The Global Research Alliance on Agricultural Greenhouse Gases

An opportunity for international Collaboration

The Global Research Alliance on Agricultural Greenhouse Gases (GRA)

- Proposed in 2009 by New Zealand
- Development in partnership with the Un States
- 21 countries at COP15 in Copenhagen endorsed a Joint Ministerial Statement t Establishment of the GRA
- After 2 senior officials meetings, a chart is ready for final government approval th June in Rome
- Currently there are 33 country members and 2 country “observers”
- Members are countries; the charter provides for Partners such as universities, research institutions, NGOs, consortia, etc.

COP15
COPENHAGEN
UN CLIMATE CHANGE CONFERENCE 2009

Goal: Reduction in net greenhouse gas emissions from agricultural systems around the world.

The Global Research Alliance on Agricultural Greenhouse Gases
in brief

- Understand GHG emissions from agriculture
- Improve measurement and estimation of GHG emissions and C sequestration
- Develop ways to reduce emissions
- Develop ways to increase C sequestration
- Mitigate GHGs while sustaining or enhancing productivity and resilience as climate changes
- Transfer new knowledge and technology to farmers/land managers worldwide
- Build scientific capacity in developing countries via partnerships

Current Members
May 20, 2011

- Argentina
- Australia
- Canada
- Chile
- Colombia
- Denmark
- Finland
- France
- Germany
- Ghana
- India
- Indonesia
- Italy
- Ireland
- Japan
- Malaysia
- Mexico
- Netherlands
- New Zealand
- Norway
- Pakistan
- Peru
- Philippines
- Russia
- South Africa
- Spain
- Sweden
- Switzerland
- Thailand
- United Kingdom
- United States
- Uruguay
- Vietnam

Benefits of the Alliance

- **Identify information and technology needs, which vary among countries.**
- **Coordinate and leverage scarce research resources.**
- **Highlight the need for increased investment in mitigation research.**
- **Research capacity building in developing countries.**
- **Information and technology transfer.**
- **International public-private partnerships.**

Basic Structure:
Multiple International Research Projects

Crop Systems

Paddy Rice

Livestock Systems (Intensive and Extensive)

Cross-cutting Group Issues

- **C & N cycling (in soils) F, AUS**
- **Improvement national inventories CA**
- **LCA/C-footprints NL**
- **Protocols for measurement methods:**
  - **communication via website on this to identify overlaps**
  - **Systems approach: integrated agriculture mid term priority for an additional stocktake**

Overarching Issues

Data management, sharing

Measurement and estimation

Outreach, technology transfer

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- Crops (USA)
- Paddy rice (Japan)
- Livestock (New Zealand, The Netherlands)
- NZ & NL
- Cross-cutting: Carbon & nitrogen cycles (soils) (France, Australia)
- Cross-cutting: Improvement of national GHG inventories (Canada)
- Cross-cutting: Lifecycle analysis, carbon footprints (the Netherlands)

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First major task related to soil carbon and nitrogen

- Develop recommendations for and test models for carbon and nitrogen fluxes from soils under diverse agricultural systems, climates, etc.
- Develop appropriate databases for model development and validation
- Step 1: take stock of what countries are doing and what they can offer

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Soil Carbon & Nitrogen Cycling Cross-Cutting Workshop

Model stock-take

Name: Sabine Grunwald, Keith Paustian, Stephen Ogle

Group: University of Florida, Colorado State University, USDA

Country(ies)-U.S.A.

Model stock-take (1/3)

Model type (1)	Model name	Peer-reviewed references (e.g. XX et al. AGEE, 2000)	Applicability, range of the model (2)	C and N cycle outputs (3)
Geostatistical, (based on VNIR measurements and library, LU/LC, climatic/hydrolic gradients)	?	1. Vasques G.M. et al. 2010. Geoderma 156: 326-336. 2. Vasques G. et al.. 2010. Soil Sci. Soc. Am. J. 74: 870-879. 3. Vasques G.M. et al. 2010. J. Environ. Qual. 39: 923-934. 4. Vasques G.M. et al. 2009. Soil Sci. Soc. Am. J. 73: 176-184.	In development	Labile, recalcitrant, total C
Process-based	Century, Daycent	Numerous	Mainly just the top 30 cm, validation mostly from Western US, developing model for deeper soils, biofuels	All

Model stock-take (2/3)

Model type (1)	Model name (1)	Data type used for calibration (2)	Data type used for evaluation (2)
Geostatistical, (based on VNIR measurements and library, LU/LC, climatic/hydrolic gradients)	?	Survey, Paired plots, Long term experiments	Survey, Paired plots, Long term experiments
Process-based	**Century, Daycent**	**All**	**All**

(1) As in slide 1.
(2) Please select: Survey; Paired plots; Long term exp.; Flux sites; Soil incubation.

