# 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**

**Methane exchange between boreal lake and atmosphere (MEBBA)**

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**Duration: 18 August 2014 – 19 September 2014, 2 occasions, total TN days 24 (2 persons)**

**Infrastructure request: TNA2 station Hyytiälä**

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
2. Fresh waters are important components of the carbon cycle both with respect to exchanges of CO2 and of CH4 (Bastviken et al., 2004). Multiple interactions take place between the surrounding landscapes through transport of organic compounds in the streams and rivers leading to and from the lakes. Boreal lakes tend to store large quantities of organic sediments which have potential of producing large amounts of methane. Thus understanding the role of freshwater systems in the carbon cycle is critical for understanding the full carbon cycle.
3. Practically all previous estimates of the emission of methane from lakes are based on indirect methods (e.g., Cole and Caraco, 1998) which indices a large uncertainty. In the upcoming INGOS workshop on ‘Advancing the science of gas exchange between fresh waters and the atmosphere’ in Hyytiälä in September 2014, different direct methods will be applied in attempts to better quantify the fluxes. These direct methods will also be compared to indirect methods in order to assess uncertainties.
4. The applicant is currently involved in different project attempting to quantify the c-cycle at landscape level such as e.g., the LAGGE project in southern Sweden (<http://www.bioenv.gu.se/english/research/research-areas/Physiological_botany/projects/lagge-eng/>). The applicant is also performing measurements of methane exchange from different forest surfaces including being responsible for micrometeorological measurements
5. **Objectives**
	1. Hypothesis and research objectives

The eddy covariance measurements that has been made on the lake at Hyytiälä has shown very small or negligible methane fluxes. This is strange since a boreal lake with a large inflow of organic material can be expected to be productive also from methane point of view. Our hypothesis is that methane is produced in the bottom sediment but then it is oxidized on its way to the surface. This is because the lake is relatively deep at the place were EC measurements are made, ca 13 m. The objective of this project is to measure the concentration of methane close to the bottom and just underneath the water surface. This will provide information about possible methane production close to the bottom and it will also tell something about the oxidation capacity.

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

The project fits well with the general aim of INGOS to “develop common quality control and quality assurance procedures for non CO2 greenhous gases and with the specific objective of “Improve analysis methods using innovative techniques and strategies”. Performing the study at Hyytiälä station is absolutely essential since this is the place where the EC measurements are perfomed, where personnel is available for supervision of measurements and were the workshop will take place!

1. **Methods and materials (legal and ethical issues)**
	1. Research method, explaining how to reach the objective

The CH4 concentration in the water at two different depths will be measured with a gas analyzer. Two permeable tubes that permit CO2 and CH4 to diffuse in/out but not water, will be submerged to the appropriate depths. The diffusion tubes will be connected in a closed system to the gas analyser, switching between tubes/level at appropriate intervals. This system have been developed and demonstrated to work for CO2 measurements and now we modify it also for CH4.

* 1. Research materials, instrumentation

Own produced gas sampling system, Los Gatos CO2/CH4/H2O ultra portable gas analyzer (UGGA). Datalogger, data communication device, power supply, water proof boxes.

* 1. Governance procedures, safety precautions, permit requirements and procedures

All installation will be performed in close and direct collaboration with the responsible project leader at Hyytiälä station. The raft were the equipment shall be placed was visited by the applicant on 1 july 2014 to study the possibilities for installation. All necessary prerequisites were met.

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

|  |  |
| --- | --- |
| Week no | Task |
| 33-34 | Modification of existing equipment including installation of UGGA |
| 35 | Transport from Lund to Hyytiälä and installation at site; 2 persons 5 days (10 TN days) |
| 35-38 | Measurement period; attendance by Hyytiälä personnel |
| 38 | Analyses of measurements during WS, dismount of equipment at end of WS and transport back to Lund, participation I WS; 2 persons 7 days (14 TN days) |
| 40 | Writing of TN report for INGOS |
| 40-50 | Joint analyses of WS measurements, publication submitted at end of year. |

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

The project requires two TN actions to take place in order to make it work. One for installation and start of measurements and one for closing of measurements and transport back home. Two persons are required to handle the equipment.

Budget

Installation: 2 persons travel Lund – Hyytiälä-Lund 2x500 + 10x50 = 1500 EURO. For the installation a rental car is required from Helsinki airport to Hyytiälä. Normal air fair cost CPH-Helsinki for economy ticket is ca 350 EURO per person. Rental car for 5 days is ca 250 Euro. Lodging at Hyytiälä is 55 EURO/night. The requested contribution will not cover all costs if daily allowance shall be included.

Dismount: It is essential that we participate in the WS with our results. Presentations about the measurements will be given to the WS participants. First analyses of results jointly with other groups doing EC and chamber measurements. 2 persons travel Lund-Hyytiälä-Lund 2x500 + 14x50 = 1700 EURO.

Total cost 3200 EURO.

* 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

Better understanding of lake methane emissions

* 1. Applicability and feasibility of the research results

Could result in better studies on lakes if the methods developed will hold what they promise

* 1. Publication plan

At least one joint publication in a peer review journal

* 1. Data access plan

Data will be freely available on the INGOS database once quality controlled

1. **Key literature**
	1. List of references used in the working plan

Bastviken, D., J. Cole, M. Pace, and L. Tranvik (2004), Methane emissions from lakes: Dependence of lake characteristics,two regional assessments, and a global estimate, Global Biogeochem. Cycles, 18, GB4009, doi:10.1029/2004GB002238.

Cole, J. J., and N. F. Caraco. 1998. Atmospheric exchange of carbon dioxide in a low-wind oligotrophic lake measured by the addition of SF6. Limnology and Oceanography **43**: 647–656