment to supporting sustainable development in the region has been crucial in enabling FONTAGRO to implement groundbreaking projects that address both local and global challenges. Finally, we extend our gratitude to the **Inter-American Institute for Cooperation on Agriculture (IICA)** for its support in enhancing agricultural development and innovation. Its collaboration has greatly contributed to strengthening capacities and fostering agricultural research and knowledge exchange across Latin America and the Caribbean.

Together, these efforts demonstrate the power of partnership in achieving sustainable and impactful agricultural innovation. We look forward to continuing this journey of collaboration, learning, and growth with all our partners.

Finally, we would like to express our heartfelt gratitude to the former Executive Secretaries of FONTAGRO, **Nicolás Mateo, Hugo Li Pun**, **Hayden Montgomery**, and **Terry Meikle** whose vision and leadership laid the foundation for this invaluable alliance. Its dedication and foresight were instrumental in shaping the collaborative efforts that continue to drive agricultural innovation and climate resilience in Latin America and the Caribbean. Its contributions serve as a lasting legacy, inspiring the ongoing work of researchers, policymakers, and institutions committed to advancing sustainable agricultural solutions in the region.

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Latin America Research and Policy Lead, Global Research Alliance on Agricultural Greenhouse Gases (GRA)

Advancing climate-smart agriculture through global collaboration

The **New Zealand Government as part of its contribution to the Global Research Alliance on Agricultural Greenhouse Gases (GRA)** is proud to collaborate with **FONTAGRO** in advancing agricultural innovation and climate resilience across Latin America and the Caribbean (LAC). This long-standing partnership exemplifies the power of international cooperation in addressing the pressing challenges posed by climate change to the agricultural sector. By leveraging **technical expertise, research capabilities, and financial resources**, our joint efforts have successfully generated new knowledge and innovative technologies that help farmers **adapt to climate variability, reduce greenhouse gas emissions, and enhance productivity**.

Through more than a decade of collaboration, the New Zealand Ministry for Primary Industries and FONTAGRO have supported projects focused on **quantifying and mitigating agricultural emissions, improving pasture management, integrating climate-smart technologies, and promoting sustainable livestock systems**. These initiatives have provided invaluable insights into best practices that not only benefit Latin American farmers but also **contribute to New Zealand's leadership in sustainable agriculture.** By working together, we are bridging research gaps, scaling up proven innovations, and fostering knowledge exchange that empowers farmers to become more efficient, resilient, and environmentally responsible.

This partnership contributes to the **(GRA), fostering links between scientists, policymakers, and farmers** to drive evidence-based solutions for **low-emission, resilient agricultural systems**. Joint research initiatives have **provided critical insights into livestock emissions mitigation, sustainable pasture management, and precision agriculture**, contributing to regional and global efforts to reduce the environmental footprint of food production. This partnership provides benefits to GRA LAC members by leveraging the regional projects with the GRA workspace as a platform that promotes knowledge exchange with scientists from the region and the rest of the world. By harnessing technical expertise, sharing knowledge, and supporting capacity-building efforts, the GRA and FONTAGRO continue to **empower farmers** with **the tools and strategies needed to adapt to climate variability and enhance agricultural sustainability**. As we progress, our commitment to strengthening scientific collaboration and scaling up impactful solutions remains unwavering, aiming to **grow more food without growing GHG emissions.**

As the global demand for climate-smart solutions grows, our partnership with FONTAGRO remains a cornerstone of our commitment to supporting science-driven, sustainable agricultural development. By continuing to collaborate, we can **enhance food security, strengthen rural livelihoods, and build more climate-resilient agricultural systems** for future generations.

Ministry for Primary Industries (MPI)
Government of New Zealand

Letter from FONTAGRO

We are pleased to present this publication, which highlights the outcomes of our fruitful collaboration with the Ministry for Primary Industries of New Zealand and other esteemed partners. Over the past 15 years, FONTAGRO has been dedicated to promoting innovation, sustainability, and resilience in the agricultural sector across Latin America and the Caribbean (LAC). This publication reflects the significant progress we have made together and shows the impact of our collective efforts.

Our partnership with the Ministry for Primary Industries of New Zealand, along with our collaboration with the Global Research Alliance on Agricultural Greenhouse Gases (GRA), has empowered us to tackle some of the most urgent challenges facing agriculture today. By combining our resources, knowledge, and expertise, we have developed and implemented groundbreaking solutions that not only mitigate the impacts of climate change but also enhance the productivity and sustainability of farming systems across the region.

The projects featured in this publication embody the spirit of cooperation and shared vision that are at the core of FONTAGRO's mission. From climate-smart livestock practices to the use of advanced digital tools and biological innovations, these initiatives reflect our commitment to fostering a more sustainable and resilient agricultural sector. We extend our deepest appreciation to the scientists, researchers, and technical experts whose dedication and hard work have been fundamental to our success.

We also wish to express our sincere gratitude to the FONTAGRO Board of Directors for their strategic leadership and unwavering support, which has been crucial in guiding our organization toward achieving impactful results. Additionally, we commend the FONTAGRO Technical and Administrative Secretariat for their outstanding efforts in coordinating our projects and ensuring their effective implementation.

We are equally thankful to the Inter-American Development Bank (IDB) for its legal and administrative support, which has been instrumental in enabling us to bring these innovative projects to life. Our collaboration with the Inter-American Institute for Cooperation on Agriculture (IICA) has also been invaluable in strengthening agricultural research and knowledge exchange across the LAC region.

Looking ahead, we remain fully committed to advancing agricultural innovation and sustainability in Latin America and the Caribbean. We firmly believe that through continued collaboration among governments, research institutions, private sector entities, and local communities, we can build a more resilient and prosperous future for agriculture, ensuring food security and well-being for all.

We hope this publication serves not only as a record of our shared achievements but also as a source of inspiration for future collaborative efforts. Together, we can continue to innovate, adapt, and thrive in the face of the challenges that lie ahead.

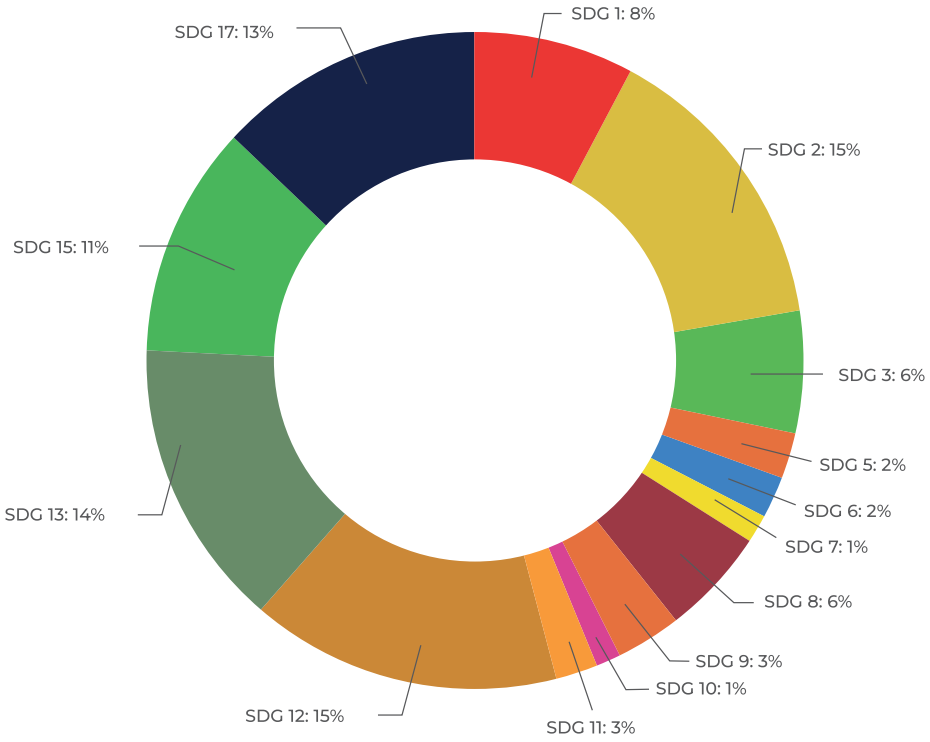
With warm regards,
The Executive Committee of FONTAGRO

Nicolás Bronzovich
President

Jorge Juan Ganoza Roncal
Vice President

Eugenia Saini
Executive Secretary

Total contributions to the Sustainable Development Goals



- SDG 1: No Poverty
- SDG 2: Zero Hunger
- SDG 3: Good Health and Well-being
- SDG 5: Gender Equality
- SDG 6: Clean Water and Sanitation
- SDG 7: Affordable and Clean Energy
- SDG 8: Decent Work and Economic Growth
- SDG 9: Industry, Innovation and Infrastructure
- SDG 10: Reduce Inequalities
- SDG 11: Sustainable Cities and Communities
- SDG 12: Responsible Consumption and Production
- SDG 13: Climate Action
- SDG 15: Life on Land
- SDG 17: Partnerships for the Goals

Fostering research collaborations across Latin America, the Caribbean, Spain, New Zealand and the United States

1 **Climate Change and Livestock**
INIA, Uruguay

2 **Developing competitive livestock production systems with low greenhouse gas emissions in Central America**
INTA, Costa Rica

3 **Improving animal production systems, with a focus on dairy farming, in a climate change context in the Andean Region**
IICA, Peru

4 **Livestock and climate change: applied research and knowledge**
FONTAGRO

5 **Sustainable intensification with legumes**
Fundación ArgenInta/INTA, Argentina

6 **Innovation for pasture management**
INIA, Uruguay

7 **Agtech for climate-smart dairy**
Fundación ArgenInta/INTA, Argentina

8 **Cattle productivity in the South American Chaco region**
Fundación ArgenInta/INTA, Argentina

9 **Organic-carbon sequestration in Latin American and Caribbean soils**
INIA, Uruguay

10 **Satellite monitoring of quantity and quality of available biomass in pastoral livestock systems**
Fundación Argeninta/INTA, Argentina

11 **Innovations to reduce methane emissions in ruminants**
AGROSAVIA, Colombia

12 **Platform for the transfer and efficient use of biologicals on Latin American farms**
CEAZA, Chile

13 **Biological products for creating resilience to climate change**
AGROSAVIA, Colombia

14 **Sustainable livestock in the Peruvian and Ecuadorian Amazonia**
UNAM, Perú

15 **Climate change and indigenous communities**
INTA, Argentina

16 **Nitrogen Optimization**
INIA, Chile

17 **Resilient production to mitigate climate change**
INTA, Argentina

18 **Scaling Innovation in Pastoral Systems**
INIA, Uruguay

19 **Reducing GHG Emissions in Potato-Pasture Systems in Ecuador and Peru**
INIAP, Ecuador

20 **Sustainable Intensification of Production in Central America**
INTA, Costa Rica

Global Impact through research collaborations

Empowering New Zealand Agriculture

- **Enhancing Scientific and Research Capabilities** – Participation in FONTAGRO projects provides New Zealand scientists access to cutting-edge research, improving domestic expertise in emissions reduction, pasture management, and digital farming.
- **Advancing Sustainable Agriculture Goals** – Insights from Latin American agricultural systems help inform and improve sustainable practices in New Zealand's livestock and cropping sectors.
- **Strengthening Trade and Diplomatic Ties** – Engaging in research partnerships fosters stronger diplomatic and trade relationships between New Zealand and Latin American nations, potentially expanding agricultural market opportunities.
- **Improving Biosecurity Measures** – Joint projects enable New Zealand scientists to study plant and animal diseases abroad, reducing the risk of introducing harmful pathogens to the country.
- **Developing Market Opportunities for AgTech and Biologiclas** – Collaboration creates commercial opportunities for New Zealand agribusinesses, enabling the export of digital agricultural tools, biologicals, and sustainable farming technologies to LAC markets.
- **Enhancing Climate Resilience and Mitigation Strategies** – By studying climate adaptation strategies in Latin America, New Zealand can apply similar approaches to its own agricultural systems to mitigate the effects of climate change.
- **Supporting Global Leadership in Climate Action** – Co-financing sustainable agricultural projects reinforces New Zealand's position as a leader in international climate change mitigation efforts under agreements like the Paris Accord.
- **Building Long-Term Scientific and Institutional Networks** – The alliance helps establish enduring research collaborations and knowledge-sharing platforms between New Zealand institutions and Latin American partners.

Strengthening strategic partnerships

- **Accelerating Climate-Smart Agriculture** – Joint projects help generate innovative solutions for reducing agricultural greenhouse gas (GHG) emissions while improving productivity and sustainability in Latin America and the Caribbean (LAC).
- **Enhancing Agricultural Innovation** – By leveraging research expertise and resources, the alliance fosters the development of new technologies, such as digital decision-support tools, improved pasture management techniques, and climate-resilient crops.
- **Strengthening Scientific Collaboration** – The partnership facilitates knowledge exchange between New Zealand, Latin American research institutions, and international organizations, driving global innovation in sustainable agriculture.
- **Supporting Rural Livelihoods** – The alliance helps smallholder farmers adopt best practices that enhance productivity, resilience, and profitability while mitigating environmental impacts.
- **Improving Food Security** – Research-driven innovations contribute to more efficient and sustainable food production systems, ensuring long-term food security in both regions.
- **Scaling Up Impact** – By linking global and regional research initiatives, the partnership maximizes the reach and effectiveness of climate-smart agricultural solutions.
- **Expanding AgTech Adoption** – The collaboration facilitates the integration of remote sensing, digital monitoring, and precision agriculture tools to improve resource efficiency and resilience.

This alliance is a win-win partnership that enhances global agricultural sustainability, strengthens scientific capacity, and opens new opportunities for innovation and collaboration in both regions.

Enhancing agricultural productivity and resilience through global partnerships

In an era marked by unprecedented environmental changes and growing climate variability, the agricultural sector faces the dual challenge of increasing food production while reducing its environmental and greenhouse gas footprint. Climate change poses significant risks to food security, rural livelihoods, and ecosystem sustainability, particularly in regions like Latin America and the Caribbean (LAC) where agriculture is a major economic driver. Addressing these complex challenges requires innovative solutions that can only be achieved through scientific collaboration across countries, disciplines, and sectors.

The Value of Collaborative Research in Climate Change Adaptation and Mitigation. Collaboration in science is critical in climate change adaptation and mitigation for several reasons. First, climate change is a global challenge that transcends national borders. Effective adaptation and mitigation strategies must, therefore, be developed and implemented on a regional or global scale, leveraging diverse perspectives, experiences, and knowledge bases. Collaborative research enables scientists and policymakers from different countries and regions to share data, methodologies, and insights, enabling the development of tailored solutions that address specific local and regional contexts. Second, climate change research is inherently multidisciplinary, requiring the integration of expertise from fields such as climatology, agronomy, ecology, economics, social sciences, and engineering. Collaborative efforts bring together diverse teams of scientists, each contributing their specialized knowledge and skills to develop holistic approaches to climate resilience that are not only effective but also sustainable, scalable and relevant at the community level.

Strengthening Capacity and Building Resilience through Partnerships. Collaboration in science also plays a vital role in building capacity and resilience among research institutions, governments, and local communities. By working together, organizations such as FONTAGRO, the Ministry for Primary Industries of New Zealand (MPI), the Global Research Alliance on Agricultural Greenhouse Gases (GRA), and the Inter-American Institute for Cooperation on Agriculture (IICA) have facilitated the exchange of knowledge, best practices, and innovative technologies. Collaborative research fosters the development of strong networks that connect scientists, policymakers, and practitioners, crucial for ensuring that scientific findings are translated into practical actions on the ground. Wider dissemination of research outcomes ensures that innovative solutions reach farmers, extension services, and decision-makers at the forefront of implementing adaptation and mitigation strategies.

Leveraging Resources and Achieving Greater Impact. Another key benefit of collaboration in climate change research is the ability to leverage resources—financial, technical, and human. By pooling much-needed resources, international and regional partnerships can undertake more comprehensive and ambitious research projects that may be beyond the capacity of any single organization or country. For example, joint initiatives between FONTAGRO, national governments, and international partners such as the Inter-American Development Bank (IDB) have enabled the scaling up of successful pilot projects and the replication of effective climate-smart agricultural practices across multiple countries. Collaborative research provides the evidence base needed to influence policy decisions, ensuring that climate actions are grounded in scientific evidence and aligned with international frameworks such as the Paris Agreement and the Sustainable Development Goals (SDGs).

