# InGOS – Integrated non-CO2 Observing System

Detailed workplan, appendix to the online application. Request for access to an infrastructure (TNA1-TNA2-TNA3). The plan must not exceed 6 pages in 12 pt single line spacing, applications exceeding this limit will not be evaluated. The following information should be included in order to be evaluated:

1. **Project name (acronym), name and contact information of the researcher(s), duration of the project (dates, number of working days), type and name of the infrastructure requested**

Project name: Methane fluxes of *Phragmites australis* under different climates

(CH4-*Phragmites*)

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Duration of the project: From 13 to 18 October 2013 (5 working days)

Infrastructure requested: Eddy covariance system located in the Rzecin peatland site (Poland)

1. **Background**
   1. Significance of the research
   2. Previous research relevant to the topic and how the proposed project links to this
   3. Links with current research of the applicant

Wetlands store 25%-30% of the global soil carbon pool (Millennium-Ecosystem-Assessment 2005) and are important CO2 sinks. In addition, wetlands act as sources for greenhouse gases (GHG) by emitting methane (CH4) to the atmosphere. In this context, the function of wetlands in relation to global warming will be the balance between net CO2 assimilation and CH4 emission. With global warming, wetlands have the potential to release stored carbon, because of the high temperature sensitivity of microbial respiration (Davidson and Janssens 2006), and contribute to the increase of atmospheric CO2 concentrations. However, it is still unknown whether wetlands will convert from long-term carbon sinks to sources as a result of global warming and other anthropogenic effects by increasing the emission of CH4 and decreasing the assimilation of CO2 via photosynthetic processes.

*Phragmites australis* is one of the most common species found in wetlands and is considered the most widespread and productive wetland plant species in the world (Brix et al. 2001; Zhou et al. 2009). Similar to other ecosystem functioning, studies about *Phragmites australis* have found that, the differences in the rate of net ecosystem CO2 exchange is related to the photosynthetic active radiation (PAR) flux density whereas ecosystem respiration is mostly related to temperature and soil water content (Zhou et al. 2009). However there are no studies regarding CH4 fluxes and their main meteorological drivers in wetlands dominated by Phragmites.

The eddy covariance technique (EC) is used worldwide to measure CO2 exchange and water vapor by "flux towers" (Baldocchi et al. 2001) at the ecosystem level. In addition, the recent development of CH4 gas analyzers to measure CH4 at fast response has opened the possibility to investigate properly CH4 fluxes at the ecosystem-scale. However, due to its earlier development, few publications regarding comparison between IRGAs for measuring CH4 fluxes were published (Peltola et al. 2013).

In this context, this project proposes to analyses the GHG exchange (mainly CH4) of two wetlands with *Phragmites australis* as the dominant species under different climates using the eddy covariance technique and two different CH4 analyzers (LI-7700 and DLT-100 Fast Methane Analyser (Los Gatos)). The first site, *Padul*, is located in southern Spain in a sub-humid warm climate, characterized by a mean annual temperature of 16ºC and total annual precipitation of ca. 470 mm. CH4 fluxes are measured by an LI-7700 since January 2013. The second site, *Rzecin* is located in Poland with a mean annual temperature of 8ºC, and a total annual precipitation around 600mm with no dry season. CH4 fluxes are measured by Los Gatos methane gas analyzer and by a LI-7700 (owned by the CSIC (Spain)), that was installed in the *Rzecin* site in June 2013.

The current research of the applicant links perfectly with the project, since the applicant is the principal investigator for the *Padul* site and the LI-7700 installed in *Rzecin*. In addition she has great expertise in measuring and publishing eddy covariance data.

1. **Objectives**
   1. Hypothesis and research objectives

The objectives of this project are (1) a field intercomparison of two CH4 gas analyzers suitable for EC fluxes and (2) analysis of GHG fluxes of *Phragmites australis* under different climates. For the first objective, we are going to analyze the CH4 fluxes measured by the LI-7700 (owned by the University of Granada (Spain)), that was installed in the *Rzecin* site in June 2013 and compare these results with those measured by Los Gatos system. After this comparison, we are able to analyses and compare the GHG exchanges (mainly CH4) of the two proposed wetlands with *Phragmites australis* (objective 2). Previous hypothesis posits higher CO2 and CH4 emissions in the *Padul* site due to higher temperatures. However, more accurate analysis are required in order to determine the effects of climate in the annual GHG balance for Phragmites since not only CO2 and CH4 emissions will be increase but also CO2 uptake due to an increase of photosynthesis as a result of an increase in light and LAI.

b. Connection with the InGOS objectives and the ‘fitness’ of the use of the requested infrastructure to the objectives

The proposed project is very well connected with two of the most important objectives of InGOS “to harmonize and standardize the GHG measurements” and “to improve measurement methods by testing new innovative techniques and strategies”. The requested infrastructure of the R*zecin* site is ideal since thanks to the LI-7700 provided by the applicant and installed at the requested site we can comparethis instrument with Los Gatos fast methane analyzer and then, compare the resulted GHG fluxes with those measured in the *Padul* site (where the applicant is the PI) dominated by the same species.

