CLIFF – GRADS

Climate, Food and Farming Network

GRA Development Scholarships

Call for proposals

The CLIFF-GRADS program invites applications from students from developing countries[1] currently enrolled in PhD programs for short-term scientific training and research stays on topics related to measurement and management of greenhouse gas emissions and carbon storage in agricultural systems.

Applicants should have a background in agriculture and climate change research and be pursuing graduate research related to agricultural greenhouse gas quantification.

Selected students will be sponsored in the amount of **10,000-12,000 USD** for short-term (4-6 month) scientific training and research stays to collaborate with projects associated with CCAFS and GRA. Specific topics will depend on the student's and host institution scientists' interests. A list of projects seeking to host students is included below under "List of research opportunities."

The grants will be used to support living and research costs at the host institution. Grants may not be used for tuition or unrelated personal expenses.

Background

CLIFF-GRADS is a joint initiative of the CGIAR Research Program on Climate Change (CCAFS) low emissions agriculture flagship and the Global Research Alliance on Agricultural Greenhouse Gases (GRA). CLIFF-GRADS aims to build the capability of early career agricultural students in developing countries to conduct applied research on climate change mitigation in agriculture. CLIFF-GRADS integrates the GRA's new Development Scholarship and the Climate Food and Farming (CLIFF) Research Network with the common goal of providing grants to graduate students to expand their knowledge and experience in quantification of agricultural greenhouse gases. Funding for CLIFF-GRADS is provided by the Government of New Zealand and the CGIAR Research Program on Climate Change, Agriculture and Food Security.

Application requirements

The application must include the following documents merged into one pdf file:

- 1-2 page motivation letter (described below)
- 1-page curriculum vitae that includes your contact details
- Letter of support from your university supervisor
- All applications must be in English

The motivation letter, which must be no more than two A4 pages**,** must include the following:

1. Your name, citizenship and the country where you are conducting your graduate study
2. The objectives of your graduate research
3. The specific research opportunity to which you are applying (see list below)

[1] Includes all countries NOT listed as "high income economies" by the World Bank http://data.worldbank.org/about/country-and-lending-groups

4. Research experience with greenhouse gas emissions from agriculture or soil carbon storage in agricultural systems (especially if you are applying to work with a project with '"preferred skills or experience")
5. A description of how scientific training with CCAFS/GRA scientists will improve your graduate research

Submission and process for selection

- Deadline for applications: **31th of December 2017**.
- Please submit your application by email to Meryl Richards, Science Officer for CCAFS Low Emissions Agriculture (meryl.richards@uvm.edu)
- Please also contact Meryl with questions.
- Successful applicants will be matched with a project and notified by email in late January of 2018.

Eligibility

- Applicants must be currently enrolled PhD students in a field related to quantification of greenhouse gas emissions or carbon sequestration in agricultural systems.
- Applicants must be students from a developing country[1].

Requirements of grant recipients

- Grant money should be used to finance the short-term scientific visit, including living and research costs at the host institution and all costs associated with that research, including travel, housing, meals, and research materials and services. Funding is not to be used for tuition, fees, or unrelated personal costs.
- Scientific visits must take place during 2018.
- Each CLIFF-GRADS recipient will work directly with a research supervisor at the host institute. The activities to be conducted by the student and a budget for the scientific visit, will be agreed upon between the student and research supervisor in a Managed Contract.
- The research supervisors will assess the quality of the CLIFF-GRADS recipient's science performance and monitor the achievement of milestones and deliverables set out in the Managed Contract.
- At the end of the research stay, the CLIFF-GRADS student will submit a Final Report describing the activities undertaken. Final payment to the CLIFF-GRADS recipient is dependent on this Final Report being approved by CCAFS and GRA.

More information

GRA: https://globalresearchalliance.org/

CCAFS: https://ccafs.cgiar.org/themes/low-emissions-agriculture

CLIFF Network: http://ccafs.cgiar.org/climate-food-and-farming-network

Please visit these websites before preparing your application.

