# GRA Flagship on Agricultural GHG Inventories

## Context and problem definition

With increased obligations for reporting on GHG emissions and Nationally Determined Contributions (NDCs) under the Paris agreement, it is important that all countries are able to estimate their GHG emissions to maximise transparency, accuracy, completeness and consistency. However, there are many issues that are preventing countries to be able to do this:

- Improving inventories requires enhanced national **capability and capacity** to gather and use relevant activity data and combine them with default and, as necessary and available, country-specific emission factors. However, many countries do not have the capability to improve their Inventory. The Inventory Flagship will aim to increase global capability and therefore capacity in the area of developing improved inventories.
- Methods and guidelines are available for countries to use to develop their own Inventories, but these are often not taken up. Understanding the **barriers to adoption** is important so that solutions can be found. This flagship will investigate what these barriers are, propose solutions, and where possible implement these solutions.
- Many countries do not have country specific information they can use to develop their inventory and yet others have a lot of data. In many cases information may be common among countries, but there is no ability, or there are barriers, to the **sharing of knowledge**. This flagship will support the sharing of existing data by utilising existing tools and supporting the development of new knowledge sharing avenues. Note that the development of new country specific data is out of scope of this flagship and is covered by the other flagships.
- Many countries have concerns that improvements may not be accepted by formal international review teams. The **sharing of experience and knowledge**, and working together on improved methods can help ensure that methods used follow good practice and represent best international science.

There are already a lot of organisations working in this area, and it will be important that activities under this flagship align with other initiatives wherever possible. It is important that the gaps are identified, and where the Inventory flagship activities can add value to already existing work, rather than repeating it.

## Fundamental principles underlying the Agricultural GHG Inventory Flagship

- Unique GRA added value – utilise knowledge & expertise of 47 member countries and partners
- Inclusive – must give opportunities for all members to be engaged in some way, availability of funds should not be a barrier to participation
- Relevant – all Members need to have benefit from some or all of the Flagship, i.e. something in it for everyone
- Solution focussed – clear link to the development and implementation of mitigation practices/technologies
- Multifaceted – address greenhouse gas mitigation and/or soil carbon sequestration along with co-benefits and synergies for livelihoods & adaptation; supportive of policy needs
- Increase capacity/capability of member countries
- Supplement and support existing efforts by Member countries and Partners

| **Enhancing inventory *structure*** | **Building *capability*** | **Acquisition and administration of *data*** | **Demonstrating *mitigation* in NDCs** |
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| *For example:*<br>• ***Regional*** and source-specific guidance for the development of advanced inventories<br>• ***Tier 2 i****nventory development – utilise expertise and experience of GRA Members*<br>• ***Guidance*** for development and adoption of modelling approaches (i.e. Tier 3) for specific sources within inventories | *For example:*<br>• ***Analyses*** of current methodologies for estimating GHG emissions adopted in national GHG inventories by source, barriers to adoption of advanced methods and experiences of countries in adopting advanced methods (networks and reports from international workshops, technical and summary papers)<br>• **Identification** of training needs; country-specific guidance and training needs developed jointly with countries.<br>• ***Delivery*** of targeted technical training to improve emission factors and design inventories that work with existing national and regional data sources. | *For example:*<br>• ***Incorporation*** of improved emission estimates in emissions databases (e.g. IPCC-EFDB, GRAMP, SAMPLES, MAGGnet) and activity databases.<br>• ***National*** and regional research projects that validate existing measurements and identify and ***validate*** approaches (measurements and modelling methodologies) to reduce the emissions intensity of food production and ensuring that those gains can be captured in inventories.<br>• ***Dissemination*** of improved estimates of GHG emissions developed from regional and national projects to inform the development and verification of methodologies by the IPCC and other inventory support mechanisms | *For example:*<br>• ***Provide*** targeted support for countries for designing agricultural *monitoring, reporting and verification (MRV)* within NAMAs or Low Emissions Development pathways based on improved inventories |

## This initial Flagship consists of a series of concepts that can be developing into proposals

Concepts are to leverage existing resources including existing data, existing projects, existing expertise and experiences, to build a project that will bring in other existing or new resources to address an issue of improving inventories and/or improving usefulness of improved inventories

Concepts that receive interest of potential support from the GRA community of Members and Partners will be developed into more detailed proposals for formal resourcing consideration. The final leaders of the project will be decided at the proposal stage to best match expertise and willingness with the scope and boundaries of the project and the requirements of supporters.

