CLIFF – GRADS

Climate, Food and Farming Network

GRA Development Scholarships

Call for student applications

The CLIFF-GRADS program invites applications for short-term (4-6 month) scientific training and research on the measurement and management of greenhouse gas emissions and carbon storage in agricultural systems. Students from developing countries[1] who are currently enrolled in PhD research related to agricultural greenhouse gas quantification or mitigation are eligible to apply. Research will be conducted in association with CCAFS and GRA scientists' projects. Applications are requested on either of two themes:

1) measurement and mitigation of agricultural greenhouse gas emissions or carbon storage in agricultural systems in developing countries, including in the context of enhancing food security;
2) quantification and mitigation of greenhouse gas emissions from reduced food loss in high emission supply chains (e.g. dairy, beef, vegetables, fruits) in developing countries, including estimation of costs and constraints to mitigation.

Selected students will be sponsored in the amount of **10,000 -12,000 USD.**

A list of research opportunities available to students is below. The grants can be used to support living and research costs at the host institution and the grant amounts have been determined based on living costs estimated by the institution. Grants may not be used for tuition, university fees 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 integrates the Global Research Alliance Development Scholarship and the Climate Food and Farming Research Network with the common goal of providing grants to PhD students in developing countries 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 CGIAR research programme on Climate Change, Agriculture and Food Security (CCAFS), the Government of New Zealand and USAID.

Application requirements

To have their application reviewed, applicants must complete the CLIFF-GRADS Round 3 Student Application online survey and submit the necessary documentation as described below to the cliffgrads@globalresearchalliance.org email. Please follow this link to complete the survey: https://www.surveymonkey.com/r/BB58VRC.

[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

Applications must be in English and 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 PhD supervisor at your current host university

Motivation Letter

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 (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 qualifications to conduct research on 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 and contribute to your career.

Submission and process for selection

The deadline for applications is **September 30, 2019.** You may submit your application by email to cliffgrads@globalresearchalliance.org. Please also contact this email address for any questions regarding the CLIFF-GRADS scholarship programme.

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 capacity.

Successful applicants will be matched with a project and notified by email by late November, 2019.

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, university fees, or unrelated personal costs.
- Scientific visits must take place during 2020.
- 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 (please visit these websites *before* preparing your application).
CLIFF-GRADS: https://ccafs.cgiar.org/CLIFF-GRADS
GRA: https://globalresearchalliance.org/
CCAFS: https://ccafs.cgiar.org/themes/low-emissions-agriculture

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LIVESTOCK RESEARCH OPPORTUNITIES

1. *Directed evolution of rumen microbial cultures towards the identification and stimulation of electron sinks alternative to methanogenesis*

Keywords: Livestock

Brief project outline:
The student will conduct experiments that form part of a 3-year project that begins in 2019. Inhibiting methanogenesis in rumen in vitro cultures results in a decrease in the recovery of metabolic hydrogen, which is in part redirected towards unidentified sinks. It is important to identify those sinks under different situations so as to understand their potential nutritive value for the ruminant host animal. 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 which electron disposal pathways alternative to methanogenesis have greater potential to be stimulated. 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.

In addition, the student may be involved in in vitro experiments studying the effects of hydrogen accumulation on carbohydrates digestion and fermentation.

Preferred student skills or experience:

- An inclination to work in the laboratory
- Independent thinking and ability to resolve problems
- Organized and meticulous
- Basic Spanish skills are desirable but not essential

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

Project leader / research supervisor:
Emilio M. Ungerfeld (emilio.ungerfeld@inia.cl)

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12,000 USD

Completion date: July to December 2020

2. *Technologies and practices to increase C sequestration in integrated crop-livestock system on humid tropical savannah*

Keywords: Livestock, Crop

Brief project outline:

Technologies and practices (T&Ps) already exist to offer promising entry points for climate change mitigation. Mixed farming systems have great potential to combine food production with environmental services, including climate change mitigation. This study aims to determine how a crop-livestock (CL) system can increase C sequestration by means of greenhouse gas (GHG) fluxes and soil organic carbon (SOC) stocks. Within the CL system, a combination of available low-carbon emission T&Ps are tested: zero-tillage, crop rotation and intercropping of main crops (such as soybean, maize and rice) with green manuring and cover crops, forage grasses, as well as biological co-inoculation to promote plant growth. Low C T&Ps can enhance nutrient cycling, reduce dependence on chemical inputs and increase crop yield. The net gas (carbon dioxide and methane) exchange between the CL system and the atmosphere using micrometeorological methods, and nitrous oxide fluxes from soil using manual static chambers are measured. Soil organic carbon and nitrogen stocks are quantified to a depth of 1 m.

The CLIFF-GRADS project proposed here will contribute to the Soil Carbon Sequestration Network of the Integrative Research Group, Soil Carbon Flagship and to the Integrated Crop-Livestock Systems Network of the Croplands Research Group of GRA. We welcome a CLIFF-GRADS PhD candidate who has knowledge in soil science, agronomy and is familiar with geochemistry and agricultural production systems to apply for the research stay at Embrapa Rice and Beans, in Santo Antonio de Goiás, Goiás State, Central-West region of Brazil. The candidate will learn about the Brazilian low-carbon emission policy and its capacity to reduce GHG emissions, and techniques to measure greenhouse gas fluxes and SOC stock change at plot and system scales.

Host institute and location: Embrapa Rice and Beans, Santo Antônio de Goiás, GO, Brazil

Collaborating institutes: University of Brasília (UnB), Brasília, DF, Brazil; Federal University of Goiás (UFG), Goiânia, GO, Brazil

Project leader / research supervisor:

Beata Emoke Madari, PhD, Embrapa Rice and Beans / UFG-Post Graduate Programme in Agronomy, beata.madari@embrapa.br (principal supervisor)
Márcia Thaís de Melo Carvalho, PhD, Embrapa Rice and Beans / UFG-Post Graduate Programme in Agrobusiness, marcia.carvalho@embrapa.br
Selma Regina Maggiotto, PhD, UnB-College of Agronomy and Veterinary Medicine, srmaggio@unb.br
Pedro L.O.A. Machado, PhD, Embrapa Rice and Beans, pedro.machado@embrapa.br

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12,000 USD

Preferred dates for research visit: March – August 2020

3. *Legumes use in grassland systems of the Argentinean Pampas region: soil quality and greenhouse gas emissions*

Keywords: Livestock

Brief project outline:
In Argentina, the livestock activity represents the main source of Greenhouse gases (GHG) emissions. In the Pampa Region, livestock production was displaced to marginal areas, due to the expansion of agriculture. In these lands, pasture productivity and quality are generally poor. The inclusion of forage legumes in grassland production systems could improve forage productivity and quality, enhance soil nitrogen (N) availability, increasing cattle fattening efficiency. Then, forage legumes could improve soil and gramineous quality. This combination would generate the possibility to increase the mitigation of GHG, both, due an enhancement of forage digestibility by reducing methane emissions, and by increases in soil carbon stocks related to N availability. It should also be considered that an increase of liveweight will reduce the permanence of the cattle in field, reducing even more methane (CH_4) emissions. However, higher soil N contents could also produce higher nitrous oxide (N_2O) soil emissions. The present project aims to generate capacities and development for a sustainable cattle system under grazing in marginal lands. It is proposed to perform an integrative analysis of legumes inclusion in grasslands on physical, chemical and biochemical soil properties, biological nitrogen fixation, and GHG emissions. The activities include identification of potential study sites, soil and GHG samplings, calibration of methodological techniques, experimental trials under controlled conditions, laboratory analysis and discussion of results.

