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Raport ştiinţific anual

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Proiect IDEI 111/5.10.2011 „Forest GHG management"

Instituţia: Institul de Cercetări şi Amenajări Silvice

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Conţinut

Summary

Carbon storage has become an new forest management goal taken into account after scientific researches have shown that forests play an important role in the carbon cycle. Storage and storage dynamics are increasingly well documented, but the impact of forest management on storage is not well known. Among others, current researches lack measurements on natural forests, which can constitute a reference or control treatment in studying the impact of forest management. The project aims to bridge to this gap, taking benefit from the existance of natural forests in Romania. The research method is based on the one developed within the European project "GHG Europe" (www.ghg-europe.eu), aimed exclusively at beech forests, but the "Forest GHG management" European project extends and complements the coverage by analyzing forests rarely studied: natural forests, reforestation and clear cuts.

Initially, 10 plots were chosen for this study, of which 4 in natural forests and planted forests 4 appropriated from geographically and ecological conditions, in order to grasp the impact of management on carbon stocks and fluxes of greenhouse gases emitted ground. The other two areas were not considered due to the strong reduction of the project's budget.

In the earlier stages of the project, dead wood density was studied. The density is a key factor to estimate carbon stock, which is very important here since the amounts of dead wood is especially high in natural forests. The results were published in a journal ISI. Was also analyzed the dynamics of biomass stocks, based on dendrochronological methods and measurements in an international working group. Since conventional methods do not fully correspond dendroecological purpose study proposes a new methodology was published in 2014.

The current phase of the project consisted in two activities:

- a first activity was focused on monitoring greenhouse gas fluxes. Monitoring consisted in the collection of samples of gases emitted from forest soils with manual chambers. Chromatography analysis allowed the determination of these fluxes. Results from previous years were presented at an international conference. The measurement of the gaz concentration in the vials was achieved as planned and laboratory data processing is in progress.

- The second activity is to achieve a synthesis of knowledge on forest carbon stock. Synthesis on carbon storage in dead wood was performed in the previous phase, the focus was now on the air live trees with established relationship between diameter and volume. Estimation of carbon stocks is based on the volume of trees in biomass conversion. The relationship depends on the wood density and the rate of growth of trees. The role of each component was studied. The study was valued in a scientific article under evaluation in a journal ISI.

Currently, 2 articles are in evaluation and 3 in progress. The priority at the beginning of the project was given to the measurements. Publications are now possible, since the databases start to be populated.

The funding was reduced by 50% the last 2 years (2013 and 2014) which left barely sufficient funds to run the chromatograph (http://news.sciencemag.org/people-events/2013/04/romania-replace-national-research-council-after-mass-resignation). Apart from the impact on the GHG monitoring, the reduction of costs have also forced the team to invest on other projects to get the necessary funds.

1 Introduction

Forests are recognised as a major carbon pool, highly significant for both terrestrial ecosystems and globally. The estimation of the amount of carbon stored in forest is a priority for all countries signatory to the Kyoto Protocol.

Despite recent efforts, the contribution of forest ecosystems to carbon storage is not precisely known, nor is their ability to capture and sequester at long terms. Forest management is optimized for the production of wood, or for the fulfillment of environmental services such as protecting the land, but not for carbon sequestration.

The aim of this project is to gain insights on the relationship between the forest management and the carbon stocks and sink strength of forests.

2 Project aims and objectives

The effects of forest management on forests' carbon stock and carbon storage capacity is less documented and is in the global objective of this project. FP7 project "GHG Europe" (www.ghg-europe.eu), funded by the EU, aimed to determine how, and to what extent, the carbon cycle and greenhouse gas emissions (GHG) emissions from terrestrial ecosystems can be managed. The basic idea is to manage GHG fluxes through terrestrial ecosystems management.

In this project, the Forest Research and Management Institute's mission is to study "The impact of land management on regional balance of greenhouse gas emissions in selected regions of Europe". Its task is to establish a gradient of management in beech forests to study the impact on the budget management of GHG. The gradient of management covers a wide range of management types but keeping confounding factors to a minimum.