A Path Forward: Collaborative Science for a Resilient Future. In conclusion, collaboration in science is not just beneficial but essential for advancing climate change adaptation and mitigation efforts. By combining the strengths of diverse stakeholders, sharing knowledge and resources, and fostering innovation, collaborative research paves the way for building resilient agricultural systems capable of withstanding climate challenges. Moving forward, strengthening these partnerships will be key to safeguarding food security, rural livelihoods, and the environment in Latin America, the Caribbean, and beyond.

More than a decade of Collaborative Work

2010

Methane and nitrous oxide emission quantification in grazing cattle.

New Zealand, Uruguay, Argentina, Chile, Colombia, Dominican Republic

Total Amount: USD 1,000,000

2014

Developing competitive livestock production systems with low greenhouse gas emissions in Central America.

Costa Rica, Honduras, Nicaragua, Panama

Total Amount: USD 857,500

2017

Improving dairy production systems with less emissions in the Andean Region.

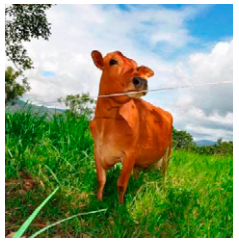
Peru, Bolivia, Colombia, Ecuador

Total Amount: USD 868,000

Collaborative research networks on resilient livestock production systems.

United States, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Spain, Honduras, Mexico, Nicaragua, New Zealand, Panama, Paraguay, Peru, Dominican Republic, Uruguay, Venezuela

Total Amount: USD 139,318



Latin American and Caribbean platform for sustainable intensification of livestock farming.

Argentina, Bolivia, Chile, Colombia, Costa Rica, Ecuador, Spain, Honduras, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay, Venezuela.

2018

Carbon sequestration opportunities in Latin American and Caribbean soils.

Uruguay, Argentina, Chile, Costa Rica

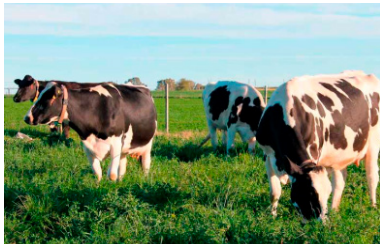
Total Amount: USD 80,000

Sustainable intensification of legume-based livestock farming.

Uruguay, Argentina, Chile, Costa Rica

Total Amount: USD 1,794,524

2019



AgTech for climate-smart dairy farming.

Argentina, Costa Rica, Honduras, Dominican Republic, Uruguay

Total Amount: USD 540,900

Digital innovations for smarter pasture management.

Uruguay, Argentina, Costa Rica, United States

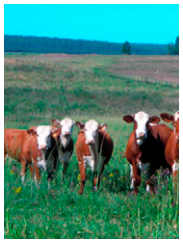
Total Amount: USD 512,940

Boosting cattle productivity in the South American Chaco.

Argentina, Bolivia, Paraguay

Total Amount: USD 657,285

2020



Soil organic carbon sequestration: opportunities and impact on the economy and the environment.

Uruguay, Argentina, Chile, Colombia, Costa Rica

Total Amount: USD 1,460,240

2021

Satellite monitoring of quantity and quality of available biomass in pastoral livestock systems in LAC.

Argentina, Colombia, Costa Rica, Uruguay

Total Amount: USD 1,347,547

2022

Innovations for reducing methane emissions in ruminants.

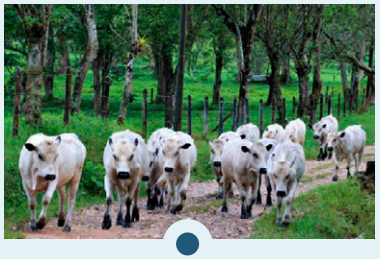
Argentina, Colombia

Total Amount: USD 633,609

Expanding the use of biologicals in Latin American agriculture.

Argentina, Colombia, Chile, Uruguay

Total Amount: USD 720,483



Leveraging biological products to build climate resilience.

Argentina, Colombia

Total Amount: USD 668,500

Sustainable livestock farming in the Amazon of Peru and Ecuador.

Peru, Ecuador, Costa Rica

Total Amount: USD 600,000

2023

Optimizing nitrogen use for sustainable farming.

Chile, Argentina, Panama, Peru, Dominican Republic

Total Amount: USD 1,037,451

Climate-smart research and indigenous communities.

Argentina, Chile, New Zealand

Total Amount: USD 943,570

2024

Building resilient agricultural systems to mitigate climate.

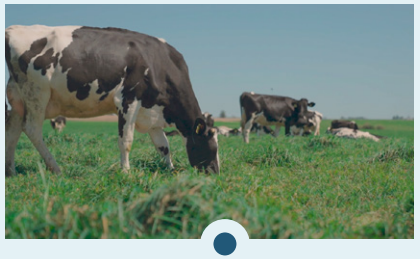
Argentina, Uruguay, Chile, Brazil, Dominican Republic

Total Amount: USD 1,108,764

Sustainable intensification of production in Central America.

Costa Rica, Argentina, Honduras, Panama, Perú, United States

Total Amount: USD 773,500



Reducing greenhouse gas emissions in potato-pasture systems in Ecuador and Peru.

Ecuador, Peru

Total Amount: USD 900,000

Scaling innovation in pastoral systems.

Uruguay, Argentina, Costa Rica

Total Amount: USD 902,790

A collaborative journey of agricultural innovation

Over the last 15 years, FONTAGRO, in collaboration with the New Zealand Ministry for Primary Industries and other esteemed partners, has embarked on a journey to drive innovation and resilience in the agricultural sector across Latin America and the Caribbean (LAC). This publication seeks to highlight the significance of these collaborative efforts, drawing from the wealth of knowledge, research, and experiences accumulated during this period. As we face an increasingly uncertain climate future, the need to retrieve, understand, and build upon the work done over the past decade is more crucial than ever. The latest report of the Intergovernmental Panel on Climate Change (IPCC) emphasized the urgency of addressing climate change's multifaceted impacts. The report lays out stark warnings: without substantial adaptation and mitigation efforts, climate change will exacerbate existing vulnerabilities, diminish agricultural productivity, and threaten food security worldwide. The LAC region, with its diverse ecosystems and agricultural systems, is particularly vulnerable to these impacts. Rising temperatures, erratic rainfall patterns, prolonged droughts, and extreme weather events pose severe risks to both the livelihoods of millions of smallholder farmers and the region's overall food systems.

Retrieving Knowledge from Past Efforts: Building on a Strong Foundation. In this context, it is imperative to revisit and analyze the body of work conducted over the last 15 years to inform future research, policies, and practices. The projects and initiatives developed under FONTAGRO's partnership with New Zealand and other stakeholders have provided valuable insights into how agricultural systems can adapt to and mitigate the impacts of climate change. This publication offers a comprehensive overview of these efforts, showcasing the successes, challenges, and lessons learned from a variety of climate-smart agricultural practices and technologies implemented across different countries and contexts. Understanding the outcomes of past projects is essential for advancing scientific research. These efforts not only demonstrate the practical application of climate-smart agriculture, but also the importance of adaptive management, participatory approaches, and capacity-building initiatives that empower local communities and stakeholders to be agents of change.

Creating a Knowledge Base for Future Research and Innovation. The IPCC's report underscores the importance of generating new knowledge that is context-specific, evidence-based, and actionable. By retrieving the extensive work done over the past 15 years, we can identify gaps, refine existing methodologies, and develop new, targeted research agendas that address the specific challenges highlighted by the IPCC. This process of knowledge generation and exchange is vital for creating a more resilient and adaptive agricultural sector that can effectively respond to the complexities of climate change. Moreover, the integration of new scientific findings with traditional knowledge and local innovations will be

critical in developing holistic and inclusive solutions. For instance, understanding how different agricultural systems respond to climate stressors, how climate-smart technologies can be scaled, and how policies can support sustainable practices will provide the foundation for more effective adaptation and mitigation strategies. Collaborative research, involving multi-stakeholder partnerships, remains key to achieving these goals.

Responding to the IPCC's Call for Action: The Role of Collaborative Science. The IPCC report calls for immediate and coordinated action to address the climate crisis. To achieve the scale and impact needed, it is essential to strengthen international cooperation and regional collaboration in climate change research. The partnership between FONTAGRO, the Ministry for Primary Industries of New Zealand (MPI), the Global Research Alliance on Agricultural Greenhouse Gases (GRA), the Inter-American Development Bank (IDB), and the Inter-American Institute for Cooperation on Agriculture (IICA) is a prime example of how collaboration can drive scientific innovation and catalyze real-world impacts. By combining financial resources, technical expertise, and strategic vision, these partnerships have enabled the development and implementation of innovative solutions that address both mitigation and adaptation needs. This publication serves as a testament to what can be achieved through collaboration and underscores the importance of continuing to work together to build a more sustainable and climate-resilient agricultural sector.

Looking Forward: Building a Resilient Future. As we look to the future, the challenge is not only to sustain but to scale up these efforts. It is essential to continue investing in research that supports sustainable agricultural practices, enhances climate resilience, and promotes equitable growth. The lessons learned from the past 15 years of collaboration provide a roadmap for the path ahead—one that prioritizes inclusive, science-driven, and collaborative approaches to climate change adaptation and mitigation. By retrieving, analyzing, and building upon our collective experiences, we can ensure that future research is more targeted, effective, and impactful in addressing the critical challenges identified by the IPCC. Together, we have the tools, knowledge, and determination to create a more sustainable and resilient future for agriculture in Latin America and the Caribbean, and beyond.

Summary of operations

From 2010 to 2025, FONTAGRO, in collaboration with the Ministry for Primary Industries of New Zealand (MPI), the Global Research Alliance on Agricultural Greenhouse Gases (GRA), and other partners, has spearheaded a diverse portfolio of projects aimed at enhancing climate resilience, promoting sustainable agricultural practices, and reducing greenhouse gas emissions across Latin America and the Caribbean (LAC). This summary provides an overview of the operations during this period, highlighting the number of projects, their status, financial investments, and the key areas of research that have driven agricultural innovation in the region.

Over the 15-year period from 2010 to 2025, FONTAGRO and its partners have implemented numerous projects with various statuses, including ongoing, closed, and completed. These projects have addressed critical challenges facing agriculture in the LAC region, focusing on innovative solutions to climate change adaptation and mitigation. The operations summary covers key metrics such as the total number of projects, total funding allocated, average funding per project, and the primary research topics that have shaped these initiatives.

The operations from 2010 to 2025 included a range of projects that were either completed successfully or are still ongoing. Projects with different statuses were tracked to provide in-sights into their progress:

- Projects labeled as “Closed” refer to those that have been completed and have met their objectives, generating valuable knowledge and practical solutions.
- Projects with other status markers indicate their stage in the pipeline, from planning to execution, showcasing a continuous pipeline of innovation.

The period saw substantial financial investments to support agricultural research and innovation, with funding contributions from FONTAGRO, MPI/GRA, and counterpart funding from national agencies. The total funding allocated across all projects varied each year, reflecting the strategic priorities and the scale of the initiatives. For example, in certain years, significant investments were directed towards large-scale projects that focused on specific thematic areas, such as reducing greenhouse gas emissions in livestock and crop systems, improving water use efficiency, and developing climate-resilient crops.

The average funding per project provides a glimpse into the level of investment in each initiative, highlighting the financial commitment to achieving impactful outcomes. Projects with higher average funding often involved multi-country collaborations or addressed broader, more complex challenges, such as the integration of digital tools in climate-smart agriculture or the development of region-wide platforms for sustainable farming practices.

Throughout the 2010-2025 period, the projects covered a wide range of research topics critical to addressing the impacts of climate change on agriculture. These topics reflect the evolving priorities and innovative approaches needed to build resilience and sustainability in agricultural systems. Key research themes included:

- **Climate-Smart Agriculture and Sustainable Intensification:** Projects focused on developing and scaling climate-smart agricultural practices, such as precision farming, agroecological approaches, and sustainable intensification. These projects aimed to increase productivity while reducing environmental impacts, optimizing resource use, and enhancing resilience to climate change.

- **Greenhouse Gas (GHG) Emission Reduction:** Several projects were dedicated to understanding and mitigating GHG emissions from agricultural activities, particularly in livestock and cropping systems. Research efforts included the quantification of methane and nitrous oxide emissions, development of emission factors specific to LAC conditions, and identification of mitigation strategies such as improved livestock management, feed additives, and rotational grazing.

- **Agro-Biodiversity and Resilient Crop Development:** Enhancing agro-biodiversity and developing resilient crop varieties were crucial research areas. Projects under this theme focused on breeding and promoting biofortified and climate-resilient crops that can withstand changing weather patterns, pests, and diseases. These initiatives were particularly important for ensuring food security and nutritional quality in the face of climate change.

- **Digital Agriculture and AgTech Solutions:** The integration of digital technologies and AgTech solutions has been a growing focus in recent years. Projects in this area explored the use of data-driven tools, remote sensing, and decision support systems to improve farm management, optimize resource use, and enhance climate resilience. The development of mobile applications and platforms for knowledge exchange and capacity building among farmers was a notable achievement.

- **Community-Based Adaptation and Indigenous Knowledge:** Recognizing the importance of local and indigenous knowledge, several projects emphasized community-based adaptation strategies that integrate traditional practices with modern scientific approaches. These initiatives aimed to empower local communities, particularly indigenous groups, to develop context-specific solutions that enhance their resilience to climate impacts while preserving cultural heritage.

Key Insights from 2010 to 2025 Operations:

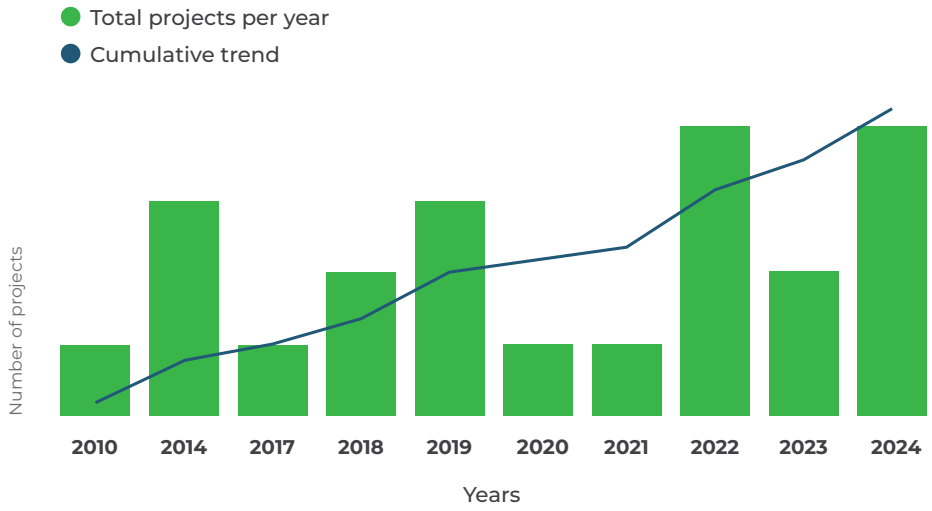
- **2010-2014:** The early years of this period focused on laying the foundation for collaborative research and capacity building. Projects launched during this time concentrated on baseline studies, capacity strengthening, and establishing networks for knowledge sharing among member countries. Key topics included sustainable crop and livestock systems and initial efforts in GHG emissions quantification.

- **2018-2019:** This phase marked an expansion in both the number and diversity of projects. Research efforts targeted specific challenges such as AgTech solutions, sustainable intensification, and integrated farming systems. The introduction of digital tools and data analytics began to play a significant role in developing innovative agricultural solutions.

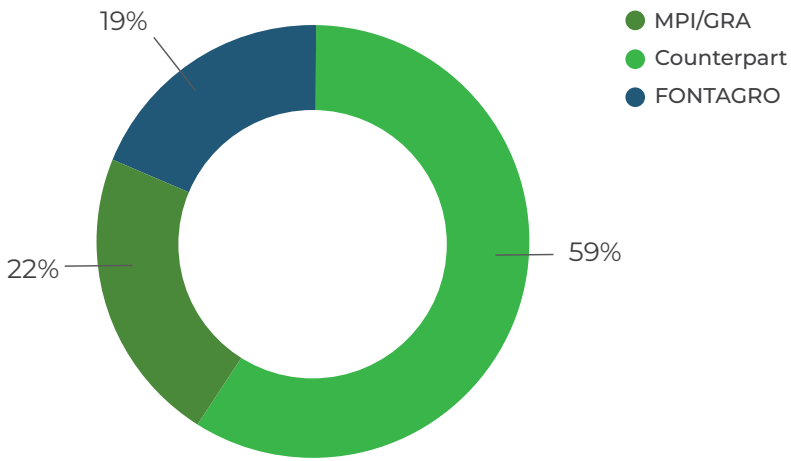
2020-2025: The most recent phase has been characterized by a robust pipeline of projects with an emphasis on scaling successful interventions and integrating cutting-edge technologies. Topics such as digital agriculture, climate-smart livestock management, and regional platforms for sustainable farming practices gained prominence. The period also saw significant efforts to integrate indigenous knowledge and promote community-driven adaptation strategies.

