BDO5

MYCARBIO

Mycorrhizae impact on biodiversity and C-balance of grassland ecosystems under changing climate

DURATION OF THE PROJECT
15/12/2006 – 31/01/2009

BUDGET
320.949 €

KEYWORDS
Grassland, arbuscular mycorrhizal fungi, climate change, biodiversity, ecosystem model, carbon

CONTEXT

Following the report from the SBSTTA and IPCC emphasizing the linkages between biodiversity and climate changes (including increasing CO_2 concentration and elevated temperature) and their overall relevance in the implementation of sustainable development, the international research effort is now oriented to provide knowledge and tools to decision-makers with the objectives to preserve biodiversity, maintain ecosystem processes and properties and mitigate climate change. In this respect, improved management of grasslands has been identified by the SBSTTA and IPCC as a potential tool to mitigate climatic change by enhancing carbon (C) storage in soils and vegetation, while conserving biodiversity.

PROJECT DESCRIPTION

Objectives

The MYCARBIO project aims to investigate the impact of arbuscular mycorrhizal fungi (AMF) on biodiversity and the C cycle in Belgian grassland ecosystems under changing climate conditions. To achieve this major objective, five specific objectives have been identified: (1) the evaluation of AMF biodiversity in selected Belgian grasslands, (2) the determination of the role of AMF for seedling establishment, plant community structure, and biodiversity in grasslands, (3) the understanding of the impacts of elevated CO_2, temperature and water availability on AMF and plant biodiversity, AMF-plant associations and C cycle, (4) the evaluation of the ecological significance of AMF-plant interactions on above- and below-ground biodiversity and C balance and (5) the modeling of the processes determining the C-balance in grassland ecosystems.

Methodology

WP 1
- Assessment of the AMF biodiversity in selected Belgian grasslands
- Identification of representative grasslands.
- Taxonomic identification, phylogenetic classification and germplasm preservation of AMF.

WP 2
- Role of AMF for seedling establishment, plant community structure, and biodiversity in grasslands and their feedbacks on AMF
- Identification of the role of AMF for seedling establishment of native grassland species.
- Determination of the role of AMF on plant community structure, and biodiversity in grasslands and vice versa.

WP 3
- Impact of elevated CO2, temperature and water availability on above- and below-ground biodiversity, AMF-plant associations and C cycle
- Identification of the AMF and AMF-plant responses to elevated CO2, temperature and water availability, and determination of the mechanisms by which these environmental factors will specifically affect AMF-plant interactions, ecosystem productivity and C cycle.

WP 4
- Evaluation of the ecological significance of AMF-plant interactions on above- and below-ground biodiversity and C balance
- Meta-analyses on the data collected from the literature and the ones gained in MYCARBIO.

WP 5
- Modeling of the processes describing C balance in grassland ecosystems
- Adaptation of the process-based simulation ANAFORE (ANAlysis of FORest Ecosystems) model to include grasslands.
- Parameterization and improvement of the soil module of the ANAFORE model by inclusion of AMF.
- Validation of the model concerning single factor effects (CO2, temperature and water availability) and interactive effects.
- Scenario runs using the full model.

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INTERACTION BETWEEN THE DIFFERENT PARTNERS

Among and within these WPs, tasks have been assigned to UCL and UA in accordance with the respective expertise of the two partners. Therefore, the responsibility of each WP will be shared between UCL and UA.

EXPECTED RESULTS AND/OR PRODUCTS

MYCARBIO aims to provide significant insights on the impacts of climatic changes on grassland ecosystems and biodiversity, which would be valuable for scientists, stakeholders, and policy makers at national and international levels. Among them we identified:

- The first study of the biodiversity of AMF in Belgian grasslands. This will include taxonomic identification, phylogenic classification and germplasm preservation of AMF in BCCM™/MUCL. This study could also serve to monitor AMF biodiversity evolution under climate change when future assessment will be undertaken.
- The in-deep investigation of the functioning of grasslands by studying the relationships between above- and below-ground communities. This will provide essential information for ecosystem preservation planning.
- Improve the understanding of the impact of climatic changes on AMF-plant interactions and their effects on AMF and plant biodiversity and C cycle.
- A first evaluation of the ecological significance of AMF-plant interactions on above- and below-ground biodiversity and C balance in the context of climate change.
- The refinement of the process-based simulation model ANAFORE to provide data on the impact of AMF on grassland C cycle. These insights will be critical to plan and evaluate actions and policies in relation to below- and above-ground biodiversity in the context of climate change. In particular, this model could be used to estimate C sinks in relation to the article 3.4 of the Kyoto Protocol to report and monitor changes in soil C stocks and provide sufficient level of "verifiability".

PARTNERS - ACTIVITIES

UCL – Unité de microbiologie
Within this unit, the CEnter of Study on AM Monoxenics (CESAMM) has made the *in vitro* cultivation of AMF its premium activity to elucidate various aspects, from genomic to functional, of the obligate biotrophic nature of these ubiquitous below-ground fungi.

UA – Departement Biologie – Onderzoekensgroep Planten- en Vegetatie-ecologie
The research group conducts studies in plant ecophysiology, physical ecology, crop micrometeorology, ecosystem physiology, and landscape ecology. The research group is also the core group of the Research Center of Excellence (ECO).

CONTACT INFORMATION

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Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting http://www.belspo.be/fedra or http://www.belspo.be/ssd