## Current Concepts under the Flagship

**Ready for consideration**

1. 'Best practice' guidelines for incorporation of mitigation into national inventories.
2. Guidance on Inventory Tiers
    a) Developing guidance for good implementation of higher Tier methods in national inventories
    b) Developing guidance for good implementation of Tier 3 models in national inventories
3. Database and Inventory Refinement for GHG Emissions associated with Manure and Nitrogen Management
4. Developing guidance for improving emissions from manure management in national inventories
5. Towards a national livestock methane database project
6. Identifying emissions and mitigation options by mapping analogous production systems
7. Establishment of GHG measurement, mitigation, adaptation and inventory Centre in West Africa.

Still under development to include pathways for engaging other Members/Partners

8. Quantification of GHG emissions from growing and fattening systems for beef production in sub-humid central area of Argentina
9. Validation of SF6 tracer technique modified for longer collection period for grazing animals on extensive management. Current funding: IPCVA, INTA

## Concept 1

**Title**: 'Best practice' guidelines for incorporation of mitigation into national inventories.

**Leader**: Person X, Country Y

**Countries involved**: tbc

**Brief description:** Guidance will be developed that identifies how to approach the incorporation of mitigation practices and technologies into agricultural GHG inventories:

- Fit mitigation into existing inventory structure; or
- Re-structure inventories so that their structure is driven by needs of a diverse range of potential mitigation technologies; and
- Re-examine data requirements and data sources; and
- Obtain clarity on the level of 'proof' needed for a technology to be recognised as mitigating emissions, i.e., scientific basis - empirical evidence, in vitro vs. in vivo or modelled results.

Guidance will consist of a complication of country experiences in incorporating mitigation into inventories, and develop guidance for a suite of indicative mitigation practices and technologies, relating to different types of agricultural activity, e.g.:

- Administering dietary additive to livestock:
    - Need to know duration and size of effect;
    - Need to know quantity of product administered;
    - Need to know when they are used or make crude assumptions about timing of administration (e.g. 70% in first 100 days of lactation, 30% in second 200 days lactation)
    - Estimate emission reduction based on proportion of cows receiving bolus at particular times of the year & CH4 production at these times
    - Need a monthly time step to obtain maximum benefit
- Novel forage type
    - Need area sown, yield, duration of effect in space and time, species grazing herbage
    - Estimate emission reduction based on proportion of animals grazing forage & proportion of high sugar grass in diet in both space and time
    - For maximum benefit may need a spatial component to define area where it is an effective mitigation tool + spatial allocation of livestock species + monthly time step
- High feed conversion efficiency animals
    - Need to know number of animals with trait, how trait is expressed, productivity & size & diet of animals with trait, location of animals with trait?
    - Estimate emission reduction based on proportion of animal with trait and their productivity & proportional reduction in intake
    - For maximum benefit may need monthly time step + comprehensive temporal disaggregation of animal population + distribution in space and time
- Application of product to soil
    - Need to know area applied, when applied, how often applied, effectiveness as mitigation of target gas (es), period of time of efficacy, response of pasture (feedback to DM

production) to product, etc.

- Spatial disaggregation of inventory, monthly time step, other factors, e.g. pasture response curve, precipitation, etc.

**Key partners and existing resources/projects:** GRA Members, CGIAR-CCAFS, IPCC TFI and EFDB,

**Benefits and contribution to flagship:** Incorporation of mitigation poses a severe challenge for current inventories. Mitigation needs should become a major driver for inventory development and countries would benefit from the development of international standards and protocols. The current situation generates considerable uncertainty in whether mitigation practices or technologies will be accepted in GHG inventories due to the fact that data requirements potentially very demanding and may come from a wider range of sources, UNFCCC Inventory reviewers do not get specific guidance for making decisions on accepting mitigation practices or technologies - simply have to consider scientific evidence and data. There will also be variation between reviewers. Therefore it would be helpful to have a reference point for process.

In time, guidance could be endorsed by IPCC and/or UNFCCC, but in the short term at least provides countries with guidance on how to approve inclusion in inventory, based on GRA 'consensus' and past experience of member countries.

