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 the 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 student and host institution scientist 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 development 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 Research Network with the common goal of providing grants to graduate students to expand their knowledge and experience in quantification of agricultural greenhouse gases. Research projects are hosted by CCAFS and GRA members and partners. Funding for CLIFF-GRADS is provided by the Government of New Zealand and by CGIAR Fund Donors and bilateral agreements support of CCAFS.

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

[1] Includes all countries listed as "low-income economies'', "lower-middle-income economies", "upper-middle-income economies" and "Latin America and the Caribbean" by the World Bank http://data.worldbank.org/about/country-and-lending-groups

3. The specific research opportunity (number and title) to which you are applying (see list below). If you are interested in more than one research opportunity, please list your preferred research opportunities (up to 3) in order of preference.
4. Your research experience with greenhouse gas emissions from agriculture or soil carbon storage in agricultural systems, as relevant to the research opportunity for which you are applying
5. A description of how scientific training with CCAFS/GRA scientists will improve your graduate research

Submission and process for selection

- Deadline for applications: **September 30, 2018.**
- Please submit your application by email to Julianna White, Program Manager for CCAFS Low Emissions Development at julianna.m.white@uvm.edu
- Please also contact Julianna with questions
- Applicants will be selected based on three criteria: (1) overall level of research experience, (2) relevance of thesis topic or other research experience to the research opportunity to which the student is applying, and (3) clear description of how the CLIFF-GRADS experience will improve the student's scientific training.
- Successful applicants will be matched with a project and notified by email by November 30, 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 2019.
- 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-GRADS: https://ccafs.cgiar.org/CLIFF-GRADS

Please visit these websites before preparing your application.

LIST OF RESEARCH OPPORTUNITIES

Project 1 – LIVESTOCK

Project title: Quantifying Hydrogen fluxes and their impact on methane production equations

Brief project outline:
Most methane emissions are quantified by various methane-emission measurement methods used in vivo at the animal level. However, methane production in the rumen is characterised by microbial interspecies electron transfer. The dominant process among members of the rumen microbiota involves the electron shuttles dihydrogen and formate produced by bacteria and protozoa. Hence, we would like to model and quantify the hydrogen fluxes in the rumen and emissions by the ruminants under normal conditions or different dietary treatments (lipid supplementation, different forage to concentrate ratio, and different forage type (grass vs red clover)). These hydrogen fluxes and emissions will be used to assess their impact on in-vivo methane emissions and to improve the accuracy of methane predictions (models). The main data will be provided by 2 main partners, in France (INRA) and in Finland (Luke), but can be extended to others who have similar data (including GRA partners of ERAGAS project "CEDERS" or "Rumen Predict") or literature data. Models derived from LUKE data can be tested against in vivo and in vitro models (Munoz et al. 2017; Guyader et al. 2015). The student will work on methane predictive models integrating mitigating strategies that favor or not Hydrogen fluxes. These models that are being developed in the Ceders and Rumen Predict projects, which are part of the Enteric Fermentation flagship, will also be used/tested in inventory tools. During the stay, the student will have the opportunity to work with INRA's post-doc student recruited in CEDERS and/or Finland's visiting PhD student (6 months), and be introduced to various methane-emission measurement methods used in vivo.

Host institute and location:
INRA - French National Institute for Agricultural Research
ARA Centre – Theix
St. Genès Champanelle, France

Project leader / research supervisor:
Maguy EUGENE

Preferred duration of research visit: 4-6 months

Preferred grant amount for visiting student: 6400-9600 USD plus insurance

Preferred dates for research visit: First semester of 2019 (neg)

Project 2 – LIVESTOCK

Project title: Directed evolution of rumen microbial cultures towards the identification and stimulation of electron sinks alternative to methanogenesis

Brief project outline:
There is a growing interest in the inhibition of methane production in the rumen because of its role as a greenhouse gas and the energy inefficiency it represents. However, despite the theoretical energy retention advantage expected, decreasing methane production in vivo with specific chemical inhibitors has not translated into consistent gains in productivity. It is important to understand why, for productivity gains could stimulate the adoption of strategies to manipulate rumen microbial activity to inhibit methanogenesis. It has been shown that inhibiting methanogenesis in rumen in vitro cultures results in a decrease in the recovery of metabolic hydrogen, which seems to be in part redirected towards unaccounted sinks. The objective of this project is to identify and stimulate electron sinks alternative to methanogenesis in rumen fermentation through microbial manipulation. We propose directing the evolution of rumen microbial communities in vitro by conducting sequential transfers of batch cultures, both in the presence and absence of inhibitors of methanogenesis. In each series of transfers, we will select cultures based on their fermentation products. In this way we will learn: 1) Which electron disposal pathways alternative to methanogenesis that have end products nutritionally useful to ruminants have greater potential to be stimulated; 2) Which are the thermodynamic limits of those pathways. We will evaluate and compare the efficiency of fermentation of different rumen microbial communities obtained through directed evolution in terms of fermentation products and microbial growth. The knowledge generated in this proof of concept experiment will be useful to design strategies to stimulate electron sinks alternative to methanogenesis in rumen fermentation that can at the same time enhance ruminant productivity.

This proposal is linked to the Development of solutions – microbiome working area of the GRA Enteric Fermentation Flagship.

Host institute and location:
Instituto de Investigaciones Agropecuarias INIA Carillanca, Temuco, Chile

Project leader / research supervisor:
Emilio M. Ungerfeld

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 10,000

Preferred dates for research visit: Second half of 2019

Project 3 – LIVESTOCK

Project title: Effect of modulating interspecies electron transfer exchanges on methane production and rumen microbiota composition

Brief project outline:
Methane production in the rumen is characterised by microbial interspecies electron transfer. The dominant process among members of the rumen microbiota involves the electron shuttles dihydrogen and formate produced by bacteria and protozoa. These electron shuttles are then used by their syntrophic archaeal partners to produce methane. In the rumen, however, the extent and importance of shuttle-free electron transfers that were described in other methanogenic environments is not well known. The student will work on in vitro rumen fermentation models that favor or not syntrophic associations and transfer of electrons. The rumen microbiota will be characterised and the data obtained will be tested and feed the rumen interaction model that is being developed in the Rumen Predict project, which is part of the Enteric Fermentation flagship. During the stay, the student will have the opportunity to be acquainted to various methane-emission measurement methods used in vivo.

Host institute and location:
INRA - French National Institute for Agricultural Research
ARA Centre – Theix
St. Genès Champanelle, France

Project leader / research supervisor:
Diego Morgavi

Preferred duration of research visit: 4-6 months

Preferred grant amount for visiting student: USD 6400-9600 plus insurance

Preferred dates for research visit: First semester of 2019 (neg)

Project 4 – LIVESTOCK

Project title: RumenPredict: Predicting appropriate GHG mitigation strategies based on modelling variables that contribute to ruminant environmental impact

Brief project outline:
Ruminant production is responsible for ~9% of anthropogenic CO_2 emission and 37% of CH_4 emissions. Release of methane results in 6-12% less energy being available to the animal. Ruminants also contribute towards NO_2 within the environment, a persistent gas in the atmosphere which has 296 times more warming potential than CO_2. RumenPredict brings together members of the international Rumen Microbial Genomics network (led by IBERS, AU), a network which underpins GRA activities, of which the Hungate 1000 (focussed on sequencing 1000 rumen microbes) and the Rumen Census (focussed on evaluating effects of diet, host genetics and geographical location on the rumen microbiome) are projects within.

RumenPredict brings together key members of the RMG network to generate the necessary data to link rumen microbiome information to host genetics and phenotype and develop feed based mitigation strategies. This will enhance innovative capacity and allow integration of new knowledge with that previously generated to devise geographic and animal-specific solutions to reduce the environmental impact of livestock ruminants. The project members have access to recent data/tools resulting from an array of projects, and RumenPredict will build upon and enhance the integration of knowledge generated from these projects whilst providing innovation through further testing and validation of key hypotheses resulting from the previously obtained data. RumenPredict will provide a platform for predicting how host genetics, feed additives or microbiome may affect emission phenotypes and develop genetic/diet/prediction technologies further for implementation to improve nitrogen use efficiency whilst decreasing environmental impact of ruminants.

