FACCE ERA-GAS

MONITORING & MITIGATION OF GREENHOUSE GASES FROM AGRI- AND SILVI-CULTURE

3DForMod

Project acronym	3DForMod
Project duration	01/10/2017 – 30/09/2020
Total requested budget	€ 702,000

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Combining remote sensing and 3D forest modelling to improve tropical forests monitoring of greenhouse gases emissions

Challenge

The main challenge of 3DForMod is to supply stakeholders and decision-makers with reliable and accessible information on tropical forest carbon stocks along with simple predictive, GIS-based models on the consequences of forest degradation in terms of GHG emissions.

Project aims

- Advancing Terrestrial Laser Scanning (TLS) technology to derive massive tree volume data for allometry development without employing destructive harvesting;
- Integrating advances in 3D forest modeling and very-high-resolution remote sensing technology to improve monitoring of tropical forest aboveground biomass;
- Improving capability of very-high-resolution satellite data to estimate tropical forest biomass and detect changes and emissions related to forest degradation or regional up-scaling;
- Collaborating with developing country forest monitoring agencies for integrating project results into their national REDD+ monitoring system and related capacity building with international partners.

Approach

We use Quantitative Structure Modeling (QSM) to collect massive non-destructive data (WP1) for tree biomass allometry development (WP2) and for the calibration of remote sensing inversion model of forest aboveground biomass (WP3) in regional tropical forest case studies (WP4) in order to provide guidelines, tools and data to national REDD+ services in three partner countries in south-America (Suriname and Guyana) and Central Africa (Cameroon) (WP5).

More information

www.eragas.eu/research-projects/3dformod

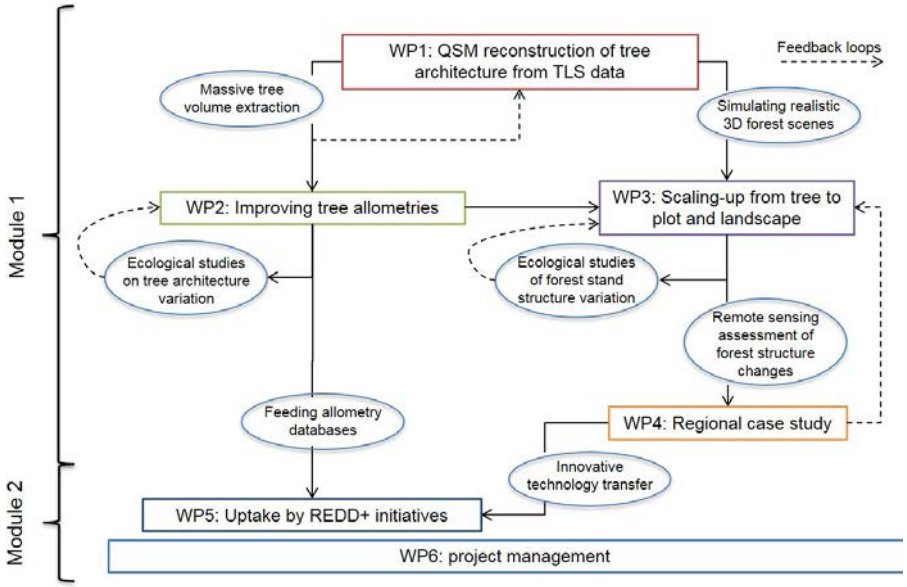
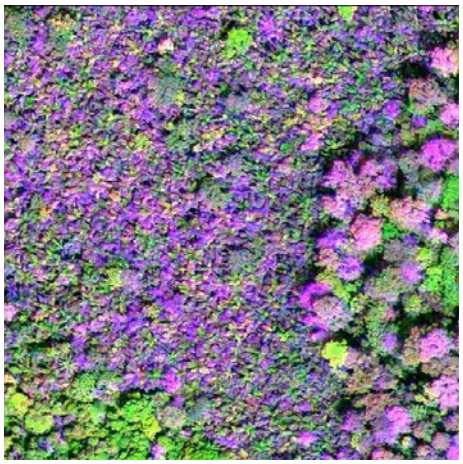


Figure 1. Schematic representation of project organisation with module 1 with core science work packages and module 2 with project management and results dissemination packages. QSM = Quantitative Structural Models; TLS = Terrestrial Laser Scanners; REDD+ = UN-Programme on Reducing Emissions from Deforestation and Forest Degradation



False color satellite imagery of a mixed-deciduous forest canopy in south-eastern Cameroon. *Photo: DigitalGlobe*

Expected results and benefits

- Reducing uncertainty in tropical forest aboveground biomass assessment for better estimations of C stocks and of emission factors from forest degradation;
- Improving methodologies for monitoring, reporting and verification of GHG emissions, sinks and mitigation actions by national agencies in developing countries;
- Technology transfers towards end-users, including national operational services and private consultancy companies, can also provide applications of high visibility of large-scale EU programs delivering Earth Observation data;
- Improving information for EU about C stocks and forest degradation impacts in several regions of the tropical world as to better support developing countries in terms of payment for environmental services, notably those in the UNFCCC stake-holders conferences;
- Enhancing resource allocation and efficiency of European Development Funds that aim to foster forest conservation and limit GHG emissions through the REDD+ process.