Links to GRA/CCAFS research groups
GRA Integrative research group (IRG): Grasslands Research Network and Soil Carbon Sequestration Network.

Host institute and location:
National Institute of Agricultural Technology (INTA), Castelar, Argentina
National Institute of Agricultural Technology (INTA), Buenos Aires, Argentina

Project leader / research supervisor:
Alejandro Costantini (costantini.alejandro@inta.gob.ar)
Romina Romaniuk (romaniuk.romina@inta.gob.ar)
Marcelo Beltrán (beltran.marcelo@inta.gob.ar)

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12000 USD

Preferred dates for research visit: May to October 2020

4. *Greenhouse gas emissions from crops fertilized with dairy manure in Argentina*

Keywords: Livestock, Feed

Brief project outline:
In Argentina, research is seeking to improve greenhouse gases (GHG) emissions database to add robustness to the estimates of the National GHG Inventory. According to this inventory, the agricultural sector contributes with 39 % of the emissions to the total (368 Mt CO2eq), with animal production being about 54 % out of that contribution. To cope with the environmental impact produced by dairy cattle, several provinces are promoting and regulating the use of dairy manure as fertilizer, since it is a cheap source of nitrogen (N) to nourish corn grown for feeding dairy animals. Under this context, studies evaluating the response of corn fertilized with dairy manure may shed some light about the feasibility of achieving substantial grain yields and mitigating GHG emissions with such practice. The candidate will participate in the GHG monitoring and the data analysis of experiments, evaluating dairy manure application to corn in Argentina. This project is linked to experiments run into the Balcarce Experimental Station facility as well as GRA livestock research groups.

Preferred student skills or experience:
- Good understanding of environmental impacts of soil fertility and environmental biophysics.
- Familiarity with IPCC and GHG monitoring
- Good ability to work with R-Studio, and excel
- Independent and reflective thinking

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

Project leader / research supervisor:
Sebastian Cambareri (cambareri.gustavo@inta.gob.ar)
Claudia Faverin (faverin,claudia@inta.gob.ar)

Preferred duration of research visit: 6 months

Preferred dates for research visit: Completed by end of 2020

Preferred grant amount: $12,000

5. *Integrating mitigation strategies to decrease methane emissions of dairy cows in pastoral systems*

Keywords: Livestock

Brief project outline:
Methane is an important greenhouse gas that contributes to climate change. One major source of methane emissions is ruminant enteric fermentation. Globally, several methane mitigating strategies have been studied, with varying degrees of applicability and methane mitigation potentials. Most studies have been conducted in intensive production systems. Less research is available for pastoral dairy systems. An effective anti-methanogenic strategy for pastoral dairy systems must:
i) Have a considerable methane mitigating potential,
ii) Have minimal negative effects on the environment, animal or food safety,
iii) Have persistent effects,
iv) Be feasible to implement in grazing conditions, and
v) Have no negative impacts on productivity and economic returns.

To date, no single strategy has been consistently effective ('silver bullet') or is readily applicable for methane mitigation in pastoral systems, and methane mitigating effects have been only mild to moderate, decreasing methane emissions by 15% at best. This project focuses on the potential of combining methane mitigation strategies that have been partially successful in pastoral systems, or that have been evaluated in intensive dairy systems and could be applied to pastoral dairy systems, to enhance their individual methane mitigating potential in a persistent manner. The student will conduct an experiment that aims to evaluate the effects of combining cottonseed supplementation and a methanogenesis inhibitor on methane production and persistency, milk production, composition and fatty acid profile of grazing dairy cows. This applied project will provide new knowledge on the effectiveness and persistency of combining different methane mitigation strategies for pastoral dairy production systems.
This proposal includes both laboratory and field work.

Preferred student skills or experience:
- Hands on experience with animals, particularly dairy cows
- Independent thinking and ability to resolve problems
- Organized and meticulous
- Effective teamwork and interpersonal skills
- Basic Spanish skills are desirable but not essential

Host institution and location: Instituto de Investigaciones Agropecuarias, INIA Remehue, Osorno, Chile.

Project leader / research supervisor: Camila Muñoz, INIA Remehue, camila.munoz@inia.cl.

Preferred duration of research visit: 6 months.

Estimated grant amount for visiting student: 12,000 USD.

Preferred dates for research visit: Sep 2020 to Feb 2021.

6. *Influence of forage legumes and N fertilizer on N_2O emissions in grazed tropical pastures.*

Keywords: Livestock, Feed

Brief project outline:
Our team has no formal link to GRA/CCAFS but we have projects funded by the Brazilian Ministry of Science, Technology and Innovation (MCTI) and 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 N2O 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 emissions and ammonia volatization using closed static chambers (see Lessa et al. 2015, Agric. Ecosyst Environ. 190, 94-103. doi: 10.1016/j.agee.2014.01.010 and Jantalia et al. 2012. Agron. J. 104:1595–1603 doi:10.2134/agronj2012.0210). 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. Some knowledge of Portuguese or Spanish is desirable but not essential.

Outcomes sought from the project:
Estimates of the total N2O and ammonia volatilization 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 (robert.boddey@embrapa.br)

Preferred duration of research visit: Five to six months

Preferred grant amount: US$ 10,000

Preferred dates for research visit: Start after March 2020.

7. *Mitigation of methane emissions and capturing the effects of diet on GHG emissions from Finnish dairy production system*

Keywords: Livestock, Feed

Brief project outline:
Livestock especially dairy cows are a major source of anthropogenic greenhouse gas (GHG) emissions. ERA-GAS co-funded project, CEDERS (https://eragas.eu/research-projects/ceders), is aiming at (i) extending the knowledge of ruminant dietary effects on GHG emissions and sustainable production, and (ii) improving GHG accounting methodologies. The candidate will participate in the experimental work on nutritional mitigation of enteric methane emissions and their trade-offs with manure methane emissions from lactating dairy cows using respiratory chambers and in vitro methane production of manure. In addition, rumen and manure microbial population will be studied. The work plan is focused on data processing and modelling the data collected during the experimental work as well as the data collated from the previous projects/experiments conducted especially using lipids on methane emissions. In addition, the candidate will become acquainted with novel techniques (i.e. next generation sequencing; NGS) for evaluation of dietary intervention effects on ruminal and faecal microbial population aiming to understand microbial role in GHG emissions. Furthermore, the candidate will be collaborating with the project partners from 8 EU countries plus New Zealand which improves his/her communications/networking within the international scientific community.

Preferred student skills or experience:
- Familiar with environmental impacts of livestock production.
- Familiar with nutritional strategies to mitigate GHG emissions from ruminants
- Good ability to work with data (Excel and SAS)
- Good writing skills

Host institute and location:
Natural Research Institute Finland (Luke), Jokioinen, FI-31600, Finland

Project leader / research supervisor:
Senior research scientist Dr Ali-Reza Bayat (alireza.bayat@luke.fi)
Senior research scientist Dr Ilma Tapio (ilma.tapio@luke.fi)

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12000 USD

Preferred dates for research visit: June – December 2020

8. *Adding value to rumen methane mitigation compounds through increasing animal efficiency*

