



RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
Food Security**



CIFOR

2013 technical report

1. Activity Reporting

Activity 663-2013 (Milestone 3.3.1 2013.)

Title: On-farm trials on strategies to increase system productivity, soil quality and carbon sequestration in East Africa.

Status: Partially complete. Field trials were conducted in the CCAFS site of western Kenya. This included: i) on-farm experiments with maize and beans where productivity, soil nutrient dynamics and GHG emissions were measured, ii) measurements of soil C and greenhouse gas emissions from 60 plots purposively selected to represent a smallholders' landscape, iii) assessment of soil C stocks in about 230 landscape plots. More detail to be found in the report for SAMPLES activities produced together with ICRAF and ILRI.

Gender component:

Deliverables:

- At least two papers on land use change and soil GHG emissions at CCAFS site in Western Kenya. Focused on agroforestry, N-fixing trees and non CO₂ gases. Will contribute to protocol.

Three papers written so far, which also contribute to the SAMPLES protocol plus one draft chapter of the protocol.

Rosenstock, T., Tully, K., Arias-Navarro, C., Neufeldt, H., Butterbach-Bahl, K., & Verchot, L. (2014). Agroforestry with N₂-fixing trees: sustainable development's friend or foe? *Current Opinion in Environmental Sustainability*, 6, 15–21. doi:10.1016/j.cosust.2013.09.001

Arias-Navarro, C., Díaz-Pinés, E., Kiese, R., Rosenstock, T. S., Rufino, M. C., Stern, D., ... Butterbach-Bahl, K. (2013). Gas pooling: A sampling technique to overcome spatial heterogeneity of soil carbon dioxide and nitrous oxide fluxes. *Soil Biology and Biochemistry*, 67, 20–23. doi:10.1016/j.soilbio.2013.08.011

Rosenstock, T. S., Rufino, M. C., Butterbach-Bahl, K., & Wollenberg, E. (2013). Toward a protocol for quantifying the greenhouse gas balance and identifying mitigation options in smallholder farming systems. *Environmental Research Letters*, 8(2), 021003. doi:10.1088/1748-9326/8/2/021003

- One additional dataset using photoacoustic measurements

One paper published showing the methodological problems of using photoacoustic measurements. Rosenstock TS, Diaz-Pines E, Zuazo P, Jordan G, Predotova M, Mutuo P, Abwanda S, Thiong'o M, Buerkert A, Rufino MC, Kiese R, Neufeldt H, Butterbach-Bahl K, 2013, Accuracy and precision of photoacoustic spectroscopy not guaranteed. *Global Change Biology* 19, 3565-3567.

Partners:

ILRI; ICRAF; Maseno University; KIT

Locations:

Activity 664-2013 (Milestone 3.3.1 2013.)

Title: Assessment of carbon stocks and land quality improvement from farmer assisted regeneration trials in the IGP.

Status: Partially complete. Datasets have been collected for 4 states in India and they have been cleaned. For the fifth state data is being collected. Analysis of the data is just beginning and we will have the outputs later in 2014. A no-cost extension agreement is in place between ICRAF and CIFOR to complete the work.

Gender component:

Deliverables:

- One manuscript submitted.

ICRAF will draft a report by ecology and paper for submission in 2014

- Second generation experiments set up and functioning on the ground.

Dataset are complete, and will be uploaded by 2015

Partners:

ICRAF

Locations:

Activity 665-2013 (Milestone 3.3.1 2013.)

Title: Studies on management effects on GHG emissions, especially nitrous oxide, in oil palm plantations in Indonesia.

Status: Partially complete. Our first student finished her PhD and has begun publishing her research. We expect more publications this year. Two other students have completed their data collection and will be analyzing and writing during 2014. Three other students continue their work on the mechanisms of GHG production in soils.

Gender component:

Deliverables:

- One paper on modelling of GHG emissions from peat in oil palm systems.

We have produced two papers in this area and have contributed to the a chapter of the IPCC Task Force on National Greenhouse Gas Inventories.