Setting up Terrestrial LiDAR Scanner for capturing tree structure in peruvian amazon forest. *Photo: Alvaro Lau Sarmiento*

FACCE ERA-GAS receives funding from the European Union's Horizon 2020 Research & Innovation Programme under Grant Agreement No. 696356

FACCE ERA-GAS

MONITORING & MITIGATION OF GREENHOUSE GASES FROM AGRI- AND SILVI-CULTURE

CEDERS

Project acronym CEDERS

Project duration 01/10/2017 – 30/09/2020

Total requested budget € 1,830,000

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Capturing Effects of Diet on Emissions from Ruminant Systems

Challenge

Feed management in ruminant production systems strongly affects agricultural greenhouse gas (GHG) emissions. CEDERS aims to (i) delineate dietary effects on various on-farm GHG sources and their trade-offs, at the farm and national scales; (ii) align national agricultural GHG inventory and mitigation research across an international consortium of partner/committed countries.

Project aims

- Develop databases to evaluate dietary mitigation strategies (including digestion and excretion) and GHG emissions
- Experiments to fill high-priority knowledge gaps on dietary effects on ruminant and manure emissions
- Evaluate consequences of dietary mitigation measures on emissions on selected farm cases with a modelling platform
- Improve farm accounting and national inventory methodologies to capture effects of dietary mitigation measures
- Disseminate the implications of findings to end-users of GHG accounting and inventory
- Extending activities to other partners/countries (the FACCE-JPI Global Network, the Network and Database on Feed and Nutrition and Manure Management Network (both part of the Global Research Alliance (GRA)), Food and Agriculture Organisation (FAO) and Agricultural Research for Development (CIRAD))

Approach

CEDERS aims to align national agricultural greenhouse gas (GHG) emissions inventory and mitigation research across an international consortium of 9 countries (8 partner countries plus New Zealand). The project focusses on capturing the dietary effects on GHG emissions, and research activities include (i) database development and analysis; (ii) model development; (iii) experimental work including manure emissions; (iv) use of process-based modelling, (v) comparison of farm accounting tools and national inventory methodologies, and (vi) dissemination of results and insights (Figure 1).