Keywords: Livestock

Brief project outline:
While a number of different additives have been proven effective in consistently reducing (15 to 60 %) ruminants' enteric CH4 emissions (i.e. 3NOP, marine algae), this decrease is often accompanied by an increase in H2 expelled, resulting in an energy loss to the animal. This is clearly limiting the use of such technology in the livestock feeding market since no economic incentive is nowadays in place only for reduced emissions practices. CSIC is currently involved in a H2020 project (MASTER: http://www.master-h2020.eu) leading a work-package specifically focused on improving animal production and reducing environmental impact through manipulation of the rumen microbiome. One objective is to identify and test compounds, which combined with methane inhibiting compounds, result in (H) metabolic redirection to yield energy-beneficial products for the animal. Given the differences in microbiome composition and types of diets used in cattle/meat and small ruminants/dairy systems, parallel work dealing with two different production systems is conducted at INRA and CSIC. CSIC welcomes CLIFF GRAD PhD candidate with interests in training on ruminant nutrition and rumen microbiology to apply for a research stay to work with rumen microbial ecosystem research group in Granada, Spain as part of the MASTER project (Microbiome Applications for Sustainable food systems through Technologies and EnteRprise). This H2020 project is part of the Microbiome Support Coordination Action of the European Commission (https://www.microbiomesupport.eu/project-partners-2/) and the stay will enable the candidate to interact with most relevant research groups working in enteric CH4 mitigation strategies related and rumen microbiology across Europe. The CLIFF GRAD project proposed here will contribute to the GRA enteric CH4 Flagship. Three phases in the project are foreseen:

1) Identification of compounds using purified products that in their metabolism in the rumen consume H2 (e.g.. pholoroglucinol) and yield metabolites that provide energy to the host. In vitro batch culture with or without methane inhibiting compounds in a dose-response approach.
2) Test available by-products/conventional and nonconventional feed ingredients/additives from the food/feed-industry containing the most interesting pure compounds screened above.
3) In vivo demonstration trials will be conducted based on in vitro data of the most effective compounds in dairy goats to assess the impact on rumen fermentation, milk yield and CH4 emissions using respirometry chambers at CSIC. The experimental design will include compounds alone and in combination with methane inhibitors against a control.

Host institute and location: Estacion Experimetal del Zaidin (CSIC, Spanish Research Council), Granada, Spain (www.eez.csic.es)

Project leader / research supervisor:
Project leader / research supervisor: Dr. David R. Yanez-Ruiz: david.yanez@eez.csic.es and Alejandro Belanche (a.belanche@csic.es)

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12,000 USD

Preferred dates for research visit: January to June 2020

9. *Use of lipids in dairy systems as a strategy of adaptation and mitigation to climate change.*

Keywords: Livestock, Feed

Brief project outline:
In this project, we propose the use of lipids as a strategy of adaptation and mitigation to climate change. The protected lipids function as "cold diets" and tend to reduce thermal stress in animals.

The information obtained in this work will be useful to develop and complete national inventories in dairy systems characteristic of our country and to have local information on the potential for reducing GHG emissions by diet management.

The candidate will participate in three research lines of the project:
1) Evaluation of productive performance by animals handling procedures.
2) Measurements of the enteric methane emission (using the SF_6 tracer technique).
3) Perform molecular techniques for the study of the dynamics of the ruminal microbiota and techniques to determine the fermentative parameters.

Preferred student skills or experience:

- Familiarity with animal handling procedures.
- Familiarity with general laboratory techniques.
- Independent and reflective thinking.

Host institute and location:
National Institute of Agricultural Technology (INTA), Rafaela, Argentina.
National Institute of Agricultural Technology (INTA), Hurlingham, Bs As, Argentina.
National Technological University, Buenos Aires Regional Faculty (UTN), Bs As, Argentina.

Project leader / research supervisor:
María Esperanza Cerón Cucchi (ceroncucchi.maria@inta.gob.ar)
María Paz Tieri (mpaztieri@gmail.com)
José Ignacio Gere (jgere@utn.frba.edu.ar)

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 11500 USD

Completion date: Before November of 2020.

10. Quantification of carbon foot prints in dairy farms for various feeding management in Thailand.

Keywords: Livestock, Accounting, LCA, Modelling

Brief project outline:
The calculation of greenhouse gas emissions and carbon footprint in livestock sector has been developed in accordance with the methods of the IPCC or LCA. However, these methods have been developed for various purposes and are based on the conditions of different regions. There is a need for research, empowerment, education and development of methods to evaluate and select the most suitable tool for calculating greenhouse gas emissions and carbon footprints, and also evaluating economic results in dairy farms in Thailand. In addition, the dairy production system in each feed management will be evaluated using certain technologies recommended by extension services and assessed the cost-benefit of specific mitigation options on farm. The candidates will participate in data analysis and modelling of production systems and mitigation strategies. This project is linked to the GRA Livestock Research Group in modelling activities, including mitigation activities on the farm.

Preferred student skills or experience:
Good understanding of the environmental impacts of dairy production and gross margin estimation.
Familiarity with IPCC and with LCA approaches
Good ability to work with excel
Independent and reflective thinking

Host institute and location:
Bureau of Animal Husbandry and Genetics Improvement, Department of Livestock Development, Patumthani Province, Thailand.
Dairy Cattle Research and Development Center, Department of Livestock Development, Nakhon Ratchasima Province, Thailand.
Chiangmai Livestock Research and Breeding Center, Department of Livestock Development, Chiangmai Province, Thailand.
Sakon nakhon Livestock Research and Breeding Center, Department of Livestock Development, Sakon nakhon Province, Thailand.
Srakaew Livestock Research and Breeding Center, Department of Livestock Development, Srakaew Province, Thailand.

Project leader / research supervisor:
Kalaya Boonyanuwat (kalayabo@gmail.com)
Warocha Jamparat (j_varocha@yahoo.com)

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 11500 USD

Completion date: End of 2021

11. Evaluating environmental impacts of the beef cow-calf system by the life cycle assessment method in Thailand.

Keywords: Livestock, LCA, Modelling

Brief project outline:
The Ministry of Agriculture and Cooperatives promotes extension of beef cattle production to support beef meet as protein food in every parts of Thailand together with environment concern. The strategy plan of evaluating the environmental impacts of beef production in Thailand is important for research program. A Life Cycle Assessment (LCA) methodology study for environmental aspects and potential impacts is necessary to generated for the beef production system.

The overall activities of this project include: 1) Technical analysis to quantitatively benchmark the carbon footprint and other environmental impacts of beef cow-calf production in Thailand, 2) Economic analysis to examine the economics of adopting potential greenhouse gas (GHG) reducing practices related to beef cow-calf production in Thailand. The results of the project will be intended to aid in product differentiation on environmental attributes, providing value-added products, nutrient and water use efficiency, production efficiency, competitiveness and potential carbon reduction. The candidates will participate in data analysis and modelling of production systems and mitigation strategies. This project is linked to the GRA Livestock Research Group in modelling activities, including mitigation activities on the farm.

Preferred student skills or experience:
- Good understanding of the environmental impacts of beef cow-calf production and gross margin estimation.
- Familiarity with IPCC and with LCA approaches
- Good ability to work with excel
- Independent and reflective thinking

Host institute and location:
Bureau of Animal Husbandry and Genetics Improvement, Department of Livestock Development, Patumthani Province, Thailand.
Beef Cattle Research and Development Center, Department of Livestock Development, Nakhon Ratchasima Province, Thailand.
Tak Livestock Research and Breeding Center, Department of Livestock Development, Tak Province, Thailand.
Sakon nakhon Livestock Research and Breeding Center, Department of Livestock Development, Sakon nakhon Province, Thailand.
Nakhon Sawan Livestock Research and Breeding Center, Department of Livestock Development, Nakhon Sawan Province, Thailand.