LIST OF RESEARCH OPPORTUNITIES

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1. **Project title:** More Rice with Lower Emissions and Lower Water Consumption

Description of project
The project focuses on the quantification of GHG emissions on family farms. Specifically, alternate wetting and drying (AWD) which represents an innovative water management approach that can contribute to both climate change adaptation and mitigation will be evaluated under Latin American conditions. AWD is expected to result in a reduction in production costs and savings in water consumption and, consequently, increase the competitiveness of rice production systems. The ability to produce rice with less water increases the resilience of rice production under drier and/or more variable climatic conditions, thus increasing the sustainability of rice production in Latin America. The project covers topics such as adaptation and mitigation, socio-economic impact, productive impact, water and soil management and is linked to the GRA Rice flagship on reducing greenhouse gas intensity of rice systems. Specifically, this work of the flagship project entitled: On farm assessment of multi-beneficial improved water management techniques, reducing costs, water use and gas emissions in America´s rice systems.

Outcomes sought from the project
Generated data will contribute towards increased awareness on sustainable rice production systems and in three Latin America countries (Chile, Peru and Colombia.

Host institute
International Center for Tropical Agriculture, Cali, Colombia

Preferred duration of research visit
4-6 months

Completion date
End of 2018

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2. **Project title:** Structures and data requirements to develop a higher Tier agricultural GHG inventory

Description of project
This project would use the UK experience in developing a higher tier agriculture GHG inventory (under the Defra GHG Platform improvement programme) in training a PhD student to develop understanding in the requirements for inventory structures and data sources across the different agricultural sectors and emission sources, and to produce recommendations for inventory development for other countries. This fits very much with the GRA Flagship on Agricultural GHG Inventories, particularly in sharing experience and knowledge, enhancing capability and capacity and in understanding the barriers to adoption. Key aspects will be identification of key category emission sources, knowledge gap analysis, scenario analyses and scoping of requirements to develop sectoral structures and country-specific emission factors and other relevant parameters.
A particular focus for the project would be development of further guidance regarding nitrous oxide emission measurements following nitrogen amendments to soils. Current IPCC recommendations are that emission measurements should cover a full 12-month period for the estimation of emission factors. The large body of UK experimental results would suggest that in many cases the majority of emissions occur over a much shorter duration (e.g. 3 months) and that resources might be better deployed to making more intense measurements over this period. A full analysis of available data (through the data archive created as part of Defra AC0116 project) would be beneficial in further developing the GRA Guidelines on nitrous oxide emission measurement methodology.

Host institute
Rothamsted Research and Bangor University

Preferred duration of research visit
6 months

Completion date
End of 2018

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3. **Project title:** Identifying hotspots of GHG emissions in dairy systems and associated efficiency gains

Description of project
The project will use the Bangor experience in consequential-LCA of dairy systems in training a PhD student to develop understanding in the requirements for data sources across the dairy industry and the application of LCA to identify current hotspots of GHG emissions and likely hotspots under intensification pathways. The project will produce recommendations for inventory development for other countries. This aligns with the GRA Flagship on Agricultural GHG Inventories and also with the goals of the GRA Integrative Research Group, which are to develop the knowledge and capabilities for estimation, monitoring, and projection of GHG emissions and soil carbon within and across agricultural systems. The project will result in the sharing of experience and knowledge, and enhance capability and capacity in understanding of the impacts of intensification pathways in the dairy sector.

An important aspect of the project and the tools for which training is offered is the inclusion of a wide system boundary and the capturing of the consequential effects on emissions from beef production systems and animal-feed-crop production systems, including the potential displacement of emissions to other sectors and countries. Through the Sêr Cymru National Research Network project, CLEANER COWS (http://www.nrn-lcee.ac.uk/cleaner-cows/), we have recently demonstrated in UK dairy systems that different intensification pathways can lead to emission hotspots in different parts of the beef and dairy production system, both in the UK and globally, via trade in animal feed and beef commodities (Styles et al., 2017). This work highlighted the limitations of static "carbon footprint" accounting and inventory reporting when evaluating the sustainability of intensification *transitions*. This methodology is now being explored for the Costa Rican dairy sector, via collaboration with CATIE in a GCRF project, *Sustainable futures for the Costa Rica dairy sector: optimising environmental and economic outcomes (SusCoRiDa),* led by Bangor University. The CLIFF-GRADS PhD student would receive training in the novel consequential LCA methods being developed within the CLEANER COWS research cluster, and generate new data through the application of these methods to developing country dairy industries. Such data are critical to better understanding of sustainable intensification pathways for dairy production globally, and especially in developing countries, closely aligning with GRA objectives.