1. **Methods and materials (legal and ethical issues)**
   1. Research method, explaining how to reach the objective
   2. Research materials, instrumentation
   3. Governance procedures, safety precautions, permit requirements and procedures

The proposed objectives will be reached by obtaining (after standardizing procedures) and comparing the final CH4 fluxes measured by Los Gatos and the LI-7700 installed in *Rzecin*. After this comparison we will be able to compare the CH4 fluxes measured by the LI-7700 in the *Padul* site and the Los Gatos analyzer in *Rzecin* and analyze changes in CH4 fluxes measured in *Phragmites* due to different climate conditions. For this purpose, the main instrumentation used in this project will be the Los Gatos analyzer and the two LI-7700, previously installed by the applicant, in the *Rzecin* and *Padul* sites. Finally, no governance procedures or safety precautions are needed for this project.

1. **Implementation: timetable, budget, distribution of work**
   1. Timetable for the research including personnel efforts, favorably table wise

|  |  |  |
| --- | --- | --- |
| *Task* | *Date* | *Personal* |
| Seminar by the applicant about GHG fluxes in Padul (first analisys and results) | 14/10/2013 | Penélope Serrano Ortiz (applicant)  Bogdan H. Chojnicki  Natalia Kowalska  Janusz Olejnik  M. Urbaniak |
| Visit to Rzecin site | 15/10/2013 | Penélope Serrano Ortiz  Bogdan H. Chojnicki  M. Urbaniak |
| CH4 flux calculations and analyses (using Los Gatos and LI-7700 analyzers) | 16/10/2013  17/10/2013 | Penélope Serrano Ortiz  Natalia Kowalska |
| Final meeting showing results of the analyses and outline of the paper | 18/10/2013 | Penélope Serrano Ortiz (applicant)  Bogdan H. Chojnicki  Natalia Kowalska  Janusz Olejnik  M. Urbaniak |

* 1. Total budget for travel and logistical support as requested

The total budget requested is 750€

* 1. Plan for specific logistal needs like visa, import/export licenses etc.

Not applicable

1. **Expected results and possible risks**
   1. Expected scientific impact of the research
   2. Applicability and feasibility of the research results
   3. Publication plan
   4. Data access plan

The results obtained by comparison between the two CH4 analyzers will be very interesting for the InGOS community since both IRGAs are commonly used for measuring CH4 fluxes. The resulting information on the comparison between GHG fluxes measured in *Phragmites australis* under different climates is essential for the second objective of the project since the two mentioned different CH4 analyzers are installed in the study sites. The main risk of the proposed project is to find great and unexplainable differences between CH4 fluxes measured by the two analyzers. In this case, further analyses will be required prior to the CH4 fluxes comparison between sites. The obtained results will be published in an international research journal.

1. **Key literature**

Baldocchi DD et al. (2001) FLUXNET: A new tool to study the temporal and spatial variability of ecosystem-scale carbon dioxide, water vapor, and energy flux densities. Bulletin of the American Meteorological Society 82: 2415–2434

Brix H, Sorrell BK, Lorenzen B (2001) Are Phragmites-dominated wetlands a net source or net sink of greenhouse gases? . Aquatic Botany 69:313-324

Davidson EA, Janssens IA (2006) Temperature sensitivity of soil carbon decomposition and feedbacks to climate change. Nature 440:165-173

Millennium-Ecosystem-Assessment (2005) Ecosystems and Human Well-being: Wetlands and Water Synthesis. , Washington, D. C.

Peltola O, Mammarella I, Haapanala S, Burba G, Vesala T (2013) Field intercomparison of four methane gas analyzers suitable for eddy covariance flux measurements. Biogeosciences 10:3749-3765

Zhou L, Zhou G, Jia Q (2009) Annual cycle of CO 2 exchange over a reed (Phragmites australis) wetland in Northeast China

Aquatic Botany 91:91-98