Project leader / research supervisor:
Kalaya Boonyanuwat (kalayabo@gmail.com)
Somporn Chokcharean (lclb_lbr@dld.go.th)

Preferred duration of research visit: 6 months
Preferred grant amount for visiting student: 11500 USD
Completion date: End of 2021

12.Ranking forage-based diets for ruminant methane and nitrogen emissions

Keywords: Livestock, Feed

Brief project outline:
Ruminant livestock are a major contributor to national greenhouse emissions in many developing countries and countries like New Zealand and Ireland. Ruminant production in these regions is mainly based on forage-based systems, but little information is available for ranking forages in terms of emissions when fed. INRA has recently (2018) released their new 'feeding system for ruminants', which also can be used to estimate methane (CH4) emissions and nitrogen excretion from ruminants in different climatic zones (temperate, Mediterranean (arid) and tropical). The aim of the current project is to rank forages (e.g. different species of grasses, legumes, brassicas and herbs) for CH4 emissions and nitrogen excretion in different ruminant classes (dairy and beef cattle, sheep) using the INRA system and compare those with values from animal trials. The system can also predict animal production and product quality to enable identification of synergies or trade-offs. Animal trial data, including those on forage dominant diets, have already been collected as part of the ERAGAS "CEDERS" and the GRA "Global Network" projects, which can be extended with data of the participating student. In the project, the student will work on selecting and processing data to enable modelling with INRA system, in collaboration with Dr Eugène and Nozière from INRA Theix and then compare modelling results with animal trial data. During the stay, the student will have the opportunity to be introduced to various methane-emission measurement methods used in vivo and in vitro at AgResearch in New Zealand.

Host institution and location:
AgResearch Limited, Grasslands Research Centre, Palmerston North, New Zealand

Project leader / research supervisor:
Dr. Arjan Jonker, AgResearch Limited, arjan.jonker@agresearch.co.nz
Dr. Maguy Eugène, INRA, France, maguy.eugene@inra.fr

Preferred duration of research visit: Six months

Estimated grant amount for visiting student: $12,000 USD

Preferred dates for research visit: Any time before the end of 2020

13. Evaluating enteric methane and excreta based nitrous oxide emissions associated with tropical forage legumes

Keywords: Livestock, Feed

Research question:
Do legume-based diets reduce total carbon footprints of cattle production systems?

Brief project outline:
Extensive grazing conditions of low-quality pastures is been associated with high greenhouse gas (GHG) emissions. Moreover, extensive systems result in the degradation of natural resources and low production parameters, making such cattle production systems less profitable and unsustainable in the long term. Methane (CH_4) is the main GHG by-product of rumen fermentation and constitutes a loss of energy (up to 18% of gross energy intake) for the animal. Supplementation strategies with legume forages that contain secondary metabolites and high protein content are known for reduce CH_4 production in cattle systems. Nitrogen (N) supplementation of grazing cattle with legumes provides benefits such as increased N intake and live-weight gains. In the tropics, several legume species improve microbial activity in the rumen and have the potential to reduce the synthesis of CH_4. However, the consumption of legumes with high protein content increases the excretion of N in the urine because of energy imbalances and high N contents of the resulting diets. A higher excretion of N in urine and faces consequently increases the amount of nitrous oxide (N_2O) emitted from excreta deposited on grazed pastures. Yet, strategies to reduce CH_4 emissions or the excretion of N have been studied independently despite the possibility that approaches aimed at reducing N excretion can generate an increase in CH_4 emissions and vice versa.

Therefore, the objective of this project is to quantify the amount of CH_4 and N_2O emissions in a silvopastoral system using legume trees with different levels of inclusion. During the research stay, the student will have the opportunity to be acquainted to various CH_4 and N_2O emission measurement methods including *in vivo* and *in vitro* practices.

Host institute and location: CIAT, Palmira, Valle del Cauca, Colombia

Project leaders: Jacobo Arango/ Ngonidzashe Chirinda

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12,000 USD

Preferred dates for research visit: Stating July 2020

14. Quantification of nitrous oxide (N_2O) emissions from beef, milk and crop-pasture rotational production systems in Uruguay.

Keywords: Livestock, Feed, Accounting

Brief project outline:
As a country signatory of the "Paris Climate Agreement" and due to the major responsibility of the Uruguayan agricultural sector (> 75%) in the total greenhouse gas (GHG) national emissions, Uruguay requires the development of agronomic practices that contribute to the mitigation of GHG emissions. In addition, the calculation of Uruguayan GHG inventories from the agricultural sector are mostly based on the default emission factors (EF) established by the Intergovernmental Panel on Climate Change (IPCC), which may result in values that overestimate national emissions. Therefore, it is necessary to quantitatively know the emissions from our agricultural production systems and to develop local EFs specific to our country.

The project proposes to contribute to the improvement of our national inventories by quantifying N_2O emissions from bovine urine, and to develop EF and mitigation alternatives for both intensive and extensive pastoral livestock production systems as well as in dairy systems. In addition, soil emissions will be quantified in crop-pasture rotation systems.

The candidate will participate in the experimental field work, lab analysis using the gas chromatography, and data analysis. The CLIFF GRAD project proposed here will contribute to the GRA Livestock Research Group.

Host institute and location:
National Institution for Agricultural Research (INIA), La Estanzuela, Colonia, Uruguay.

Project leader / research supervisor: Verónica Ciganda (vciganda@inia.org.uy)

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12000 USD

Preferred dates for research visit: February to June 2020

15. Implementing sustainable agricultural and livestock systems for simultaneous targeting of forest conservation for climate change mitigation (REDD+) and peace-building in Colombia

Keywords: Livestock, Agroforestry

Brief project outline:
This project aims to contribute towards the reduction of land-based GHG emissions, conserving forest, restoration of degraded landscapes and improving rural livelihoods, while stimulating peace-building in rural Colombia. Project outputs are expected to benefit Colombia's REDD+, NDCs and peacebuilding processes by designing sustainable land-use systems (SLUS) (including sustainable crop and cattle production systems). To increase their effectiveness, SLUS are being tailored to specific contexts. Thus, the project is using SLUS to inform in-depth understanding of enabling conditions and existent institutional arrangements together with agricultural value chains (VC) actors. Upgrading strategies within the VC will foster adoption of promising land-use systems (and may integrate financial, nonfinancial incentives and services arrangements). The project targets farmers located in priority areas for carbon-storage and landscape restoration, as both are present in armed conflict affected territories.

During the visit, the student will focus on quantifying greenhouse gas fluxes associated with different land use options proposed as part of the peace-building efforts in Colombia. This Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) funded project is also linked to CCAFS' Latin America Mitigation Network funded through FP3.

Host institution and location: CIAT Colombia

Project leader: Augusto Castro, PhD, CIAT, Augusto.Castro@cgiar.org

Research supervisors: Ngonidzashe Chirinda, PhD, CIAT, n.chirinda@cgiar.org and Louis Verchot L.VERCHOT@CGIAR.ORG

Preferred duration of research visit: 6 months

Estimated grant amount for visiting student: USD 12, 000

Preferred dates for research visit: March-August 2020

16. Evaluating effects of increased use of animal manure in horticulture on agricultural greenhouse gas emissions.

Keywords: Livestock
Brief project outline:
Animal production increasingly takes place close to urbanised areas where little land is available. Since feed is produced elsewhere, a geographical disconnection exists between feed and animal production, leading to significant challenges of utilizing animal manure as a fertilizer. As a consequence, manure is often disposed into the environment, causing environmental pollution and loss of valuable nutrients. Wageningen Livestock Research (WLR) is currently implementing a project to reduce greenhouse gas (GHG) emissions from Indonesian agriculture by closing regional nutrient cycles, as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) with funding support from the government of The Netherlands.