**Resourcing needs:** Dedicated person (coordinator) to take charge of producing the guidance. In-kind contributions from Members to provide experiences in incorporating mitigation into inventories, and develop guidance for the suite of indicative mitigation practices and technologies.

**Resourcing mechanisms:** Post-doctoral award to support the database coordinator. In-kind contributions by countries involved to support dedicated country contact points.

## Concept 2 A.

**Title:** Developing guidance for good implementation of higher Tier methods in national inventories

**Leader: Person X, Country Y**

**Countries involved: tbc**

**Brief Description:** The primary product will be a document or series of documents targeted for researchers and inventory practitioners familiar with Tier 1 methods but who are planning to move to higher Tiers. The document(s) describes principles for sound practice for moving from Tier 1 and implementing Tier 2 and Tier 3 methods for GHG emissions and/or removals. It will cover decision processes for implementation and sound practice for transparency, accuracy, consistency, completeness, and comparability. The document will make extensive use of case studies and examples of moving from Tier 1 to higher Tiers including advice on activity data gap filling and selection of appropriate emission factors. Individual countries offer input and agree to discuss the sound practice. Dedicated writers and editors may be provided to improve development and usability of the document. The document can be written in sections. The first sections could be provided within a year of starting the activity. Scientific papers regarding particular scientific aspects such recommended procedures for validation, comparability, and uncertainty estimation would expand the scope and allow the work to inform IPCC processes. The scope could be large and complete, or confined to some specific gases and sources, such as enteric methane emissions.

As inventories are estimated and compiled by task forces beyond the research community, training activities for inventory developers and compilers will be carried with a regional focus, to favour the adoption of recommended practices. This will further improve the representation of documents and examples generated within this activity.

**Key partners and existing resources/projects:** GRA Members, CGIAR-CCAFS, FAO, IPCC, UNFCCC, IPCC TFI and EFDB

**Benefits and contribution to flagship:** There is a need for guidance regarding what is required to have sound practice among these countries for transparency (e.g. what needs to be open for inspection), accuracy (e.g. . validation principles), consistency (i.e. combining data from multiple experiments to produce set of consistent emission factors), completeness (e.g. developing comprehensive activity data for higher tier for specific emissions or removals), and comparability (e.g. comparing emission factors with other countries and with EFDB). Methods for estimating the uncertainty of higher tiers and model estimates are also needed. Countries will benefit by having an internationally vetted sound practice that fits a range of national circumstances and they will be better able to make decisions on how to implement Tier 2 or Tier 3 methods for key emissions or removals categories. Reviewers will benefit because they have a better idea of what can be reasonably expected for sound implementation of higher tiers in a national inventory.

**Resources needs:** In-kind (several weeks to several months of professional time per country). 1 year). Travel to several multi-day meetings would be useful.

**Resourcing needs:** Dedicated person (coordinator) to take charge of producing the guidance as well as

dedicated writers/editors for the documents. In-kind contributions from national inventory practitioners and GHG modellers to provide experiences in Tier 3 methodologies.

**Resourcing mechanisms:** Post-doctoral award to support the coordinator. In-kind contributions by countries involved to support dedicated country contact points.

**Concept 2 B.**

**Title:** Developing guidance for good implementation of Tier 3 models in national inventories

**Leader: Person X, Country Y**

**Countries involved: tbc**

**Brief Description:** The primary product will be a solution-focused document or series of documents aimed at researchers and inventory practitioners who are well-grounded in Tier 2 methodology. The documents describes principles for sound practice for implementing Tier 3 model for GHG emissions and/or removals. It will cover decision processes for implementation and sound practice for transparency, accuracy, consistency, completeness, and comparability. The document will make extensive use of case studies and examples of moving to Tier 3, including advice on developing defensible activity data for model input. The document can be written in sections. The first sections could be provided within a year of starting the activity. Scientific papers regarding particular scientific aspects such recommended procedures for validation, comparability, and uncertainty estimation for process models would expand the scope and allow the work to inform IPCC processes. The scope could be large and complete, or confined to some specific gases and sources, such as direct $N_2O$ emissions from the soil.

