Methane and nitrous oxide emissions in freshwater swamps and marshes in southeastern México

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Introduction

Wetlands ecosystems

- Wetlands are considered carbon sinks. However, they are also significant source of greenhouse gases (GHG).

- CH$_4$ and N$_2$O are two important GHG with 20 and 300 times GWP than CO$_2$, respectively.

- Few studies about GHG emissions has been done in tropical wetlands.
about 0.6% of the total wetlands in the world are in **Mexico**

10% (Two-thirds of these wetlands are freshwater wetlands)

Source: Olmsted (1993)
Freshwater wetlands

Marshes

Swamps
Quantify and compare methane and nitrous oxide emissions in coastal freshwater wetlands with different plant community (swamps vs marshes) in southeasterneastern Mexico
Location of the study sites in the coastal plain of Veracruz, Mexico.

Methods
Estero Dulce (ED)

*Thalia geniculata*, *Cyperus giganteus*, *Echinochloa pyramidalis*, *Pachira aquatica*
Laguna Chica (LCH)

Cyperus giganteus, Typha domingensis

Pachira aquatica, Hippocratea celastroides
Boquilla de oro (BO)

*Cyperus giganteus, Pontederia sagitatta.*

*Ficus insipida*
Methods

Gas sampling
- Closed chambers (every 2 months)

Gas analysis
Gas chromatograph (Perkin Elmer)
- Methane and nitrous oxide fluxes were estimated according to the following equation:

\[ Fc = (\Delta c/t) * (V/A) \]

Data analysis
The data were performed with SPSS 18 version for windows.

Field measurements
- Redox Potential
- Water level
- Water chemistry
Methane Emissions
Results

Boquilla de Oro

Swamps

Marshes

Methane emissions in Boquilla de Oro. Values are means (n=4), bars represent standard error, and letters indicate significant difference at level of p<0.05.
Methane emissions in Laguna Chica. Values are means (n=4), bars represent standard error, and letters indicate significant difference at level of p<0.05.
Methane emissions in Estero Dulce. Values are means (n=4), bars represent standart error, and letters indicate significant difference at level of p<0.05.
Methane emissions in wetlands with different plant community. Values are means (n=144). Bars indicate standard errors. Same letters indicate no significant differences (p>0.05).
Nitrous oxide emissions
Nitrous oxide emissions in Boquilla de Oro. Values are means (n=4), bars represent standard error, and letters indicate significant difference at level of p<0.05.
Nitrous oxide emissions in Laguna Chica. Values are means (n=4), bars represent standard error, and letters indicate significant difference at level of p<0.05.
Results cont.

Nitrous oxide emissions in Estero Dulce. Values are means (n=4), bars represent standard error, and letters indicate significant difference at level of p<0.05.
Nitrous oxide emissions in wetlands with different plant community. Values are means (n=144). Bars indicate standard errors. Same letters indicate no significant differences (p>0.05).
Methane emissions (mg C-CH$_4$ m$^{-2}$ d$^{-1}$) from wetlands in different regions.

-1.3 to 644 (4, 8, 16, 17, 18, 19)

0.1 to 1000 (7, 9, 10, 12, 14, 15)

-3000 to 6000 (1)

100 to 10000 (2) M
0 TO 9000 (2) S

10 to 550 (11) S

146 to 960 (3, 5, 6, 13, 20, 21)

1.3 to 644 (4, 8, 16, 17, 18, 19)

This study

Nahlik & Mitsch 2011

Yu et al. 2008

Liikanen et al. 2009

Chang & Yang 2003

Song et al. 2008

Augustin et al. 1998

Moore & Knowles 1990

Altor et al. 2006, 2007

Nahlik & Mitsch 2010

Tathy et al. 1992

Crill et al. 1988

Alford et al. 1997

Frolking & Crill 1994

Willson et al. 1989

Liblik et al. 1997

Bellisario et al. 1999

Whalen & Reeburg 1992

Bartlett et al. 1992

Ding et al, 2002

Singh et al. 2000
Nitrous oxide emissions (mg N-N$_2$O m$^{-2}$ d$^{-1}$) from wetlands in different regions.

-0.05 to 5.3 (4, 5, 6, 10, 14)

-0.6 to 9 (3, 8, 9, 13)

-4.8 to 39 (2, 7, 11, 12)

-10 to 70 (1)

1. This study
2. Yan et al. 2000
3. Kang et al. 1998
4. Takakai et al. 2006
5. Regina et al. 1996
6. Regina et al. 1999
7. Yu et al. 2010
8. Agustin et al. 1998
9. Dhondt et al. 2004
12. Li et al. 2009
Coastal freshwater marshes and swamps of Veracruz Mexico are sink and source of methane and nitrous oxide.

There was no significant differences of methane and nitrous oxide emissions between freshwater wetlands with different type of vegetation community.

Methane emissions in these coastal wetlands increased during rainy and wind season (August to February).

Nitrous oxide emissions during the study period were variable and did not follow seasonal patterns.
Thank you!

FUNDING PROVIDED BY:

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