The operations from 2010 to 2025 reflect FONTAGRO's commitment, along with its partners, to drive impactful change in the agricultural sector across Latin America and the Caribbean. The diverse research topics and substantial financial investments made during this period underline the collaborative efforts to enhance climate resilience, promote sustainable practices, and support the agricultural communities most affected by climate change. Looking ahead, these operations provide a strong foundation for future innovation and partnership, ensuring that agriculture in the LAC region remains sustainable and resilient.

Total projects in which MPI/GRA participated as a donor



Total financing in which MPI/GRA participated as a donor



Project-specific success stories

Overview

This section presents an in-depth exploration of the collaborative efforts between FONTAGRO and the Ministry for Primary Industries of New Zealand (MPI), highlighting the successes achieved from 2010 to 2025. Over this period, several projects were undertaken to address the pressing challenges posed by climate change and to promote sustainable agricultural practices in Latin America and the Caribbean (LAC). This executive summary provides a brief overview of these collaborative efforts, emphasizing the importance of showcasing success stories to inspire continued innovation and investment in climate-smart agriculture. These projects focused on developing and implementing climate-smart agricultural practices, improving resource efficiency, reducing greenhouse gas emissions, and enhancing the livelihoods of rural communities. The initiatives were designed to address both global and local challenges, reflecting the diverse agro-ecological conditions and socio-economic contexts of LAC countries.

Importance of Showcasing Success Stories. Showcasing the success stories from these projects is vital for several reasons:

- **Learning and Replication:** Highlighting successful projects provides valuable lessons that can be replicated or adapted in other regions facing similar challenges. It helps stakeholders, including policymakers, researchers, and practitioners, understand what works, why it works, and how it can be scaled up or modified to suit different contexts.
- **Promoting Best Practices:** By sharing tangible results, these stories promote best practices in climate-smart agriculture, sustainable livestock management, and community-based adaptation. They serve as evidence-based examples that can guide future research, policy development, and on-the-ground implementation.
- **Encouraging Investment and Collaboration:** Demonstrating successful outcomes can attract additional funding and support from both public and private sectors. It encourages further collaboration among international and regional partners, fostering a cooperative approach to tackling climate change and promoting sustainable agriculture.

The projects implemented between 2010 and 2025 under the FONTAGRO-New Zealand partnership span a wide range of research topics and practical applications, resulting in significant environmental, economic, and social impacts. The types of successes highlighted in this publication include:

- **Environmental Impact:** Many of the projects focused on reducing greenhouse gas emissions from agricultural activities, and promoting sustainable land use. For instance, the project on quantifying methane and nitrous oxide emissions from grazing cattle and developing tailored mitigation strategies demonstrates how targeted research could lead to more accurate reporting of emissions and improved management practices. Other projects introduced eco-friendly practices such as sustainable livestock intensification, reduced chemical inputs, and the integration of biological solutions, thereby minimizing environ-mental footprints.

- **Economic Benefits:** Several projects have led to economic gains for farmers by optimizing resource use, increasing productivity, and enhancing market access. For example, the development of competitive livestock production systems with low greenhouse gas emissions in Central America not only reduced emissions but also improved farm profitability through better feeding strategies, pasture management, and efficient use of resources. Similarly, projects focused on climate-smart dairy farming utilized digital tools and AgTech solutions to improve farm management efficiency, resulting in higher productivity.

- **Social Improvements:** The initiatives have also contributed to significant social benefits, particularly in rural and indigenous communities. Projects that integrated local knowledge with scientific research empowered communities to develop context-specific solutions, thereby enhancing their resilience to climate change. Training and capacity-building activities were key components of these projects, ensuring that local farmers and researchers gained the skills needed to sustain these improvements over time. Furthermore, the emphasis on community-based adaptation strategies fostered social cohesion and empowered vulnerable groups, such as women and indigenous people.

The collaborative projects between FONTAGRO and the Ministry for Primary Industries of New Zealand (MPI) from 2010 to 2025 demonstrate the power of international cooperation in advancing sustainable agricultural practices and climate resilience in Latin America and the Caribbean. By showcasing these success stories, this publication not only highlights the tangible impacts of these initiatives but also provides a roadmap for future efforts. It underscores the importance of continued collaboration, innovation, and investment in building a more sustainable and resilient agricultural sector that can adapt to the challenges posed by climate change.

PROJECT 1

Methane and nitrous oxide emission quantification in grazing cattle

Background: This project was conducted to address the environmental impact of greenhouse gas emissions from cattle grazing in Latin America. The project was executed between 2012 and 2016 by a consortium of institutions from Uruguay, Argentina, Chile, Colombia, and the Dominican Republic. The main objective of the project was to enhance the positioning of the participating countries within the United Nations Framework Convention on Climate Change (UNFCCC) and the international agricultural market by accurately quantifying methane (CH_4) and nitrous oxide (N_2O) emissions from cattle grazing and developing tailored emission factors and mitigation strategies. The project contributed to implementing the capacity of at least five institutions in the region to measure greenhouse gas emissions in grazing cattle and their analysis in laboratories of the participating countries. This included learning methane measurement techniques using the sulfur hexafluoride tracer (SF_6), and the use of static closed-flow cameras for field nitrous oxide measurement, and their laboratory analysis by gas chromatography. Measurements in field experiments allowed estimation of new emission factors, especially for nitrous oxide, with values well below the default factors established by the IPCC. These new emission factors will improve the estimates to be reported to the IPCC by the participating countries and improve their positioning, since they could negotiate better conditions for the export of livestock products, by demonstrating that they are adher-ing to their international commitments. The results of the estimates could also be used to design policies that promote climate-smart livestock farming worldwide.

Beyond emissions quantification, the project significantly enhanced research capacities in the participating countries. **Over 20 professionals and technicians** were trained in emissions measurement techniques, and new gas chromatographs were installed in Argentina and Uruguay to improve laboratory analyses. The study also evaluated mitigation options, including the use of high-quality pastures and nitrification inhibitors, which showed potential for reducing emissions without compromising productivity. The project's findings were disseminated through **numerous scientific publications, workshops, and international conferences**, positioning the participating institutions as regional leaders in greenhouse gas research for livestock production. These results will contribute **to improving national greenhouse gas inventories, supporting policy development, and strengthening Latin America's role in global climate change discussions**.

Achievements:

- Quantification of methane emissions using the SF_6 tracer technique and nitrous oxide emissions using closed static chambers.

- Development of country-specific emission factors for CH_4 and N_2O, which were found to be lower than those reported by the Intergovernmental Panel on Climate Change (IPCC) in three of the five participating countries.
- Training and capacity building for over 20 professionals and technicians in each participat-ing country.
- Implementation and validation of measurement methodologies across different climatic and geographical conditions in Latin America.
- Dissemination of findings through seminars, workshops, and conferences.

Impact:

- Improving the ability of the participating countries to report accurate greenhouse gas emissions to the UNFCCC.
- Enhancing their agricultural practices with sustainable and environmentally friendly strategies.
- Building technical and scientific capacity in the region, which is essential for ongoing and future climate change mitigation efforts.

Benefits to New Zealand agriculture

- **Enhancing Emission Quantification** – Improves the accuracy of methane and nitrous oxide emission factors applicable to New Zealand's livestock sector.
- **Supporting Policy Development** – Provides robust data that can be used to refine New Zealand's agricultural GHG reporting under the UNFCCC.
- **Advancing Livestock Emission Mitigation** – Helps develop best practices for reducing enteric methane emissions in pastoral farming systems.
- **Strengthening Scientific Networks** – Connects New Zealand researchers with Latin American institutions for ongoing climate change studies.
- **Improving Feed Efficiency Research** – Contributes insights into pasture-based livestock feeding strategies that optimize productivity while reducing emis-sions.


ARGENTINA


CHILE


URUGUAY


COLOMBIA


REP. DOMINICANA

Country	N_2O Emission Factor
Chile	0.07
Colombia	< 0.002
Uruguay	0.28-0.55

Source: Project images of the field experiments.

PROJECT 2

Developing competitive livestock production systems with low greenhouse gas emissions in Central America

Background: Focused on enhancing livestock production systems to be more eco-friendly. Farms with lower intensification only have grazing systems and generate more CH_4 emissions than higher intensified farms. In contrast, farms with greater intensification systems have feeding strategies such as supplementing lactating cows with commercial supplements, minerals, and silage. Furthermore, they tend to implement more management strategies such as pasture management plans, soil analysis, technical fertilization recommendations, rest periods, proper animal load and type of grasses and legumes usage. All these strategies result in greater milk production per cow and lower CH_4 emissions per liter of milk produced. Enteric fermentation is the main source of livestock emissions. Farms that are less intensified only have grazed animals and generate 103% more methane emissions than more intensified farms that supplement with forage banks and concentrates. Furthermore, more intensified farms produce an average of 2.1 more liters of milk per cow. This project took place in Honduras, Nicaragua, Costa Rica and Panama and was coordinated by CATIE. It was implemented by the coordinating agency in close cooperation with the National Agricultural Research Institutes of the four countries. It involved the analysis of indirect methods to estimate GHG emissions from livestock based on IPCC (2006) protocols, socioeconomic monitoring of farms to evaluate farm profitability, conduction of experiments to estimate nitrous oxide and methane emission factors according to farm management, knowledge management and capacity building.

Achievements:

- Introduced low-emission livestock management practices, resulting in a 15% reduction in greenhouse gases.
- Identification of limitations for the estimation of GHG emissions and selection of meas-urement tools and methods for the project.
- Identification of good practices that contribute to reducing GHG emissions in Central American farms were identified and validated in local conditions.
- It was identified that farming systems with better technology and management practices can decrease emissions levels.

- Greater awareness was obtained by implementing a result dissemination and knowledge management strategy.
- Scaling up the use of research and addressing knowledge gaps for the improvement of livestock systems with lower GHG emissions in Central America.

Impacts:

- 400 farms for carbon dioxide (CO_2) baseline quantification.
- 74 professionals trained.
- 7 undergraduate and graduate level theses.
- Led to understanding how different levels of farming intensification and better feeding and herd management practices can decrease the intensity of GHG emissions.
- Identified at the farm level that enteric fermentation is the main source of emissions in livestock production.
- Facilitated participating countries' data requirements for the IPCC.

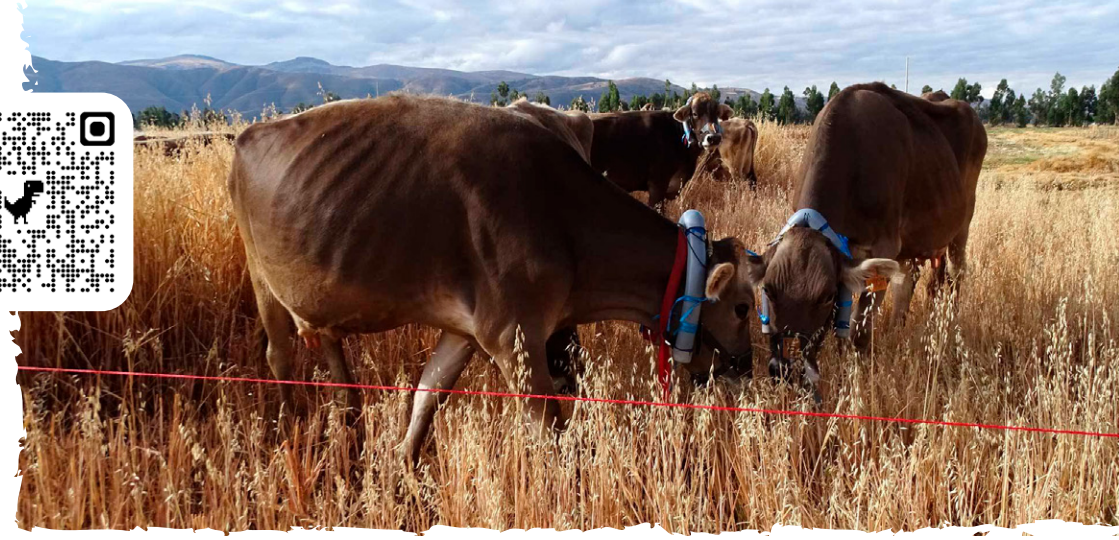
Benefits to New Zealand agriculture

- **Optimizing Farming Intensification** – Provides comparative insights on intensification strategies to reduce emissions without compromising productivity.
- **Enhancing Carbon Efficiency in Dairy** – Findings can be applied to improve emissions intensity per liter of milk produced in New Zealand.
- **Supporting Sustainable Dairy Practices** – Helps refine pasture management strategies for climate-smart dairy farming.
- **Capacity Building in Carbon Footprint Analysis**–Strengthens methodologies for assessing the carbon footprint of different dairy farming models.
- **Promoting Efficient Grazing Systems** – Offers insights on the impact of rotational grazing and supplementary feeding on methane emissions.


Source: Project images of the field experiments.

PROJECT 3

Improving dairy production systems with less emissions in the Andean Region



Background: Aimed at enhancing dairy farming practices to adapt to climate change. The project took place in Bolivia, Colombia, Ecuador and Peru and was implemented through IICA-Peru and coordinated technically by UNALM of Peru. The general objective was to improve the positioning of the Andean Region countries in the IPCC on the estimates of GHG emissions (methane and nitrous oxide) and generate mitigation strategies in dairy production.

This project was structured with five components:

- Biophysical and socioeconomic characterization of dairy production sites.
- CH_4 and N_2O emissions were evaluated in production systems (traditional and improved).
- Evaluation of feeding strategies to enhance milk production systems and to reduce their emissions.
- Development of greenhouse gas mitigation scenarios for pilot sites.
- Improvements in research capacities in CH_4 and N_2O and contribution to public policies.

Achievements:

- Developed climate-resilient dairy farming techniques, leading to a 25% increase in milk production.
- Two pilot sites identified in Colombia and Peru.
- Training was provided to at least two professionals per participating institution.
- Capacity established in at least four institutions of the Andes for the measurement of GHG emissions.
- Capacity established in at least four institutions of the Andes for the modeling of scenarios to mitigate GHG emissions.
- Development of strategies to increase livestock productivity and reduce GHG emissions.
- Contributions to policy dialogue. Increased number of members of GRA.

Impacts:

- 1 new facility for methane quantification (AGROSAVIA, Colombia).
- 1 new facility for quantification of methane and nitrous oxide (UNALM, Peru).
- 51 professionals trained.
- 6 graduate level theses.
- Data generated will be used for the development of strategies to increase livestock productivity and reduce GHG emissions.
- Facilitated participating countries' data requirements for the IPCC.
- The improved systems had higher milk production per lactation compared to traditional systems (2,369 vs. 1,990 kg/lactation). Additionally, production costs were lower in improved systems ($0.21/kg vs. $0.29/kg), and methane emissions per liter of milk were re-duced (29 vs. 44 g methane/kg of milk) due to diets with fewer structural carbohydrates and more crude protein, reducing enteric fermentation and enhancing milk production.

Benefits to New Zealand agriculture

- **Improving Dairy Farming Resilience –** Research on milk productivity under changing climatic conditions benefits New Zealand dairy farms.
- **Developing Low-Emission Diets –** Identifies dietary strategies that can be adapted to reduce enteric methane emissions in New Zealand livestock.
- **Enhancing Climate Change Adaptation –** Helps develop mitigation strategies to main-tain production stability amid climate fluctuations.
- **Supporting Pasture Management Innovations –** Provides data on pasture compositions that improve milk yield and lower emissions.
- **Facilitating Research Collaboration –** Strengthens international partnerships in dairy and livestock research.

Production according the system

	Traditional system	Improved system	Comparison
Milk yield, kg/lactation	1990	2369	
Average production, liters/day	6.86	8.2	
Cost of production, $/kg	0.29	0.21	
Methane emission, kg/year	100	85	
Methane emission, g/kg milk	44	29	

Source: Project images of the field experiments.