Host institute and location:
Queens University, Belfast, UK

Project leader / research supervisor:
Dr Sharon Huws

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: From January 2019

Project 5 – LIVESTOCK

Project title: Measuring ammonia emissions and collecting farm data from Costa Rican dairies

Brief Project Outline:
The PhD student would work with CATIE´s team of the SusCoRiDa project. The student would learn how to measure and interpret ammonia emissions from pastures and how to model carbon and nitrogen nutrient flows on dairy farms applying IPPC methodology. Furthermore, the student would support CATIE´s data collection efforts, such as farm surveys, to support the life cycle and economic analysis of dairy farms in Costa Rica conducted by Bangor University´s team. In additions, the student would be included in the interdisciplinary and interinstitutional efforts of the SusCoRiDa team to determine profitable mitigation strategies for dairy farmers.

Host institute:
CATIE (The Tropical Agricultural Research and Higher Education Center), Turrialba, Costa Rica

Project contact:
Dr Claudia Arndt

Preferred duration of research visit: 4-6 months

Preferred grant amount for visiting student: USD 10,000

Completion date: July 2019

Project 6 – LIVESTOCK

Project title: Sustainable Dairy Intensification in Central American and Caribbean region (FTG/RF-15940-RG)

Brief project outline:
The aim of the Sustainable Dairy Intensification in Latin America and the Caribbean project (LACTIS by its acronym) is to build a cooperation platform for the study of sustainable intensification in developing countries. The objective of the study is to set a baseline of typical production systems ("modal") in all participant countries with a common methodology that includes economic, social and environmental indicators for further modeling of strategies for future intensification. Greenhouse gas emissions (total and per kg of animal product) are one of the main environmental indicators to be evaluated. The project is comprised by a total of 13 research institutions from 11 different countries (Dominican Republic, Honduras, Nicaragua, Costa Rica, Panama, Venezuela, Ecuador, Paraguay, Chile, Argentina and Uruguay). It started in November 2017 and has a duration of 3 years.

The study to be conducted within the timeframe of this CLIFF-GRADS project will be the modelling of typical production systems ("modal") in countries belonging to the Central American and Caribbean region. It will include both the modeling the baseline and 3 or 4 strategies for future intensification. Original data will be provided by each country.

Host institute and location:
INIA Uruguay, Colonia, Uruguay

Project leader: Santiago Fariña
Research supervisors:
Cecilia Cajarville
Sofía Stirling
Santiago Fariña

Preferred duration of research visit: 6 months (with possible extension of 6 months being covered by the host institution)

Preferred grant amount for visiting student: USD 12,000
$US 4.000 accommodation, meals and insurance
$US 3.500 flights (to and from country of origin + project workshops) and local transport
$US 4.500 research costs (nutritive value analysis of feeds, software license and others)

Preferred dates for research visit: From January 2019

NOTE: preference will be given to candidates from Panamá, Costa Rica, Honduras, Nicaragua and Dominican Republic.

Project 7 – LIVESTOCK

Project title: Sustainable Dairy Intensification in the Andean region (FTG/RF-15940-RG)

Brief project outline:
The aim of the Sustainable Dairy Intensification in Latin America and the Caribbean project (LACTIS by its acronym) is to build a cooperation platform for the study of sustainable intensification in developing countries. The objective of the study is to set a baseline of typical production systems ("modal") in all participant countries with a common methodology that includes economic, social and environmental indicators for further modeling of strategies for future intensification. Greenhouse gas emissions (total and per kg of animal product) are one of the main environmental indicators to be evaluated. The project is comprised by a total of 13 research institutions from 11 different countries (Dominican Republic, Honduras, Nicaragua, Costa Rica, Panama, Venezuela, Ecuador, Paraguay, Chile, Argentina and Uruguay). It started in November 2017 and has a duration of 3 years.

The study to be conducted within the timeframe of this CLIFF-GRADS project will be the modelling of typical production systems ("modal") in countries belonging to the Andean region. It will include both modeling the baseline and 3 or 4 strategies for future intensification. Original data will be provided by each country.

Host institute and location:
INIA Uruguay, Colonia, Uruguay

Project leader: Santiago Fariña
Research supervisors:
Cecilia Cajarville
Sofía Stirling
Santiago Fariña

Preferred duration of research visit:
6 months (with possible extension of 6 months being covered by the host institution)

Preferred grant amount for visiting student: USD 12,000
$US 4.000 accommodation, meals and insurance
$US 3.500 flights (to and from country of origin + project workshops) and local transport
$US 4.500 research costs (nutritive value analysis of feeds, software license and others)

Preferred dates for research visit: From January 2019

NOTE: preference will be given to candidates from Venezuela and Ecuador

Project 8 – LIVESTOCK

Project title: Targeting N_2O emission hot-spots in intensive dairy pastures for mitigation action

Brief project outline:
Livestock add complexity to our understanding of the fate and management of farm nitrogen, especially due to their movement and excretal deposition within pastures. Areas of pasture which are often frequented by livestock such as shaded areas, laneways and gateways can become farm-scale nitrous oxide emission hot-spots. How effective nitrification inhibitors are in these circumstances of elevated nutrient loads, compaction and conditions favoring denitrification are uncertain. The student will work closely with a visiting Marie Sklodowska Curie Global Fellow from Bangor University on the *Target-N_2O* project, who will be combining molecular ecology, stable isotope methods and modelling to determine the agronomic and economic efficacy of a targeted nitrification inhibitor application strategy. The work will take place on intensive dairy pastures, building on research conducted as part of the Australian *More Profit from Nitrogen Project*. The student will have opportunity to contribute to the experimental component of the project, which will provide training opportunities including N_2O emission measurements and the use of nitrogen stable isotopes to parameterize soil and pasture growth models.

The student will:

- Become competent in the measurement of soil N2O emissions from field and lab studies
- Have the opportunity to learn about stable isotope techniques as a tracer
- Gain an understanding of the interacting factors which can cause elevated N2O emissions (e.g. compaction, excretal events and soil moisture) in dairy pastures
- Contribute to understanding the effectiveness of nitrification inhibitors and other mitigation options in managing farm-scale N2O emission hot-spots

Host institute and location:
The University of Melbourne, Australia (collaborating with Bangor University)

Project leader / research supervisors:
Prof Richard Eckard
collaborating with Prof Dave Chadwick, Bangor University

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: April-October 2019

Project 9 – LIVESTOCK

Project title: Economic implications of greenhouse gas mitigation from dairy and beef systems

Brief project outline:
The project would use the Bangor experience in farm management models that estimate the farm-level economic effects of reducing greenhouse gas (GHG) emissions by changing farm practices. This would contribute in training a PhD student to develop understanding in the requirements for data sources across the dairy and beef industry, the identification of current hotspots of GHG emissions, and management practices to mitigate these hotspots. The project will produce country specific marginal abatement cost curves across a range of agricultural management practices. These curves illustrate the trade-off between GHG mitigation and economic effects. 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 economic barriers to adoption. The project builds on the CLEANER COWS (http://www.nrn-lcee.ac.uk/cleaner-cows/) and the GCRF funded SuCoriDa projects evaluating the environmental and socio-economic effects of dairy intensification in the UK and Costa Rica respectively.

An important aspect of the project and the tools for which training is offered is the use of models that optimise either GHG emissions or farm-level economic returns. That is, as well as a static accounting of the economic effects of change in farm management, the approach will estimate on-farm adaption to the new management practice. For example, change in pasture management may incentivise a change in animal numbers or breed. These secondary effects can enhance or reduce GHG mitigation. The project would allow the application of these methods to developing country dairy industries. The project outcome would be training and enhanced knowledge/capability for a developing country, and improved understanding of estimating the economic effects of mitigating emission in developing countries.