WLR is seeking assistance from a PhD candidate in evaluating the potential environmental effects of replacing part of the synthetic fertilizer used in horticulture by animal manure. The PhD student will analyse existing databases and carry out Life Cycle Assessments (LCA's) to estimate GHG emissions from dairy and crop farms. This work could potentially lead to a collaborative scientific publication. We are looking for an enthusiastic PhD candidate with a background in agricultural science, extensive experience with Microsoft Excel, and speaking and writing fluent English.

Host institution and location:
Wageningen Livestock Research, Wageningen, Netherlands.

Project leader / research supervisor:
Dr. Marion de Vries, Ph.D., Wageningen Livestock Research, marion.devries@wur.nl

Preferred duration of research visit: 6 months

Estimated grant amount for visiting student: 12,000 USD

Preferred dates for research visit: January – June 2020

SOIL RESEARCH OPPORTUNITIES

17. Greenhouse gas emissions and soil carbon sequestration with tillage systems and crop types

Keywords: Soil Carbon

Brief project outline:
Quantification of greenhouse gas (GHG) emissions from agricultural sector and best management practices for mitigating GHG emissions are still evolving. The project involves (1) measuring GHG (CO_2, N_2O, and CH_4) emissions and C sequestration from no-till, strip till and conventional till systems under corn, wheat, and sugarbeet, (2) calculate net greenhouse emissions using global warming potential (GWP) and greenhouse gas intensity (GHGI), and (3) determine best management practice to mitigate GHG emissions from croplands. The student will work with a team on ongoing projects on the impact of tillage system and crop type on GHG emissions in the northern Great Plains, USA. The student will learn to measure and quantify GHG emissions and soil C sequestration under using various tillage systems and crop types and calculate net GHG emissions using GWP and GHGI where all sources and sinks of CO_2 emissions are accounted.

Links to GRA/CCAFS research groups
GRA Integrative Research Group (IRG): Grasslands Research Network and Soil Carbon Sequestration Network and the GRA Livestock Research Group (LRG).

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

Project leader / research supervisor:
Upendra M. Sainju
Research Soil Scientist
Email: Upendra.sainju@ars.usda.gov

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: April-October 2020

18. Using a Tier II Model (CQESTR) to Predict Soil Organic Carbon Storage and CO_2 Emissions.

Keywords: Soil Carbon, Accounting, Modelling

Brief project outline:
Several models have been developed for soil organic carbon (SOC) sequestration predictions and CO_2 emissions. The IPCC methodology Tier I method and CQESTR Tier II Model will be used in this project to predict SOC from our long-term tillage plots or from data collected by candidate. It is proposed that a graduate student will obtain experience in process-based C modeling, using the CQESTR model, long-term soil organic C data, soil physical properties, climatic data, and above-ground crop biomass to calculate the potential for sequestering soil C under different management practices. 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 CO_2 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 C pools. 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 student 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 or Soil Carbon Modeling.

Preferred student skills/experience:
A PhD candidate competent in soil science with a good understanding of factors influencing soil organic C sequestration and CO_2 emissions, and have some experience in modeling and statistical analysis.

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

Project leader/ research supervisor: 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 - September 2020

19. Assessing Impact of Cover Crop on Nitrogen Use Efficiency and Greenhouse Gas Emissions Project

Keywords: Soil Carbon

Brief project outline:
It is proposed that a student will obtain experience in collecting soil samples and Greenhouse Gas (GHG) samples using removable vented static chambers and GRACEnet protocols from the USDA-ARS in wheat-fallow and wheat-pea cover crop rotations. 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 (Scion-456-GC, with ECD, TCD and FID), and data will be processed and analysed using several procedures and models (e.g., HM, HMR) to calculate GHG fluxes. Soil gas samples (CO_2, N_2O, and CH_4) and NH_3 are collected weekly during the growing season, and periodically after harvest.

Specifically, the student will (1) participate in field studies to collect GHG (CO_2, N_2O, and CH_4) and NH3 emissions; (2) process the samples and determine gas emissions from each plot; (3) estimate the effects of tillage, cover crop, 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 his/her experiment or from our NUE experiment, to synthesize and integrate the information into a written report selecting the best management practices for the particular soil and climatic conditions. Upon returning to his/her home country the student should be able to design experiments to reduce GHG 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.

Preferred student skills/experience:
PhD candidate competent in soil science and have a good understanding of major factors influencing soil N_2O and CO_2 emissions, and the role of soil water content, cover crop residues, soil organic matter, and mineral N fertilizers in GHG emissions under dryland cropping system.

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

Project leader/ research supervisor: Dr. Hero Gollany

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: USD 12,000

Preferred dates for research visit: April - October 2020

20. Tracing the contribution of deep roots to soil carbon sequestration using isotopic tracers

Keywords: Soil Carbon

Brief project outline:
Sequestering carbon (C) in soil has great potential to help combat climate change. Of the many potential strategies proposed, the implementation of deep-rooting crops represents one that is 1) cheap to implement, 2) is feasible for global adoption by farmers, 3) has a growing supporting evidence base, and 4) has the potential to enhance crop resilience and yields. However, in situ measurement of deep-rooting crops is a major challenge and few studies have looked at deep-rooting in conjunction with C sequestration. Those that do, look at total C and do not separate the 'old' C from the 'new' C provided by roots via rhizodeposition. The objective of this project is to trace photosynthetically fixed carbon from the leaves to the roots and then into the soil using 12C and 14C isotopes. It will compare crops with different rooting traits (i.e. shallow vs. deep rooting) at the Henfaes Research Centre, which is part of the Global Farm Platform Network. By supplying deep-rooting crops with 14CO2, the direct contribution of roots to soil C at different depths can be quantified. Simultaneously, using gas collectors at different depths, the mineralization of plant C can be measured. The results of this project will allow greater understanding of the movement of C from the atmosphere into the soil and/or back to the atmosphere. This information will inform C sequestration strategies and help in C budgeting.

Host institution and location:
Environment Centre Wales, Bangor University, North Wales, UK
Where the student will be trained in the use of the 14C radio-isotope, and will work in the highly productive radio-isotope laboratory at Bangor University under the supervision of Prof Davey Jones, and will join a cohort of other PhD students with similar interests in reducing GHG emissions and developing strategies to increase C sequestration in soil.

Project leader / research supervisor:
Prof. Davey Jones, Bangor University, UK; and University of Western Australia, AUS; d.jones@bangor.ac.uk
Erik Button, Bangor University, UK; e.button@bangor.ac.uk
Prof. Dave Chadwick, Bangor University, UK; and Southwest University, Chongqing, China; d.chadwick@bangor.ac.uk

Preferred duration of research visit: 6 Months

Preferred grant amount for visiting student: 10,000 USD

Preferred dates for research visit: March 2020

21. N2O consumption in subsoils: A hidden sink?

Keywords: Soil Carbon, Soil N2O, Soil CH4

Brief project outline:
It is well established that soils represent a major source of N2O in agricultural systems, particularly in response to the application of inorganic fertilizers. Measurements of N2O in soil, however, suggest that N2O concentrations at depth (below 50 cm) can be very high. Measurements of N2O emissions from the soil surface, however, fail to show this N2O reaching the soil surface. This suggests the N2O is consumed during transit through the soil towards the soil surface, offering the potential for enhancing this process to reduce direct N2O losses, as well as indirect N2O (i.e. via NO3- leaching) losses further. This project will measure N2O, CH4 and CO2 concentrations down the soil profile in a wheat cropping system at Bangor University Farm, which is a site in the Global Farm Platform Network. This will provide an assessment of the soil atmosphere. Samples of soil collected from different depths will then be placed in different atmospheres and 15N2O used to investigate the rate of consumption. Sterilized controls will be used to assess if the process is biologically or abiotically mediated. The data will be supported by measurements of other soil quality indicators (e.g. rates of microbial C and N processing and microbial biomass and composition). The project is linked to a large joint UK-China programme promoting N use efficiency in agricultural systems led by Rothamsted Research. There will be opportunity to run an additional experiment at Rothamsted Research North Wyke using the denitrification (DENIS) system to explore the controls that affect N2O consumption rates in soil.