PROJECT 4

Collaborative research networks on resilient livestock production systems

Background: Conducted applied research to address climate change impacts on livestock farming. This project contemplated the financing of networking and capacity building activities for Latin America and the Caribbean and was executed by FONTAGRO/TAS. The objective was to create a network on livestock and climate change to exchange information, standardize methodologies, provide mutual technical support and promote collaboration. This project consisted of 3 components:

- The Coordination Committee and network meetings, aimed to coordinate, review progress and plan initiatives. A plenary meeting of members was organized every 18 months to share research results, and coordinate activities, to achieve efficiency.
- Development of a web page to share information and knowledge on livestock and climate change.
- Building research capacity on the measurement of GHG emissions and on livestock systems research and modelling among the participating countries. Before the start of the projects, two workshops were conducted to train researchers. At least two professionals per institution were trained on pastures, livestock production systems, and measurement of GHG emissions. Furthermore, funding was provided for several graduate students from the various institutions participating in the consortia.

Achievements:

- Successfully integrated legume crops into livestock farming, enhancing soil health and reducing feed costs.
- It has been identified that enteric methane (CH_4) emissions decrease when pastures have legumes with optimal contents of condensed tannins; and that pastures with legumes increase C stocks in the first centimeters of the soil. There are publications that prove these claims.
- Institutional tools are also used, such as INTA Informa in the case of INTA Argentina when there is a relevant result or event to disseminate. At the same time, since the project began, 8 internal training sessions were held to instruct graduate students and technicians in the taking and processing of samples. 78 open training sessions were carried out, including workshops, technical meetings, field days and webinars. In the academic field, 21 works were presented at conferences, and 16 research papers were published (3 more have been sent for review). In mass media there were 13 publications.

- Finally, 4 CLIFF-GRAD scholarship holders were trained, 4 undergraduate students completed their theses, and 11 postgraduate students worked on 9 doctoral and 2 master's theses. In total, 19 beneficiaries have been trained within the framework of this project.
- New Publication "Latin American and Caribbean platform for sustainable intensification of livestock farming".

Impacts:

- At least 450 people (scientists, professionals, policymakers, farmer associations, and entrepreneurs) from 25 countries linked by a platform.
- 30 scientists from 14 countries trained in research methods for sustainable livestock systems.
- 6 graduate-level theses.

Benefits to New Zealand agriculture

- **Scientific and Technological Direct Applications –** Strengthens New Zealand's leadership in climate-smart livestock farming.
- **Improving GHG Measurement Tools –** Introduces standardized methodologies applicable to New Zealand's pastoral systems.
- **Enhancing Training Programs –** Contributes to knowledge-sharing initiatives for sus-tainable livestock farming.
- **Increasing Access to Emission-**Reduction Strategies – Facilitates the adaptation of effective methane and nitrous oxide reduction practices.
- **Developing Digital Decision Support Tools –** Advances monitoring technologies that can be integrated into New Zealand farming systems.
- **Policy and Regulatory Insights** – Generates science-based policy insights that can inform New Zealand's own regulatory frameworks.

Participating countries:

United States, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Mexico, New Zealand, Nicaragua, Panama, Paraguay, Peru, Spain, Uruguay, Venezuela

Source: Project images of the field experiments.

PROJECT 5

Sustainable intensification of legume-based livestock farming

Background: This project brings together eight countries with significant livestock industries, both for meat and milk production. Together, they comprise approximately 400 million heads of cattle, which accounts for more than 20% of the world's stock. While livestock is primarily raised through direct grazing, there exists a wide variety of agroecosystems and a high diversity of forage resources. However, commonalities among these countries include grazing on agriculturally marginal areas, low livestock productivity and efficiency rates, poor grazing management, low stocking rates, and livestock as the primary source of greenhouse gas (GHG) emissions. Additionally, all countries participating in the platform have legume species adapted to their environments, available for use as fodder crops. Fodder legumes can play a central and strategic role by providing nitrogen (N) through atmospheric biological nitrogen fixation (BNF) and by improving the nutritional value of animal diets, thereby reducing GHG emissions. Before the start of the project, there were few results from similar studies and there was no general overview of the contributions of legumes to extensive pasture systems in Latin America and the Caribbean. Addressing the construction of data and results on the topic has involved challenges and opportunities facilitated through a joint effort. Thus, the project aims to establish a regional platform for cooperation in improving livestock systems using fodder legumes. Direct beneficiaries were 2,532 people, including farmers, technicians, researchers, and students of the eight participating countries (Argentina 361, Brazil 163, Chile 333, Ecuador 336, Nicaragua 120, Paraguay 85, Dominican Republic 98, and Uruguay 1,036. Additionally, 37 research institutes will participate with their respective experimental stations, and 18 universities.

Achievements:

- Successfully integrated legume crops into livestock farming, enhancing soil health and reducing feed costs.
- It has been identified that enteric methane (CH4) emissions decrease when pastures have legumes with optimal contents of condensed tannins; and that pastures with legumes increase carbon stocks in the first centimeters of the soil. There are publications that prove these claims.
- Institutional tools are also used, such as INTA Informa in the case of INTA Argentina when there is a relevant result or event to disseminate. At the same time, since the project be-gan, 8 internal training sessions were held to instruct graduate students and technicians in the taking and processing of samples. 78 open training sessions were carried out, including workshops, technical meetings, field days and webinars. In the academic field, 21 works were presented at conferences, and 16 research papers were published (3 more have been sent for review). In mass media there were 13 publications.

- Finally, 4 CLIFF-GRAD scholarship holders were trained, 4 undergraduate students completed their theses, and 11 postgraduate students worked on 9 doctoral and 2 master's theses. In total, 19 beneficiaries have been trained within the framework of this project.

Impacts:

- Biophysical and socioeconomic characterization of dairy production sites.
- CH_4 and N_2O emissions were evaluated in production systems (traditional and improved).
- Evaluation of feeding strategies to enhance milk production systems and to reduce their emissions.
- Development of greenhouse gas mitigation scenarios for pilot sites.
- Improvements in research capacities in CH_4 and N_2O and contribution to public policies.

Benefits to New Zealand agriculture

- **Promoting Legume-Based Pastures** – Supports the integration of legume crops into New Zealand's livestock sector for soil health and productivity.
- **Reducing Dependence on Synthetic Fertilizers** – Findings assist in reducing nitrogen fertilizer use through biological nitrogen fixation.
- **Mitigating Enteric Methane Emissions** – Identifies forage species that naturally reduce methane emissions from livestock.
- **Enhancing Soil Carbon Sequestration** – Improves soil health management practices for New Zealand's pasturelands.
- **Expanding Alternative Feed Research** – Provides additional options for optimizing livestock feed efficiency.

109kg
Cumulative fixed N ha^{-1} in soil with cattle grazing

22%
Average CH_4 emission reduction

20
Publications in peer-reviewed journals

17
Postgraduate students within the project

+40%
Proportion of women in technical teams

5441
Farmers trained

>10
Difference between IPCC N urine EF vs. measured urine EF

=>60
% N fixed in the aboveground biomass of the legume

Source: Project images of the field experiments.

PROJECT 6

Digital innovations for smarter pasture management

Background: Forage harvest levels in Latin American and Caribbean production systems are very low in relation to their potential. In tropical zones, such as Costa Rica, dry matter (DM) production of the main forage species ranges between 10 and 25 t DM/ha/year, but on average animals consume less than 45% of the available pasture. In temperate zones, as in Uruguay, forage production averages 4.5 t DM/ha/year, when the potential is at least 10 t DM/ha/year. In Argentina, it is estimated that between 2 and 4 t DM/ha/year are harvested, while the potential can reach up to 15 t DM/ha/year. Improving pasture production and consumption levels on the farm requires easily adopted grazing management technologies to optimize the use of pasture in quantity and quality throughout the year. The objective of this project was to improve the self-sufficiency and sustainability of livestock production by increasing by at least 30% the harvest of pasture produced on family farms in Uruguay, Argentina and Costa Rica through better decision making in pasture management. The development of technology involved the implementation of a cloud-based service accessible via web or app that collected information from each farm (users), processed it, developed management indicators and visualized grazing and stocking decisions. The proposed solution aimed to: i) simplify and optimize decision making in real time regarding the sequence of paddocks to be grazed, the necessary subdivisions, the required grazing time, the area to be mechanically harvested for stocking and the optimal date to do so; and ii) automate biomass measurement through the use of remote measurement devices (drones or satellites) that are easy to adopt. The AgTech solution has very positive impacts on production systems, including improving the profitability of production systems, sustainability and the level of self-sufficiency. Implementing this technology in family livestock and dairy farms in Latin America and the Caribbean is of great interest since the food base of these systems is pastoral. Pasture production is very sensitive to climatic changes; nowadays we are facing very changing climatic scenarios, so increasing pasture production will give family farmers in the region an increase in productivity and quality of life. This in turn translates into increased natural habitats for animals, reduced input use, increased nutrient recycling and increased carbon sequestration of pastures. The developed tool, available in the cloud, provides real-time information on the sequence of paddocks to be grazed and the area available for the creation of reserves and was designed with a “User Centered Design” approach. This approach allowed a participatory development that contemplated the needs of end users, achieving an optimal balance between usability, complexity of the tool and capacity to generate impact on productive systems, facilitating its commercial adoption.

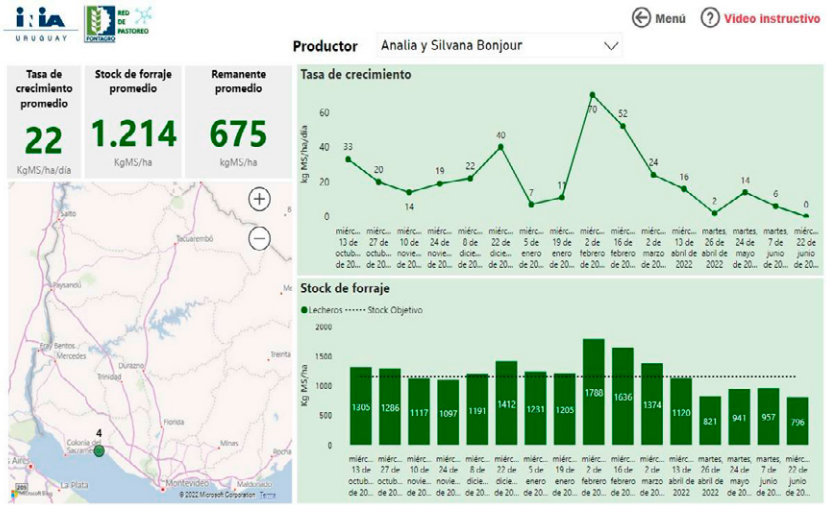
Achievements:

- A regional platform was formed by three Latin American and Caribbean countries, with the objective of improving self-sufficiency and sustainability on family livestock and dairy farms.
- A pastoral network was established among the participating countries, promoting the continuous exchange of experiences among technicians (facilitators) and researchers.
- Developed and validated a prototype AgTech solution, a web-based tool designed to increase the levels of forage produced, either for direct consumption or for the production of reserves.
- Validation of the web tool was completed through the experience of end users, which allowed the tool to be adjusted to their real needs and improved its usability, thus facilitating its adoption and optimization in production systems.
- An API was generated that allows scaling the tool on other platforms, facilitating its integration, expansion and long-term sustainability, and ensuring its adaptability to different contexts and needs.
- Activities were carried out to calibrate the use of drones for remote biomass estimation for species representative of the three countries.
- A significant number of technicians and producers were trained, which contributed to the successful implementation of the tool.
- Despite the completion of the project intervention, the system continues to increase the number of users and hectares monitored, demonstrating the success of the project.

Source: Project images of the field experiments.

Impacts:

- Enhanced livestock nutrition and farm productivity.
- Functional platform with a continually increasing userbase. There are currently 44 producers in Uruguay, 30 in Argentina and 11 in Costa Rica using the DSS tool.
- 18,941 hectares affected by the project so far.
- Over 200 producers and technicians in Uruguay, Argentina and Costa Rica benefitted directly from the project.
- Approximately 4,200 farmers benefited indirectly from the project.



Evolution of the average growth rate (line graph, above) and average pasture stock (bar graph, below) of the grazing platform on a beef farm from Rio Negro Department, Uru-guay, from April of 2021 to May of 2022.

Benefits to New Zealand agriculture

- **Developing AgTech Solutions for Grazing –** Introduces digital tools for monitoring pasture quality and availability.
- **Improving Livestock Productivity –** Increases pasture utilization rates, reducing reliance on imported feed.
- **Enhancing Drought Resilience –** Supports strategies to optimize pasture growth in variable climate conditions.
- **Reducing Carbon Footprint –** Enables precise pasture management to lower overall farm emissions.
- **Facilitating Farmer Adoption of Digital Technologies –** Promotes the use of web-based platforms for real-time grazing management.

Source: Project images of the field experiments.

PROJECT 7

AgTech for climate-smart dairy farming

Background: There is currently an increase in global demand for animal protein that is estimated to grow 70% by 2050. This is an opportunity for milk-producing countries in LAC to supply domestic and foreign markets with dairy products. However, an increase in livestock production may have a significant environmental impact due to greenhouse gas (GHG) emissions. In addition, climate change (cycles, rainfall patterns and intensive temperature) threatens production and increases the vulnerability of dairy production systems. To reduce these effects, these systems need better indicators of efficiency and productivity to enable a sustainable intensification of resource use, such as water, soil, and climate. This project developed a digital tool to improve real-time information capture about production systems, enabling a transition to climate-smart dairy farms. Livestock systems face complex issues related to the depletion of natural resources, climatic variations, increased demand for food, price volatility, rising costs, environmental regulations, among others. The necessary growth of livestock production may have positive environmental impacts if systems are efficient. **Climate-smart agriculture (CSA)** is an approach that has recently gained widespread attention, given the adaptation and mitigation challenges facing humankind. CSA has three objectives: 1) increase agricultural productivity, food security and development; 2) increase adaptive capacity at multiple levels and 3) decrease GHG emissions and increase carbon sinks. The main objective of this project was to build new capacities for the LAC dairy sector to implement sustainable management practices to achieve climate-smart dairy farms. This project was carried out in Argentina, Costa Rica, Dominican Republic, Honduras and Uruguay. A private-public platform was built, with public and private entities, farmer associations, and sectoral and governmental technical advisers. The partnership has the purpose of building new capacities for the global dairy sector to implement sustainable management processes to achieve climate-smart dairy fAvarms (CSDF).

Achievements:

- Deployed smart farming technologies, resulting in a 20% increase in efficiency.
- New capacities built for the dairy production sector in LAC and implementation of CSDF.
- Establishment of a public-private network with the technical capacity to develop climate-smart dairy production.
- Digital tools (a web platform, applications for mobile devices and computers), based on good practices, to manage climate-smart dairy farms.

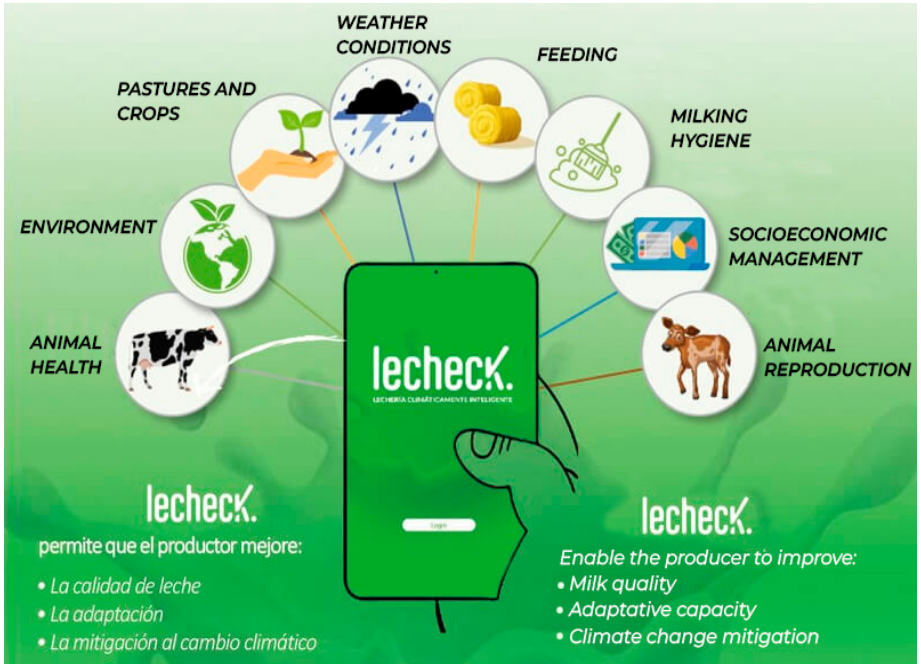
- Dairy farmers, technicians and extension workers trained in the use of technological tools for the sustainable management of dairy establishments.
- Consensus on document of good practices reached by participant countries, specifically related to pastures and crops, hygiene in milking, animal health, environment, animal reproduction, socioeconomic management, feeding, animal welfare, and inclement weather.
- Development of LECHECK.APP, an application based on the consensus document that helps producers and technicians to implement good practices in dairy farms. Technicians have started to be trained in the use of the app in different countries.