As inventories are estimated and compiled by task forces beyond the research community, the project would include facilitation of networks involving both researchers and inventory practitioners. Networks would be developed around particular models, sources, and/or issues (e.g. uncertainty analysis, treatment of inter-annual weather variation, appropriateness of subnational calibration, etc.). The networks would be required to produce summary documents of experiences, recommendations, and results form joint actions/projects arising from the networks.

**Key partners and existing resources/projects:** GRA Members, CGIAR-CCAFS, FAO, IPCC, UNFCCC, IPCC TFI, GRA projects (GRAMP, MAGGNET), Concept 2 A. Moving to higher Tier methods

**Benefits and contribution to flagship:** There is a need for guidance regarding what is required to have sound practice among these countries for transparency (e.g. acceptability of "black-box" models), accuracy (i.e. validation principles), consistency (e.g. parameterization/calibration principles), completeness (e.g. decision about when to use or not use a model versus Tier 2 for specific emissions or removals), and comparability (e.g. what should be reported to compare with other methods and/or model applications in other countries). Methods for estimating the uncertainty of model estimates are also needed. Countries will benefit by having an internationally vetted sound practice that fits a range of national circumstances and they will be better able to make decisions on how to implement Tier 3 models for key emissions or removals categories. Reviewers will benefit because they have a better idea of what can be reasonably expected for sound implementation of higher tiers in a national inventory.

**Resources needs:** In-kind (several weeks to several months of professional time per country). 1 year). Travel to several multi-day meetings would be useful.

**Resourcing needs:** Dedicated person (coordinator) to take charge of producing the guidance as well as dedicated writers/editors for the documents. In-kind contributions from national inventory practitioners and GHG modellers to provide experiences in Tier 3 methodologies.

**Resourcing mechanisms:** Post-doctoral award to support the coordinator. In-kind contributions by countries involved to support dedicated country contact points.

## Concept 3.

**Title**: Database and Inventory Refinement for GHG Emissions associated with Manure and Nitrogen Management

**Leader**: Person X, Country Y

**Countries involved**: GRA Countries (5 European and New Zealand) but has global relevance and could be opened up to a wider group of participants

**Brief description:** This activity will develop a central database of emission factors ($CH_4$ and N emissions) for complete manure management and N excretion chains associated with different livestock production systems. Disaggregated emission data, emission factors and activity data will be collected from project partners, associated GRA partners and from peer-reviewed literature. The database will be interrogated to produce statistical relationships between activity and GHG emissions, providing information on climatic, management and other abiotic drivers. The new information generated will allow countries using Tier 1 emission factors to upgrade inventories by using third party datasets from countries with similar production systems, soils and climate, as long as adequate activity data is available. Apart from contributing to wider utilisation of higher Tier methodologies, this activity will also ensure that the impact of manure management and N fertiliser abatement strategies on emissions are reflected in national and farm-scale inventories. The refined emission factors could also be used to enhance farm-scale decision support and emissions accountancy tools.

**Key partners and existing resources/projects:** Project partners from GRA countries, as well as associated GRA partners, IPCC, FAO, Eurostat, TFRN, GRA-LRG Manure Management Network, RAMIRAN

**Benefits and contribution to flagship:** Strongly supports policy needs via contribution to improved national inventories and monitoring, reporting and verification of emissions; develops capability; relevant to multiple countries; utilises and builds on existing resources; tangible product produced, contributes to other international processes (IPCC).

**Resourcing needs:** Dedicated person (coordinator) to coordinate the database development. Staff/PhD student in each partner country to consolidate and interrogate available datasets and conduct statistical modelling.

**Resourcing mechanisms:** Fundraising.

**Linkages:** *Identify planned or existing activities from within or outside the GRA where there will or could be linkages in terms of sharing of resources, knowledge, data, and/or delivery of output.*

## Concept 4.

**Full Title:** Developing guidance for improving emissions from manure management in national inventories

**Leader: Person X, Country Y**

**Countries involved: tbc**

**Brief Description:** The primary products of this activity will include

1. Series of documents describing the key areas to be considered for the improvement of manure management emissions estimation (both $N_2O$ and $CH_4$), from relevant animal species. This will include decision trees development, activity data gap filling and advances in emission factors development. These documents will be provided in different languages to favour it use by national inventory compilers or task forces (years 1 and 2).
2. Database (excel type) compiling relevant aspects for the estimation of manure management emissions, including methane conversion factors under different climates or manure (year 1) management systems and N excretion values, among others. This data base will be available for all countries, with more suitable default values available for specific national conditions
3. Scientific papers in specific issues (comparability analysis or meta-analysis could be further elaborate based on the previous information) (years 2-3). This will also highlight gaps in knowledge in this area
4. Scientific projects to be develop further in time (years 3-4) to cover gap areas

As inventories are estimated and compiled by task forces beyond the research community, training activities for inventory developers and compilers will be carried with a regional focus, to favour the adoption of recommended practices. This will further improve the representation of documents and examples generated within this activity.