Host institute and location:
Bangor University, UK

Project leader:
James Gibbons

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: July-December 2019

Project 10 – LIVESTOCK

Project title: Manure management interventions to mitigate greenhouse gas emissions

Brief project outline:
The goal of the project is to test GHG mitigation options for existing livestock systems in East Africa. Thereby, greenhouse gas (GHG) emissions from manure management are the second most important contributors to agricultural GHG emissions besides reducing emissions from enteric fermentation. The purpose of this project is the improvement of current estimates of GHG emissions from livestock systems by generating region specific information (baseline and benchmark estimates) for manure management. The project encompasses, in detail, a) the generation of accurate GHG emissions data for locally predominant livestock systems by testing best-bet options for manure management, b) exploration of two completely different manure management intervention options that aim at minimizing nutrient losses from manure while similarly saving essential nutrients in manure to optimize forage crop growth, and (c) supplying subsequently a higher quality manure leading to improved crop growth. The project is currently ongoing and directly contributes to CCAFS outputs under the LED focus.

The successful candidate will run a minimum of one experimental trial that aims at monitoring GHG emissions from the two different manure management interventions within ILRI's Mazingira Centre – a state-of-the-art environmental and education laboratory. The experiment will quantify both gaseous and liquid nutrient losses and assess dry matter, carbon and nitrogen content of the manure over typical storage periods of >1 month and up to 6 months. The results will help to derive accurate GHG emission estimates from manure management interventions, provide region-specific values for the so-called methane conversion factor, and further be implemented into training materials for smallholder farmers to improve overall farm productivity.

Host institute and location:
International Livestock Research Institute, Mazingira Centre, Nairobi, Kenya

Project leader / research supervisors:
Dr. Lutz Merbold
Dr. Sonja Leitner

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: January-June 2019

Project 11 – LIVESTOCK

Project title: Influence of forage legumes and N fertilizer on N_2O emissions in grazed tropical pastures

Brief project outline:
We have projects funded by the Brazilian Ministry of Science, Technology and Innovation (MCTI), the National Research Council (CNPq) and Rio State Research Foundation (FAPERJ), to investigate the impact of the introduction of a forage legume into Brachiaria pastures, compared to N fertilization, on greenhouse gas emissions from the grazing systems (soil/plant/animal). We have three large experiments installed and under grazing with *Arachis pintoi* (forage groundnut), *Desmodium ovalifolium* and *Macrotyloma axillare* (java) as the legume components.

The objective of the study is to determine the impact of the forage legume in the diet of the cattle and the plant residues in the pasture on N_2O emissions from the soil. Dung and urine from cattle grazing pure grass swards, with or without N fertilizer, or a mixed grass/legume, will be placed within areas protected from trampling with the paddocks and monitored for N2O emission using closed static chambers (see Lessa et al. 2015, Agric. Ecosyst Environ. 190, 94-103.doi: 10.1016/j.agee.2014.01.010).

Also monitored using the same technique will be areas where urea fertilizer was added in the grass-alone pasture and in areas without N fertilizer and in the mixed grass-legume sward to assess emissions from decomposing plant residues. Urine samples will be taken for analysis of creatinine to assess total daily urine production (see Chizotti et al., 2008 Livestock Science 113, 218–225. doi:10.1016/j.livsci.2007.03.013) and N content.

Preferred student skills or experience:
1. Highly motivated
2. A background in Agronomy or Animal Sciences
3. Be willing to live in simple lodgings in a rural area.
4. Some knowledge of Portuguese or Spanish is desirable but not essential.

Outcomes sought from the project:
Estimates of the total N_2O emissions per month from mixed grass-legume pasture and grass-alone (*Brachiaria brizantha*) pastures with and without N fertilizer application

Host institute and location:
1. Embrapa Agrobiologia, Seropédica, Rio de Janeiro, Brazil.
2. Animal Husbandry station CEPEC/CEPLAC, Itabela, Southern Bahia, Brazil.

Project leader / research supervisor:
Robert Michael Boddey

Preferred duration of research visit: 5-6 months

Preferred grant amount for visiting student: USD 10,000

Preferred dates for research visit: Start after May 2019

Project 12 – LIVESTOCK

Project title: Understanding the controls of N_2O emissions in grazed upland and lowland systems

Brief project outline:
Ruminant production systems result in GHG emissions via nitrous oxide (N_2O) from excreta deposited during grazing, especially the urine patch, fertilizer N and manure inputs, as well as ruminant methane (CH_4) generated by livestock themselves. The UK has recently improved its Agriculture Greenhouse Gas Inventory with country-specific N_2O emission factors for fertilizer and manures applied to land, as well as excreta deposited by grazing livestock, via >35 plot-scale experiments across the country. However, the new grazing excreta N_2O EF is currently based on experiments conducted in the lowlands, on mineral soils, and with cattle urine. There is a current assumption that this new cattle excretal N_2O EF can be used for sheep excreta, and that the N_2O EF from lowland soils can be extrapolated to upland soils, where soil properties and climate can be very different. This project will address these two assumptions through experimentation to compare N_2O emissions from cattle and sheep excreta in upland and lowland soils.

The project will follow on a current NERC funded project to determine how grazing behavior, urine composition and soil factors control nitrous oxide emissions from urine patches in the uplands (*Uplands-N_2O*). It will take place on the Bangor University Farm, on its altitudinal transect, offering different intensities of grassland production from sea level to >900m asl. The student will join a number of PhD students exploring factors controlling both N_2O and ruminant CH_4 emissions in lowland and upland sheep systems.

The student will:

- be trained in good lab and field practice for N2O emission measurements
- make use of manual and automated GHG measurement systems (and understand the pros and cons of both)
- gain an understanding of the importance of how differences in soil, environmental and management factors in the uplands and lowland affect N2O emissions
- focus on an understudied grazed agro-ecosystem, i.e. the uplands

Host institute and location:
Bangor University, UK

Project leader / research supervisor:
Prof Dave Chadwick

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: April-October 2019

Project 13 – LIVESTOCK

Project Title: Quantification of carbon footprints in livestock production systems under contrasting management of Argentina

Brief project outline:
Several spreadsheet models have been developed for greenhouse gas calculation based on the IPCC methodology or LCA; however, these tools were developed for different purposes. They are necessary for research, capacitation, education and extension to evaluate and select the most adequate tools for calculating carbon footprint and also estimate economic results in template livestock farms in Argentina. Additionally, the same livestock production systems will be evaluated using some technology recommended by extension services and assessed for the cost-benefit of specific mitigation options on-farm. The candidate will participate in the data analysis and modelling of production systems and mitigation strategies. This project is linked with GRA livestock research groups in modeling activities as well as on farm mitigation work activities.

Preferred student skills or experience:
- Good understanding of environmental impacts of livestock production and gross margin estimation
- Familiarity with IPCC and with LCA approaches
- Good ability to work with MS Excel
- Independent and reflective thinking

Host institute and location:
National Institute of Agricultural Technology (INTA), Balcarce, Argentina
National Institute of Agricultural Technology (INTA), Cesareo Naredo, Argentina

Project leader / research supervisors:
Claudia Faverin
José I. Arroquy
Enrique Pavan

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 11,500

Completion date: End of 2019

Project 14 – LIVESTOCK

Project title: Climate change mitigation potential of improved forage plots

Brief project outline:
The goal is to test greenhouse gas mitigation options for existing livestock systems in East Africa. In order to achieve sustainable livestock production, reliable forage production is key. A variety of agricultural interventions are known that improve agricultural yields include forage fields. While each of the available techniques is known to improve pasture productivity, an accurate environmental assessment of nutrient losses in form of greenhouse gas (GHG) emissions and or leaching losses in sub-Saharan Africa remains lacking. Similarly, additional potential positive feedbacks such as enhanced soil carbon sequestration have rarely been investigated in tropical forage fields. Therefore, the proposed experiment aims at holistically evaluating known forms of pasture improvement.