More information

www.eragas.eu/research-projects/ceders

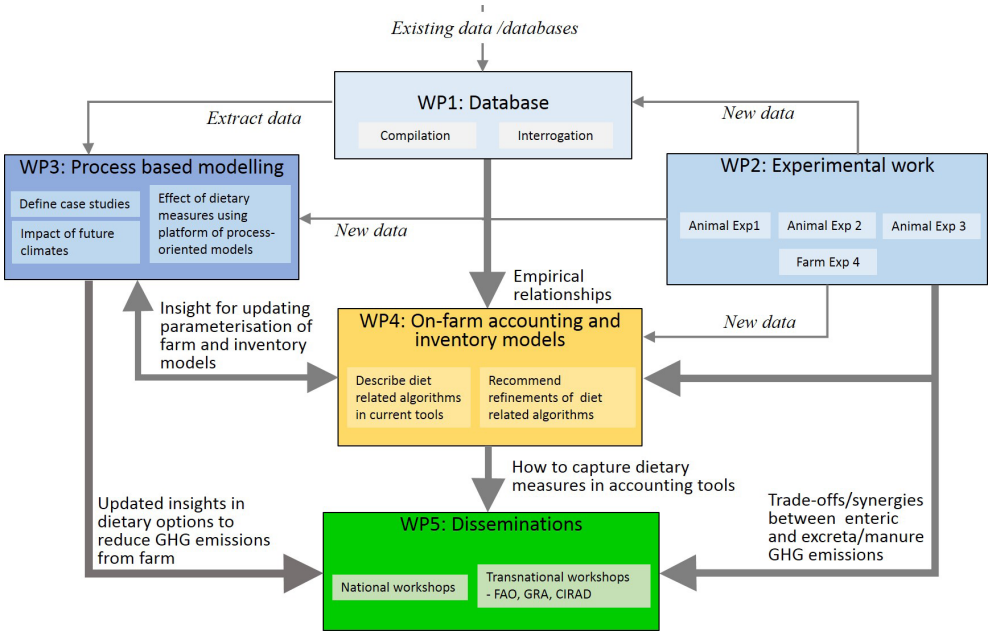

Figure 1. Overview of Work Packages and their interaction in the CEDERS project

Dairy cows grazing in the meadow

Dairy cows in the barn

Expected results and benefits

- Refinement of methodologies to estimate the effect of dietary measures on different on-farm GHG emissions, and their trade-offs
- Empirical evidence is gathered for the trade-offs between animal, excreta/manure and soil related GHG emissions
- Detailed process-based models are applied in combination with the evaluation of well-monitored farm cases with sufficient data available to capture actual farming conditions and to constrain models well enough to obtain realistic GHG emissions projections
- Relationships between dietary factors and the whole farm GHG profile, as well as the emission potential of enteric methane and emissions from excreta/manure
- Refined insight into the inter-dependencies of on-farm GHG emissions (trade-offs and synergies, integral assessments), and the consequences for farm- and country-specific methodologies of GHG accounting
- Country and end-user specific recommendations on how to capture and account for the consequences of dietary measures on GHG emissions with on-farm accounting tools and national GHG inventory methodologies
- Guidelines for non-partner countries that seek collaboration
- Working in conjunction with the Feed and Nutrition Network Group (FNN) in particular under the Global Research Alliance (GRA) platform; expanding current databases from the FACCE-JPI Global Network, UK GHG platform projects and French GHG database

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FORCLIMIT

Project acronym FORCLIMIT

Project duration 01/10/2017 – 31/05/2020

Total requested budget € 1,123,000

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Mobilizing and Monitoring Climate Positive Efforts in Forests and Forestry

Challenge

The mitigation potential of Europe's forests is significant, but is underutilized in the EU climate policy framework. European forests offset approximately 13% of European fossil fuel-based emissions. To increase the mitigation in forest landscapes incentives are needed and the uncertainty regarding implementation and effects of mitigation strategies must be reduced.

Project aims

The aim of FORCLIMIT is to build and provide the stepping stones of an effective forest-based climate change mitigation strategy. The specific aims is:

- To analyze and suggest improvements in a unified international policy framework that facilitates consistent carbon accounting of forests across countries.
- To analyze economic and policy strategies for motivating landowners to undertake efforts for mitigation in forests and further on down the wood value chain.
- To add to an MRV system aimed at improved estimation of soils emissions and sinks, improved emissions and sinks estimates from stand to landscape level and assessment of economic and policy measures.

Approach

The overall concept of FORCLIMIT is almost cyclical (Figure 1): it rests on a combination of policy analysis, connections to strategies to motivate landowners and the required improved insights in emissions factors for soils and improved MRV.

WP1 and 2 address the forest accounting problem among Parties to the UNFCCC, i.e. how the LULUCF sector will be included in the international Paris-based and EU Climate policy framework(s). WP4 and 5 addresses how national and local level data can be improved to further reduce uncertainties.

The project further addresses strategies for incentivizing carbon-friendly efforts from the national all the way down to the landowner levels, and further to end users and consumers of forest products in WP3. The improved strategies to motivate landowners and the improved emissions factors are assessed in carbon balance models at the country level in scenario studies which span a great diversity in forestry and MRV practices and problems (WP6).

More information

www.eragas.eu/research-projects/forclimit

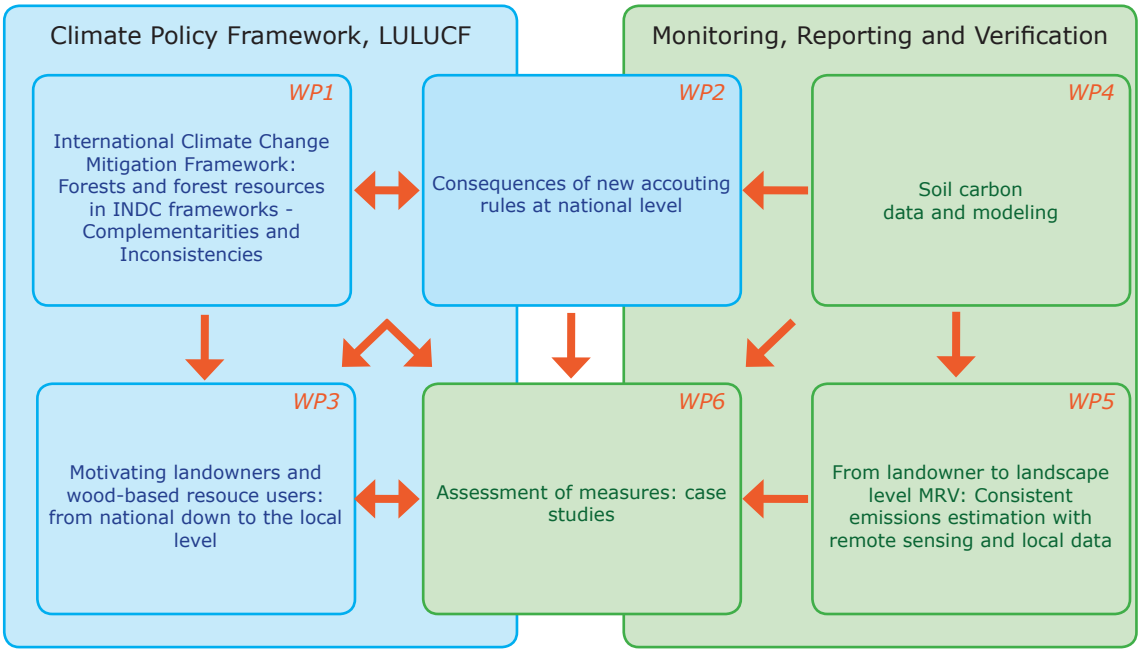

Figure 1. Relation between Work Package topics in FORCLIMIT

The FORCLIMIT project team at the kick-off in mid-November 2017. *Photo: Hurdalsjøen hotel*