Host institution and location:
Environment Centre Wales, Bangor University, Bangor, UK, with potential to conduct some experimental work at North Wyke, Rothamsted Research, Devon, UK.
Where the student will be trained in making measurements of subsurface GHG concentrations, 15N isotope techniques, enzyme- and 14C-based assays of C and N cycling in soil, 16S metabarcoding of microbial communities and data analysis.

Project leader / research supervisor:
Prof. Dave Chadwick, Bangor University, UK; and Southwest University, Chongqing, China; d.chadwick@bangor.ac.uk
Prof. Davey Jones, Bangor University, UK; and University of Western Australia, AUS; d.jones@bangor.ac.uk
Dr. Laura Cardenas, Rothamsted Research, UK; laura.cardenas@rothamsted.ac.uk

Preferred duration of research visit: 6 Months

Estimated grant amount for visiting student:
10,000 USD

Preferred dates for research visit: March 2020

22. Assessment of total denitrification, nitrous oxide emissions, and nitrate leaching in pasture soils with and without shelterbelts.

Keywords: Soil Carbon, Soil N2O

Brief project outline:
Nitrogen (N) is the major nutrient element that most strongly regulates plant production, but it is also identified as a key contaminant contributing to degradation of surface and subsurface environment in New Zealand agricultural systems through either the release of nitrous oxide (N_2O) or the leaching of nitrate down to subsurface or groundwater. Sharp increase in fertiliser N inputs since 1990s to grazed pastures in New Zealand has thus rekindled the debate on its impact on environment. The microclimate created by shelterbelts can have a substantial influence on N_2O emissions. Moreover, the presence of shelterbelts helps mitigate N leaching through plant N uptake and increased C/N ratios at shelterbelt boarders, which favours N immobilisation. The candidate will participate in the field and laboratory work to collect data on N_2O emissions in soils at various farms. This project is linked with sustainable farming funded project "Opportunities of Shelterbelt in pastoral Systems" looking into differences in soil C stocks and N_2O emissions on farms with and without shelterbelts.

Preferred student skills or experience:

- A good understanding of implications of added nitrogen on grazed farms
- Familiarity of dairy and beef farm systems
- Skills to follow good laboratory practices
- Problem solving, decision making and team player

Host institute and location:
School of Agriculture and Environment, Massey University, Palmerston North, New Zealand

Project leader / research supervisor:
Neha Jha (N.Jha@massey.ac.nz)
Marta Camps (M.Camps@massey.ac.nz)
Lucy Burkitt (L.Burkitt@massey.ac.nz)

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12000 USD

Completion date: End of 2020

23. Crop intensification through improved fertilizer application decision making in Ethiopia to face climate change impacts

Keywords: Crop

Brief project outline:
Agriculture in Ethiopia is confronted with soil fertility decline caused by nutrient mining and associated soil resource degradation. To address this problem, the Ethiopian Soil Information System (EthioSIS) flagship national program was established in 2012. EthioSIS aims at using cutting-edge digital soil mapping technologies to produce high-resolution soil maps and derive fine-tuned fertilizer type recommendations for agricultural regions in Ethiopia. The ultimate aim is to achieve increased agricultural productivity in Ethiopia in an economically viable and environmentally sustainable way. While the current EthioSIS soil maps have proven very useful to derive fertilizer type recommendations, they still have a too coarse spatial resolution and large uncertainties. ISRIC is engaged in a project to derive fine-resolution soil maps for selected woredas in Ethiopia and reduce the associated map uncertainties. Propagation of soil map uncertainty through crop yield models will be analysed too. In addition, the project aims to take uncertainty in soil and other environmental information (e.g., climatic and socioeconomic variables) into account for optimizing fertilizer recommendation and develop strategies for risk-aversive farmers. Such an approach enables to best capture variabilities at small farm holders' level and implement tailored decision support to enhance crop productivity, while addressing climate smart agriculture and reduce vulnerability to climate risks.

ISRIC welcomes a CLIFF GRAD PhD candidate competent in digital soil mapping and agronomy to apply for a research stay to work with the ISRIC team on the development and application of fine-resolution digital soil mapping methodologies and uncertainty propagation analysis of fertilizer recommendation strategies.

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

Estimated grant amount for visiting student: 12,000 USD

Preferred dates for research visit: May to October 2020

24. Improved soil carbon mapping in sub-Saharan Africa to support soil fertility studies

Keywords: Soil Carbon, Crop, Mapping

Brief project outline:
Globally, 1500 Pg of soil organic carbon (SOC) is stored in the first meter of the soil. This massive storage of SOC plays a major role in climate regulation. SOC is also an important indicator of soil quality and agronomic productivity, as it influences important soil and agronomic processes. SoilGrids (www.soilgrids.org) is one of ISRIC's flagship products that stores soil properties for the whole world at 250 m resolution. SOC is one of the most important soil properties currently mapped by SoilGrids, and is among others used to derive fertilizer recommendation strategies in sub-Saharan Africa. SoilGrids uses parametric regression models and machine learning (e.g. random forests) to derive soil properties from environmental covariates. An on-going ISRIC project aims to improve SOC maps for (parts of) sub-Saharan Africa by taking into account that the SOC observations used to train the statistical model are not error-free and are not all equally accurate. For instance, observations derived from proximal soil sensing are less accurate than wet chemistry laboratory observations, although the latter can have substantial errors too. How uncertainties in observations can be included in the machine learning models to improve SOC maps needs to be researched and tested.

ISRIC welcomes a CLIFF GRAD PhD candidate competent in digital soil mapping, machine learning and soil organic carbon variability studies to apply for a research stay to work with the ISRIC team on the advancement and application of digital soil mapping methods to improve the SoilGrids SOC maps for selected regions in Sub-Saharan Africa.

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: 4-6 months

Estimated grant amount for visiting student: 12,000 USD

Preferred dates for research visit: July to December 2020.

25. Mapping soil organic carbon change to support climate change mitigation

Keywords: Soil Carbon, Mapping

Brief project outline:
Globally, 1500 Pg of soil organic carbon (SOC) is stored in the first meter of the soil. This massive storage of SOC plays a major role in climate regulation, because the soil CO_2 flux is one of the biggest fluxes of the global carbon cycle. It is therefore crucially important to monitor and map SOC stock over time and quantify SOC stock changes and trends. ISRIC is involved in a project that maps the SOC stock in space and time using SOC observations from 1955 onwards and linking the space-time SOC observations to static and dynamic environmental covariates, such as vegetation indices, terrain and climate parameters, and land cover. Modelling is hampered by the fact that SOC temporal variation is small relative to SOC spatial variation and the limited number of observation locations repeatedly monitored in time. First results obtained for Argentina are promising but need improvement and extension to other parts of the world, among others developing countries. This is particularly relevant because SOC is not only an important driver of climate change but also a strong indicator of soil quality. Downward trends in SOC have a negative impact on soil fertility and hence crop yield and food security.

ISRIC welcomes a CLIFF GRAD PhD candidate competent in space-time modelling of soil organic carbon stock to apply for a research stay to work with the ISRIC team on the advancement of our space-time SOC modelling approach and application and testing of the model to a region in sub-Saharan Africa.