More information: Styles D, Gonzalez-Mejia A, Moorby J, Foskolos A, Gibbons J. 2017. Climate mitigation by dairy intensification depends on intensive use of spared grassland. Global Change Biology; 00:1–13. https://doi.org/10.1111/gcb.13868

Host institute
Bangor University, UK

Preferred duration of research visit
6 months

Completion date
End of 2018

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4. **Project title:** Developing an international knowledge information system for the CIRCASA project

Description of project
The CIRCASA knowledge information system will include geo-referenced meta-data and data from experiments, observations and surveys as well as from models and knowledge synthesis. It will include maps showing the technical potential of SOC sequestration of an extended range of agricultural practices in contrasted soil and climate conditions.

The knowledge information system will be built with open sources and technologies. The platform will also provide spatial and temporal patterns of SOC, building on existing information products e.g. ISRIC's SoilGrids www.soilgrids.org. It will include methodological guidelines (on monitoring, reporting and verification of SOC stock changes).

Host institute
ISRIC - World Soil Information is CIRCASA Task leader for the knowledge information system

Preferred duration of research visit
6 months

Completion date
The report on the main features of the knowledge information system needs to delivered end of March 2018

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5. **Project title:** Bringing Climate Smart practices to scale: assessing their contributions to narrow nutrient and yield gaps

Description of project
Within the international research project "*Bringing Climate Smart practices to scale: assessing their contributions to narrow nutrient and yield gaps*", a trade-off analysis will be done on maize production in East Africa. Effects of a number of nutrient management practices on crop yields, greenhouse gas emissions, soil carbon and profitability will be assessed. Depending on the skills and background of the PhD candidate, he or she can participate in reviewing literature, data analysis, modelling of trade-offs or performing a sensitivity analysis. More information: http://www.cropnutrientgap.org/

Preferred student skills or experience
- Preference for a PhD candidate from Ethiopia, Tanzania or Kenya
- Statistical skills
- Background in agronomy
- Pro-active attitude
- Modelling experience would be welcome

Host institute
Wageningen University & Research, Wageningen, Netherlands

Preferred duration of research visit
4-6 months

Completion date
End of 2018

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6. **Project title:** Productivity, reduced methane emissions and reduced dependency on external inputs on tropical livestock farms

Description of project
The research will include laboratory and field activities testing a diverse range of tropical forages alone and in mixtures to test their bromatological characteristics and also test their potential to reduce enteric methane production as a result on the rumen microbiota. More information: https://ccafs.cgiar.org/supporting-low-emissions-development-latin-american-cattle-sector-livestockplus

Preferred student skills or experience
- Strong background on tropical livestock systems
- Proven proficiency on measuring enteric methane emissions at field and laboratory level
- Laboratory skills for chemical characterization of forages and molecular biology
- Interest to track changes in rumen microbiota as responds to dietary changes and its association with methane emissions.

Host institute
International Center for Tropical Agriculture, Cali, Colombia

Preferred duration of research visit
4-6 months

Completion date
End of 2018

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7. **Project title:** Pasture type influence on soil N_2O emission from cattle excreta

Description of project
Plant identity has a marked influence on N_2O emissions. An understanding of this influence will substantially improve our understanding of the factors driving variability in N_2O emissions. The student will conduct on-farm measurements of GHG emissions from cattle excreta (urine and dung) deposited on four pasture types in the department of Meta in Colombia. Specifically, GHG emission measurements will be conducted on one soil type under four pasture types namely, *Brachiaria humidicola*, *Brachiaria decumbens*, *Pasto llanero* and Native savanna. The student's work, which will be an expansion of soil carbon and *in vitro* methane production work conducted on the selected farm, will be linked to CCAFS' LivestockPlus project and the Standing Panel of Impact Assessments and Gates Foundation funded project on the adoption and impacts of *Brachiaria* grasses in Colombia. More information:
- https://ccafs.cgiar.org/supporting-low-emissions-development-latin-american-cattle-sector-livestockplus
- https://doi.org/10.1016/j.soilbio.2016.12.029

Preferred student skills or experience
- Basic understanding of methodologies for quantifying greenhouse gas emissions from pasture soils
- Self-motivated and enthusiastic to learn.