Forest, students and morning fog in the NMBU-park. *Photo: Gisle Bjørneby - NMBU*

Expected results and benefits

FORCLIMIT will make a significant impact especially through the joint endeavour of policy framework, motivating landowners and improved MRVs. Thus,

- We expect optimization in the forest policy framework within the national decision-making frameworks, providing strategies for more rapid, cost-efficient and successful climate change mitigation.
- We also expect to identify meaningful sectoral level forest and forest resource-based mitigation strategies, to link these strategies to local landowners and regional-level climate change mitigation strategies, and to provide an important contribution to general climate change mitigation goals. Currently, the optimal range of options and how national level strategies can mobilize these resources lacks research. Consequently, the potential represented by forests and forest-based resources is not adequately integrated into the general climate policy framework.
- Further, knowledge and the successful modelling of the forest and forest-resource based sequestration potential has been hampered by the lack of good soil-based models. We will integrate soil modelling into our analysis of forest and forest resource-based mitigation potentials. Incorporation of soil carbon inputs in local estimates (local MRV) is also a prerequisite for implementing local mitigation strategies. We expect these components to have an important impact on future modelling and estimation/monitoring potential and thus the pursuit of forest-based mitigation goals.

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MONITORING & MITIGATION OF GREENHOUSE GASES FROM AGRI- AND SILVI-CULTURE

GHG-Manage

Project acronym GHG-Manage

Project duration 01/10/2017 – 30/09/2020

Total requested budget € 1,229,000

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Managing and reporting of greenhouse gas emissions and carbon sequestration in different landscape mosaics

Challenge

The overall contribution of a combination of different land uses to carbon sequestration and greenhouse gas (GHG) emissions has been poorly quantified. The objective in this project is to assess the contribution of typical EU landscape mosaics to GHG emissions and carbon sequestration and provide estimates of surface warming effects.

Project aims

- Quantification of the combined impact of different land uses on carbon sequestration and GHG emissions
- Quantification of the combined impact of different land uses on on-farm afforestation and land use-related GHG offsetting
- Identification of optimal land use configurations for offsetting purposes and an assessment of the contribution of forest soils to nitrous oxide and methane budgets
- Assessment of the economic impacts of land use and afforestation-related GHG offsetting
- Development of on-farm reporting tools and methodologies for assessing the effects of landscape scale GHG emissions compensation mechanisms and their economic consequences

Approach

The approach is directed at providing the evidence base for utilizing different landscape elements for mitigation purposes through a better understanding of how these can be configured to minimize or offset GHG emissions and enhance carbon sequestration. This will be supported by the development of on-farm sensors providing real time information on GHG budgets. Focus will be on some of the typical farmed landscape found throughout the EU, with a particular emphasis on those associated with organic soils, which are often unrepresented in studies of GHG budgets. The capacity for forest soils to offset GHG emissions will also be investigated, particularly their capacity for methane oxidation. Also will be examined how differences in albedo might also be used to offset the warming impact of contrasting land uses. The results will be incorporated into models for on-farm assessments of the economic costs and mitigation potential of different land use combinations.