In detail, the project will quantify soil greenhouse gas emissions from differently managed forage plots. The focus will thereby be on easy-to-apply interventions and focus on the three most important tropical forage grasses available in East Africa (Rhodes grass, Napier grass and Brachiaria grass – often referred to as the 'wonder-grass'). Within an existing large-scale agronomic trial, five interventions for pasture improvement will be tested. The individual interventions are: (1) intercropping with easily available legumes, (2) application of farmyard manure, (3) application of bioslurry produced from faryard manure, (4) application of slow-release urea fertilizer, and (5) application of biochar together with manure, besides (6) a control treatment. The project will monitor soil greenhouse gas emissions for one growing season (maximum up to 5 months), and assess the baseline in soil nutrient contents, pasture productivity and forage quality. Following this, evidence-based recommendations will be communicated via in-house produced training materials to smallholder farmers. The project is currently ongoing and directly contributes to CCAFS under the LED framework.

The successful candidate will sample each experimental location at minimum weekly and with higher sampling frequencies following fertilizer applications or other pasture management activities. GHG observations will be done uses static soil chambers, both manual and automatic. All other variables, including soil nutrient content analysis, pasture productivity and forage quality will be assessed less frequently. The experiment will take place within ILRI's Mazingira Centre – a state-of-the-art environmental and education laboratory. The results will help to derive accurate GHG emission estimate from pasture management, provide region specific GHG emissions factors and further be implemented into training materials for smallholder farmers to improve overall farm productivity.

Host institute and location:
International Livestock Research Institute, Mazingira Centre, Nairobi, Kenya

Project leader / research supervisors:
Dr. Lutz Merbold
Dr. Sonja Leitner

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: January-June 2019

Project 15 – LIVESTOCK

Project title: Do Biological Nitrification Inhibitors from Brachiaria pastures remain active to suppress soil nitrification and nitrous oxide emissions after passing the cattle digestive system?

Brief project outline:
Shoots and roots of several grasses (e.g. Brachiaria species) contain soil nitrification inhibitory compounds, and we have shown that this results in lower nitrous oxide (N_2O) emissions from soil after N fertilization and also after cattle urine deposition. We are now interested to investigate if these inhibitory compounds remain active after passing the cattle digestive system. Our hypothesis is that when cattle consume forages with high biological nitrification inhibitory (BNI) capacity, the BNI compounds are transferred to the urine and/or dung, resulting in low N_2O emissions when the urine/dung are voided. We propose to test this hypothesis by selecting forages with different BNI capacities. Soil N_2O emissions from urine/dung deposited by cattle fed on the selected forages will be quantified. In-depth studies will be conducted on feed-based changes in metabolic composition of urine and its impact on N content in urine/dung, soil nitrifier populations and soil N dynamics in general. We aim to identify forages and describe mechanisms that could serve to cost-effectively reduce N_2O emissions from cattle waste.

Host institute and location:
International Center for Tropical Agriculture (CIAT) in Colombia

Project leader / research supervisors:
Jacobo Arango
Ngonidzashe Chirinda

Preferred duration of research visit: 5 months

Preferred grant amount for visiting student: USD 11,000

Preferred dates for research visit: Start April/May 2019

Project 16 – LIVESTOCK

Project title: GHG mitigation strategies on cow/calf production systems

Brief project outline:
The objective of this proposal is to study feeding strategies to reduce intensity of GHG emissions in cow/calf production systems of Argentina. The research will include on-field and laboratory activities evaluating a wide range of feeding possibilities (i.e., supplements, feed additives, animal feeding behavior, etc.) under grazing conditions. The training also will include GHG measurements (chambers, SF6, etc.) and other techniques for research in ruminant nutrition and animal feeding behavior. This project has close collaborative activities with GRA livestock groups, and it will permit a greater interactive work with Feed and Nutrition Network as well as with flagships. Preferred student skills or experience: background in ruminant nutrition, knowledge of on pasture cow/calf systems, laboratory skills, rumen metabolism.

Host institute and location:
National Institute of Agricultural Technology (INTA), Cesareo Naredo, Argentina
National Institute of Agricultural Technology (INTA), Balcarce, Argentina

Project leader / research supervisors:
Dr. José I. Arroquy
Dr. Ricci Patricia

Preferred dates for research visit: 6 months

Preferred grant amount for visiting student: USD 11,500

Completion date: End of 2019

Project 17 – LIVESTOCK

Project title: Assessing (agro)forestry landscape restoration options in livestock-degraded regions of montane Kenya and Tanzania

Brief project outline:
Dietary changes and growing populations in Sub-Saharan Africa are leading to major increases in demand for livestock products. As agriculture is the major source of GHG emissions in East Africa and livestock its major contributor, we can expect an increase of total GHG emissions associated to that future demand. Low Emissions Development Strategies (LEDs) for the dairy sector are therefore a top priority for East Africa governments and donors. Smallholders would therefore directly benefit from productivity increases that reduce GHG emissions intensities in livestock systems through more productive animals and better diets. While livestock LEDs are a fundamental effort, no gross mitigation potential in the livestock sector is foreseen, as reduced emission intensities will be compensated by increasing herds. Moreover, livestock production is also a major driver of land use change (LUC) and soil degradation, causing loss of natural vegetation cover and changes in soil properties. Land restoration initiatives that lead to forest recovery and expansion, as well as avoided deforestation, are therefore fundamental complementary initiatives to compensate unavoidable future livestock emissions.

In this proposal we aim at 1) assessing the mitigation potential of a gradient of forest restoration scenarios for degraded areas in Kenya and Tanzania (from pure forest, to agroforestry to pastoralism options); 2) assessing the carbon and economic costs associated with these scenarios using available tools when existing (i.e. EX-ACT FAO tool). We are searching for an independent student who has experience in GIS and GIS software (i.e. ARCGIS), and some background on landscape restoration, climate mitigation and GHG assessments.

We aim for this proposal to be a CIFOR-ICRAF-CIAT multi-center cooperation where each center contributes and discusses different restoration scenarios and tools (from pure forestry, to agro-forestry, to silvopastoralism). The student will be co-supervised in a coordinated manner, by a supervision team that will include a representative from each CGIAR center.

Host institute and location:
Center for International Forestry Research (CIFOR). ICRAF Campus. United Nations Avenue. PO Box 30677, 00100, Nairobi, Kenya

Project leader / research supervisors:
Rosa Maria Roman-Cuesta from CIFOR
Todd Rosenstock/Muhammad Ahmad from ICRAF
Deissy Martinez and Jacobo Arango from CIAT

Preferred duration of research visit: 4 months

Preferred grant amount for visiting student: 10,000 USD

Preferred dates for research visit: From January 2019

Project 18 – LIVESTOCK

Project title: GHG emissions from adequately managed rangelands in Kenya

Brief project outline:
Rangeland ecosystems are home to the majority of livestock in sub-Saharan Africa, and agriculture contributes on average 30% to national GHG emission inventories in sub-Saharan African countries. To date, few studies have investigated the environmental footprint and more precisely GHG emissions jointly with pasture productivity and pasture quality in Eastern Africa. However, there is the urgent need for region-specific data to support East African countries to meet their reporting and mitigation requirements following the Paris Climate Agreement.

Therefore, the proposed project aims at quantifying soil greenhouse gas emissions from a pasture that is managed to maximize livestock production in dry rangelands. Subsequently the site chosen represents a benchmark site that serves the three pillars of climate smart agriculture, enhanced productivity, and climate change mitigation, as well as adaptation. Besides GHG emission measurements from the site using static soil GHG emissions within the footprint area of a recently permanently established GHG flux observations station, the project aims at spatially explicit characterization of soil properties, soil nutrient stocks and pasture productivity. Based on the results of the project, evidence-based recommendations will be communicated to relevant stakeholders. The project is anticipated to start in March 2019 and directly contributes to CCAFS under the LED projects.

Host institute and location:
International Livestock Research Institute, Mazingira Centre, Nairobi, Kenya

Project leader / research supervisors:
Dr. Lutz Merbold
Dr. Sonja Leitner

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: February-July 2019

Project 19 – RICE

Project title: Compiling a structured Rice Policy Information Portal and demonstrating its potential use in mitigation projects

Brief project outline:
The rice-growing countries of Asia have very distinct governance systems and institutional settings. In turn, country-specific circumstances will have to be considered for any form of policy analysis – including an assessment of policies affecting mitigation projects in rice as aimed for by this study. Most of these policy documents from different countries are available on the internet, but are scattered at different sources without any structured meta-data base or repository. Therefore, IRRI has started archiving relevant policy documents within a new "Rice Policy Information Portal" (RPIP) which currently comprises documents for two countries (Vietnam and Laos).