The aim of the present project is to complete this management gradient with new unstudied situations in Europe, typical and relevant to Romania, namely natural forests and wooded pastures. The objective is to obtain data from experimental measurements GHG stocks and fluxes. The gradient of GHG project management built in Europe is developed for beech, a species widespread in Europe but which is the main species in Romania in terms of standing volume, thus having great relevance both nationally and at European level. Gradient followed currently consists of 12 areas, representative of typical forest management, contrasting with frequency and intensity of silvicultural interventions executed during the life cycle stands.

3 Project structure

The project is structured in two main activities:

- the first activity is the estimation of the aerial carbon stock dynamics in the forests. This work brings knowledge on forest carbon storage capacity and its sensitivity to forest management. In particular, attention was paid to carbon storage in natural forests, which is rarely assessed yet expected by the scientific community, because of the paucity of this type of forests, despite the fact that they represent a point of reference very helpful.

- The second activity is the monitoring of greenhouse gas fluxes from forest soils. The monitoring is also rarely performed, because the equipment requires a susbtantial investment of time. The two activities are complementary, since the soil remains uncovered by the first activity unless specific tests are performed.

4 Results

4.1 Soil GHG flux monitoring

4.1.1 Monitoring in beech stands

The greenhouse gas sampling from forest soil was conducted according to the plan and without reducing the frequency.

Samples were collected once a month during the growing season, which is represents over 386 samples. According to the methodology, the sampling is accompanied by soil and air temperature measurements. Samples were sent to the laboratory for analysis.

4.1.2 Monitoring in spruce stands

The sampling could not be realized as planned because of the partial destruction of the sites. Some of the permanent rings used to fix the chambers and sample the gaz were removed by ill-intentioned people. The consequences on the fluxes measured were very high.

4.1.3 Monitoring in abandoned pastures

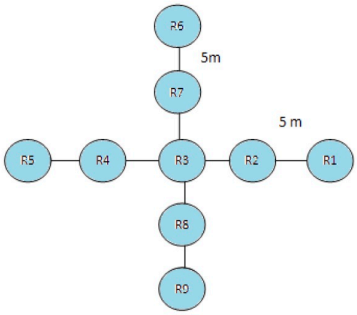
The greenhouse gas sampling from forest soil was conducted according to the plan and the budget. The good accessibility enabled a convenient sampling.

Thus over 7*48 = 336 sample vials were collected. Time coverage was very good and the documentationof the quantitative fluctuations of GHG concentrations will allow greenhouse gas emissions in comparison with areas located in the woods.

4.1.4 *Monitoring in forest regeneration*

CO_2 flux measurement

Soil's CO2 flux was measured with a portable, small-sized echipment (SRC-1). This device (EGM - Environmnetal Gas Monitor, PP-systems, Hitchin, Hertfordshire, UK) is based on infra-red CO2 concentration measurements in its portable chamber.