**Key partners and existing resources/projects:** GRA Members, FAO, IPCC TFI and EFDB, GRA-LRG Manure management Network, RAMIRAN (European manure scientific network), Manure South (Latin American manure network), Latin American network of Inventory Compilers

**Benefits and contribution to flagship:** This activity will compiled available information to improve the estimation of $CH_4$ and $N_2O$ emissions from manure management, for different animal species and manure management practices. It will produce practical guidelines for this improvement oriented to national inventory compilers or task forces, in different languages. The scientific papers to be generated will contribute to IPCC guidelines improvement process. The research projects will further enhance available information on emissions from manure management systems/animal species/regions still little developed.

**Resources needs:** In-kind (several weeks to several months of professional time per country). Funding for travel to several multi-day meetings (regional workshops) and for open access publication of scientific manuscripts will be also required. Also funding for documents layout and translation, prior to publication will be required.

**Resourcing needs:** Dedicated collaborators and participants will be required, both to lead this activity and to compile information and documents. Statistician to further analysed compiled data (from data base)

would be useful to produce scientific outputs.

**Resourcing mechanisms:** Post-doctoral award to support the coordinator. In-kind contributions by countries involved to support dedicated country contact points would be essential. For research projects international calls could be used.

## Concept 5.

**Full title:** Towards a national livestock methane database project

**Leaders:** Claudia Faverin & Patricia Ricci (INTA Balcarce, Argentina)

**Countries involved:** Argentina (at the moment, but open for all members)

The measurement of methane emissions from grazing livestock is a relatively new topic in Argentina. However, information about beef production systems and diets are usually generated in national research, development projects or extension services by different public and private institutions. There is a need to count with a repository where information could be preserved and used for short-, medium- and long-term analysis contributing to improve the national inventory and detect knowledge gaps. The objective of this project idea is the construction of a database template prototype for one of the most important region in Argentina (Flooding Pampas) for the beef cow-calf operation. Decisions about database structure and data management requirements are necessary to develop a national metadata in the future, not only including diet characterization but also measured methane values. The prototype could be developed with the information of projects and individual experiments focused on ruminant nutrition and production systems. A glossary will be developed with a description of the variables included in the database which could be used to extrapolate the methodology to other regions in the future. Participative methodology will be applied for the construction of the database structure inviting to researchers involved in the national GHG network (REDGEI) to participate. After that the database will be created and completed with local data.

**Benefits:** Available information from projects and individual trials from beef production systems will be organized to improve the national inventory and explore regional mitigation options. It could be applied in other regions and countries.

**Resourcing needs:** A System Engineer to take charge of the database development and maintenance and a postgraduate fellow to collaborate in the data collection.

**Resourcing mechanisms:** Team to create and complete the database

**Key partners and existing resources/projects:**

- INTA (National Institute of Agricultural Technology, Argentina).
- Animal science researchers in Argentina have created an Inter-institutional Network of Greenhouse Gas (GHG) Emission from Livestock **(REDGEI** in Spanish) involved researchers from different institutions such as University of Buenos Aires **(UBA), ** National University of the Centre of Buenos Aires Province **(UNCPBA**, Faculty of Veterinary Science, and Faculty of Physics), **CONICET**, **AACREA** and **INTA**.