The main objective of this internship is two-fold, namely:

- to expand RPIP for all ASEAN countries by compiling documents relevant to rice and climate change
- to demonstrate the potential use of RPIP through an in-depth study on the policy environment for IRRI's mitigation projects in Thailand

The internship is perceived as 'desk top study' at IRRI-HQ. In addition to the supervision at IRRI-HQ (by R. Wassmann), the intern can avail of specific information on policy documents that can be requested from the IRRI offices in the respective country. In terms of demonstrating the potential use of RPIP, emphasis will be given to mitigation projects in Thailand by interacting with the newly established project office based in the Thai Rice Department (1 international and 1 national IRRI staff). This may require one or two short trips to Thailand as part of the internship.

Host institute and location:
International Rice Research Institute, Los Baños, Philippines

Project leader / research supervisor:
R. Wassmann

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000 (may require 1-2 trips to Bangkok from Manila)

Preferred dates for research visit: January-July 2019

Project 20 – RICE

Project title: Turning to rice cultivars for solving the methane puzzle in irrigated rice systems

Brief project outline:
A major puzzle in the irrigated rice sectors in Latin America and Caribbean (LAC) and Africa is related to finding ways to meet the burgeoning demand for rice without increasing the amounts of methane gas emitted during the rice growing season. To solve this puzzle researchers in LAC have explored water management (i.e., AWD), residue management, tillage practices and seeding practices (Chirinda et al., 2018). Yet, no studies have explored the potential of different rice cultivars to contribute towards the mitigation of methane (CH_4) emissions from irrigated rice systems in LAC and Africa. Studies conducted in other regions have reported inter-varietal differences in CH_4 emissions (Butterbach-Bahl, et al., 1997; Sigren et al., 1997; Jiang et al. 2017), which they have attributed to dissimilar rice attributes including the tiller numbers, leaf area and quantity, root structure and exudates, grain starch content, duration in the field and the aerenchyma structure. In this study, the grant recipient will conduct:

1) A desk-top study using peer-reviewed, grey literature and personal communications with rice experts, to identify key mechanisms and rice attributes contributing to differences in CH4 emissions among rice cultivars.
2) An initial screening of FLAR landmark varieties and elite lines, based on current knowledge of key rice attributes contributing to inter-varietal differences in CH4 emissions.
3) A laboratory-based study to determine differences in aerenchyma structure between major rice cultivars grown in LAC and African countries.

Results obtained during this short scientific visit will add value to those obtained from previous and on-going field measurements of CH4 emissions in different GRA member countries. The grant recipient will be based at CIAT-FLAR, in Colombia, and will work closely with researchers from the GRA, CCAFS Flagship 3, CIAT, IRRI, FLAR and AfricaRice. Results will inform actions aimed at mitigating methane emissions from irrigated rice growing countries.

Host institute and location:
CIAT-FLAR, Cali, Colombia

Project leader / research supervisor:
Ngonidzashe Chirinda

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12,000 USD

Preferred dates for research visit: January-June 2019

Project 21 – RICE

Project title: Toward low methane-emitting rice varieties

Brief project outline:
Flooded rice ecosystems play an important role in providing food for more than half the global population, but are also a major source of atmospheric methane. With increasing population pressure, rice production will increase mainly through breeding efforts to improve genetic potential and via improved fertilizer management. With current technologies and agronomic methods, increased rice production is likely to result in elevated methane emissions as a result of increased plant growth and carbon flow in the soil. Thus, there is a need to find/breed for rice varieties that are high yielding, but low methane producing.

Some studies conducted in SE and S Asia have shown that there is genetic variation in methane emissions across rice varieties. For example Jiang et al. 2017 evaluated 33 rice cultivars in China, achieving a 10% increase in rice grain yield accompanied with a 10.3% reduction in methane emissions.

In this study we aim to compare methane emissions of a number of rice varieties that show strong variation in their root systems. The objectives are (i) to analyse if differences in methane emissions can be detected between varieties with different root architecture, (ii) to assess if correlation between root traits and methane emissions exist, and (iii) to test a new emissions measurement approach suggested by Weller et al. (2018).

This work is in line with research priorities of the GRA Paddy Rice Research Group and CCAFS Flagship 3 that has funded exploratory research in this area in 2017. The project will be conducted as a joint effort of different research clusters in IRRI.

Host institute and location:
IRRI, Los Banos, Philippines

Project leader / research supervisor:
Pauline Chivenge

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: January-June 2019

Project 22 – CROPS

Project title: Cover crop and animal manure impacts on soil N_2O emissions

Brief project outline:
Nitrous oxide (N_2O) is a greenhouse gas and the dominant catalyst of stratospheric ozone degradation. Agricultural soils are the dominant anthropogenic source of N_2O. While nitrogen (N) inputs are generally recognized as the major factor influencing soil N_2O emissions, the role of organic sources of N (soil organic matter, crop and cover crop residues, and animal manures) is less well understood than that of mineral N fertilizers, particularly in the context of the 4 R's of nutrient management: right source, rate, placement, and timing. In addition, the potential to mitigate soil N_2O emissions using multiple strategies in combination, particularly using organic N sources, has received very little attention. The GRA Integrated Nutrient Management Network and others have recognized the need to better understand the impact of these options on soil N_2O emissions (https://globalresearchalliance.org/research/croplands/networks/nutrient-management-network/).

This project will assess the impacts of three different legume-grass cover crop mixtures and four different rates of poultry litter application on soil N_2O emissions during the corn growing season within the context of a long-term agricultural research (LTAR) project. Legume-grass cover crop mixtures include hairy vetch+rye planted on two different dates in the fall and an alfalfa-triticale crop. Poultry litter application rates of 0, 0.33x, 0.67x and 1.0x (where x depends on predicted cover crop N contributions) have been established within the cover crop treatments such that the candidate can focus on measuring soil N_2O emissions in a manner that captures the high temporal variability of these emissions. The student will also be part of a team that collects soil moisture, mineral N, temperature and electrical conductivity data that will be used to interpret soil N_2O emissions data. The student will be fully trained to sample gases and analyze samples on a GC for N_2O, CH_4 and CO_2 and on measuring ancillary data.

Host institute and location:
USDA Agricultural Research Service, Beltsville Agricultural Research Center, Sustainable Agricultural Systems Laboratory, 10300 Baltimore Ave., Beltsville, MD 20705, USA

Project leader / research supervisor:
Michel Cavigelli

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: May-October 2019

Project 23 – CROPS

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

Brief project outline:
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.

Outcomes sought from the project: Generated data will inform the new Central America, Climate Smart Agriculture strategy and contribute towards increased awareness on the mitigation potential of technological and management options promoted in the different climate smart villages of Nicaragua. The results will be presented in a peer-reviewed journal article.

Host Institution and location
International Center for Tropical Agriculture, Cali, Colombia

Project leader:
Ngonidzashe Chirinda

Preferred duration of research visit: 5 months

Preferred grant amount for visiting student: USD 11,000

Preferred dates for research visit: January-July 2019

Project 24 – CROPS

Project title: Nitrogen fertilizer rate, crop residue amount and soil water content influence on N_2O emissions

Brief project outline:
It is proposed that a student will obtain experience in collecting soil and Greenhouse Gas (GHG) samples from the USDA-ARS Nitrogen Use Efficiency (NUE) Project using removable vented static chambers and GRACEnet protocols. In addition the student will have the opportunity to shadow a physical science technician and become familiar with techniques employed to process samples and report gas emissions. Soil gas samples will be analyzed by Gas Chromatography (CP-3800, with ECD, TCD and FID), and data will be processed and analyzed using several procedures and models (e.g., HM, HMR) to calculate GHG fluxes. Soil gas samples (CO2, N2O, and CH4) are collected weekly during the growing season, and periodically after harvest.