More information

www.eragas.eu/research-projects/ghg-manage

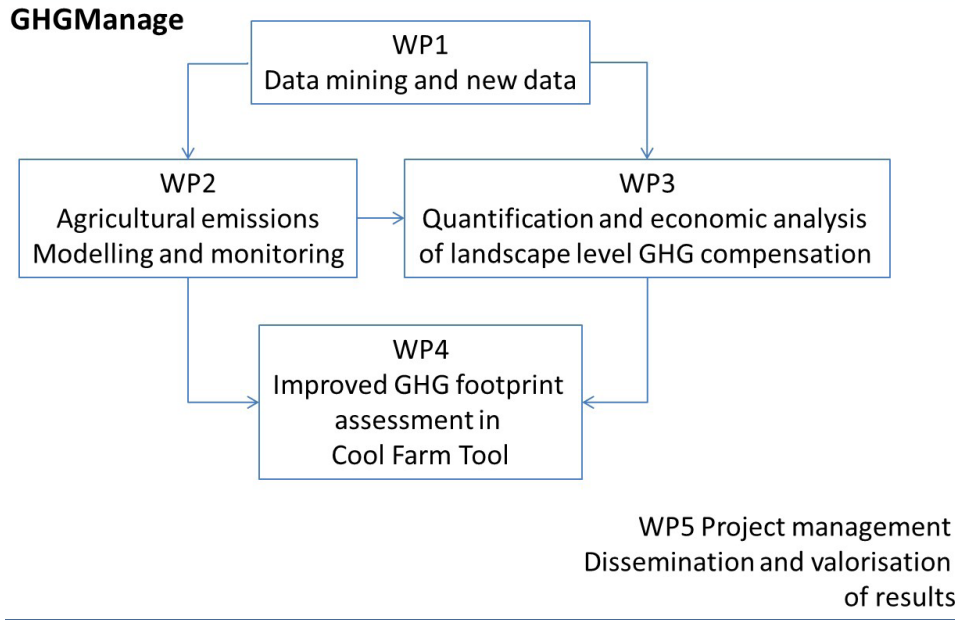

Figure 1. Overview and relationship of Work Packages in GHG-Manage

Example of contrasting landscape mosaics.

Expected results and benefits

GHG-Manage expects the results to provide more informed, evidence based assessments of how different landscape elements, including afforestation, on both mineral and organic soils might be configured to minimize their impacts on GHG emissions, enhance carbon sequestration and reduce any direct global warming effects. Importantly, we will also assess the economic implications of different land scape scale modifications. These results will be important for the development of new models and reporting tools, for refining national GHG inventories and the development of new methodologies, data sets and tools and for the identification of mitigation options. Life cycle assessments that evaluate the socio-economic constraints across different land quality and livestock production systems will provide more details on suitable management choices that are open to the farmer. In a wider context this information will be important for a wide range of stakeholders and for policy development and reporting purposes at national and international/EU level as part of country-wide commitments on reducing GHG emissions and enhancing soil carbon sequestration in agro-ecosystems.

Example of contrasting landscape mosaics.

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MONITORING & MITIGATION OF GREENHOUSE GASES FROM AGRI- AND SILVI-CULTURE

INVENT

Project acronym	INVENT
Project duration	01/10/2017 – 30/09/2020
Total requested budget	€ 1,027,000

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Improving National forest inventory-based carbon stock change estimates for greenhouse gas inVENTories

Challenge

The annual carbon sequestration in European forests is large, 400-450 million tons CO_2-equivalents. However, high uncertainties in estimates challenge its inclusion into international mitigation mechanisms. In addition, national mitigation efforts are not captured in current greenhouse gas (GHG) reporting methods due to a lack of methods applicable to the sub-national scale.

Project aims

- To increase the precision of carbon stock change (CSC) estimates in forest living biomass by utilizing auxiliary information, such as remotely sensed data, within a model-assisted framework.
- To improve the accuracy of soil organic carbon change (and stock) estimates by combining soil inventory data, empirical models, auxiliary data/maps and process model estimates.
- To develop methods facilitating GHG inventories in forest on the local scale (municipality, estate).
- To implement new methods in current national GHG inventories and evaluate their impacts on estimated emissions, their applicability relating to the UNFCCC reporting demands, and their potential for the development of mitigation strategies.

Approach

The project team consists of LULUCF reporting experts in four countries. In the project, two technical WP's (biomass C and soil C) will use auxiliary data (incl. remote sensing, harvest registration, terrain models, updated soil C model input) to improve spatial information relevant for GHG inventories at the national and the sub-national scale. The reduction, quantification and communication of uncertainties are important. Stakeholders at both the national and the sub-national level will participate in designing and evaluating methods. A third WP will implement new methods and evaluate their impacts and applicability.

More information

www.eragas.eu/research-projects/invent

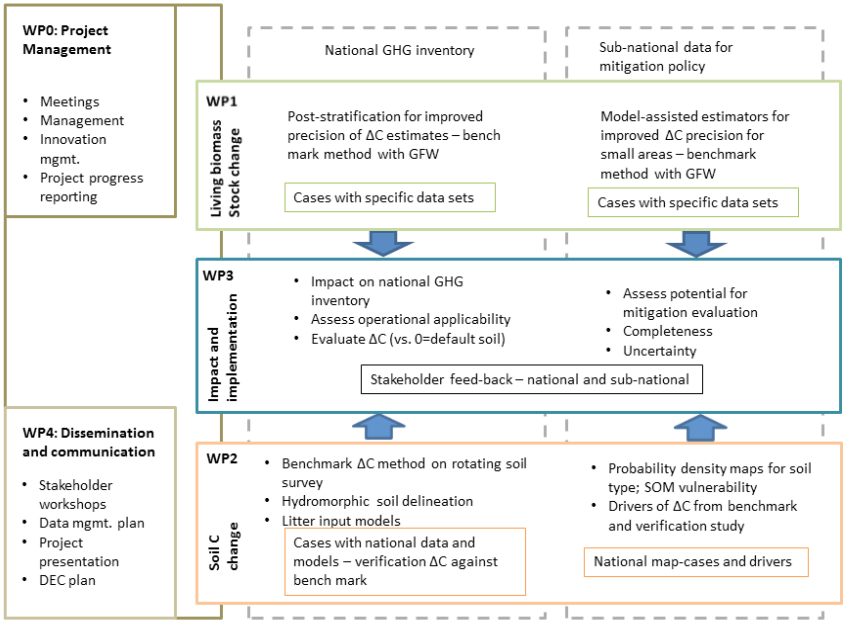

Figure 1. INVENT explores the potential for improving GHG reporting of living biomass and soil carbon changes in forest by developing new methods and testing these with stakeholders and in existing national GHG inventories