Other beneficiaries impacted by the project include:

- 20 organizations (coops, associations, clusters, and SMEs).
- 200 professionals and technicians from the dairy sector.
- 300 students from agricultural high schools and university programs about milk production.
- 10 milk processing companies and 25 municipal residents from Argentina, Uruguay, the Dominican Republic, Costa Rica and Honduras, trained in the use of AgTech tools for milk production.

Impact:

- Reduced environmental footprint and increased dairy production.
- The purpose of LECHECK.APP is to improve productivity, guarantee milk quality, mitigate GHG production and adapt to climate change in order to achieve CSDF status.
- The app was validated for one year and has 526 users across 508 farms, entailing 79,756 Good Practices which were surveyed in 12 countries.
- Excellent results were obtained in terms of usability, and a list of necessary improvements was agreed upon, based on users' recommendations
- 11 scientific articles published.
- 31 workshops held.



Source: project images about the field experiments

Benefits to New Zealand agriculture

- **Scaling Digital Agriculture Solutions** – Provides tested smart farming technologies applicable to New Zealand dairy farms.
- **Enhancing Dairy Efficiency** – Develops digital tools that optimize milk production while reducing emissions.
- **Improving Animal Health Monitoring** – Integrates sensors and monitoring systems to enhance herd management.
- **Supporting Sustainable Milk Production** – Advances best practices for emissions reduction in intensive and extensive dairy farming.
- **Facilitating Climate Adaptation Strategies** – Identifies precision agriculture techniques that can help New Zealand's dairy industry adapt to climate shifts.

73 Practices to mitigate climate change

48 Practices for adaptation to climate change

2372 Persons trained

906 Women trained

11 Scientific articles produced

31 Workshops held

1 Consensus document about good practices

1 Doctoral program student

Source: Project images of the field experiments.

PROJECT 8

Boosting cattle productivity in the South American Chaco

Background: In recent decades there has been a rapid expansion and intensification of agricultural production in the South American Chaco region. However, most livestock producers still have very low productivity levels. A valid indicator of this productivity is the low annual weaning rate (calves per cow per year), which is below 50%. Low productivity can be explained by poor availability and planning of forage resources (e.g. pastures, rangeland and reserves), a lack of farm infrastructure (e.g. pasture and corral), inefficient herd management (e.g. lack of planning and organization of services, weaning) and lack of adequate health management (e.g. reproductive and parasitic diseases). This project improved the efficiency, stability and resilience of family livestock systems in the Chaco region through the incorporation of alternative technologies and capacities to improve livestock management. Researchers, extension workers and producers from the three countries that share the South American Chaco: Argentina, Bolivia and Paraguay, participated in this project. A network of farmers, working together with scientists, developed pilot sites where technologies and new agronomic management were implemented to better adapt to climate variations and pasture production. This project improved the efficiency, stability and resilience of family livestock systems in the Chaco region and therefore creating opportunities for farmers to be more resilient to environmental changes.

Through a participatory approach, extension agents and producers agreed the critical technologies to be implemented in each pilot site, which were grouped into 4 types:

a) fodder and food: pasture implantation, preparation of fodder reserves, stock adjustment according to fodder supply and animal requirements, and improvement of grazing systems;

b) Infrastructure and business management: field divisions, water collection and distribution systems; registration and monitoring of administrative performance indicators;

c) Animal health: Adaptation of the health plan to the system and the area, control of parasitic and infectious diseases and bull evaluation; and

d) Herd management: monitoring of animal body condition, elimination of unproductive categories, supplementation of calves and heifers, seasonal breeding, pregnancy diagnosis and early weaning.

Achievements:

- Introduced sustainable cattle breeding and management practices.
- An updated characterization of family cattle systems in the Chaco region, with technological alternatives to be incorporated into intervention strategies and an ensured continuity of actions in the future.

- A farmers network of 90 pilot sites across the 3 countries, where technological improvements are applied and serve as demonstrative and training units during and following the project.
- Producers, extension agents and advisors trained in bovine production in Chaco Region. A virtual livestock innovation course for the region that can be scaled up to other producers will be available.
- Information available on productivity indicators, level of uptake of the proposed technologi-cal alternatives and their effect on the productivity of family livestock systems.

Impacts:

- A total of 124 training sessions were conducted for 2,595 producers, over 700 of which were women, 152 extension agents, and advisors in bovine production in the Chaco.
- Participating producers, on average, increased their initial calf weaning percentage from 54.5% to 61.9% (a 13.58% increase) even in a challenging climatic context, and raised their meat production by at least 10.06%.
- The active participation of family livestock producers in identifying the key issues behind their low productivity, followed by their collaboration with technical advisors and extensionists to determine the most suitable technologies for improvement, fostered a strong local ownership of the project's objectives—something that would not have been achieved otherwise.

Benefits to New Zealand agriculture

- **Building a Global Livestock Climate Network –** Strengthens New Zealand's leadership in climate-smart livestock farming.
- **Improving GHG Measurement Tools –** Introduces standardized methodologies applicable to New Zealand's pastoral systems.
- **Enhancing Training Programs –** Contributes to knowledge-sharing initiatives for sustainable livestock farming.
- **Increasing Access to Emission-Reduction Strategies –** Facilitates the adaptation of effective methane and nitrous oxide reduction practices.
- **Developing Digital Decision Support Tools –** Advances monitoring technologies that can be integrated into New Zealand farming systems.

3 Characterisation of livestock systems and possible technologies for incorporation

86 Livestock producer groups

2595 Trained producers

851 Trained women

90 Pilot sites

385 SMEs receive technical assistance

117 Public officers trained

10 Institutions with strengthened capacities

Source: Project images of the field experiments.

PROJECT 9

Soil organic carbon sequestration: opportunities and impact on the economy and the environment

Background: There are several international efforts to seek solutions to global problems such as climate change, food security and environmental pollution. One of them is the Paris agreement signed in 2015, in which 196 countries join efforts to limit global warming. Different scenarios have been created and the most ambitious is to limit the temperature increase to less than 2 degrees. One objective proposed in this agreement is to limit greenhouse gas emissions. To this end, each country that is part of the agreement must periodically quantify and present national inventories, with mitigation strategies according to its emissions. A possible solution to these problems is found in soil organic carbon (SOC). The importance of focusing on this issue lies in the fact that SOC is an indicator of soil productivity, as well as favoring the sequestration of greenhouse gases (GHG). "Carbon sequestration" is defined as the removal of CO_2 from the atmosphere and its storage in ecological sinks, such as soil organic matter. In this case, carbon sequestration will be quantified as changes in the SOC pool. These changes can occur in response to changes in land management, such as increased use of fertilization, irrigation, or in response to changes in land use, such as the conversion of crops to afforestation. Soils in Latin America and the Caribbean (LAC) could have a relevant role in SOC sequestration since, depending on their management, pastures and agricultural soils have potential as large SOC sinks. Beneficial management strategies are inclusion of service crops in agricultural sequences, the integration of agricultural and livestock systems, the increase in the availability of water and nutrients (irrigation, fertilization, amendments), and the restoration of sown pastures and degraded natural pastures. In each country, the most effective strategy to increase the national stock of SOC will depend on the expected sequestration rates and the area covered by such systems. The objective of this project is to contribute to the design of land use and management with a high potential for SOC sequestration in agricultural production systems of LAC, while generating capacities in LAC for the quantification and monitoring of the SOC stock. This objective will be achieved through the development of a multi-agency platform that provides LAC countries with information to report their SOC inventories in Tier 2. The technological solution proposed aims to identify and evaluate intensification strategies for agricultural production systems in LAC that have the potential to mitigate and adapt to climate change. It also seeks to calibrate rapid and low-cost methodologies to estimate soil organic carbon on a large scale and thus be able to carry out sampling in time and space in order to have a solid and updated data-base. This project is currently carried out in Uruguay, Argentina, Chile, Colombia and Costa Rica, and was executed by INIA-Uruguay.

Achievements:

- A multi-agency platform was formed between five countries in Latin America and the Caribbean, signing the corresponding inter-institutional agreements that allow the co-execution of funds to the participating institutions in each country.
- 10 distance meetings have been held, in which the objectives and a common work plan for the countries that make up the platform have been defined.
- Progress has been made in preparing a face-to-face workshop in Chile to train the technicians who are part of the project.

Impacts:

- To have a basis and reference for the agencies in charge of reporting national GHG inventories in each country, and for those agencies involved in the generation of NDCs and NAMAs.
- To obtain an identified opportunity for SOC sequestration, with potential for implementation as a NAMA evaluated in terms of its potential economic and environmental impact for the five LAC countries participating in the project.
- Train staff to update their SOC stock reports and stock changes with the necessary quality in the time required by international agreements in the five countries participating in the project and develop reference material for further consultation.

Benefits to New Zealand Agriculture

- **Enhancing Soil Carbon Monitoring** – Strengthens New Zealand's carbon sequestration measurement capabilities.
- **Supporting Climate Mitigation Strategies** – Provides best practices for increasing soil organic carbon levels.
- **Improving Pasture Fertility** – Helps develop land management techniques that boost pasture resilience.
- **Reducing Soil Degradation** – Offers regenerative agriculture insights that maintain soil health.
- **Facilitating Policy Development on Carbon Farming** – Supports carbon credit market opportunities in New Zealand.

30 Total technicians

23 % Women trained

28 Dissemination and training instances

+624 Sampling sites

+ 5 Technological solutions and innovations

+ 5 Technologies with lower emissions

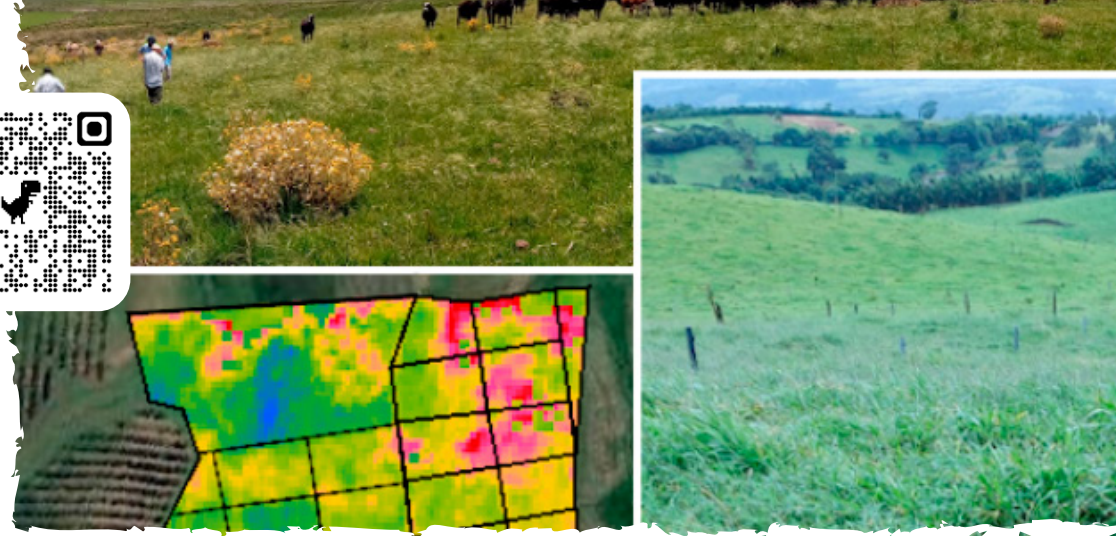
3 Protocols generated

+ 34 Networked institutions

Source: Project images of the field experiments.

PROJECT 10

Satellite monitoring of quantity and quality of available biomass in pastoral livestock systems



Background: Pastoral livestock contributes 46% of GDP and is key to Latin American and Caribbean countries' food and social security. Currently, pastoral systems for bovine production face the challenge of increasing their profitability while reducing their environmental impact, since high costs and growing concern about their contribution to global warming threaten their development. Knowing the quantity and quality of available biomass is key to making management decisions that improve the productive efficiency and profitability of these livestock systems, while allowing monitoring, reporting and verifying the effect of greenhouse gas (GHG) emission mitigation strategies. However, frequent field measurements that cover an entire production unit are expensive and often impractical. In the last five years, the availability of satellite data on a spatial and temporal scale compatible with weekly management decisions of individual paddocks has advanced enormously, and prediction models of the quantity and quality of biomass based on remote sensors are beginning to appear. For this technology to result in productive improvements, it is necessary to have reliable, locally validated models and mechanisms that make the information available to different users. The main objective of the project is to lower the cost of estimating in real time and with adequate precision the quantity and quality of biomass available in pastoral livestock systems through a satellite tool. A protocol, a mobile application and a webpage were developed to record ground-truth data (biomass and forage quality measured at field). A field monitoring network was consolidated, with the participation of more than 70 researchers and technicians. Currently, there are more than 800 pairs of webpage were developed to record ground-truth data. Models will be able to be extrapolated for the range of situations evaluated. The accuracy of the prediction models will be tested at the system scale. Demonstration modules from the experimental stations belonging to the participating institutions and 12 commercial farms that participate in the associated projects that promote the adoption of technologies in pastoral livestock systems will be used. Dissemination and training activities will be carried out to ensure that the developed products reach potential users and that they are capable of using them appropriately.

Achievements:

- A technical note was produced containing a protocol for sampling both the quantity and quality of forage biomass in field conditions.
- The protocol is designed to be compatible with satellite data and is adaptable to various forage resources. It includes a set of guidelines for conducting field sampling and incorporates digital tools to streamline data recording processes.
- Currently, the protocol is being implemented at three sites in Argentina, with plans to extend its application to additional sites across all participating countries.

Impacts:

- **Enhanced Decision-Making for Grazing Management:** providing real-time, accurate data on the quantity and quality of available biomass, livestock producers can make informed decisions to optimize grazing practices, leading to increased forage utilization and system profitability.
- **Cost Reduction in Biomass Assessment:** the implementation of satellite tools reduces the need for frequent and costly field measurements, making the estimation of biomass more efficient and economically feasible for producers.
- **Improved Monitoring of Greenhouse Gas Emissions:** accurate data on biomass availability enables better monitoring, reporting, and verification of greenhouse gas emissions, assisting in the evaluation of mitigation strategies and supporting environmental sustainability efforts.
- **Facilitation of Technology Adoption:** the development of user-friendly tools, such as mobile applications and web platforms, along with training and dissemination activities, encourages the adoption of advanced technologies among livestock producers, leading to more efficient and sustainable practices.
- **Strengthened Research and Collaboration Networks:** the consolidation of a field monitoring network involving over 70 researchers and technicians fosters collaboration and data sharing, enhancing the overall capacity for innovation and continuous improvement in pastoral livestock systems. Those impacts collectively contribute to the advancement of sustainable and profitable pastoral livestock systems in Latin America and the Caribbean.

3
PhD thesis in progress

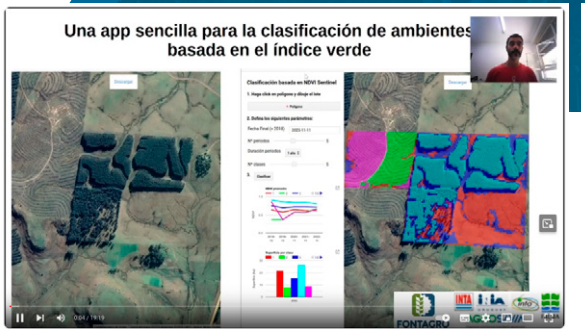
79
Researchers and technicians involved in biomass sampling

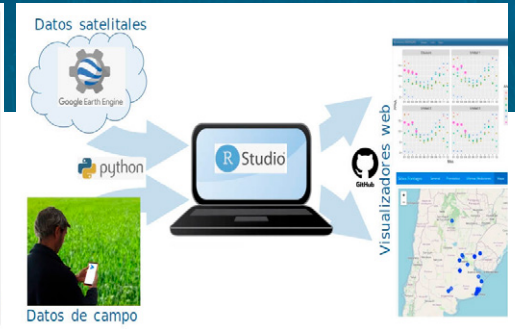
8
Training and field days

1
App for recording and systematizing data

Benefits to New Zealand agriculture

- **Enhancing Remote Sensing Capabilities** – Advances real-time monitoring of pasture biomass availability.
- **Supporting Precision Livestock Management** – Provides a model for using satellite data in farm planning.
- **Reducing Overgrazing Impacts** – Helps optimize grazing strategies using real-time data.
- **Improving Climate Resilience** – Supports adaptation of grazing practices based on seasonal variability.
- **Facilitating Data-Driven Decision-Making** – Promotes smart farming through the integration of satellite analytics.