Host institute
International Center for Tropical Agriculture, Cali, Colombia

Preferred duration of research visit
5 months

Completion date
End of 2018

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8. **Project title:** Just how smart are the climate smart options promoted in the Climate Smart Villages of Nicaragua?

Description of project
The project focuses on quantifying greenhouse gas emissions from management and technological options promoted in the Climate Smart Villages of Nicaragua (Tuma La Dalia or Wasaka Abajo). Specifically, the GHG mitigation potential of options promoted and adopted in the CSV will be evaluated. The student will be responsible for identifying promising options and evaluating on-farm greenhouse gas emissions from traditional and improved crop production systems. For example, the student may consider evaluating the fertilizer-based GHG emissions from traditional coffee production systems and those in which cacao trees are included.

This project is linked to the Latin America CCAFS' regional offices' climate change mitigation strategy and the Latin American Greenhouse Gas Mitigation Network (LAMNET). This work is part of a larger programme, which includes a wide range of partners that contribute towards evaluating several climate smart options which are relevant to specific Climate-Smart Villages.

Preferred student skills or experience
- Basic understanding of methodologies for quantifying greenhouse gas emissions from pasture soils
- Self-motivated and enthusiastic to learn
- Proficient in Spanish and English

Host Institute
International Center for Tropical Agriculture, Cali, Colombia (with time spent in Nicaragua)

Preferred duration of research visit
5 months

Completion date
End of 2018

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9. **Project title:** Using greenhouse gas calculation tools for rice in combination with existing GIS data

Description of project
Over recent years, several spreadsheet models have been developed for greenhouse gas calculation based on the IPCC methodology. However, each of these tools was developed for different purposes (see review in Colomb et al. 2013 https://doi.org/10.1088/1748-9326/8/1/015029) and all have pros and cons. At the International Rice Research Institute (IRRI), we have tested some of these tools for their use in mitigation projects and realized that none of them was really suitable for this purpose. One of the key pitfalls is that most of the tools work on point scale without any aggregation capability. In turn, data on area and crop management have to be entered manually for each field/ farm – and results are also compiled in individual formats for each unit. In the case of mitigation projects, however, the scale of one individual field or farm becomes rather meaningless, because CO2eq will be only minimal. Likewise, mitigation projects can hardly target entire countries given limited resources and logistic constraints.

To address these limitations, researchers at IRRI have now developed our own spreadsheet model capable of aggregation of individual entities. The available beta version is now tested in 3 mitigation projects that require aggregation of (i) farms to villages, (ii) districts to provinces and (iii) several provinces to sub-regions, respectively. The tool will now be further improved and soon be made available to the public. The SECTOR-Rice Tool drastically cuts down operation times by allowing direct entries (copy-pasting) of data from existing data bases. This feature opens up the possible linkage with existing GIS data bases on rice production. The IRRI GIS lab has developed comprehensive data bases on high-resolution area coverage ('rice masks') for different countries. These data encompass fairly detailed information on sowing and cropping times that have already been used in 2 published articles to map AWD suitability. In combination with a GHG calculator, these national data bases could be developed into a versatile tool allowing

- rapid assessments of GHG mitigation under different crop management scenarios and
- visualization of results in form of maps of different scales.

The CLIFF-GRADS scholar will be responsible for further development of the tool by linking it with GIS databases.

Preferred student skills or experience

- Solid know-how on major principles of GHG emissions from the agriculture sector
- Familiarity with IPCC approach
- Good ability to work with EXCEL
- Independent and reflective thinking
- Ideally: Coming from SE Asia with specific links to national institutes of home country

Host Institute
International Rice Research Institute, Los Baños, Philippines

Preferred duration of research visit
4-6 months

Completion date
End of 2018

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10. Project title: Determining Scaling Factors for management practices in rice: Expanding the list from the IPCC guidelines

Description of project
The IPCC guidelines are the standard procedure to estimate greenhouse gas (GHG) emissions from rice production and the basis of many GHG calculator tools. The current set of formulas includes scaling factors for seasonal emissions to reflect the effect of different management practices (e.g. water management and added organic amendments) on methane emissions.
While the formulas for rice cultivation are comparably well developed in detail, the current version is more than 10 years old and new management techniques are not considered due to limited or no data availability when the guidelines were established.