Other models proposed

- AMG
- RothC
- FullCAM
- SOCRATES
- DNDC and DNDC-Rice
- WNMM
- IPCC
- APSIM
- Ecosys
- Agro-C
- IAP-N-GAS & IAP-N
- CH4-MOD
- Yasoo07
- NOE
- Volt'air
- STICS
- CERES-EGC
- Melodie-TNT2
- Nitroscape
- TAO
- MOMOS
- Pastis
- MITERRA
- ECOSSE

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Soil Carbon & Nitrogen Cycling Cross-Cutting Workshop

Data for model benchmarking stock-take

Name(s) – Larry West, Skye Wills, Chris Smith, Rich Ferguson, Ellis Benham, Chris Swanston, Peter Griffith

Group(s) – USDA, US Carbon Cycle IWG

Country(ies) – U.S.A., Canada,Mexico

Data for model benchmarking (1)

Data type (1)	Country, Region(s) (2)	Soil type(s) (3)	Climate type(s) (4)	Land use type(s) (5)	Land management (6)	Duration of data collection
Soil Survey	Conterminous U.S.	All	All	All (not just agriculture)	All	1 time snapshot of C stocks for entire country
North American Soil Carbon Network: Database-all options in (1) included plus carbon isotopes	North America, from arctic to tropics	All	All	All (not just agriculture)	All	Variable, some one-time, some time series from experiments
North American Carbon Program-Field campaigns, flux tower sites, long term , paired fields, bomb carbon	North America, from arctic to tropics but mostly temperate	all	all	All (not just agriculture)	All	Variable—from continuous over decades to one time

(1) Please select: Soil survey; Paired field plots; Long term field experiments; Eddy covariance flux sites; Chamber flux measurements; Soil incubation experiment; Controlled environment experiment; Other.
(2) Please add if possible Latitude and Longitude.
(3) Please use if possible FAO classification
(4) Please indicate the range of mean annual temperatures and precipitations, the elevation above sea level.
(5) E.g. arable, grassland, fallow…
(6) Please indicate: e.g. crop rotation, high N, low P, irrigation, etc…

Data for model benchmarking (2)

Data type (1)	Country, Region(s) (1)	Soil C stock (or soil C fractions) (2)	Soil N (mineral N or N fluxes) (2)	CO2 flux (2)	N20 flux (2)	CH4 flux (2)	Other (2)
Soil Survey	Cotermino us U.S.	1 time inventory of C stocks to 1 m	NA	NA	NA	NA	Soil , land cover, and landform description
North American Soil Carbon Network: Database-all options in (1) included plus carbon isotopes	North America, from arctic to tropics	Variable intervals, includes replicated field plots and gradients, includes soil C fractions	Some, but incomplete	Mostly just soil	NA	NA	
North American Carbon Program-Field campaigns, flux tower sites, long term , paired fields, bomb carbon	North America, from arctic to tropics but mostly temperate	Variable intervals, includes replicated field plots and gradients, includes soil C fractions	limited	Daily	NA	planned	

(1) As in slide 1
(2) Please indicate typical measurement frequency (e.g. every 3 years, fortnightly…) and number of replicate field plots

Data for model benchmarking (2)

Data type (1)	Country, Region(s) (1)	Strengths	Weaknesses
Soil Survey	Conterminous US	Large data set – 6000 locations; 30,000 sample points (5 per location) stratified by soil properties (includes climate) and land cover. Samples to 1 m depth, Total C, CaCO3, and bulk density measured.	Total C and CaCO3 measurements made by diffuse reflectance visible and near infrared spectroscopy – precision not as good as standard lab procedures; cropping system management factors not captured in great detail.
North American Soil Carbon Network: Database-all options in (1) included plus , bomb carbon & isotopes	North America, from arctic to tropics	Large database, user friendly interface, can take subsets, contains metadata	Collections of different methods, still in process, many from non=agricultural soils
North American Carbon Program-Field campaigns, flux tower sites, long term , paired fields	North America, from arctic to tropics but mostly temperate	Database of research projects and links to publications	Data stored in many places, inconsistent collection protocols