Source: Project images of the field experiments.

PROJECT 11

Innovations for reducing methane emissions in ruminants

Background: Pastoral livestock farming is essential in Latin America and the Caribbean (LAC), with pastures covering 80% of agricultural lands. Although socially accepted and contributing to rural development, its sustainability is fragile due to the limited technological innovation that allows for the timely identification and establishment of strategies for sustainable productivity increase. There are limitations in assessing key animal efficiency variables such as intake, ingestive behavior, digestibility, and enteric CH_4 emissions in real-time at the farm level under grazing conditions. This is a barrier to reducing CH_4 emissions and improving the competitiveness and sustainability of pastoral livestock farming in LAC through management, feeding, and additive use strategies. Obtaining accurate and adequate information on forage consumption and digestibility, enteric methane emissions and ingestive behavior in grazing will allow agile decision-making to increase feed efficiency. This project aims to reduce emission intensity (g CO_{2e}/kg of meat) by 10% through technological innovation, developed in Latin America, for the quantification and mitigation of greenhouse gases. Uptake of these innovations will lead to increased sustainability and climate change resilience of livestock systems in LAC. Implementing three local technological innovations to generate positive impacts on the socio-economic and environmental components of the meat chain actor's population based on pastoral livestock systems in LAC. The expected results are from an economic perspective, to reduce the cost and time required to obtain information on forage intake and digestibility, enteric methane emissions, and ingestive behavior in grazing cattle, which are key variables for the sustainability of any livestock system. This information will enable decision-making to increase the efficiency of forage and animal resource utilization, thereby promoting a 10% increase in weight gain (kg/day). Environmentally, the proposal aims to reduce per-animal CO_{2e} equivalent emissions by at least 10% through the optimization of ruminal fermentation using a local additive. The project is working on:

- The implementation of a system based on remote sensors for monitoring ingestive behavior and quantifying enteric methane emissions in grazing cattle.
- The recommendations for the use of a feed additive to reduce enteric methane emissions in pastoral bovine husbandry.
- The validation of Fefecal near-infrared spectroscopy (NIRS) technology for quantifying intake and digestibility in grazing cattle.
- The capacity building and training of scientists, technicians, farmers and other stakeholders.

Benefits to New Zealand agriculture

- **Developing Methane Reduction Strategies –** Provides validated approaches to lowering enteric methane emissions in grazing livestock.
- **Enhancing Feed Efficiency Research –** Identifies innovative feeding strategies to optimize nutrient intake while reducing GHG emissions.
- **Supporting Smart Livestock Monitoring –** Introduces digital and sensor-based solutions for measuring methane emissions in real-time.
- **Scaling Sustainable Beef and Dairy Production –** Offers replicable models for New Zealand's pastoral farming to improve sustainability.
- **Advancing Research on Feed Additives –** Supports the development of low-methane feed formulations for the livestock sector.

Expected beneficiaries: Direct beneficiaries include pastoral livestock producers, technical assistants, and the academic community. This project will contribute to the training of at least two undergraduate students, two postgraduate students, a postdoctoral fellowship, and the strengthening of technical-scientific capacities of 20 researchers, of which 12 (60%) are women. Expected positive impacts of the implementation of the three technological innovations on pastoral cattle producers include a reduction of CO_2 equivalent emissions per animal of at least 10% and an increase of up to 10% in weight gain (kg/day), driven by increased efficiency in use of forage and animal resources, optimization of ruminal fermentation and mitigation of enteric CH_4 emissions.

2 Databases expected to be generated

12 Workshops with beneficiaries expected

20 Students, teachers, and researchers are expected to be trained

1 Laboratory methodology validation expected

2 Guides for producers expected

6 Scientific documents expected

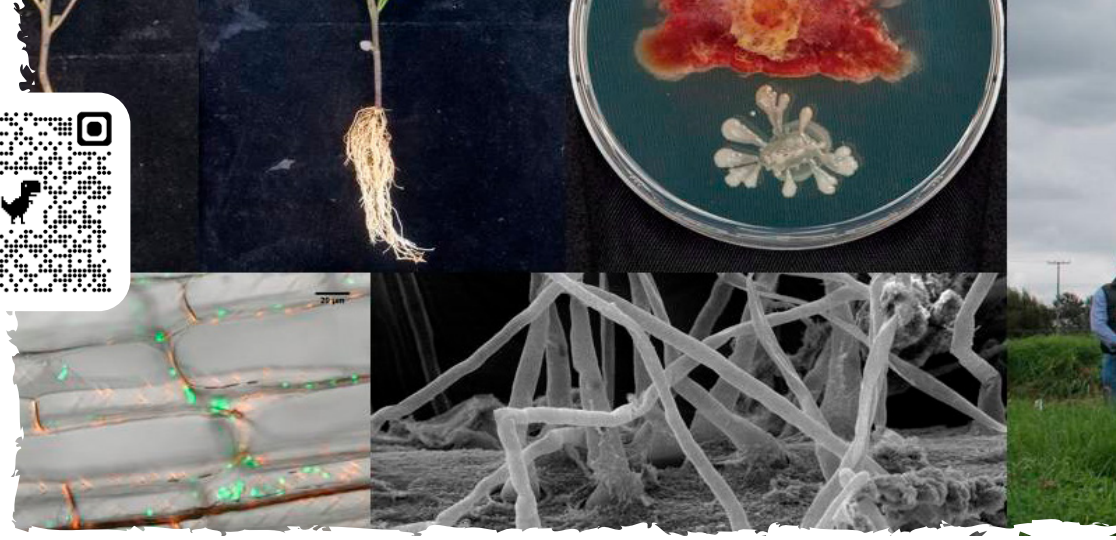
-10% Emission intensity (g de CO_{2e}/kg meat) expected

3 Local technologies implemented

Source: Project images of the field experiments.

PROJECT 12

Expanding the use of biologicals in Latin American agriculture



Background: The intensification of agricultural activities to meet global food demand has negatively impacted the environment and sustainability, necessitating the development of new technologies for more sustainable resource use in agriculture. There is an urgent need for the implementation and development of more sustainable agricultural technologies. Beneficial microorganisms that promote plant growth, known as biologicals, play a crucial role in fostering plant health and productivity. The use of biologicals, specifically bioinoculants (biofertilizers, biopesticides and biocontrollers), based on beneficial microbes which can promote plant growth and also plant protection is a promising technology that can be improved in efficacy, adoption and commercial registration for its use. These bioinoculants are underutilized due to inconsistent field results, perceived complexity, and lack of awareness. Moreover, regulatory frameworks in Latin America regarding the quality and efficiency of biotechnological products based on bioinoculants are still developing. This project focuses on discerning gaps in the incorporation of bioinoculants in the technological toolboxes of agricultural farms in Latin America and the Caribbean (LAC) as an alternative to agrochemicals, in order to provide for the growing world-wide population and food demand. The project addresses the low adoption rate of biologicals in LAC agricultural practices. It aims to provide robust evidence and standardized methodologies to evaluate and promote the use of biologicals.

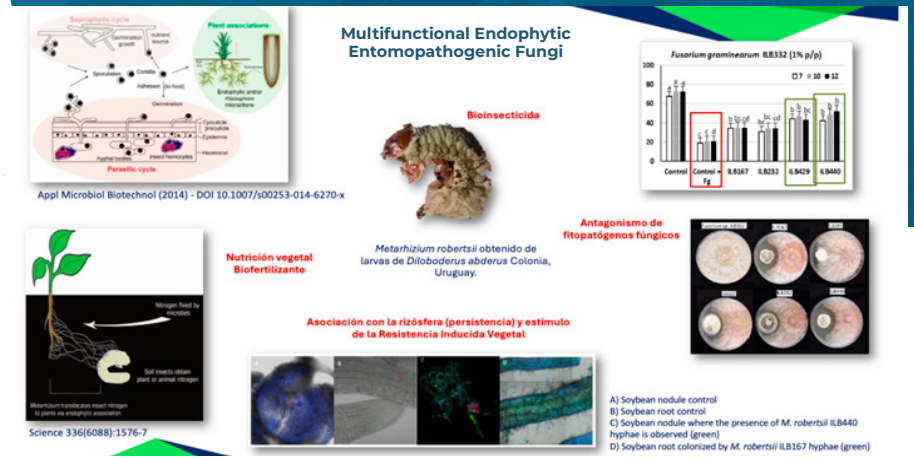
Expected results:

- The project aims to increase crop yield by at least 10% and improve phytosanitary control by at least 15%, depending on the crop and context of the test.
- Integration of information into bioinoculants application manuals and in a platform through a collaborative network of participating LAC research institutes and farmers.
- Achievements and knowledge on the efficient use of biologicals will be generated and disseminated through different media to reach both specialized and general audiences.
- Provide innovative solutions for the development, transfer and use of bioinoculants in LAC, based on microorganisms with biofertilizing and bioprotecting capabilities.

Benefits to New Zealand agriculture

- **Enhancing Soil Health and Fertility** – Provides insights into beneficial microbes that can improve soil productivity and sustainability.
- **Reducing Agricultural Chemical Use** – Supports New Zealand's regulatory and policy goals for reducing environmental impact from agrochemicals.
- **Developing Efficient Biofertilizers and Biocontrol Agents** – Promotes the integration of biologicals into mainstream farming.
- **Strengthening New Zealand's Biotech Sector** – Offers commercial opportunities for New Zealand-based biotech firms in the growing biologicals market.

Expected beneficiaries: The expected beneficiaries include 38 biologicals companies, 12,007 small and medium-sized producers in each country, as well as promote associations with international organizations, academic institutions, private sector, regulatory framework, and governments.



Source: Project images of the field experiments.

PROJECT 13

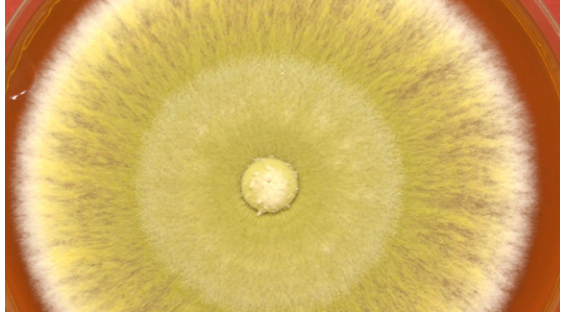
Leveraging biological products to build climate resilience

Background: Global agricultural production faces challenges from climate change, drought, nutrient availability, pests and diseases. Biological products can reduce the use of agrochemicals and help improve productivity by minimizing the environmental risks of toxic waste and water pollution. Entomopathogenic fungi (HEP), phytopathogenic antagonists (PAH) and Arbuscular mycorrhizal fungi (HFMA) have been studied for their application as insecticides or pathogen antagonists. However, their potential for developing bio-products has been studied little. This project proposes the integration of beneficial fungi including EPF, PPA and AMF to improve production (+5%) and the resilience of maize crops to climate change with added benefits via reduced agrochemical use (50%), the control of pests and diseases, greater tolerance to drought and soil carbon sequestration. This will be achieved using the native biodiversity of Colombia; Argentina and New Zealand are looking for the most promising alternatives for the development of biologicals that can be integrated into a technological package to be applied in maize cultivation and replicated in other crops post-validation. Microbiological biodiversity has already evaluated for biopesticide and biofertilizer qualities will be integrated to mitigate the effects of climate change.

Innovation or need addressed: There is a need to increase the production and resilience of maize and other crops in Colombia and Argentina, while also mitigating the effects of climate change.

Expected results:

- Molecular identification of beneficial fungal isolates used in the project.
- Baseline of insecticide activity for each native fungal isolate.
- Baseline of antagonistic activity for each native fungal isolation.
- Baseline of entomopathogenic and antagonistic activity of foreign fungal isolates.
- Standardized methodology for measuring soil-based carbon sequestration.
- Proven soil-based carbon sequestration by beneficial fungi.
- Drought tolerance results in beneficial fungi.

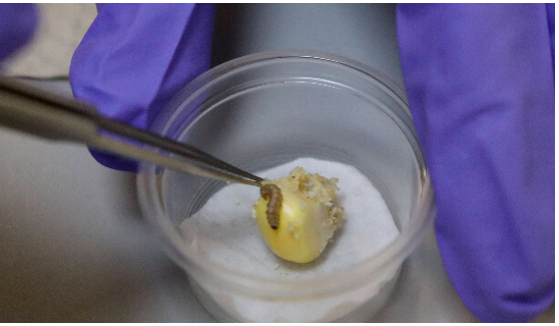


- Analysis of the benefits of fungal application represented by reduced fertilizer and pesticide use.
- Protocols of methods applied during the project and information about selected beneficial fungi.
- Workshops for strategies to consider for uptake by producers.
- Documents to form the basis of at least two scientific papers, a video for dissemination and a publication that agricultural producers can access.

Expected beneficiaries: Direct beneficiaries will be maize producers in Colombia and Argentina. Further beneficiaries include professionals, students and technical assistants that will participate directly and indirectly in the development of this proposal (100 per country). Indirect beneficiaries will be businesses that produce and commercialize biologicals, the academic sector and research sectors of the involved countries. Poultry and pork production chains will benefit from maize production being directed to animal feed, one of the greatest unmet demands in Colombia where 80% is imported.

Benefits to New Zealand agriculture

- **Increasing Crop Resilience to Climate Change –** Develops biological solutions that enhance plant tolerance to drought and pests.
- **Reducing Dependence on Chemical Inputs –** Advances the use of fungal-based biofertilizers and biopesticides in sustainable agriculture.
- **Enhancing Carbon Sequestration in Soils –** Demonstrates the role of beneficial fungi in improving soil carbon capture.
- **Scaling Sustainable Maize Production –** Provides data on biological solutions that could improve New Zealand's corn and grain systems.
- **Supporting the Development of Climate-Smart Agricultural Inputs –** Strengthens research collaborations in the biologicals sector.



+5%
Increase in productivity expected

-50%
Reduction in the use of agrochemicals expected

+200
Farmers expected to be trained in sustainable practices

+10%
Improvement in soil carbon stabilization expected

+10
Bioproducts expected to be developed

+3000
Farmers expected to be impacted through sustainable agricultural practices

Source: Project images of the field experiments.

PROJECT 14

Sustainable livestock farming in the Amazon of Peru and Ecuador

Background: Livestock farming is an essential activity for the livelihoods of farmer families in Peru and Ecuador, generating economic, social and nutritional benefits. In the Amazon region of these countries, both livestock and agriculture have been expanding, resulting in benefits but also environmental problems, especially when extensive systems have been implemented at the expense of deforestation and the generation of crop residues and wastes from agro-industries. Dual-purpose livestock systems, however, have great potential for growth, especially due to the unsatisfied demand for milk and dairy products in both countries. These systems are mainly based on the use of crossbred cattle between Zebu and European breeds, and a grass-based diet with little feed supplementation. They have low productivity in terms of beef and milk produced per animal and per hectare. High consumption of fibrous foods also results in increased generation of greenhouse gases. However, the low animal productivity of dual-purpose systems can be improved with adequate supplementary feeding using locally-produced agro-industrial residues. This project aims to sustainably intensify dual-purpose livestock systems in the Peruvian and Ecuadorian Amazon through supplementation with agro-industrial by-products and crop residues. There is a need to reduce the environmental impacts of expanding agricultural production in the Amazon region.

Expected results:

- Baseline study of dual-purpose livestock systems prevalent in the Peruvian and Ecuadorian Amazon.
- Development of an inventory of available agro-industrial by-products with potential use as cattle feed.
- Nutritional values of available agro-industrial by-products.
- Effect of supplementation with agro-industrial by-products on productive performance of cattle.
- Predictions of enteric methane emissions from the inclusion of by-products and/or forage in the diet of ruminants.
- Life cycle analysis (LCA) of dual-purpose livestock systems.
- Development of a virtual innovation platform on bovine supplementation with agro-industrial by-products.
- Dissemination of activities.

Expected beneficiaries: Direct beneficiaries will be the 500 producers and professionals who will participate in research, training and technology transfer activities. Indirect beneficiaries will be some 6,490 producers with cattle in the participating countries.