1. Farmer J, R Matthews, P Smith, C Langan, K Hergoualc'h, L Verchot, JU Smith 2014. Comparison of methods for quantifying soil carbon in tropical peats. *Geoderma* 214–215:177–183.

2. Hergoualc'h K, LV Verchot. 2013. Greenhouse gas emission factors for land use and land-use change in Southeast Asia. *Mitigation and Adaptation Strategies for Global Change*. DOI 10.1007/s11027-013-9511-x.

3. Drösler M, Verchot LV, Pan G, Freibauer A, Evans CD, Bourbonniere RA, Alm JP, Page S, Agus, Sabiham S, Wang C, Srivastava N, Borgeau-Chavez L, Couwenberg J, Hergoualc'h K, Hooijer A, Jauhiainen J, Minkinen K, French N, Strand T, Sirin A, Mickler R, Tansey K, Larkin N. 2014. Drained Inland Organic Soils. 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. IPCC Task Force on National Greenhouse Gas Inventories, Published by the Institute for Global Environmental Strategies (IGES), Hayama,

Japan on behalf of the IPCC. http://www.ipcc.ch/scripts/_session_template.php?page=_37ipcc.htm

- One dataset on CO₂ emissions from trenched plot experiment

The dataset will be made publically available soon after the PhD students defend their thesis and publish their results. We expect to upload the dataset following CCAFS protocols by 2015.

Partners:

ISRI; ICRAF; University of Aberdeen

Locations:

2. Succinct summary of activities and deliverables by Output level

Output: 3.3.1

Summary:

Dataset of GHG emissions from different landuses for 60 landscape level plots (6-9 months of data)at the Nyando site of CCAFS.

Dataset on C stocks for different land uses for 260 landscape plots at the Nyando site of CCAFS.

Preliminary analysis on costs of mitigation for hot spots of GHG emissions.

3. Publications

Publication #1

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Hergoualc'h K, Verchot, LV 2013. Greenhouse gas emission factors for land use and land-use change in Southeast Asia. Mitigation and Adaptation Strategies for Global Change. DOI 10.1007/s11027-013-9511-x.

Publication #2

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Farmer J, Matthews R, Smith P, Langan C, Hergoualc'h K, Verchot LV, Smith JU. 2014. Comparison of methods for quantifying soil carbon in tropical peats. *Geoderma* 214–215:177–183.

Publication #3

Type: Book chapters

CCAFS Themes: Theme 3

Citation: Drösler M., Verchot LV, Pan G, Freibauer A, Evans CD, Bourbonniere RA, Alm JP, Page S, Agus F, Sabiham S, Wang C, Srivastava N, Borgeau-Chavez L, Couwenberg J, Hergoualc'h K, Hooijer A, Jauhiainen J, Minkinen K, French N, Strand T, Sirin A, Mickler R, Tansey K, Larkin N. 2014. Drained Inland Organic Soils. 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. IPCC Task Force on National Greenhouse Gas Inventories, Published by the Institute for Global Environmental Strategies (IGES), Hayama, Japan on behalf of the IPCC.

Publication #4

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Arias-Navarro C, Díaz-Pinés E, Kiese R, Rosenstock TS, Rufino MC, Stern S, Neufeldt H, Verchot LV, Butterbach-Bahl K. 2013 Gas pooling: A sampling technique to overcome spatial heterogeneity of soil greenhouse gas fluxes. *Soil Biol Biochem* 67: 20-23

Publication #5

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Rosenstock TS, Rufino MC, Butterbach-Bahl K, Wollenberg E, 2013, Toward a protocol for quantifying the greenhouse gas balance and identifying mitigation options in smallholder farming systems. Environ. Res. Lett. 8, 021003

Publication #6

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Rosenstock TS, Diaz-Pines E, Zuazo P, Jordan G, Predotova M, Mutuo P, Abwanda S, Thiong'o M, Buerkert A, Rufino MC, Kiese R, Neufeldt H, Butterbach-Bahl K, 2013, Accuracy and precision of photoacoustic spectroscopy not guaranteed. Global Change Biology 19, 3565-3567.