Specifically, the student will (1) use field studies to collect GHG (CO2, N2O, and CH4) emissions; (2) process the samples and determine gas emissions from each plot; (3) estimate the effects of tillage, N fertilizer rates and total precipitations on GHG flux; (3) learn how to select the proper model for each individual gas; (4) utilize existing experimental data from the NUE experiment, to synthesize and integrate the information into a written report selecting the best management practices for the particular soil and climatic conditions.

Expected Results: The student is expected to develop a basic understanding of methodologies for collecting GHGs (CO2, N2O, and CH4), analyzing and quantifying gas emissions from different N rate treatments. Prior to departure the student will give an exit seminar. Upon returning to his/her home country the student should be able to design experiments to reduce greenhouse gas emissions, transfer knowledge gained to colleagues, and continue research collaboration with Conservation Agriculture Network and Managing Agricultural Greenhouse Gases Network (MAGGnet) members under GRA- Croplands.

Host institute and location:
USDA-ARS- Soil and Water Conservation Research Unit, Pendleton OR 97801

Project leader:
Dr. Hero Gollany

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: October 2019

Project 25 – CROPS

Project title: Pan-India analysis of N input/output, NUE and associated GHG emission from rice, wheat and maize

Brief project outline:
The objective of the work is to establish NUE benchmarks in Rice, Maize and Wheat to determine safe operating space of nutrient management that increases yield and income while reducing the environmental footprint. The work will involve meta-analysis of data from networks of on-farm trials as well as published literature on crop yield response to nutrients and associated GHG emissions. The work will be aligned to CIMMYT's "achieving cost-effective mitigation in agriculture at scale" project to be submitted to CCAFS. This will eventually contribute to the global efforts being coordinated by the EU N Expert panel to establish NUE benchmarks for different crops under different production environments.

Host institute and location:
International Maize and Wheat Improvement Center (CIMMYT), New Delhi, India

Project leader / research supervisor:
Tek Sapkota

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12000

Preferred dates for research visit: Start after June 2019

Project 26 - SOIL CARBON

Project title: Using a Tier II Model (CQESTR) to Predict Soil Organic Carbon Storage and CO_2 Emissions

Brief project outline:
It is proposed that a graduate student will obtain experience in process-based carbon (C) modeling, using the CQESTR model, long-term soil organic carbon data and climatic data, above-ground crop biomass, and soil physical properties to calculate the potential for sequestering soil carbon. Specifically, the graduate student will (1) learn how to prepare CQESTR input files; (2) utilize existing experimental data to run CQESTR model simulations (data from our long-term experiments and published literature, or data collected by the graduate student at his/her institution); (3) predict best management practices for C storage and reduced CO2 emissions under particular soil and climatic conditions; (4) run climate change simulation scenarios under IPCC projected RCP scenarios; and (5) synthesize and integrate the information and select the best management practices for future climatic conditions.

Expected Results:
The graduate student is expected to learn how to measure carbon fractions (organic, inorganic, labile C, and recalcitrant), and analyze soil carbon pools. Available equipment includes Skalar Primacs TOC Analyzer (Total organic carbon and inorganic C) and Thermo-Finnigan FLASH EA1112 Analyzer (C/N/S analyzers), Formacs Combustion TOC Analyzer (TDOC, and TDIC). The fellow will be provided with additional input to run the models and estimate carbon storage/loss under different land management scenarios while in the United States. Prior to departure the fellow will give an exit seminar. Upon returning to his/her home country, the fellow should be able to design experiments to improve the potential to sequester C, transfer knowledge gained to colleagues, and continue research collaboration with U.S. scientists and Conservation Agriculture Network and Managing Agricultural Greenhouse Gases Network (MAGGnet) members under GRA- Croplands.

Host institute and location:
USDA-ARS- Soil and Water Conservation Research Unit, Pendleton OR 97801

Project leader:
Dr. Hero Gollany

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 11,000

Preferred dates for research visit: April 2019

Project 27 - SOIL CARBON

Project title: Accounting for errors in SOC estimates introduced by proximal sensing methods

Brief project outline:
Sustainable Development Goal 15.3 foresees implementation of projects to restore degraded lands and achieve Land Degradation Neutrality (LDN) by 2030. The LDN agenda is implemented by the UNCCD which has asked MIROVA to set up a finance instrument (the LDN Fund) to enhance access to investment for land restoration. ISRIC - World Soil Information will undertake a project that will be funded by the LDN Fund to advise on in situ cost effective methods to estimate stocks of Soil Organic Carbon, one of the sub-indicators for SDG 15.3. Proximal Soil Sensing (PSS) methods, such as based on Mid-Infrared and Near-Infrared (MIR/NIR) spectroscopy, allow more cost-effective measurements than traditional wet-chemistry based SOC analysis. However, the use of PSS introduces errors that are propagated into derived products and need to be accounted for in the final SOC and organic carbon stock estimates.

ISRIC welcomes PhD candidates with a background in MIR/NIR spectroscopy and Digital Soil Mapping to apply for a research stay to work with the ISRIC team on analysis of the propagation of errors in MIR/NIR PSS-based carbon stock estimates, and to develop methods and tools to account for these in the reporting to MIROVA, the UNCCD and SDG 15.3. The CLIFF-GRADS project will contribute to the GRA Soil Carbon Flagship.

Host institute and location:
ISRIC - World Soil Information, Wageningen

Project leader / research supervisor:
Prof. Dr. G.B.M. Heuvelink

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: January-June 2019

Project 28 - SOIL CARBON

Project title: Net greenhouse gas emissions and soil carbon sequestration in response to tillage systems and cropping sequences

Brief project outline:
The project quantifies greenhouse gas (GHG) emissions and soil carbon sequestration from various tillage systems and cropping sequences under irrigated cropping systems and calculate global warming potential (GWP) and greenhouse gas intensity (GHGI) to determine net greenhouse gas emissions per unit area or crop yield. Experiments are being conducted to evaluate the effects of tillage systems (no-tillage, strip tillage, and conventional tillage) and cropping sequences (corn-sugarbeet and corn-soybean-sugarbeet malt barley rotations) on greenhouse gas emissions and soil carbon sequestration in the northern Great Plains, USA. The student will learn how to measure and quantify GHG emissions and soil C sequestration using various management practices and calculate net GHG emissions using GWP and GHGI where all sources and sinks of CO_2 emissions are accounted.

Host institute and location:
USDA, Agricultural Research Service, Northern Plains Agricultural Research Laboratory, Sidney, Montana 59270, USA.

Project leader / research supervisor:
Upendra M. Sainju

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: April-October 2019

Project 29 - SOIL CARBON

Project title: Assessing the impact of land use change scenarios on soil organic carbon stocks

Brief project outline:
Evaluation of the performance and effectiveness of carbon sequestration policies requires methods to inform on the status and trends in Soil Organic Carbon (SOC). ISRIC - World Soil Information implements a project funded by The Nature Conservancy (TNC) to develop space-time statistical modelling approaches that use machine learning techniques to predict future SOC stocks based on historic and current SOC observations and environmental covariates (e.g. land use, parent material, terrain and climate). In 2018, ISRIC will pilot and assess the performance of this space-time approach for Argentina, in collaboration with the Argentinian National Agricultural Technology Institute (INTA) and the Woods Hole Research Center (USA). The data from this pilot area will be used in the first half of 2019 for a scenario study to assess the evolution of SOC under various land use scenarios.

ISRIC welcomes a CLIFF GRAD PhD candidate competent in soil science and digital soil mapping to apply for a research stay to work with the ISRIC team on the development and application of these scenario studies. The CLIFF GRAD project proposed here will contribute to the GRA Soil Carbon Flagship.