Benefits to New Zealand Agriculture

- **Developing Sustainable Dual-Purpose Livestock Systems** – Provides models for integrating beef and dairy production under sustainable intensification.
- **Optimizing Use of Agro-Industrial By-Products** – Introduces strategies for incorporating food processing waste as an alternative cattle feed.
- **Reducing the Carbon Footprint of Livestock** – Supports climate-friendly production models applicable to New Zealand's grazing systems.
- **Improving Nutritional Efficiency in Cattle** – Enhances knowledge on feed supplementation strategies to optimize productivity.
- **Strengthening Livestock Climate Adaptation Strategies** – Supports sustainable intensification practices that improve resilience in vulnerable farming regions.

250 Dual-purpose cattle systems

10 Agro-industrial by-products

3 Breeds of cattle

250 Interviews with farmers

2 Workshops with farmers

-5% Feeding costs

100% Crop utilization

+90g Daily weight gain

Source: Project images of the field experiments.

PROJECT 15

Climate-smart research and indigenous communities

Background: This project aims to promote sustainability and food security in indigenous Mapuche communities in rural areas of Argentina and Chile. Through the implementation of climate-smart livestock practices, the goal is to enhance livestock production on small-scale farms in these regions. The project builds upon previous research and draws from accumulated experience, proposing effective solutions tailored to the specific context of the Mapuche communities. In Argentina, the focus is on the provinces of Río Negro and Neuquén, where Mapuche communities face challenges due to limited water availability, inadequate livestock nutrition, and restricted access to local markets. In Chile, the emphasis is on the La Araucanía region, where Mapuche communities also confront changing climatic conditions and limitations in livestock rearing. The proposal involves engaging Mapuche communities in project planning and execution. The focus is on co-creating solutions and validating the proposed project. Additionally, efforts are directed towards disseminating innovations through demonstration plots and participatory transfer activities, with the objective of achieving broader adoption in rural communities. This project not only seeks to increase livestock productivity but also to preserve culture by incorporating the ancestral perspectives of the communities into solutions. With an emphasis on sustainable development and climate adaptation, it provides support to vulnerable communities in their pursuit of resilience and prosperity. The overall objective of the project is to promote sustainability and food security in Mapuche indigenous communities through the adoption of livestock practices that are resilient to climate change.

Innovation or need addressed: Mapuche communities face challenging conditions such as limited water availability, changing climatic conditions, inadequate livestock nutrition, and restricted access to local markets. This project not only seeks to sustainably increase livestock productivity and food security but also to preserve culture by incorporating the ancestral perspectives of the communities into solutions.

Expected results:

- The creation and characterization of at least 15 Innovation Units (IUs) defined and selected in a participatory manner across five Mapuche communities.
- The implementation of a set of climate-adapted livestock practices, specific to each of these IUs, carried out in consensus with the communities involved.
- The implementation and evaluation of at least two climate-smart livestock practices in each IU to improve productivity and natural resource management.

- The measurement and quantification of the reduction of greenhouse gas emissions intensity as a result of the implementation of these practices in the IUs.
- Dissemination of the knowledge and practices developed through informative materials and extension and knowledge exchange workshops.
- The strengthening of an inclusive and open innovation ecosystem through the formation of a transdisciplinary team and the realization of exchanges and internships between communi-ties and technical teams.

Expected beneficiaries: The direct beneficiaries of this project are the Mapuche communities located in the Argentine provinces of Río Negro and Neuquén, and in the Chilean region of La Araucanía. The project includes to work with Māori organizations in New Zealand through the Indigenous Research Network (IRN). The integration of their ancestral wisdom into the proposed solutions enriches the project, ensuring more relevant and lasting results for the communities involved. Indirect beneficiaries include research institutions such as INTA in Argentina and INIA in Chile, which will gain valuable knowledge and experience transferable to similar contexts.

Benefits to New Zealand agriculture

- **Integrating Indigenous Knowledge into Climate Adaptation –** Promotes traditional and local knowledge as part of climate-smart agriculture strategies.
- **Strengthening Community-Led Sustainable Farming Models –** Encourages participatory approaches for adaptation, applicable to Māori agricultural practices.
- **Enhancing Smallholder Farming Resilience –** Demonstrates successful interventions for improving productivity under extreme climate conditions.
- **Promoting Sustainable Livestock Practices –** Identifies low-impact grazing techniques that support biodiversity conservation.
- **Supporting Cultural Preservation in Agriculture –** Reinforces the role of indigenous leadership in sustainable farming initiatives.

15
Innovations Units chosen through a participatory process

+5
Initial diagnosis

20
Training provided

+8
Exchange workshops

+1
Doctoral thesis supported

10
International peer-reviewed publications and conference abstracts

Source: Project images of the field experiments.

PROJECT 16

Optimizing nitrogen use for sustainable farming

Background: Food production has increased worldwide strongly in the last 20 years in response to population growth, with a significant impact on the countries of the Americas. This is owed to their agricultural potential, in terms of land area and climatic conditions suitable for agriculture. However, the maintenance of this productivity, as well as its future potential development, depends on the effects of climate change, and the strategies proposed to face the climate crisis, to maintain and increase food production under more sustainable systems. The use of nitrogen-based fertilizers in agricultural soils is an essential requirement for food production, however, it is responsible for the generation of nitrous oxide (N_2O), which is a potent greenhouse gas (GHG) that is generated in the soil by biochemical processes for degradation. In most countries, considering the agriculture sector, this greenhouse gas (GHG) is the second most important, after methane (CH_4) produced by enteric fermentation, and has important implications for global warming. This has prompted different actions involving the public and private sectors, to promote its mitigation, including the development of site-specific emission factors and of best management practices that promote the use of the Right N source, the Right rate, the Right moment and the Right place of application (4Rs). This project is made up of Chile, Argentina, Peru, Panama and the Dominican Republic, countries that need to build capacities on GHG measurements to determine emissions factors (EFs) based on locally marketed nitrogen sources and evaluate the doses of fertilizer commonly used by farmers. This baseline information is essential to define and evaluate mitigation strategies ensuring food production. For this, each participating country will evaluate, under field conditions, the production and emission of N_2O to determine nationally specific EFs, for different nitrogen sources, doses, and times of the year. They will also develop mitigation strategies to reduce emissions while maintaining yields.

Innovation or need addressed: The innovation lies in developing best practices and EFs for nitrogen fertilizer use, enhancing nitrogen efficiency while reducing GHG, thus supporting more accurate GHG inventories and better informed public policies in the participating countries.

Expected results: This project will strengthen GHG measurement capacities in the participating countries by evaluating nitrogen sources and mitigation measures to generate emission factors for crops and grasslands. Additionally, it will promote the efficient use of nitrogen fertilizers and the development of public policies aligned with GHG reduction commitments. In all countries, progress was made in

implementing GHG measurements from the soil, but a common work protocol must be updated to account for local differences in soil and climate conditions. The goal is to generate representative Tier 2 EFs for international validation. Expected outcomes include developing mitigation strategies for nitrous oxide emissions in each country and production system, and strengthening capacities for EF determination and mitigation strategy design.

Expected beneficiaries: The direct beneficiaries of the project include decision-makers for public policy development, as well as agricultural producers, technicians, researchers, and students from Argentina, Chile, Peru, the Dominican Republic, and Panama through the transfer of evaluated technologies. The project is expected to benefit 600 people in Chile, 600 in Argentina, 300 in Peru, 300 in the Dominican Republic, and 150 in Panama, with an estimated 17,317 indirect beneficiaries across all countries. Additionally, the initiative will foster international collaboration through platforms like the Nitrogen Flagship of the Global Research Alliance on Agricultural Greenhouse Gases (GRA).

Benefits to New Zealand agriculture

- **Developing More Efficient Fertilization Strategies –** Helps optimize nitrogen use to balance productivity and environmental protection.
- **Reducing Nitrous Oxide Emissions –** Provides emission factor data that can be applied to refine New Zealand's national GHG inventory.
- **Improving Soil Nutrient Management –** Supports the transition toward precision application of fertilizers in pastoral and arable farming.
- **Enhancing Public Policy on Nitrogen Use –** Offers science-based recommendations for nitrogen regulations in New Zealand agriculture.
- **Supporting Regenerative Farming Practices –** Provides guidance on sustainable nutrient cycling and soil restoration.

Source: Project images of the field experiments.

PROJECT 17

Building resilient agricultural systems to mitigate climate change

Background: Over the past 20 years, land-use changes due to deforestation and pasture replacement have increased in Latin America and the Caribbean (LAC), with livestock accounting for 18-25% of greenhouse gas (GHG). Silvopastoral systems (SPS) offer a solution by integrating trees with pastures to GHG emissions, enhance carbon sequestration, and improve ecological, productive, and socioeconomic stability, making livestock production more sustainable and resilient to climate change. The objective is to enhance the resilience and climate change mitigation capacity of livestock systems in LAC by evaluating the integration of silvopastoral systems (SPS), aimed at increasing carbon reserves, promoting productive diversification, and improving environmental sustainability.

Innovation or need addressed: The technological solution is the development of region-specific data on carbon sequestration, GHG emissions, and ecosystem services in SPS. This data will provide more accurate emissions factors, improving climate change reporting for countries lacking in their own GHG emission factors and carbon balances for integrated production systems.

Expected results: The project results will be available to the public and private sectors to promote policies that contribute to the implementation of SPS in LAC by considering the particularities of each country and productive region.

- Quantification of the environmental and productive impacts of sustainable intensification in agricultural systems.
- Identification of practices that improve the provision of ecosystem services and promote carbon sequestration without increasing GHG emissions.
- Evaluation of carbon captured in soils and biomass, and the carbon footprint compared to traditional livestock systems.
- Dissemination of results to promote policies that support the implementation of these systems in each region.

Expected beneficiaries: The project will directly benefit 2,510 people across Argentina, Brazil, Chile, Uruguay, and the Dominican Republic, including 37 research institutes, 18 universities, 247 professionals, and 2,230 producers. Indirect beneficiaries are estimated to reach 33,000 across the five countries.

Benefits to New Zealand agriculture

- **Advancing Silvopastoral Systems –** Supports New Zealand's efforts to integrate trees into grazing landscapes for climate resilience.
- **Quantifying Carbon Sequestration in Agricultural Systems –** Provides data for policy development around carbon farming initiatives.
- **Enhancing Biodiversity in Livestock Farming –** Promotes diversified farming systems that improve soil health and ecosystem resilience.
- **Reducing Deforestation from Agricultural Expansion–** Offers sustainable land-use practices that balance productivity with conservation.
- **Strengthening Climate-Smart Livestock Research –** Facilitates knowledge transfer in low-emission livestock intensification.

Source: Project images of the field experiments.

PROJECT 18

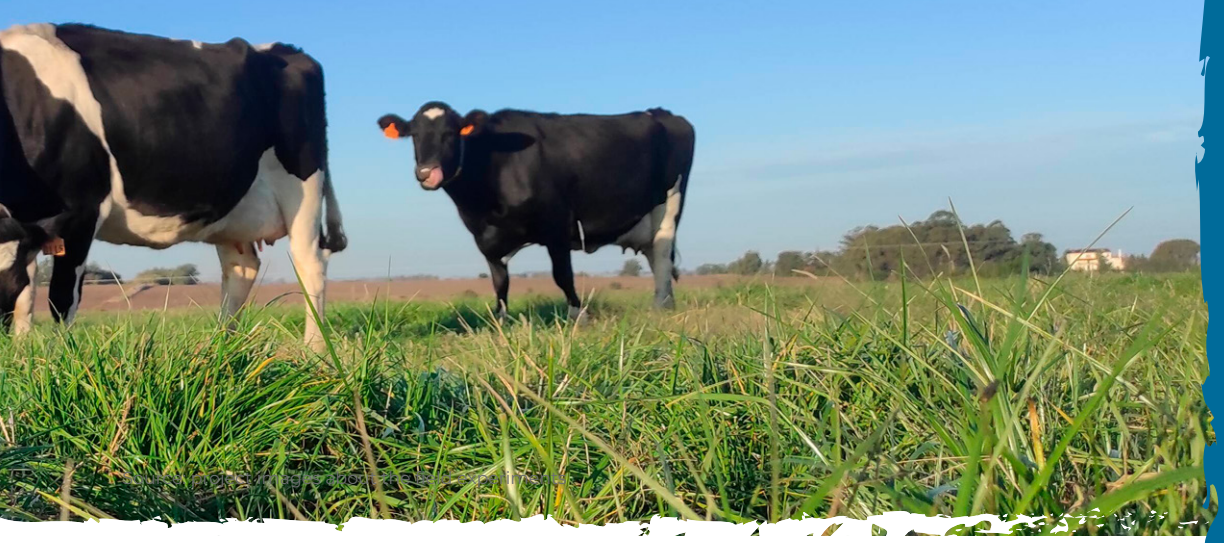
Scaling innovation in pastoral systems

Background: Improving grass consumption on farms requires easily adoptable grazing management technologies that optimize grass use in quantity and quality year-round and are scalable. The sensitivity of pasture growth to short-term changes in water balance, heightened by climate change, necessitates weekly grazing management. This project aims to expand the use of AgTech tools developed under the **"Digital innovations for smarter pasture management"** project to optimize grazing management and forage reserves in pastoral systems across Latin America and the Caribbean (LAC). By increasing on-farm grass utilization, the project enhances economic and environmental sustainability. Current forage harvest levels in tropical and temperate regions remain below potential (2-5 t DM/ha/year), highlighting the need for technologies that are both effective and easy to adopt. The project seeks to improve these indicators, promoting self-sufficiency and resilience in grazing systems.

Innovation or need addressed: The technological solution aims to expand and scale the use of the "3Rweb" app on commercial farms. This cloud-based AgTech tool collects and processes farm data in real time, providing users with indicators for optimal grazing and forage reserve management, including stock levels, and current and expected grass growth rates. The goal is to improve decision-making and enhance the sustainability of pastoral systems.

Expected results: The proposed strategy focuses on expanding the capabilities of the "3Rweb v2.0" app to improve grazing management, nutrition, and sustainability in pastoral systems. It includes several enhancements to optimize animal nutrition, match grass supply to demand, and estimate greenhouse gas (GHG) emissions.

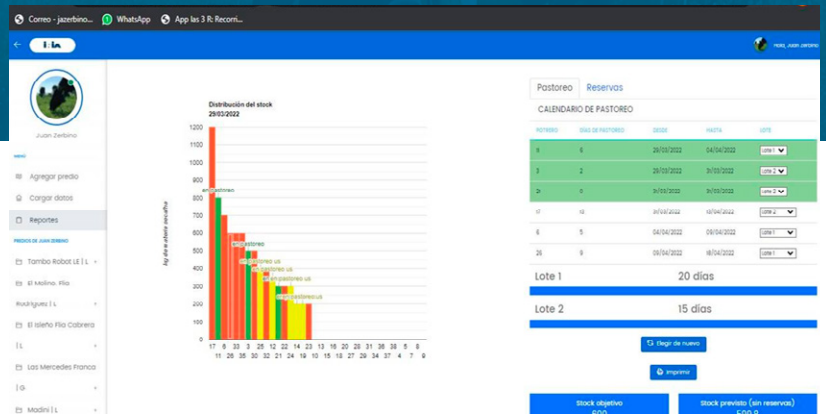
- Improved animal nutrition by incorporating modules for lactating cows and growing cattle.
- Better alignment of grazing management with energy demand and grass supply.
- Estimation of GHG emissions intensity from animals.
- Optimization of grazing decisions for weight gain or sustainable animal load.
- Forecasting of optimal rotation speed for grazing.
- Benchmarking grass harvest performance for dairy and livestock systems.



Expected beneficiaries: The beneficiaries of this project include two groups: (1) producers and technicians aiming to improve the productivity and profitability of their pastoral-based enterprises, and (2) service providers, such as non-university technicians, interested in offering grass management services. Additionally, the project seeks to collaborate with web-based farm management platforms to integrate the solution into their service offerings.

Benefits to New Zealand Agriculture

- **Expanding the Use of AgTech in Grazing Management–** Introduces scalable technologies that optimize forage availability and utilization.
- **Improving Grass Productivity –** Helps increase pasture yields in New Zealand's dairy and beef farming systems.
- **Developing Digital Tools for Farmers –** Provides models for cloud-based farm management solutions.
- **Reducing Greenhouse Gas Emissions in Pasture-Based Farming –** Supports methane reduction strategies linked to better grazing efficiency.
- **Enhancing Resilience of Grazing Systems to Climate Variability –** Promotes adaptive management strategies based on real-time pasture data.