4. Communications

Media campaigns:

1. Media visit to the Nyando site of CCAFS to show GHG emissions measurements

<http://www.scidev.net/sub-saharan-africa/environment/news/lack-of-greenhouse-emissions-data-demands-action.html>

<http://ccaafs.cgiar.org/media-visit-nyando-climate-smart-villages#.Uuz9btGIrml>

Blogs:

1. Tropical Peat Swamp Forests: how land use change affects methane and carbon emissions

http://ccaafs.cgiar.org/fr/blog/tropical-peat-swamp-forests-how-land-use-change-affects-methane-and-carbon-emissions#.Uutc_9GIrml

2. Rachel Kyte (VP WB) visits climate-smart villages in western Kenya

<https://blogs.worldbank.org/voices/plump-goats-and-pawpaws-story-climate-smart-farming-kenya>

<http://www.flickr.com/photos/cgiarclimate/sets/72157637624184943/>

3. From field to landscape: Tackling mitigation and livelihoods with help from farmers

<http://ccaafs.cgiar.org/fr/blog/From-field-landscape-tackling-mitigation-livelihoods%2520%2520#.Uu0Au9GIrml>

4. Emissions hotspots maps provide grist for climate change strategies

<http://blog.cifor.org/20304/qa-emissions-hotspots-maps-provide-grist-for-climate-change-strategies#.Uu0CLNGIrmI>

Websites:

<http://www.worldagroforestry.org/project/samples>

Social media campaigns:

none

Newsletters:

none

Events:

1. Comeau L-P., K. Hergoualc'h, L.V. Verchot, and J. Smith. 2013. Carbon dioxide fluxes and soil organic matter characteristics associated with land-use change in tropical peatlands of Jambi, Indonesia. 11th International Conference of the East and Southeast Asia Federation of Soil Science Societies, Bogor, Indonesia, 21-24 October 2013.
2. Comeau L-P., K. Hergoualc'h, L.V. Verchot, J. Smith, and J.A. Hartill. 2013. Soil CO₂ emission and soil organic matter characteristics associated with land-use change in tropical peatlands of Sumatra, Indonesia. IUSS Global Soil Carbon Conference, Madison WI, USA, 3-6 June 2013.
3. Rufino MC, Rosenstock TS, E Wollenberg, K Butterbach-Bahl. 2013. Identifying pro-poor mitigation options for smallholder agriculture in the developing world: a multi-criteria and across-scales assessment. Climate Smart Agriculture Conference Davis, 22 March 2013.
<http://www.slideshare.net/cgiarclimate/mariana-rufino-2013-identifying-propoor-mitigation-options-for-smallholder-agriculture-in-the-developing-world>

Videos and other multimedia:

none

Other communications and outreach:

1. CIFOR co-organized with CCAFS the Global Landscape forum in Warsaw 16-17 November 2013
2. Mariana Rufino participated of the meetings for "Taking Forward the Implementation of the Agricultural Priority Actions in the Kenyan NCCAP 2013 – 2017"

5. Case studies

Title: Contribution to the IPCC Wetlands Supplement

Author: Lou Verchot

Type: Successful communications, Policy engagement

Project description:

This work was associated with several projects funded by the EU, AusAID, NORAD, and USAID. Three of the projects specifically addressed REDD and we undertook these measurements in the context of developing better MRV systems. The fourth project focused on carbon in wetlands. This work was carried out in FTA and CCAFS projects, depending on the land uses. Research consisted of literature syntheses and intensive measurement campaigns at several sites in Sumatra and Borneo.