Host institute and location:
ISRIC - World Soil Information, Wageningen, Netherlands

Project leader / research supervisor:
Prof. Dr. G.B.M. Heuvelink

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: January-June 2019

Project 30 - SOIL CARBON

Project title: Developing the Global Soil Information System (GLOSIS)

Brief project outline:
The development of carbon sequestration policies creates a demand for tools to facilitate the archiving, management and sharing of in situ data on Soil Organic Carbon (SOC) and other soil properties. To serve this latent demand, the Global Soil Partnership (GSP) envisages under GSP Pillars 4 and 5 to develop a Global Soil Information System (GloSIS). GloSIS is being designed to function as a federative system, composed by multiple and heterogeneous nodes that share soil profile data according to existing geo-spatial standards. On behalf of the GSP, ISRIC World Soil Information is currently implementing the development of the GloSIS.

ISRIC welcomes CLIFF GRAD PhD candidates in soil informatics to apply for a research stay to work with the ISRIC team on GloSIS development in the following areas:
1. Conduct a pilot study with the integration of a national or regional soil information system into GloSIS. This will include the deployment of a GloSIS node to a soil data provider and the transformation and load of local datasets into that node. The student will collaborate with data providers and authorities responsible for compilation and reporting soil information, such as SOC.
2. Develop and test procedures to update the software components and the data model underpinning a GloSIS node. An automatic data transformation procedure between different versions of the GloSIS data model will be part of this work. Of especial concern will be guaranteeing continued quality and functionality of soil information like SOC after software updates.

The CLIFF GRAD project will contribute to the GRA Soil Carbon Flagship and GSP Pillars 4 and 5.

Host institute and location:
ISRIC - World Soil Information, Wageningen

Project leader / research supervisor:
Dr. L. de Sousa

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: January-June 2019

Project 31 - SOIL CARBON

Project title: Effects of rangeland management on soil carbon sequestration

Brief project outline:
Rangelands are the most widespread terrestrial biome in the world but little is known about how livestock management decisions (e.g. timing and intensity) affect soil carbon sequestration. We have initiated a factorially designed field experiment testing the effect of grazing intensity (moderate, severe) with grazing season (June, October/November). Experimental paddocks (60 × 30 m, 20 total paddocks) were arranged in a grid in a randomized complete block design with 5 replications ([2 grazing intensities × 2 grazing seasons × 5 replications] + 5 ungrazed controls = 25 sampled areas) in a northern mixed-grass prairie. Cattle (*Bos taurus*) grazing intensities approximated recommended (i.e. moderate; 1 AUD/ha) and severe (1.5 AUD/ha) stocking rates, with an estimated 656 and 309 kg/ha of post-grazing residual standing biomass, respectively. Soil cores were collected pretreatment in 2013 and again in 2018. Samples will be used to estimate soil organic carbon (kg/m^2 to 60 cm depth), test for treatment effects, and guide recommendations to land managers.

Depending on the background of the PhD candidate, he/she can participate in data collection, data analysis, and possibly additional analyzes of a related dataset (i.e. spatial analysis, sampling intensity). Preferred student skills or experience include: background in soil ecology (or related fields), statistical skills, and a pro-active attitude.

Host institute and location:
USDA-ARS, Fort Keogh Livestock & Range Research Laboratory, Miles City, MT USA

Project leader / research supervisor: Kurt Reinhart

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: 2019

Project 32 - SOIL CARBON

Project title: Comparing deep soil carbon stocks under kiwifruit and pasture land use

Brief project outline:
This project presents a training opportunity in methodology on quantifying soil carbon stocks and assessing soil carbon sequestration potential under different agricultural land uses. The project focuses on determining the depth distribution and stability of soil carbon stocks under kiwifruit and pasture land use.

Measures of land-use effects on soil carbon stocks generally focus on the topsoil as this layer has the highest carbon concentration. However, while subsoil horizons have low carbon concentrations, they contain a greater absolute amount of carbon with longer mean residence times than topsoil layers. In the face of climate change, the potential of subsoils to sequester carbon needs quantifying. Perennial horticultural crops offer potential to store carbon deep in the soil profile because of their long-lived and deep rooting systems. This project will quantify soil carbon stocks under kiwifruit and pasture land use to a depth of 2 m. The stability of these soil carbon stocks with depth will be assessed using a combination of physical fractionation and incubation techniques. This work will improve our understanding of deep soil carbon sequestration potential under different land uses.

Host institute and location:
The New Zealand Institute for Plant & Food Research, Palmerston North, New Zealand

Project leader / research supervisor:
Roberta Gentile

Preferred duration of research visit: 4-6 months

Preferred grant amount for visiting student: USD 10,000

Preferred dates for research visit: From January 2019

Project 33 – OTHER

Project title: Greenhouse gas emissions from Patagonian meadows: environmental and anthropic influences

Brief project outline:
Meadows (locally called "mallines") are habitats that host numerous animal and plant species, mitigate climate change, controlling desertification and contributing to the hydrological cycle in the dry regions of Northern Patagonia, Argentina; also, they are very important for the development and sustainability of rural communities. Due to land use changes (e.g. overgrazing) along with climate change (e.g. increase in temperature) these natural ecosystems are currently threatened. The aim of this project is to measure the annual greenhouse gas emission from mallines and evaluate how the above factors affects these functions. The information obtained from this part of the project will allow a) to characterize the natural and annual dynamics of the GHG emissions from this type of wetlands (GHG Inventories), b) to understand the sense and magnitude of change of biogeochemical cycles in different climate change scenarios (temperature), c) to validate biogeochemical models, used to better understand the dynamics of mallines ecosystems, to fill gaps in information, to simulate future scenarios and to predict situations, and d) to motivate conservation strategies or adaptive management strategies to achieve the sustainability of this region under the new expected scenarios.

This project is actually financed through: 1) PICT-2016-1909 grant, Category B: Evaluation of greenhouse gas emissions from Patagonian wetlands and the impact of climate change and overgrazing on this ecosystem function. Period: 2018-2020. Innovative Argentina Plan 2020-FONCyT. 2) The National Natural Resources Project, Strategic Project: Emissions of greenhouse gases. PNNAT-1128023 of 2013-2019. National Institute of Agricultural Technology (INTA), and coordinated by Dr. Gabriela Posse. Dr. Posse is linked to this project and will also accompany the student in tasks related to the processing and analysis of data. Dr. Posse is part of the GRA (https://globalresearchalliance.org/country/argentina-2/) through the MAGGnet: An international network to foster mitigation of agricultural greenhouse gases (http: // dx.doi.org/10.1080/17583004.2016.1180586). EEA INTA Bariloche count with a Soil and Water laboratory, so training in lab work is also intended within this project.

Host institute and location:
Instituto Nacional de Tecnología Agropecuaria
San Carlos de Bariloche, Río Negro, ARGENTINA.

Project leader / research supervisor:
Andrea Soledad Enriquez

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 10,000

Preferred dates for research visit: January-June 2019

Project 34 – OTHER

Project title: Measurement of the methane oxidation potential and respiration rate in soils submitted to different uses.

Brief project outline:
The global budget of atmospheric CH_4 is mainly the result of environmental microbial processes, such as the microbial methane oxidation under aerated soils. The objective of the project will be to study the kinetics of methane oxidation in aerated soils by determining the methane oxidation potential under different atmospheric concentrations of the gas; the results will be indicative of the type of methanotrophic populations present. Soil samples typical of the Pampean region (Argentina) will be studied, from three contiguous plots submitted to different uses: a forestry with silvopastoral management, a plot under agriculture, and a naturalized pasture (control). In all cases, two samples from the top til 20 cm depth will be taken in two different climatic conditions and the samples will be carried away to the laboratory for different in vitro determinations. Soil samples will be separated in 5 cm depth layers and will be incubated at 25 ° C in closed chambers under ambient air and high CH_4 mixing ratios. The methane oxidation rate will be determined by the static chamber technique in each of the layers and also the kinetics parameters. It is also proposed to determine the soil respiration rate (determination of CO_2 with NaOH) and other typical soil parameters (pH, humidity, organic matter, apparent density).

The generated knowledge will be useful when defining the impact of land use changes on the balance of GHGs. This proposal is part of a bigger study of emissions and sequestration of GHGs in silvopastoral systems in different Argentine soils.