The task for the CLIFF-GRADS scholar in this project is to expand the IPCC list of scaling factors for rice production through white and grey literature research. Potential new scaling factors are to be determined for crop management practices such as laser land leveling, fertilizer deep placement and a detailed disaggregation of straw management practices.

Preferred student skills or experience

- Solid know-how on major principles of GHG emissions from the agriculture sector

- Familiarity with IPCC approach
- Good ability to work with EXCEL
- Independent and reflective thinking
- Ideally: Coming from SE Asia with specific links to national institutes of home country

Host institute
International Rice Research Institute, Los Baños, Philippines

Preferred duration of research visit
4-6 months

Completion date
End of 2018

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11. **Project title:** Quantification of environmental foot prints of various climate smart practices under contrasting rotations, management, soil type and agroecologies of South Asia

Description of project
This work would build on data from Climate Smart Villages as well as that of long term research trials at CIMMYT.

Host Institute
International Maize and Wheat Improvement Center, New Delhi, India

Preferred duration of research visit
4-6 months

Completion date
End of 2018

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12. **Project title:** Identifying greenhouse gas emissions hotspots and mitigation options for the agricultural sector in Bangladesh

Description of project
This study proposes to take a bottom-up, stakeholder-informed approach to the analysis of greenhouse gas mitigation options in Bangladesh's agriculture sector to address the questions:

- What are the major sources of GHG emissions in agriculture?
- Which are the most promising mitigation options in relation to factors such as: ease of uptake, technical feasibility, mitigation potential, cost-effectiveness?

This study will involve data collection, modelling and stakeholder engagement.

Host institute
International Maize and Wheat Improvement Center, Dhaka, Bangladesh

Preferred duration of research visit
4-6 months

Completion date
End of 2018

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13. **Project title:** Quantifying the mitigation potential of currently promoted crop and livestock management strategies in Vietnam

Description of project
We are starting a project aiming at quantifying the mitigation potential of currently promoted crop and livestock management strategies in Vietnam, and identifying high-production, low-emissions development trajectories in the agricultural sector. The project will be implemented in collaboration with the National Institute of Animal Sciences (NIAS) and in consultation with the Climate change and REDD+ Research Group of the Institute of Policy and Strategy for Agriculture & Rural Development (IPSARD) in Vietnam. The tasks of the student could include the measurement of CH4 and N_2O fluxes in contrasting systems using the Gasmet X4040 portable device, the evaluation of GHG balances and mitigation options following for example the SAMPLES set of methods, and/or making the linkage with carbon cycle and carbon sequestration in contrasting crop-livestock systems.

Preferred student skills or experience
MSc in animal sciences, environmental sciences or related topic

- Good understanding of integrated systems and environmental impacts of livestock production
- Experience with field data measurement (greenhouse gas measurement and/or carbon accounting)

Host Institute
International Center for Tropical Agriculture, Hanoi, Vietnam

Preferred duration of research visit
4-6 months

Completion date
End of 2018

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14. Project title: CH_4 emissions from bovines under different feeding regimes using SF_6 methodology

Description of project
Several feeding strategies are currently being tested as options to mitigate enteric fermentation in dairy grazing systems of southern Chile. These have included the inclusion of different levels of concentrate and proportions of fat within the diet. Additionally, pasture quality has also been tested. In this project, and depending of funding available at the time, a conventional feeding strategy will be compared with an improve management, such as the inclusion of legumes within the pasture, or the use of see weeds as feeding supplements. This project would link to the enteric fermentation flagship project (Livestock Research Group).