Introduction / objectives:

The objectives were i) to summarize studies published since the publication of the 2006 IPCC National Inventory Guidelines, and ii) to assess the impact of conversion of peat swamp forests to oil palm at a few sites through rigorously designed studies that would also shine a light on the mechanisms at work in the soils that controlled spatial and temporal variability of GHG emissions

Project results:

IPCC Wetlands Supplement: the supplement was accepted by the IPCC plenary and was published online. The final version will be released in 2014. The significance of progress in GHG inventories was summarized by ENB: "GHG inventories are one of the most critical, if often overlooked, aspects of the multilateral climate regime..." Although highly technical, methodology reports are politically significant for climate negotiations, as they constitute the operating manuals behind certain key decisions.

Partners:

Indonesia Soils Research Institute/CRAF

Links/sources for further information:

http://www.ipcc.ch/scripts/session_template.php?page=37ipcc.htm

6. Outcomes

Title:

IPCC Wetlands Supplement accepted and published on-line

What is the outcome of the research (i.e. use of research results by non-research partners)?

The methodology is now mandatory for all countries preparing national GHG inventories

What outputs produced in the three preceding years resulted in this outcome?

1. Hergoualc'h, K. and L. Verchot. 2010. Carbon loss associated with the conversion of tropical peat forests to oil palm plantations. International Conference on Oil Palm and Environment (ICOPE) March 2010 Bali, Indonesia.
2. Hergoualc'h, K. and L.V. Verchot. 2010. Carbon loss associated with land use change in tropical peat forests: Methods and quantification. XXIII IUFRO World Congress, August 2010, Seoul, Korea.
3. Murdiyarso, D., K. Hergoualc'h, and L.V. Verchot. 2010. Opportunities for reducing GHG emissions in Tropical Peatlands. Proceedings of the American National Academy of Sciences 107: 19655–19660, doi10.1073/pnas.0911966107.
4. Hergoualc'h, K. and L.V. Verchot. 2011. Stocks and fluxes of carbon associated with land-use change in tropical peatlands: a review. Global Biogeochemical Cycles. 25: GB2001, doi:10.1029/2009GB003718.
5. Hergoualc'h, K. and L. Verchot. 2011. Changes in soil CH₄ fluxes from the conversion of tropical peat swamp forests: a meta-analysis. Sixth International Symposium on Non-CO₂ Greenhouse Gases (NCGG-6) – Science, Policy and Integration Amsterdam, the Netherlands November 2-4, 2011. <http://milcon.e-captain.nl/file.php?id=255>.
6. Verchot, L.V. IPCC guidelines and processes. 2011. Tropical Wetland Ecosystems of Indonesia: Science Needs to Address Climate Change Adaptation and Mitigation, Bali, April 2011.
7. Verchot, L.V., REDD+ Accounting constraints with emissions factors required to operationalize IPCC equations. REDD+ Expectations and Experiences Copenhagen 14 September 2011
8. Aini, F.K., K. Hergoualc'h, L.V. Verchot, and J. Smith. 2011. CH₄ and N₂O flux changes from forest conversion to rubber and oil palm plantation in Jambi, Sumatra, Indonesia. Sixth International Symposium on Non-CO₂ Greenhouse Gases (NCGG-6) Science, Policy and Integration November, 2011, Amsterdam, the Netherlands.
9. Hergoualc'h K., L.V. Verchot. 2011. Changes in soil CH₄ fluxes from the conversion of tropical peat swamp forests: a meta-analysis. Sixth International Symposium on Non-CO₂ Greenhouse Gases (NCGG-6) Science, Policy and Integration. November, 2011, Amsterdam, the Netherlands.
10. Persch, S., Hergoualc'h, K., Laumonier, Y., Verchot, L.V.. 2012. Carbon stock in coarse root biomass in different land-use systems on tropical peat in Jambi, Sumatra 3rd International Conference on Oil Palm and Environment (ICOPE), Bali, Indonesia, 22-24 February 2012.
11. Hergoualc'h, K., Handayani, E.P., Indrasuara, K., van Noordwijk, M., Bonneau, X., Verchot, L.V. 2012. Soil CO₂, CH₄, and N₂O emissions from an oil palm plantation on deep peat as affected by nitrogen