Clearcut and forest landscape in Buskerud, south-east Norway. *Photo: John Y. Larsson*

Expected results and benefits

INVENT combines existing data and models in a framework for developing more accurate (unbiased) and precise (minimised random error) estimation procedures for CSC in forest at different spatial scales. INVENT will propose and make available new methodology but will also perform a test through implementation in GHG inventories and by including national and sub-national stakeholders. Expected results and benefits include:

- A decrease in uncertainty for CSC estimates for forest in national GHG inventories
- The development of methods that facilitate GHG inventory on the sub-national scale and identify limitations and uncertainties
- The identification of data and resolution needed for future sub-national GHG inventories.
- The identification of the potential benefits of using different remote sensing data sources and harvest registrations for improving NFI-based estimates of CSC in living biomass
- The development of an empirical model for soil C stocks and changes based on soil inventory data – and compare this (where relevant) to dynamic soil C model estimates.
- Identify relevant use of soil maps (soil related auxiliary data, model generated maps) in GHG inventories
- Communication of results and protocols to reporting teams elsewhere facilitating the development of new and improved methods in other countries.
- Long term benefit will be higher confidence in mitigation policy and development of FMRL

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MONITORING & MITIGATION OF GREENHOUSE GASES FROM AGRI- AND SILVI-CULTURE

MAGGE-pH

Project acronym	MAGGE-pH
Project duration	01/11/2017 – 31/10/2020
Total requested budget	€ 2,269,000

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Mitigating Agricultural Greenhouse Gas Emissions by improved pH management of soils

Challenge

Climate forcing from plant production is dominated by N_2O emissions. Although emissions can be marginally reduced by "good agronomic practice", we need more targeted approaches to make progress. For that, MAGGE-pH concentrates on the microbial processes responsible for production and consumption of N_2O in soils. Our point of departure is the emerging understanding of how soil pH pervasively controls the $N2O/(N_2O+N_2)$ product ratio of denitrification.

Project aims

- To evaluate the effects of soil pH on N_2O emission in field experiments in cool climates
- To understand the mechanisms behind these effects, using mesocosm experiments
- To explore novel options for pH control and fertilization that will not increase N_2O emission
- To evaluate the potential for upscaling N_2O mitigation across Europe, by integrating soil maps, liming practices and N_2O emission responses into empirical models
- To identify suitable policy instruments that promote the implementation of GHG-targeted pH management schemes

Approach

MAGGE-pH is a field-based research project with a strong dissemination component involving universities, agricultural research institutes, extension services and precision agriculture companies. To support and generalise findings from field research, a multidisciplinary team will work on different aspects of pH control in soil-plant systems (microbial C and N cycling, GHG turnover, microbial ecology) under controlled laboratory conditions, using soils from the field experiments and applying high-end molecular and isotope approaches. Partners with documented expertise in economic modelling and regionalisation of biogeochemical fluxes will synthesize findings and provide cost-benefit analyses. Thus, MAGGE-pH will: i) provide candid evaluation of soil pH management effects on yields and N_2O emissions in relevant cropping systems, ii) improve our understanding of the mechanisms involved, iii) create a database on N_2O emission factors, which is explicit for soil pH/liming, and iv) estimate regional cost/benefits. The project will generate a substantial amount of yield-scaled N_2O emission data, which will be available for GHG inventories.