Source: Project images of the field experiments.

PROJECT 19

Reducing greenhouse gas emissions in potato-pasture systems in Ecuador and Peru.

Background: The potato-pasture production systems in the Andean region (AR) of Ecuador and Peru are essential for the sustainability of households in both countries, providing economic, social, and nutritional benefits. In this region, the production of potatoes and pastures for bovine feed has been expanding, generating economic and social benefits but also causing environmental problems when these activities are practiced using extensive production models. This is mainly due to poor agricultural practices, particularly the mismanagement of soils and inputs used in crop production. However, potato-pasture production systems have great potential, especially due to the unmet demand for rotational crops and pastures used as the primary nutrient for producing milk and dairy products in both countries. These systems mainly rely on conventional management practices with production technologies where the use of tillage and nitrogen fertilizers is excessive, promoting higher greehouse gas emissions and relatively low productivity. The project aims to reduce greenhouse gas (GHG) emissions through the use of Conservation Agriculture (CA) practices in the potato-pasture production systems of the AR in Ecuador and Peru. It includes the following components: 1. Establishment of the baseline through the characterization and typification of agricultural production systems in the study areas. 2. Evaluation of the effect of CA and conventional practices on crop productivity, soil conservation and nutrients, economic benefits, and GHG emissions. 3. Comparison of GHG emissions measured through gas chromatography with estimates made by the IPCC and integration of information using extrapolation methods at the regional level. 4. Capacity building through knowledge management, cooperation, and training. The project will be executed by a cooperation platform integrated by the National Institute of Agricultural Research (INIAP) of Ecuador and the National Agrarian University La Molina (UNALM) of Peru.

Expected results: Measuring GHG emissions in agriculture is crucial for developing innovative, sustainable practices that enhance productivity and soil health while reducing environmental impact. It supports compliance with international commitments like the Paris Agreement, driving both efficiency and sustainability in the agricultural sector.

The project is expected to deliver a baseline characterization and typification of potato-pasture production systems in Ecuador, and Peru. It will assess productivity, soil quality, economic benefits, and GHG fluxes by comparing conservation agriculture practices with conventional systems. Additionally, the study will evaluate measured soil GHG fluxes against IPCC estimates, integrate productive, socio-economic, and environmental data at the regional level, and contribute to the development of an innovation platform. The project will also facilitate knowledge dissemination and capacity building for researchers and professionals engaged in the study.

Source: project images about the field experiments

Expected beneficiaries: In the AR of Ecuador and Peru, approximately 200 families involved in potato-pasture production systems, along with 20 professionals—including teachers, technicians, and researchers from the National Institute of Agricultural Research (INIAP) and the National Agrarian University La Molina (UNALM)—will directly benefit from this initiative. Indirect beneficiaries in the AR of Ecuador and Peru include Agricultural Production Units (APUs) dedicated to the potato-pasture system, estimated at 500 APUs in Chimborazo province, Ecuador, and 500 APUs in Junín department, Jauja province, Peru. It is expected that at least 120 students from agricultural faculties in Ecuador and Peru, along with 60 professionals—including teachers, technicians, and researchers from other institutions—will also indirectly participate.

Benefits to New Zealand agriculture

- **Enhancing Sustainable Potato Production –** Introduces regenerative practices for potato farming, a key crop for New Zealand.
- **Reducing GHG Emissions in Mixed Farming Systems –** Provides low-emission strategies for diversified farming landscapes.
- **Optimizing Nutrient Management in Pasture-Potato Rotations –** Improves soil health and productivity through integrated cropping systems.
- **Developing Low-Carbon Agronomic Practices –** Supports efforts to decarbonize root and tuber production in New Zealand.
- **Strengthening Resilience in Smallholder Farming –** Offers climate adaptation strategies for high-altitude and marginal farming areas.

30 Learning plots

8 Training workshops

4 Treatments

+15% Yield

-20% GHG emissions

1500 Beneficiaries

50% Trained women

100 Benefited students

Source: Project images of the field experiments.

PROJECT 20

Sustainable intensification of production in Central America

Background: In Central America and the Caribbean, there are opportunities to enhance agricultural productivity while ensuring sustainable resource use and climate resilience. The Central American Dry Corridor (CADC), prone to droughts and extreme weather, impacts local livelihoods and food security. Introducing drought-tolerant crops like sorghum could diversify and intensify production systems. The primary objective of the project is to identify the most suitable sorghum genotypes and agronomic management practices for each environment in the region, to enhance the productivity, sustainability, and resilience of the CADC agricultural systems. The expected technological solution is the incorporation of sorghum genotypes adapted to different environments of the CADC, based on a precise characterization of environmental factors (soil and climate) and agronomic practices. This will increase the productivity and resilience of agricultural systems in the face of water scarcity. Sorghum, with its efficiency in water use and CO_2 capture, will be key to sustainably intensifying production systems and contributing to food security and agricultural sustainability.

Expected results:

- A technical, operational, and resource feasibility assessment for project implementation in each country.
- Environmental characterization of the study region.
- Identification of key representative environments.
- The analysis will highlight top-performing genotypes and superior environments. Additionally, a predictive algorithm and machine learning model will be developed, tested, and integrated into an online platform for user access.
- Knowledge dissemination will focus on farmers, agronomy technicians, advisors, and students, with an emphasis on “farmer-to-farmer” transfer. INTA Costa Rica will coordinate these activities.

Benefits to New Zealand agriculture

- **Developing Climate-Resilient Cropping Systems** – Offers models for increasing farm productivity while reducing environmental impacts.
- **Enhancing Water Efficiency in Agriculture** – Supports improved irrigation and soil moisture management techniques.
- **Reducing Agricultural GHG Emissions** – Identifies best practices for emissions reduction across multiple cropping and livestock systems.
- **Improving Carbon Balance in Farming** – Provides new data for refining New Zealand's sustainable farming policies.
- **Strengthening Science-Policy Interface** – Helps bridge the gap between research findings and policy decisions in sustainable agriculture.

Expected beneficiaries: The project aims to directly benefit around 2,000 small and medium producers in the CADC and other regions in Latin America (Colombia, Peru). Indirect beneficiaries include inhabitants of the CADC, whose economies depend on agricultural income. Producers will adopt drought-tolerant sorghum to diversify subsistence farming systems, improving resilience. Knowledge will be transferred through technical stations, field demonstrations, advisors, and online channels.

80%
Regionally consumed staple foods produced by local farmers

58%
Total area of the Corridor classified as a high/severe drought risk zone

2500
Small and medium scale farmers directly benefited

200
Trained students, technicians, and professionals

6
Learning plots for field experiments

20%
Expected increase in grain production

1
Online platform with cultivar selection recommendation

2
Workshops with producers, students, technicians and professionals

Source: Project images of the field experiments.

Closing remarks

Over the past 15 years, the collaboration between **FONTAGRO, the Ministry for Primary Industries of New Zealand (MPI), and the Global Research Alliance on Agricultural Greenhouse Gases (GRA)** has been instrumental in advancing **climate-smart agriculture and sustainable innovation** across Latin America and the Caribbean. Through **strategic partnerships, cutting-edge research, and shared technical expertise**, we have collectively tackled some of the most pressing challenges in agriculture-**reducing greenhouse gas emissions, improving productivity, enhancing resilience to climate change, and supporting rural communities**.

This collaboration has not only benefited farmers and researchers in the Latin American region but has also **provided valuable insights for New Zealand's agricultural sector**, strengthening its position as a global leader **in sustainable farming, emissions reduction, and agri-tech innovation**. By fostering **knowledge exchange, scientific cooperation, and policy alignment**, this alliance has demonstrated that **international partnerships are essential for driving agricultural transformation**.

As we look to the future, the urgency of climate change and food security challenges demands **continued commitment and collaboration**. We call upon governments, research institutions, international organizations, and the private sector to **build upon this momentum** and further **scale up climate-smart solutions, accelerate innovation, and enhance farmer-led adaptation strategies**.

We must continue strengthening this **remarkable partnership with FONTAGRO**, a key driver of innovation and collaboration in the region. By working hand in hand, we can **amplify our collective impact, expand research-driven solutions, and unlock new opportunities for sustainable agricultural development**. The time to act is now—**together, we can shape a future where agriculture is more productive, resilient, and environmentally sustainable for generations to come**.

Portfolio

No	Year	Status	ID	Title	FONTAGRO	MPI/GRA	Counterpart	Total	Executing Agency	Co executing agencies and Associated organizations
20	2024	Active	**RG-T4649**	Reducing greenhouse gas emissions in potato-pasture systems in Ecuador and Peru		**300,000**	**600,000**	**900,000**	INIAP Ecuador	UNALM (Peru)
19	2024	Active	**RG-T4648**	Scaling innovation in pastoral systems		**300,000**	**602,790**	**902,790**	INIA Uruguay	INTA Argentina, INTA Costa Rica, GENTOS Uruguay, IDIAP Panama
18	2024	Active	**RG-T4647**	Sustainable intensification of production in Central America		**200,000**	**573,500**	**773,500**	INTA Costa Rica	DICTA Honduras, IDIAP Panama, INIA Peru, INTA Argentina, AGROSAVIA Colombia, IDIAF Dominican Republic, University of Florida, Corteva Agriscience (USA), "Feed the Future" Innovation Lab (Cornell University), INTA Nicaragua
17	2024	Active	**RG-T4646**	Building resilient agricultural systems to mitigate climate change		**300,000**	**808,764**	**1,108,764**	INTA Argentina	INIA Chile, INIA Uruguay, EMBRAPA Brasil, IDIAF Dominican Republic, Scotland´s Rural College, CENUR Noreste (UDELAR), Cornell University, North Carolina State University
16	2023	Active	**ATN/RF-20639-RG/ ATN/RF-20640-RG**	Climate-smart research and indigenous communities	**150,000**	**150,000**	**643,570**	**943,570**	INTA Argentina	INIA Chile, CONICET (Argentina), Mapuche indigenous communities from Argentina: Huayquillan, Nehuen Co, Wefu Huechu and Calfucurá. Mapuche indigenous communities from Chile: Cheuquen Nguilliu
15	2023	Active	**ATN/RF-20642-RG**	Optimizing nitrogen use for sustainable farming	**200,000**	**200,000**	**637,451**	**1,037,451**	INIA Chile	INTA Argentina, UNALM (Peru), IDIAF Dominican Republic, IDIAP Panama, UBA Argentina, INIA Perú, GRA (New Zealand), AgResearch (New Zealand), CAAS (China), FEDELECHE (Chile), Chancay- Hural (Peru), AAPRESID (Argentina), Arroyo Grande Milk Producers Association, Dominican Rep., FUNDICCEP Panama, Panama and the Tierras Altas Producer Community Association
14	2022	Active	**ATN/RF-20627-RG**	Sustainable livestock farming in the Amazon of Peru and Ecuador		**200,000**	**400,000**	**600,000**	IICA/UNALM	INIAP Ecuador, AgResearch (New Zealand)
13	2022	Active	**ATN/RF-20638-RG**	Leveraging biological products to build climate resilience		**200,000**	**468,500**	**668,500**	AGROSAVIA Colombia	INBIOTEC (Argentina), UNQUI (Argentina), FENALCE (Colombia), IPADS Balcarce INTA-CONICET, AgResearch (New Zealand)
12	2022	Active	**ATN/RF-20643-RG**	Expanding the use of biologicals in Latin American agriculture		**200,000**	**520,483**	**720,483**	CEAZA (Chile)	IIBCE (Uruguay), INIA Uruguay, AGROSAVIA Colombia, INIAB-UNRC (Argentina), FAgro-Udelar (Uruguay), AgResearch (New Zealand), Lincoln University (New Zealand), ALAR, IPAVE INTA Argentina, Red Chilena de Bioinsumos, Ministry of Agriculture (Chile), SAN (Chile), DNSA-MGAP (Uruguay), FAICE (Uruguay), Ceres Demeter (Argentina)
11	2022	Active	**ATN/RF-20637-RG**	Innovations for reducing methane emissions in ruminants		**200,000**	**433,609**	**633,609**	AGROSAVIA Colombia	INTA Argentina, UNIANDES (Colombia), UNC (Argentina), GRA (New Zealand)
10	2021	Active	**ATN/RF-19787-RG / ATN/RF-19788-RG**	Satellite monitoring of quantity and quality of available biomass in pastoral livestock systems	**200,000**	**199,479**	**947,547**	**1,347,026**	ARGENINTA	INTA Argentina, FAUBA, INIA Uruguay, AGROSAVIA Colombia, INTA Costa Rica, Fittacori Foundation (Costa Rica), MAGyP (Argentina), MGAP (Uruguay), AACREA (Argentina), GRSB, Proleche (Costa Rica)

No	Year	Status	ID	Title	FONTAGRO	MPI/GRA	Counterpart	Total	Executing Agency	Co executing agencies and Associated organizations
9	2020	Active	**ATN/RF-18769-RG/ ATN/RF-18770-RG**	Soil-based carbon sequestration opportunities in Latin America and the Caribbean	**200,000**	**280,889**	**980,240**	**1,461,129**	INIA Uruguay	AGROSAVIA Colombia, INIA (Chile), INTA (Argentina), INTA (Costa Rica), Fittacori Foundation (Costa Rica), MAGyP (Argentina), MGAP (Uruguay), Bioversity-CIAT Alliance
8	2019	Audit	**ATN/RF-18079-RG**	Boosting cattle productivity in the South American Chaco		**200,000**	**457,285**	**657,285**	ARGENINTA	INTA (Argentina), IPTA (Paraguay), INIAF (Bolivia), FEGASACRUZ (Bolivia)
7	2019	Audit	**ATN/RF-18078-RG**	AgTech for climate-smart dairy farming		**180,000**	**360,900**	**540,900**	ARGENINTA	INTA Argentina, FCA-UNC (Argentina), IDIAF Dominican Republic, INIA Uruguay, CAHLE (Honduras), INTA Costa Rica, Fittacori Foundation (Costa Rica), DNL (Argentina), MAyG (Argentina),Cluster Lechero Regional, SGLyRN, Tambotech SAS, Milk Producers Association Dominican Republic, Cámara de Ganaderos (Costa Rica), Milk Producers Organisation (Uruguay)
6	2019	Audit	**ATN/RF-18077-RG**	Digital innovations for smarter pasture management		**200,000**	**312,940**	**512,940**	INIA Uruguay	INTA Argentina, ArgenINTA, INTA Costa Rica, Fittacori Foundation (Costa Rica), AACREA (Argentina), FUCREA (Uruguay), Gentos S.A., Proleche (Costa Rica), Michigan State University
5	2018	Audit	**ATN/RF-16926-RG / ATN/RF-16927-RG**	Sustainable intensification of legume-based livestock farming	**305,000**	**68,025**	**1,421,499**	**1,794,524**	ArgenINTA	INTA Argentina, INIA Chile, IPTA Paraguay, INIA Uruguay, INIAP Ecuador, INTA Nicaragua, IDIAF Dominican Republic, EMBRAPA Brasil, PROCISUR/ IICA
4	2014	Closed	**FTG/RF-14652-RG**	Developing competitive livestock production systems with low greenhouse gas emissions in Central America	**114,000**	**186,000**	**557,500**	**857,500**	CATIE Costa Rica	IDIAP Panama, INTA Costa Rica, INTA Nicaragua, DICTA Honduras
3	2014	Closed	**FTG/RF-14653-RG**	Improving dairy production systems with less emissions in the Andean Region	**139,840**	**228,160**	**500,000**	**868,000**	IICA/UNALM	INIAP Ecuador, AGROSAVIA Colombia, INIAF Bolivia
2	2014	Closed	**FTG/RF-14654-RG**	Collaborative research networks on resilient livestock production systems	**86,242**	**53,076**		**139,318**	FTG	Regional
1	2010	Closed	**FTG/RF-1028-RG**	Methane and nitrous oxide emission quantification in grazing cattle	**67,750**	**432,250**	**500,000**	**1,000,000**	INIA Uruguay	IDIAF Dominican Republic, INIA Chile, INTA Argentina, PROCISUR, UNAL Colombia, MPI (New Zealand)
			FONTAGRO Extra Contribution	Other FONTAGRO's initiatives Call 2022	**800,000**			**800,000**		FONTAGRO Contribution
			FONTAGRO Extra Contribution	Other FONTAGRO's initiatives Call 2024	**1,400,000**			**1,400,000**		FONTAGRO Contribution
				Total	**3,662,832**	**4,277,879**	**11,726,578**	**19,667,289**		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