(1) As in slide 1

Soil Processes Project Directors meeting: Oral presentations

- Spatial and temporal dynamics of soil structure as influenced by wetting and drying cycles, Teamrat Ghezzehei, UC Merced
- Multi-Scale Analysis of Mechanisms and Impacts of Phosphorus Mobilization in Wetland Soils Created from Drained Agricultural Fields, Michael Vepraskas, NC State Univ.
- Assessing complexity of hydrology, nutrient inputs and phosphorus dynamics within agricultural drainage sediments, Robert Kroger, Mississippi State U.
- The emerging dynamics of Fe redox processes in soils, Aaron Thompson, University of Georgia
- Dynamics of Soil State Variables and Related Processes Across a Land Use Gradient in Spatial and Temporal Transition, Ole Wendroth, Univ. Kentucky

Soil Processes Project Directors meeting: Oral presentations

- Rapid Assessment and Trajectory Modeling of Soil Carbon Across a Southeastern Landscape, Sabine Grunwald, Univ. Florida
- Moisture variability as a "master regulator" of microbial diversity and soil respiration across an Agricultural Landscape, Jay Lennon, Michigan State Univ.
- Linking Soil-Chemical Molecular Level Interactions to Macroscopic Sorption Behavior Via NMR studies, Robert Cook, LSU
- Gene Expression and Genetic Adaptation for Herbicide Degradation in a Model Dynamic Soil System, Julie Zilles and Charles Werth, Univ. Illinois
- Molecular and stable isotope investigation of anammox and denitrification in agricultural soils, Bongkeun Song, Univ. NC Wilmington

Soil Processes Project Directors meeting: Poster presentations

Plants Need Water: Controlling Organic Matter Structure to Improve Soil Wettability	Maria Ines Dragila, Oregon State University
Establishing a Quantitative Link Between Episodic Mineral Transformations, Speciation, and the Transport of Arsenical Pesticides in Soils	Ben Bostick and Student, Columbia University
Niche Differentiation of Nitrification in Soils	Peter Bottomley and Ann Taylor, Oregon State University
Natural synthesis of polychlorinated dibenzo-p-dioxins in soils	Stephen A. Boyd, Michigan State University
Integrating Soil Water Flowpaths and the Nitrogen Cycle	Michael Castellano, Iowa State University
Anammox Activity and Nitrogen Dynamics in Flooded Taro Soils of Hawaii	Jonathan Deenik, University of Hawaii
The influence of genetic improvement and fertilization on the soil organic matter dynamics of loblolly pine forests	Eric Jokela, University of Florida
Response of soil processes to an above ground plant-fungal symbiosis: from rhizosphere to regional scales	David McNear, University of Kentucky
Molecular Scale Study of Organic Matter and Phosphorus Interactions with Surfaces: Ultrahigh Resolution Mass Spectrometry & FTIR Approaches	Susan Erich and Stom Ohno, University of Maine

Soil Processes Project Directors meeting: Poster presentations

Rhizosphere priming effects on soil N availability: the role of root exudates in coupling ecosystem C and N cycles under elevated CO2	Richard Philips, Indiana University
Conference on synchrotron characterization of airborne soil organic and mineral particulates originating from agricultural and other modifie	Alvin Smucker, Michigan State University
Spatial variation of anammox, codenitrification and denitrification across two agricultural fields in North Carolina	Andrew Long and B.K. Song, University of North Carolina Wilmington
Carbon cycle research, coordination, and outreach through the National Soil Carbon Network	Chris Swanston and Lucas E. Nave, US Forest Service
Quantifying Soil Iron Oscillations In Redox Transition Environments: Impacts On Carbon Degradation Rates And Phosphorus Availability	Aaron Thompson and students, University of Georgia
A Novel Approach to Quantifying Soil Evaporation Rates with High Resolution Thermal Imaging and Heat Flux Measurements	Markus Tuller, University of Arizona
Acceleration of inorganic nut. release & mineral-organic matter assoc. by biophysical soil mixing along an earthworm invasion chronosequence	Kathryn Resner and Kyungsoo Yoo, University of Minnesota