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

Project leader / research supervisor: Prof.dr. G.B.M. Heuvelink, Wageningen University and ISRIC, gerard.heuvelink@wur.nl)

Preferred duration of research visit: 6 months

Estimated grant amount for visiting student: 12,000 USD

Preferred dates for research visit: April to September 2020

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

Keywords: Soil CH4

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 the determination of 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.

Extensive grazing conditions of low-quality pastures is been associated with high greenhouse gas (GHG) emissions. Moreover, extensive systems result in the degradation of natural resources and low production parameters, making such cattle production systems less profitable and unsustainable in the long term. Methane (CH_4) is the main GHG by-product of rumen fermentation and constitutes a loss of energy (up to 18% of gross energy intake) for the animal. Supplementation strategies with legume forages that contain secondary metabolites and high protein content are known for reducing CH_4 production in cattle systems.

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

Project leader / research supervisor:
Dra. Paula Juliarena pjuliarena@exa.unicen.edu.ar
Dra. María Eugenia Priano mpriano@exa.unicen.edu.ar

Preferred duration of research visit: 5 months

Preferred grant amount for visiting student: USD 10,500

Preferred dates for research visit: May to September 2019.

27. Assessing the impacts of contourbased water harvesting technologies, soil water retention membranes and nutrient management options on soil organic carbon accumulation and greenhouse gas emissions from coarse-textured soils in Zimbabwe

Keywords: Soil Carbon

Brief project outline:
The use of field-edge contour based water-harvesting technologies (infiltration pits and tied contours) has the potential to reduce runoff, reduce soil erosion and increase water storage for use by crops for longer periods of time. However, in coarse-textured soils, which are characterised by high water and nutrient percolation rates, water-harvesting structures may not be sufficient to sustain crop productivity in rain-fed cropping systems. To address this shortfall, the integration of field-edge water harvesting techniques with subsurface water retention technology (SWRT) can be a solution. Yet, the integration of contour-based water-harvesting techniques, SWRT and organic and inorganic fertilisers can potentially result in an increase in greenhouse gas emissions. Bindura University of Science Education, The International Centre for Tropical Agriculture (CIAT), the Swedish University of Agricultural Sciences (SLU) and Michigan State University (MSU) will evaluate the effect of combining contour-based water-harvesting technologies, soil water retention membranes and different nutrient management options on soil organic carbon accumulation and greenhouse gas (GHG) emissions from coarse-textured soils in the Manicaland province of Zimbabwe.

During the visit the student will quantify GHG emissions from an on-farm field experiment in Zimbabwe - a new GRA member state.

Host institute and location: Bindura University in Zimbabwe

Project leader: Libére Nkurunziza, PhD, SLU, libere.nkurunziza@slu.se

Research supervisor: George Nyamadzawo, Professor, Bindura University, gnyama@yahoo.com and Dr Ngonidzashe Chirinda, PhD, CIAT n.chirinda@cgiar.org

Preferred duration of research visit: 6 months

Preferred grant amount for visiting student: 12,000 USD

Preferred dates for research visit: June to December 2020

RICE RESEARCH OPPORTUNITIES

28. Post-harvest management in rice paddy fields for carbon budget optimization

Keywords: Rice

Brief project outline:

CARBOCERT is a Spanish national project with two main objectives: 1) to determine agronomic measures for increasing carbon stock in the most representative Spanish crops and 2) to examine and analyse the existing soil carbon monitoring and quantification methodologies for verification of carbon offsets. In rice cultivation, straw and water management during the fallow season has important agronomic and environmental implications regarding not only the carbon budget but also crop productivity through its effects on soil quality and fertility. Straw return to paddy field after harvest has the potential to mitigate greenhouse gas emissions by increasing SOC stocks, but such an effect can be offset by large CH4 emissions. In the frame of CARBOCERT project, IRTA is conducting field experiments to 1) assess the effects of different post-harvest strategies during the fallow season on carbon stock and budget and; 2) develop statistical modelling approaches using machine learning techniques to predict changes in SOC stocks based agronomic and environmental factors.

IRTA welcomes a CLIFFGRAD PhD candidate competent in soil science, rice agronomy and/or modeling to apply for a research stay with our rice research team. According to the interests of the candidate and the scope of his/her PhD project, the student will be involved in the field experiments and/or modeling, as jointly agreed with the IRTA research team. The CLIFF GRAD project proposed here will contribute to the GRA Soil Carbon and Water Management Flagships and to the international initiative “4 per 1000”.

Host institution and location:

IRTA- Marine and Continental Waters Program

Project leader / research supervisor:

Dr. Maite Martínez-Eixarch, IRTA- Marine and Continental Waters Program,
maite.martinezeixarch@irta.cat

Preferred duration of research visit: 6 months

Estimated grant amount for visiting student: 12,000 USD

Preferred dates for research visit (must be before end of 2020): June to December 2020

29. The greenhouse gas emission potential of Sustainable Rice Platform (SRP) practices for sustainable rice cultivation

Keywords: Rice

Brief project outline:
Rice is one of the most important food staples that feed billions of people in the world . However, it is widely recognized that rice production, on one hand, is under increasing climate risks due to unpredictable climate variation and change. On the other hand, global rice production also produces around 10% of global methane emissions that contributes to global warming and results in faster climate change. Therefore, there is the need to cultivate rice in a sustainable way.
The Sustainable Rice Platform (SRP) co-convened by UN Environment and the International Rice Research Institute (IRRI) has established a standard for sustainable rice production. The SRP standard consists of 40+ requirements for all stages of rice production and covers areas such as protecting the environment, meeting requirements of food safety and food security as well as climate change adaptation and minimizing GHG emissions.

However, the overall GHG mitigation potential of the SRP practices has not been assessed in a comprehensive and transparent way. The student will quantify the GHG mitigation potential of all SRP standard requirements that have an impact on GHGs based on available literature. The student will then develop a template for GHG calculation of SRP practices that can support existing GHG calculator tools for rapid appraisals of SRP programs and projects.

Preferred student skills or experience:
- Basic knowledge about rice production
- Preferably understanding of agricultural GHG emission
- Experienced with excel or similar data management tool
- Independent and reflective thinking

Host institution and location:
International Rice Research Institute, Vietnam office, Hanoi

Project leader / research supervisor:
Bjoern Ole Sander (b.sander@irri.org), Bui Tan Yen (y.bui@irri.org)

Preferred duration of research visit: 6 months

Estimated grant amount for visiting student: 12,000 USD

Preferred dates for research visit: Start in first half of 2020

30. Assessing the economic and climate impacts of improved post-harvest practices along the rice value chain

Keywords: Rice

Brief project outline:
Post-harvest losses represent not only reduced income and food availability but also account for significant greenhouse gas (GHG) emissions. Poor post-harvest practices waste labor, land, water, fertilizer and energy which all generate unnecessary emissions for food that will never reach consumers. Improvements to post-harvest practices can be realized during harvesting, drying, storing and transportation. Besides the rice grain, straw can be a valuable product of rice farming that has a large impact on GHG emissions depending on different straw management practices.

Building on existing research that has produced data on the differences in losses of post-harvest processes, the student will conduct analyses to convert losses from post-harvest practices into equivalent GHG emissions and calculate the economic value of these losses and potential impact along the rice value chain (i.e. through new livelihood and income opportunities in the straw market). This environmental and economic cost-benefit analysis can assist decision-making at the individual and policy levels by identifying context-specific interventions that are feasible, cost-effective, and have a high environmental impact.

The student will identify the trade-offs associated with changing post-harvest practices to facilitate decision processes with the goal of reducing emissions, reducing food loss, and improving well-being. Additionally, gender and socio-cultural dimensions will be considered to identify barriers to behavior change for different groups. The research will involve secondary data analysis as well as some survey data collection in the field.

