An integrated assessment of soil and fire emissions of greenhouse gases from slash-and-burn and chop-and-mulch agriculture in the eastern Amazon

Eric A Davidson, The Woods Hole Research Cener, edavidson@whrc.org (Presenting)
Tatiana D. d A. Sá, EMBRAPA, diretoria.tatiana@embrapa.br
Claudio Reis de Carvalho, EMBRAPA, carvalho@cpatu.embrapa.br
Ricardo de O. Figueiredo, EMBRAPA, ricardo@cpatu.embrapa.br
Francoise Yoko Ishida, CENA, fyishida@cena.usp.br
Renata T Sabá, EMBRAPA, renatatuma@hotmail.com
Elisana B. dos Santos, IPAM, elisanabs@hotmail.com
Jorge F.B. Freitas, UFRA, freitasjorge@hotmail.com

The sustainability of agricultural systems must be considered at both local scales, were soil fertility and crop yield are paramount, and at global scales, where unsustainable increases in greenhouse gas concentrations are occurring in the atmosphere due, in part, to agricultural activities. Management practices designed to improve or maintain soil fertility could alter several sources and sinks of greenhouse gases and thus have unintended consequences for sustainability at global scales. Alternatives to slash-and-burn practices, such as chop-and-mulch technology, can avoid significant losses of essential plant nutrients and emissions of radiatively important trace gases by eliminating the use of fire for site preparation. On the other hand, additions of mulch to the soil could significantly increase denitrification and methanogenesis, thus possibly increasing soil emissions of CH4 and N2O. The objective of this study was to measure soil emissions of N2O, CH4, CO2, and NO throughout an entire cropping cycle in slash-and-burn, chop-and-mulch, and continuous fallow fields in the eastern Amazon region. The soils were a net sink for CH4 in the burned area and in the continuous fallow and were a net source of CH4 in the mulch treatment, causing a net increase of soil emissions of about 15 kg CH4/ha over slightly more than two years of the study. Mulching also increased NO and N2O soil emissions, but the differences among treatments were modest. However, based on estimates of biomass burned during site preparation and literature values of emission factors, the fire in the slash-and-burn treatment released more than ten times as much CH4 and NO than can be attributed to increased soil emissions in the mulching treatment. Only by complete accounting of greenhouse gas emissions throughout the cropping cycle is it possible to assess the overall impacts of the common practice of slash-and-burn tropical agriculture and the mulching technology that has been developed as an alternative. Chop-and-mulch management appears to be a win-win option from the perspectives of both local soil fertility and avoided greenhouse gas emissions.

Science Theme: TG (Trace Gases)

Session: 2C: Trace Gases and Aerosols

Presentation Type: Oral

Abstract ID: 53

View presentation