- fertilization. 3rd International Conference on Oil Palm and Environment (ICOPE), Bali, Indonesia, 22-24 February 2012.
12. Hergoualc'h K., and L.V. Verchot. 2012. Changes in soil CH₄ fluxes from the conversion of tropical peat swamp forests: a meta-analysis. *Journal of Integrative Environmental Sciences* 9: 93–101.
 13. Persch, S., K. Hergoualc'h, and L.V. Verchot. 2012. Phytomass carbon stock changes following peat swamp forest conversion to oil palm plantation in Jambi, Sumatra. ATBC – Asia Pacific Chapter Annual Meeting, Xishuangbanna, China, 24-27 March 2012.
 14. Hergoualc'h, K., and L.V. Verchot. 2012. Carbon loss associated with land-use change and wildfires in tropical peat swamp forests. 14th International Peat Congress, Stockholm, Sweden, 3-8 June 2012
 15. Hergoualc'h, K., and L.V. Verchot. 2012. Greenhouse gas emissions associated with land-use change in tropical peat swamp forests. In: Hergoualc'h, K., DeFries, R. (organizers) Symposium on The effect of land-use change on greenhouse gas emissions in the Tropics and Subtropics. IUFRO Landscape ecology conference, Concepción, Chile, 5-8 November 2012.
 16. Murdiyarso, D., J.B. Kauffman, and L.V. Verchot. 2013. Climate change mitigation strategies should include tropical wetlands. *Carbon Management*, 4:509–517.
 17. Hergoualc'h, K., and L.V. Verchot. 2013. Greenhouse gas emission factors for land use and land-use change in Southeast Asia. *Mitigation and Adaptation Strategies for Global Change*. DOI 10.1007/s11027-013-9511-x.
 18. Comeau L-P., K. Hergoualc'h, L.V. Verchot, and J. Smith. 2013. Carbon dioxide fluxes and soil organic matter characteristics associated with land-use change in tropical peatlands of Jambi, Indonesia. 11th International Conference of the East and Southeast Asia Federation of Soil Science Societies, Bogor, Indonesia, 21-24 October 2013.
 19. Comeau L-P., K. Hergoualc'h, L.V. Verchot, J. Smith, and J.A. Hartill. 2013. Soil CO₂ emission and soil organic matter characteristics associated with land-use change in tropical peatlands of Sumatra, Indonesia. IUSS Global Soil Carbon Conference, Madison WI, USA, 3-6 June 2013.

What partners helped in producing the outcome?

Indonesia Soils Research Institute
 ICRAF

Who used the output?

No one yet, but eventually every country in the world

How was the output used?

National GHG inventories
 REDD+ GHG accounting.

What is the evidence for this outcome?

Specifically, what kind of study was conducted to show the connection between the research and the outcome?

Who conducted it? Please provide a reference or source.

It is now a mandatory part of national GHG inventories.

7. Outcome indicators

Outcome indicator #1

Outcome indicator:

Findings and evaluation tools on mitigation and livelihoods benefits of alternative agricultural development pathways used by global agencies and decision-makers in two countries in each of the three regions

Achievements:

The work conducted under SAMPLES contributes tools to assess mitigation options, and data (EFs) that can be used to prioritize development interventions at local and regional level

Evidence:

Our science will be used this year to design NAMAs for at least one country

Outcome indicator #2

Outcome indicator:

Project design and monitoring guidelines for smallholder agriculture in developing countries produced and contributing to global standards

Achievements:

Contribution to the IPCC Wetlands Supplement

Evidence:

The methodology is now mandatory for all countries preparing national GHG inventories. We will see an improvement of reports to UNFCCC

8. Leveraged funds

Leverage funds #1:

Title:

IRADIATE - funds to support research on GHG emissions and capacity building in western Kenya

Partner name: Maseno University

Budget: \$70000

Theme: T3

Leverage funds #2:

Title:

IRADIATE - funds to support research on GHG emissions and capacity building in western Kenya

Partner name: Karlsruhe Institute for technology (KIT)

Budget: \$260000

Theme: T3