Measurements are made twice a month and for each sample is taken every plot nine repetitions, located 5 meters apart (see figure above). A week before starting measurements plots were materialized in the field, by placing a stick at each plot center, in order preserve the original position measuring. A number of measurements (972 reads) lasts about 2-3 days, depending on weather and and accessibility. Measurements can be realized from 9.00 to 16.00 o'clock, having in mind the diurnal variations in soil flux. Each measurement lasts minutes. For each measurements were measured, along the CO_2 fluxes, the air temperature, the soil temperature at 5 and 10 cm depth, and the soil humidity over 15 cm using a TDR probe.

```
;EGM-4 Data
;SoftwareVersion=1.05
;Plot    RecNo    Day    Month    Hour    Min    CO2 Ref    mb Ref    mbR Temp
01       0001     01     04       10      42     00437      09.7      +17.2    0000
01       0002     01     04       10      42     00440      09.7      +17.2    0000
01       0003     01     04       10      42     00444      09.7      +17.3    0000
01       0004     01     04       10      42     00447      09.8      +17.3    0000
01       0005     01     04       10      42     00449      09.8      +17.3    0000
01       0006     01     04       10      42     00453      09.8      +17.4    0000
01       0007     01     04       10      42     00456      09.8      +17.3    0000
01       0008     01     04       10      42     00458      09.9      +17.4    0000
01       0009     01     04       10      43     00461      09.9      +17.4    0000
01       0010     01     04       10      43     00464      09.9      +17.4    0000
01       0011     01     04       10      43     00467      10.0      +17.4    0000
01       0012     01     04       10      43     00469      10.0      +17.4    0000
01       0013     01     04       10      43     00471      10.1      +17.5    0000
01       0014     01     04       10      43     00472      10.2      +17.5    0000
01       0015     01     04       10      43     00474      10.2      +17.5    0000
01       0016     01     04       10      43     00476      10.2      +17.5    0000
01       0017     01     04       10      43     00479      10.3      +17.5    0000
01       0018     01     04       10      43     00481      10.3      +17.5    0000
01       0019     01     04       10      43     00483      10.3      +17.5    0000
01       0020     01     04       10      43     00486      10.4      +17.6    0000
01       0021     01     04       10      44     00487      10.5      +17.6    0000
01       0022     01     04       10      44     00490      10.5      +17.5    0000
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4.2 Sinteza

The synthesis activity was focused on some key methodological issues in the assessment of carbon as biomass is the air shaft, namely estimation stands productivity.

Productivity is the main entrance of a forest stand (almost exclusive) carbon. Spontaneous contribution of undergrowth plants can be neglected in terms of the amount of carbon. The assimilation of carbon through photosynthesis is carried out. The vents are those incurred breaths carbon autotrophic and heterotrophic, and filtering of various molecules in the soil carbonate. Estimating carbon fluxes of a forest stand is very difficult because carbon has many forms, contributes to a variety of molecules that enter or IESA through several processes. Estimating the storage and the amount absorbed in one year by a stand of forest is also very difficult (temporal variability and inter-individual variability is very high, there are also many factors that influence the photosynthetic activity of trees) but there is a good approximation by calculating differences carbon Stock in two different times.

The research focused on biomass estimates overhead and increase in biomass of trees and forest stands. The results were published in journalul most specialized and recognized in the field: Biogeosciences (cf. § Dissemination).

Estimates of the volume and biomass of trees remains a fundamental step in estimating carbon stock that represents a forest. This step is based on models that biomathematics simple measuring elements such as base diameter trees (international reference is 1.3 m) and total height, which are converted in biomass using allometric relationships.

5 Dissemination

In stage 5 were published 3 articles ISI, and a presentation of the project's results in a conference with committee review.

5.1 PointRes: An R package to analyze pointer years and components of resilience.

Marieke van der Maaten-Theunissen, Ernst van der Maaten, Olivier Bouriaud

Dendrochronologia 06/2015; 35:34-38. DOI:10.1016/j.dendro.2015.05.006 · 1.80 Impact Factor

5.2 Influence of wood density in tree-ring based annual productivity assessments and its errors in Norway spruce

O. Bouriaud, M. Teodosiu, A. V. Kirdyanov, C. Wirth
Biogeosciences Discussions 04/2015; 12(8):5871-5905. DOI:10.5194/bgd-12-5871-2015
Biogeosciences 10/2015; 12(20):6205-6217. doi:10.5194/bg-12-6205-2015 · 3.97 Impact Factor

5.3 Publicații viitoare

2 items are final or quasi final form and would be sent for evaluation in ISI journals in a very short time.
3 more articles are being written in a less advanced stage but will be sent for evaluation during the next phase.

6 Concluzii și direcții viitoare de cercetare

For one essential aspect of the project, monitoring greenhouse gas flows, optimal conditions were not met because of severe budget reduction, leading to delays in delivery of results. The late compensation of the budget could not compensate for this.

The priorities within the project were adapted to take into account both the reduction and phase budget and the creation of a new phase. Thus, we focused on the realisation of the measurements, whose lack internationally led to the fundamentals of this project.

The next phase will be more focused on processing and publication of the results of this phase.

The pace of forest science publication is not very high, among other because of the length measuring minimum require their forests and vegetation cycle. The number of ISI articles published under the proposed project has already achieved, and will increase during the next phase.