Host institute
Instituto de Investigaciones Agropecuarias (INIA) Remehue, Osorno, Chile

Preferred duration of research visit
4-6 months, preferred in the first semester of 2018

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15. Project title: Nitrous oxide emissions from pastures using novel fertilizer formulations

Description of project
Nitrogen losses in volcanic soils with high OM content and no animal effects are low. This could be explained by N sorption phenomena occurring in the soil profile, which would prevail on top of other pathways and lead to a competition from plants to capture available N forms from soil solution. Preliminary findings indicate that foliar N application based on urea increases nutrient use efficiency significantly but this could be associated to an increase in total N uptake with a greater proportion of

non-protein N rather than protein formation in the plant. This has negative implications for animal consumption and could also increase N losses to the environment due to volatilization. The use of nanoparticles for the generation of slow-release fertilizers has previously been described for agricultural use and has allowed us to synthesize a urea-based enriched molecule (14% N) that could be used for application as a liquid suspension, increasing NUE, favouring protein formation, and reducing N losses to the environment.

Both laboratory and field experiments will be used to i) optimize the nano-molecule synthesis, and ii) carry out concurrent measurements to estimate N fate in grassland soils after N application using the conventional and novel N sources, including effects on yield and N portioning in plants. This project would link to the GRA N_2O flagship project and to activities related to animal nutrition (protein/energy balance).

Preferred student skills or experience
[to come]

Host institute
Instituto de Investigaciones Agropecuarias (INIA) Remehue, Osorno, Chile

Preferred duration of research visit
4-6 months

Completion date
Second semester 2018

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16. Project title: Effects of inhibiting rumen methanogenesis on microbial biomass production and composition

Description of project
Inhibiting methane production in the rumen results in a strong decrease in the recovery of metabolic hydrogen in fermentation products. We speculate that the unaccounted electrons can be partly explained by incorporation of reducing equivalents into anabolic pathways. We hypothesize that: i) Greater flow of reducing equivalents will stimulate incorporation of ammonia into carbon chains and inhibit deamination, resulting in an increase in microbial protein production in the rumen; ii) Greater flow of reducing equivalents will stimulate fatty acids synthesis and biohydrogenation. Eight ruminally-cannulated Holstein cows in early to mid lactation will be blocked by days in milk and milk production and randomly allocated to 16% or 20% CP mixed diets, the difference in total N due to urea supplementation. The experiment will comprise two 3-weeks periods (2 weeks for adaptation and 1 week for measurements). Animals will be their own controls and the first period will be the baseline with which to compare the second period in which methane production will be inhibited using 9, 10-anthraquinone. We will record performance variables, methane and dihydrogen production, rumen fermentation variables, nitrogen balance, and in situ measurements of microbial biomass production and composition, as well as the microbial community composition. This experiment will illustrate the effects of inhibiting methanogenesis on nitrogen and fatty acids metabolism in the rumen and its consequences to digestion, metabolism and performance of lactating dairy cows.

Host institute
Instituto de Investigaciones Agropecuarias (INIA) Remehue, Osorno, Chile

Preferred duration of research visit
4-6 months

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17. **Project title:** Sustainable futures for the Costa Rica dairy sector: optimizing environmental and economic outcomes (SusCoRiDa)

Description of project
The PhD student will contribute to the SusCoRiDa project, which will categorize the Costa Rican Dairy sector, estimate its GHG emissions, calculate carbon and nitrogen cycling and perform an attributional and consequential LCA to provide evidence on sustainable intensification pathways for tropical dairy farms. A discreet cost-benefit assessments of specific mitigation options (e.g. biogas, abated urea fertilizers, etc.) at a farm and sector level will estimate consequences of possible structural changes in the future (e.g. towards fewer and larger farms, or towards agroforestry farms producing multiple products). The project will also generate data on ammonia emission and contamination of soils and water from the Tropical Agricultural Research and Higher Education Center (CATIE) and commercial Costa Rican dairy farms to evaluate the tradeoffs of GHG mitigation actions. Key stakeholders in Costa Rica will be involved throughout the project to develop and recommend actions to encourage the sustainable development of the Costa Rican dairy sector.

Host institute
CATIE (Centro Agronómico Tropical de Investigación y Enseñanza), Turrialba, Costa Rica

Preferred student skills or experience
- Experience in dairy production systems
- Background in economics
- Experience in effects and costs of introducing potential mitigation strategies
- Experience in applying the IPCC inventory methodology, determining nutrient flows and losses at the farm scale would also be advantageous

Preferred duration of research visit
3-5 months

Completion date
October 2019