Host institute and location:
Universidad Nacional del Centro de la Provincia de Buenos Aires.
Facultad de Ciencias Exactas.

Project leader / research supervisors:
Dra. Paula Juliarena
Dra. María Eugenia Priano

Preferred duration of research visit: 5 months

Preferred grant amount for visiting student: USD 10,500

Preferred dates for research visit: May-September 2019

Project 35 – CROPS

Project title: Modeling pH effects on direct nitrous oxide emissions from agricultural soils through process description and parameterization of the biogeochemical model MONICA

Brief project outline:

Recent findings indicate that the pH-value of soils regulates enzymatic activities within the denitrification chain and thus the amount of nitrous oxide emitted to the atmosphere by agricultural soils. Therefore climate-smart pH regulation within agricultural practice could mitigate nitrous oxide emissions. The ERA GAS project MAGGE-pH conducts experiments to examine pH effects at lab and field scale. Biogeochemical models will be used to analyse mitigation potentials and trade-offs of a climate-smart pH regulation in combination with a range of soil types, weather conditions and management options for agro-ecosystems. Beforehand, models need to be improved and validated to describe pH effects on nitrogen cycling processes.

The CLIFF-GRADS scholar will evaluate process description and parameterization of the biogeochemical model MONICA (Leibniz Centre for Agricultural Landscape Research) focusing on nitrogen cycling in soil. If necessary, process description will be extended to describe pH effects on reduction of N2O to N2.The required experimental data will come from mesoscale incubation experiments conducted for 4 agricultural soils with several pH treatments. A comprehensive measurement setup with isotope labelling will allow for disentangling CO2, N2 and N2O producing processes.

The Thünen Institute is one of four German federal research institutes under the auspices of the German Federal Ministry of Agriculture and was created in 2008. Within Thünen, the Institute of Climate-Smart Agriculture (Thünen-AK) investigates the impact of agriculture on greenhouse gas emissions, soil organic carbon and air pollutant fluxes in agro-ecosystems. At Thünen-AK yearly estimates the emissions from the sector agriculture and land use are derived for the national German emission inventories under the international climate convention UNFCC. Since its foundation, Thünen-AK became the leading German research institute for greenhouse gas emissions, land use and climate mitigation in agricultural systems. The institute combines a strong experimental and observational expertise with local to global scale modelling. Our institute is involved in GRA cropping group but also has a focus on grasslands.

Preferred student skills
Experience in Python and C++

Host institute and location
Institute of Climate-Smart Agriculture, Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries

Project leader / research supervisor
Dr. Rene Dechow

Preferred duration of research visit
6 months
Preferred grant amount for visiting student
11.000 USD
Preferred dates for research visit
Aug 2019 – Dec 2019

PROJECT 36 - CROPS

Project title: Modeling pH effects on direct nitrous oxide emissions from agricultural soils through complex stable isotope labelling

Brief project outline
Recent findings indicate that the pH-value of soils regulates enzymatic activities within the denitrification chain and thus the amount of nitrous oxide emitted to the atmosphere by agricultural soils. Therefore climate-smart pH regulation within agricultural practice could mitigate nitrous oxide emissions. The ERA GAS project MAGGE-pH conducts experiments to examine pH effects at lab and field scale. Biogeochemical models will be used to analyse mitigation potentials and trade-offs of a climate-smart pH regulation in combination with a range of soil types, weather conditions and management options for agro-ecosystems. Within the consortium, the Thünen Institute conducts mesocosm experiments with soils from the project's field experiments to elucidate process regulation of pH on denitrification. Stable isotope techniques are used to measure N_2 fluxes and to disentangle the complex network of processes involved in N_2O production. The CLIFF-GRADS scholar will, together with a local PhD student, conduct an experiment with complex stable isotope labelling (^{15}N, ^{13}C, ^{18}O) to investigate the pH effect on contribution of different processes to N_2O emissions and to distinguish CO_2 fluxes originating from organic matter and from lime. They will be involved in evaluating the results and thereby learn to analyze stable isotope data.

The Thünen Institute is one of four German federal research institutes under the auspices of the German Federal Ministry of Agriculture and was created in 2008. Within Thünen, the Institute of Climate-Smart Agriculture (Thünen-AK) investigates the impact of agriculture on greenhouse gas emissions, soil organic carbon and air pollutant fluxes in agro-ecosystems. At Thünen-AK yearly estimates the emissions from the sector agriculture and land use are derived for the national German emission inventories under the international climate convention UNFCC. Since its foundation, Thünen-AK became the leading German research institute for greenhouse gas emissions, land use and climate mitigation in agricultural systems. The institute combines a strong experimental and observational expertise with local to global scale modelling. Our institute is involved in GRA cropping group but also has a focus on grasslands. Part of the institute is one of the world's leading labs for N_2O and N_2 stable isotope analytics with several mass spectrometers and a strong expertise in analyzing isotopic data. The CLIFF-GRADS scholar will work integrated in a dynamic team with a strong publication record.

Preferred student skills
Experience in lab work, good knowledge of soil science

Host institute and location
Institute of Climate-Smart Agriculture, Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries
Project leader / research supervisor
Dr. Reinhard Well

Preferred duration of research visit
6 months
Preferred grant amount for visiting student
11.000 USD
Preferred dates for research visit
Aug 2019 – Dec 2019

PROJECT 37 – SOIL CARBON

Project title: Soil organic matter sensitivity to land management impact on grasslands and croplands

Brief project outline

Soil organic matter is a key component in the global carbon cycle and determined the greenhouse gas balance of agricultural production systems. Soil organic carbon (SOC) sequestration is challenging since SOC is comprised of a wide range of chemical components with different physico-chemical degree of stabilisation. Two analytical tools have been developed and increasingly used to explore the turnover and degree of stabilisation of different SOC pools: SOC fractionation methods and stable isotopes ^{13}C as label and with natural abundance studies. Physical and chemical fractionation methods have been developed and evaluated in our institute (www.somfractionation.org) and are essential to separate labile and stabilised SOC pools. Land management effects can be first detected in the labile pools and thus the labile fraction is a sensitive indicators for C sequestration and C losses from soils. Stable isotopes are powerful to trace the origin of SOC in soils. The shift from C3 to C4 plant or vice versa and the continuous accumulation of heavy SOC with age allow to quantify the SOC turnover of different pools. New microbiological methods to measure the carbon use efficiency of microbes have been established in our lab. The carbon use efficiency maybe a key for a better process understanding of SOC cycling under different land management, e.g. the impact of fertilization and crop rotations. Such techniques can be tested and used in our lab to explore the SOC sensitivity under different land management.

The Thünen Institute is one of four German federal research institutes under the auspices of the German Federal Ministry of Agriculture and was created in 2008. Within Thünen, the Institute of Climate-Smart Agriculture (Thünen-AK) investigates the impact of agriculture on greenhouse gas emissions, soil organic carbon and air pollutant fluxes in agro-ecosystems. At Thünen-AK yearly estimates the emissions from the sector agriculture and land use are derived for the national German emission inventories under the international climate convention UNFCC. Since its foundation, Thünen-AK became the leading German research institute for greenhouse gas emissions, land use and climate mitigation in agricultural systems. The institute combines a strong experimental and observational expertise with local to global scale modelling. Our institute is involved in GRA cropping group but also has a focus on grasslands. During the last eight year the first German soil carbon inventory on agricultural land was conducted in our institute, the largest German soil science project with more than 3000 sampling sites (https://www.thuenen.de/en/ak/projects/agricultural-soil-inventory-bze-lw/). Additionally experimental research on long-term field experiments was conducted on grasslands and croplands. These studies and the methods outlined above are the backbone of a proposed research project conducted with a visiting PhD student. The project will be designed for the PhD student and involves extensive analytical work in the lab and statistical data exploration.

Host institute and location: Institute of Climate-Smart Agriculture, Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries
Project leader / research supervisor: Dr. Axel Don

Preferred duration of research visit: 6 months (shorter visit duration is possible)
Preferred grant amount for visiting student: 12,000 for 6 months
Preferred dates for research visit: Completed before end of 2019