IRRI welcomes a CLIFF GRAD PhD candidate competent in quantitative analysis for calculating greenhouse gas emissions and economic variables.

Host institution and location:
International Rice Research Institute, Vietnam office, Hanoi

Project leader / research supervisor:
Dr. Bjoern Ole Sander (b.sander@irri.org) and Dr. Katie Nelson (k.nelson@irri.org)

Preferred duration of research visit: 6 months

Estimated grant amount for visiting student: 12,000 USD

Preferred dates for research visit: March to August 2020

31. Alternate wetting and drying (AWD) suitability mapping for selected rice growing regions in Thailand

Keywords: Rice

Brief project outline:
Rice production is an important agricultural sector of Thailand. With approximately 10 million hectares of rice-growing areas, Thailand produces more than 20 million tons of milled rice annually[2]. Rice is mainly grown in the northeast and the Central Plains of the country[3]. Most of rice lands in Thailand are rainfed (nearly 80% of total harvested area). Therefore, availability of rain water largely influences rice production of the country. Although climate conditions are suitable to grow three rice crops a year, water demand for rice cultivation is a significant concern and thus, the Thai government is urging water-saving practices in rice production.

Rice production is also a large source of methane emission. Thailand's rice-related greenhouse gas emissions were 35.6 Mt CO2e according to FAO. The actual emissions from rice fields vary depending on ecosystems, crop seasons, and management practices[4]. The Alternative Wetting and Drying (AWD) technology in rice cultivation is an innovative practice that can reduce irrigation water use by 15-30% and reduce around 50% of total methane emission from rice fields.
In order to support the dissemination of AWD in Thailand, suitable area for the technology must be identified.

Objective
The main objective of this study is to analyze bio-physical suitability and adoption capacity of AWD practice in different rice production regions in Thailand taking into account local specifics of natural, technical and social readiness of the regions.

Activities
1. Fine-tune bio-physical suitability evaluation:
    a. Identify priority regions from national AWD suitability maps
    b. Collect additional data from priority regions (e.g. higher resolution data)
    c. Develop high resolution biophysical AWD suitability map
2. Adoption capacity evaluation:
    a. Participatory evaluation of readiness of infrastructure, extension capacity, local perception and traditional cultivation practices in priority regions.
    b. Participatory classification of adoption capacity
3. Reporting and publication

Expected outputs
1. High-resolution biophysical AWD suitability maps
2. Participatory maps of AWD adoption capacity
3. A study report and/or scientific publication

[2] https://www.krungsri.com/bank/getmedia/f229bd87-0e17-42d3-a712-00ae07989ada/IO_Rice_2018_EN.aspx
[3] http://www.fao.org/3/y4347e/y4347e1o.htm

Timeframe

The study will be done in 6 months. Schedule of activities by month is summarized as below

Activity	**1st month**	**2nd month**	**3rd month**	**4th month**	**5th month**	**6th month**
1.Bio-physical suitability evaluation						
1.a,b Data collection						
1.c Refined suitability analysis						
2. Adoption capacity evaluation						
2.a Readiness for AWD						
2.b participatory classification						
3. Report, publication						

Host institution and location:
International Rice Research Institute, Vietnam office, Hanoi

Project leader / research supervisor:
Bjoern Ole Sander (b.sander@irri.org), Yen Tan Bui (y.bui@irri.org)

Preferred duration of research visit: 6 months

Estimated grant amount for visiting student: 12,000 USD

Preferred dates for research visit: Preferably start in first half of 2020

32. Temporal patterns of methane emissions from rice in the Vietnamese Mekong Delta: Impact of ambient meteorological conditions

Keywords: Rice

Brief project outline:

Previous field observations in rice fields have resulted in a very large range of methane emission rates – in some cases even varying within orders of magnitude over short distances or intervals. These variations can to some extent be attributed to inherent limitations of the methodology. Emissions are typically measured by the closed chamber method based on manual sampling procedures. In turn, the covered plot areas and exposure times are inherently limited in size and duration, respectively. Moreover, this approach creates somewhat different conditions inside the chamber as compared to outside.

The envisaged measurements of this study will record emission rates using closed chamber technique alongside with basic meteorological parameters, namely temperature, rainfall and atmospheric pressure that will be obtained with an automated meteorological station. In addition to correlation assessments of empirical data, the candidate will also conduct targeted experiments to assess the impact of weather patterns on actual emission rates. These additional experiments will encompass different approaches to assess emissions, for example with and without rainfall. The field experiments will be done over one entire rainy season which typically lasts from May to Sept.

The objectives of the scholarship are:

- Assessing statistical correlations between methane emission rates and ambient conditions, namely temperature, rainfall and atmospheric pressure
- In collaboration with an ongoing project, quantifying differences between dry and wet season methane emissions as well as differences in temporal emission patterns

Host institution and location:
International Rice Research Institute (in collaboration with Karlsruhe Institute of Technology, Germany), Vietnam

Project leader / research supervisor:

B.O. Sander (project leader)	R. Wassmann (supervisor)
Senior Scientist	Senior Scientist (in joint appointment by IRRI and Karlsruhe Institute for Technology, Germany)
B.Sander@irri.org	R.Wassmann@irri.org

Preferred duration of research visit (between 4-6 months): 6 months

Estimated grant amount for visiting student: 12,000 USD

Preferred dates for research visit: May to Oct. 2019

AGROFORESTRY RESEARCH OPPORTUNITIES

33. Assessing the impacts of contour- Integration of trees into farming systems to increase yield, resilience and carbon stocks

Brief project outline:
The Forest Investments Program's project has the objective of demonstrating soils and crops technologies that could increase yield, resilience and carbon stocks to smallholder farmers through the mobilization and investing of funds to reduce deforestation and forest degradation to financially benefit local communities. This will lead to emission reductions and the protection of carbon reservoirs as part of $REDD^{+}$ agenda. The project forms part of Ghana Investment Plan for the Forest Investment Program. The project supports;

- ✓ Restoration of degraded agricultural landscapes
- ✓ Climate smart agriculture
- ✓ Livelihood improvement
- ✓ Capacity building

The selected candidate will be sampling from two experimental plots established in the Western region at Sefwi Boako and Sefwi Ahwiaso on two contrasting soils amended with biochar, cowdung and a control un-amended treatment. The samples will be fractionated to determine mean width diameter (MWD) to assess soil structural stability. Maize and cowpea yield data will be collected from established experimental plots. The candidate will describe current management practices and devise best-bet Integrated Soil Fertility Management (ISFM) options and quantify on-farm biomass and identify potential from highest users. The CLIFF GRAD project proposed here will contribute to the GRA Flagship Programme: "measurement and mitigation of agricultural greenhouse gas emissions or carbon storage in agricultural systems relevant to developing countries, including in the context of enhancing food security;" through enhancing crop productivity following agro-ecological principles and enhancing soil C stocks. The FIP project is being implemented by the Ministry of Lands and Natural Resources (Forestry Commission) with key partners from Crops Research Institute (CRI), Soils Research Institute (SRI) and Forestry Research Institute of Ghana (FORIG).

Preferred student skills or experience:

- The candidate should be competent in soil science
- Familiarity with soil fractionation to determine aggregate stability will be an advantage
- Good ability to work with excel
- Independent and reflective thinking

Host institution and location: SRI, Kwadaso Municipality, Ashanti region, Ghana.

Project leader: Dr. Edward Yeboah (PhD), eyeboah5@hotmail.com

Preferred duration of research visit: 5-6 months

Preferred dates for research visit: August to December, 2020

Preferred grant amount for visiting student: 12,000 USD