**Concept 6.**

**Title**: Identifying emissions and mitigation options by mapping analogous production systems

**Leader**: Lini Wollenberg, CCAFS

**Countries involved**: Global; could also be tested at country and regional levels

**Brief description:** This activity will identify the spatial domain of major livestock, crop and paddy rice systems production systems globally to enable extrapolation of emission data and mitigation options from one site where robust data exist to larger areas. Analysis will (1) review available production system classifications, environmental data and maps, (2) use existing emissions and mitigation options data to construct profiles of representative production systems, testing the scale of classification for variability and uncertainty, (3) use statistical techniques to upscale profiles to larger spatial domains, and (4) identify where major gaps occur and more research is needed. This information would be used to identify areas where common emission factors or mitigation measures can be used to reduce the costs of estimation. One post-doc would be needed for each of livestock, crop and paddy rice systems and be based with organizations having expertise in modeling that sub-sector. The work is intended to be global, but could also take place at country or regional levels. Final output will be a spatial dataset and maps, and up to three co-authored papers.

**Key partners and existing resources/projects:** CSIRO, Wageningen University, U. Aberdeen, CG centres

**Benefits and contribution to flagship:** Strongly supports policy needs via contribution to improved national inventories; develops capability; relevant to multiple countries; utilises and builds on existing resources; tangible product produced, contributes to other international processes (IPCC).

**Resourcing needs:** Dedicated person (coordinator) 25-50% to lead 1-3 post-doctoral fellows

**Resourcing mechanisms:** Fundraising.

**Linkages:** This work will have linkages with the yield-gap atlas of WUR, livestock production modeling by IIASA, FAO and CSIRO, spatial databases of AFSIS, and others**.**

**Concept 7.**

**Title**: Establishment of GHG measurement, mitigation, adaptation and inventory Centre in West Africa.

**Leader**: TBC

**Countries involved**: TBC

**Brief description:** Building on the successful GRA training workshops held in Africa over the last few years, it is proposed that a teaching and training centre is developed in Ghana. It will seek to enhance animal productivity in the sub-region with minimal environmental carbon footprint with the long-term impact on food security and capacity building of scientists, students and policy makers in the measurement, mitigation and adaptation to the changes in climate.

The Centre will be established on a 2-hactare arable field at the Department of Animal Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

The centre will carry out:

- Training on GHG measurement – due to the type of farming systems in the sub-region, the centre will mainly focus on the use on the Sulphur hexafluoride (SF6) technique Other techniques like the respiratory chamber, GreenFeed and Micromet techniques will be considered for teaching and training purposes.
- Inventory - The centre will focus on generating country specific data (Tier 2) for the West African sub-region. Data will be generated on feed intake, digestibility, weight gain and methane emission per unit feed intake or product to feed into the TIER 2 approach according to the IPCC guidelines.
- Mitigation and adaptation through forage development and animal breeding
- Project sustainability – supply and host training to scientists and policy makers on measurement, mitigation, adaptation and GHG inventory and GHG studies in Africa. The centre will serve as a nucleus animal and forage bank where improved and drought tolerant forages and heat tolerant breeds will be sold to National Research stations in the sub-region and farmers as well.

Outcomes

(1) Capacity of African scientists is enhanced to adapt innovative and proven GHG emissions measurement techniques in their research.

(2) Participating scientists in any training workshop acquire relevant skills to measure and quantify emissions of GHG and contribute to the development of GHG database in their respective countries.

(3) Partnerships and networks are established among scientists and policy makers and an avenue created to address GHG emissions from agricultural production, mitigation and adaptation strategies for Africa.

**Key partners and existing resources/projects:**

**Benefits and contribution to flagship:**

**Resourcing needs:**

**Resourcing mechanisms:**

**Linkages:** *Identify planned or existing activities from within or outside the GRA where there will or could be linkages in terms of sharing of resources, knowledge, data, and/or delivery of output.*

## Concept 8.

**Title**: Quantification of GHG emissions from growing and fattening systems for beef production in sub-humid temperate climates

**Leader**: Jorge Martinez Ferrer (National Institute of Agricultural Technology, Argentina - INTA from now onward)

**Team:** Carolina Alvarez (INTA), Florencia Garcia (National University of Cordoba/ National Council of Scientific and Technical Research, Argentina), Nestor Latimori (INTA)

**Countries involved**: Argentina (at the moment, but open for all members).

One product could be a synthesis paper involving research from several countries that describes the important factors that affect various emissions to help countries decide on a factor for their conditions and to better prioritize future research.