More information

www.eragas.eu/research-projects/magge-ph

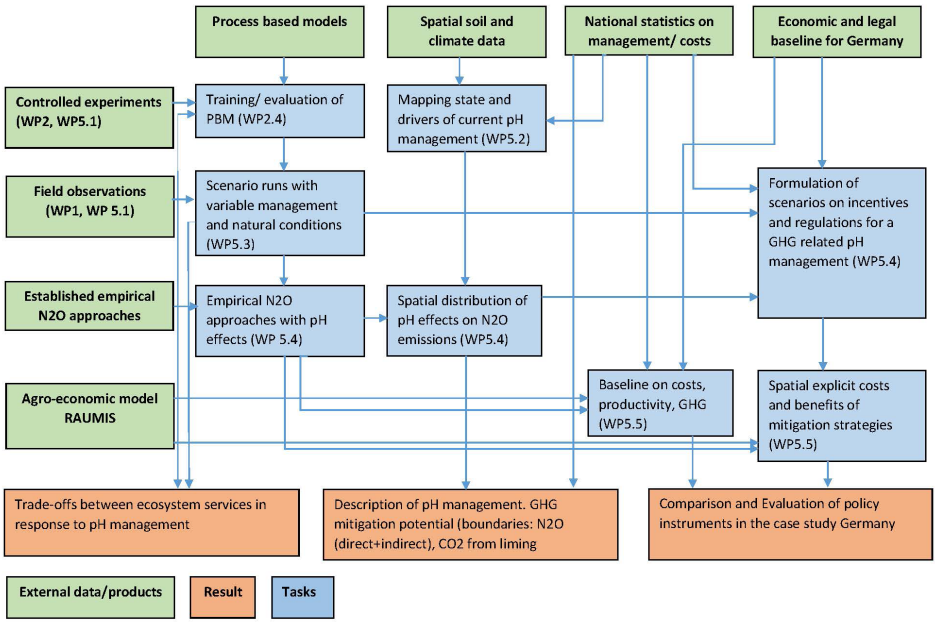
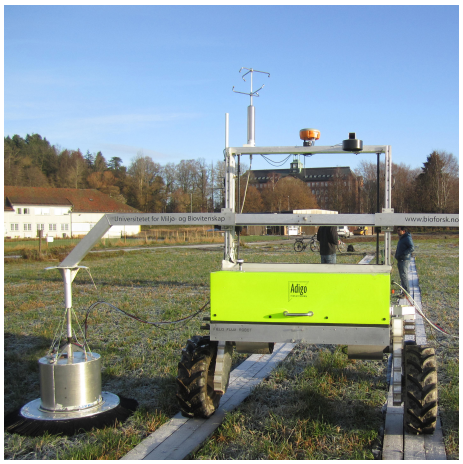
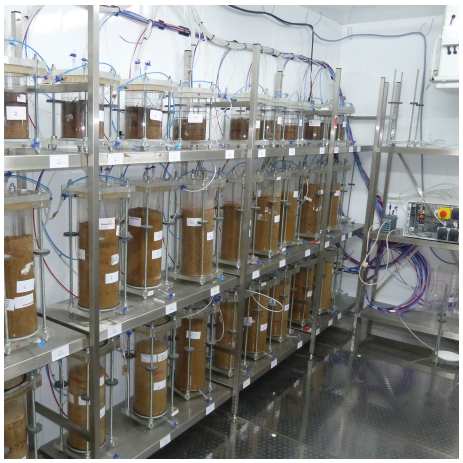


Figure 1. The flow of information through experiments, analyses and models into outputs, recommendations and policy implications



The N_2O sampling robot at the field site of the Norwegian University of Life Sciences



Soil mesocosm incubation system for continuous monitoring of gaseous fluxes at the Thünen Institute. *Photo: Wordell-Dietrich*

Expected results and benefits

The Magge-pH project:

- Creates a scientific framework for targeting GHG emissions through pH management that if successful, can be implemented immediately and cost efficiently;
- Improves national GHG inventories by providing emission data for multiple representative field sites, and upscaling to regional levels;
- Enhances innovation and commercial strength of associated SMEs by new ideas, evaluation of products, and by exposure to stakeholders;
- Fosters innovations both at the farm level and in collaboration with industries that provide tools/materials for soil management in general, and soil pH management in particular;
- Provides a platform for testing innovations for monitoring and precision farming, which will strengthen the SMEs by exposure to as well as transfer of knowledge;
- Strengthens the innovative capacity of the N_2O research community, by interaction with other disciplines as well as stakeholders and innovative SMEs; and
- Communicates new knowledge to stakeholders and policymakers, and enhances the innovation of new policy instruments to make implementations economically feasible.

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MONITORING & MITIGATION OF GREENHOUSE GASES FROM AGRI- AND SILVI-CULTURE

METHLAB

Project acronym METHLAB

Project duration 01/10/2017 – 30/09/2020

Total requested budget € 1,036,000

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Refining direct fed microbials (DFM) and silage inoculants for reduction of methane emissions from ruminants

Challenge

Reducing agricultural green-house-gas (GHG) emissions is a challenge, particularly as agricultural intensity is increasing globally. In this proposal, on-farm lactic acid bacteria (LAB) technologies such as feed supplements and/or silage inoculants, currently used to increase production and improve health of ruminant animals, will be refined with a methane-reducing benefit.

Project aims

- To develop a prioritized list of METHLAB strains with known ability to reduce methane in ruminant animals
- To incorporate METHLAB strains with known ability to reduce methane in ruminants into a product prototype (DFM and/or silage inoculant) to facilitate implementation at farm level
- To evaluate METHLAB strain(s) in ruminants (sheep and dairy cows) to confirm efficacy of methane reduction in vivo and on production parameters (dairy cows)
- To develop an Intellectual Property (IP) Management Plan (the Plan), established by all participating institutes to address management of IP that will be developed as a result of the work performed.