**Brief description:** The objective is to quantify GHG emissions from different beef production systems. In Argentina, two activities are schedule to start in 2017. One of them is to evaluate four growing and fattening systems: two pasture-based, one concentrate-based and one that combines both pasture and feedlot phases. These feeding schemes are designed to obtain animals with different slaughter weights aiming to target different consumers preference (either domestic or for export beef products). Methane emissions will be estimated seasonally with the $SF_6$ tracer technique. The other scheduled activity is to evaluate methane and nitrous oxide soil emissions from cropping areas (for animal feed) and from pastures, also comparing typical pasture and feedlot-based systems. GHG will be measured from soils with or without urine and dung patches using statics chambers in an alfalfa pasture and in pens where animals are fed. Measurements will also be made from soils destined for a corn crop, harvested either for grain or for whole crop silage production. This project aims to generate local information of GHG emissions from the animal and from the soil, in growing and fattening systems, and to set a standpoint for further evaluation of strategies to reduce both methane and nitrous oxide (long term).

**Product:** Synthesis paper describing important aspects that affect emission factors from beef production systems, involving research from several countries.

**Benefits:** Available information from different systems for beef production, for regional and national decision-making. Collecting these data from a variety of systems from different countries would allow improving local estimation of emission factors. On the other hand, would facilitate the comparison of these local emission factors, as the methodology implemented would be the same.Contribute with data to determine local $Y_m$ to improve national inventories and regional mitigation potential measurements. Evaluation of potential impact of mitigation strategies. This would help countries to decide on a factor for their specific conditions and to better prioritize future research.

**Existing resources/projects:** Team responsible for the design and carry on the experiments, actually founded by INTA and IPCVA (Institute for Promoting Argentinean Beef Meat). INTA also provides on-farm facilities, animals, feeds, machinery and technicians.

**Resourcing needs:** More field and laboratory equipment to allow the evaluation of a larger number of animals and different field conditions.

## Concept 9.

**Title**: Validation of SF6 tracer technique modified for longer collection period for grazing animals on extensive management. Current funding: IPCVA, INTA

**Leader**: Patricia Ricci, INTA Balcarce, Argentina

**Countries involved**: Argentina (at the moment, but open for all members)

**Brief description:** Individual methane production (MP) from grazing animals is typically measured with the SF6 tracer technique in 24hs collection periods. A modification of the original method has been proposed; where a different canister and airflow restrictor is used allowing an extended sample collection period (5 continuous days). The aim is to allow animals to graze extent rangelands. Validation of this method was performed indoors. However, under grazing conditions previous experiments have shown deviations from expected results when the traditional (24hs) vs. modified method (5 days) were used. This project has the aim to validate the modified SF6 method for longer collection periods under grazing conditions, and compare both against respiration chamber (RC) measurements. A running experiment in Argentina will begin the validation with 20 backgrounding grazing steers in September 2017. Each animal will be equipped with the traditional and modified SF6 equipment. Afterwards, measured animals will enter to RC. Collaboration with other countries will be relevant to increase data collection and validating the modified technique under different type of animals and feeding conditions.

**Benefits:** a validated SF6 technique with longer sample collection periods, will contribute easiness and flexibility for MP measurements mainly in areas physically restrainged for cattle managing and gathering (i.e. large extension of rangelands, native forests, mountains). This method will allow measuring MP from ruminants on diverse agroecosystems, most of them unmanaged and from which no such information exists. It will also contribute local $Y_m$ data to improve national inventories and regional mitigation potential measurements.

**Resourcing needs:** Dedicated person (coordinator) to take charge of the experiment coordination if other GRA members adopt the project. Complementary equipment for MP measurement as well as human resources to continue with subsequent experiments. Resources (funded time) for each country contact point, one of whom will lead the project (and needs to be resourced to do so), to identify, obtain and submit data to the database and contribute to the co-authored paper.

**Resourcing mechanisms:** LEARN post-doctoral award to support the database coordinator. In-kind contributions by countries involved to support dedicated country contact points.

**Key partners and existing resources/projects:**

- INTA (National Institute of Agricultural Technology, Argentina). Includes on-farm facilities, animals, feeds, machinery and technicians.
- IFASS (Institute of Environmental Physics … UNCPBA). Includes SF6 lab, CG, etc.
- IPCVA (Institute of Promoting Argentinean Beef Meat). Main project funding.