Approach

Live microbial cultures with demonstrated ability to reduce methane in vitro and suitable for industrial use will be isolated and applied in animal trials, to confirm efficacy of methane reduction effects on the rumen microbiome and production parameters in vivo. A route to market is considered relatively straightforward as DFMs and silage inoculants have LAB as a main microbial ingredient and are already commercially available, accepted, and used on farms worldwide. This proposal thus supports the development of a competitive, sustainable and profitable global Agri-food sector. The partners in this proposal are all from Global Research Alliance (GRA) member countries that share the goal of reducing methane emission intensity across ruminant classes in a manner that maintains agricultural production and sustains environmental integrity.

More information

www.eragas.eu/research-projects/methlab

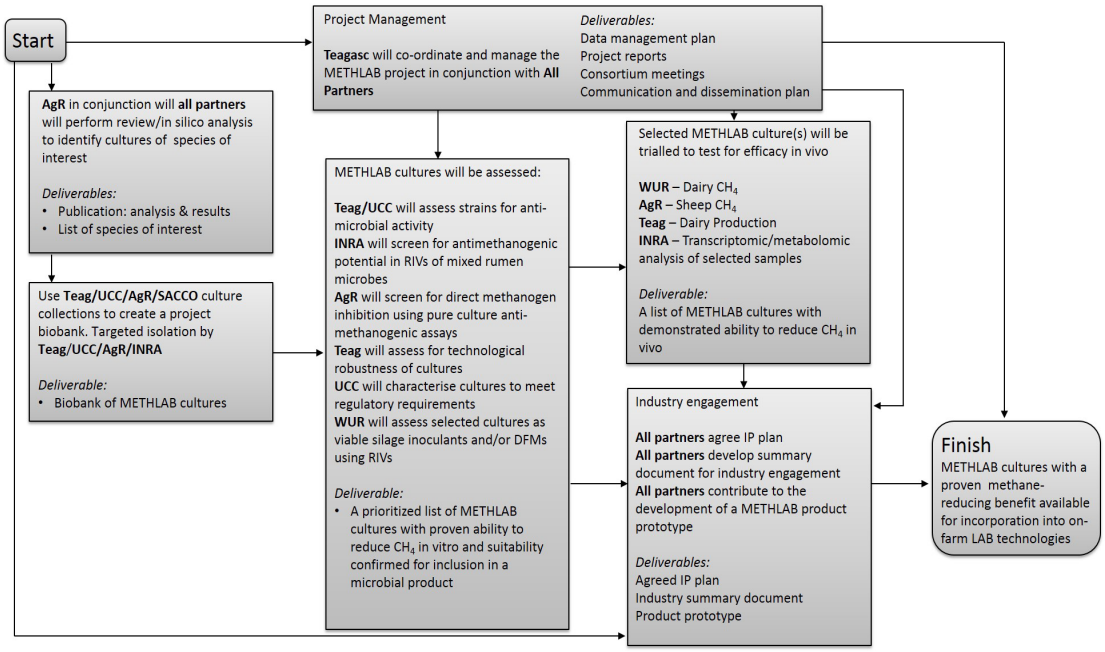

Figure 1. Schematic overview of the METHLAB project

Cows grazing

Expected results and benefits

METHLAB has brought together a transnational multidisciplinary team of experts to generate new knowledge and solutions to mitigate GHG emissions. The overall goal of METHLAB is to identify and select innovative methane-reducing lactic acid bacteria (LAB) which can be successfully incorporated into ruminant feedstuffs to create a more sustainable, emission-efficient food production system.

Expected Results:

- A prioritised list of METHLAB strains with known ability to reduce methane in ruminant animals
- Optimised METHLAB strain(s) incorporated into an appropriate product (DFM and/or silage inoculant) to facilitate implementation at farm level
- Building capacity and knowledge sharing between countries to foster synergies and strengthen co-operation and collaboration to address the challenge of greenhouse gases emissions
- Create environmental benefits with the potential to deliver green jobs and increase competitiveness
- Disseminate the scientific findings and technological solutions to all relevant stakeholders (from the farmer to policy makers)

METHLAB

FACCE ERA-GAS receives funding from the European Union's Horizon 2020 Research & Innovation Programme under Grant Agreement No. 696356

FACCE ERA-GAS

MONITORING & MITIGATION OF GREENHOUSE GASES FROM AGRI- AND SILVI-CULTURE

PEATWISE

Project acronym	PEATWISE
Project duration	01/11/2017 – 31/10/2020
Total requested budget	€ 1,939,000

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Wise use of drained peatlands in a bio-based economy:
Development of improved assessment practices and sustainable techniques for mitigation of greenhouse gases

Challenge

Drained peat soils are known hotspots for greenhouse gas (GHG) emissions. EU countries are responsible for the second largest emissions from drained peatlands worldwide. Drainage is a precondition for "classical" biomass production such as agriculture and forestry, but leads to oxidation of peat (organic matter) resulting in emissions of CO_2 and N_2O, in particular. The GHG emission rates (fluxes) depend on a range of factors such as soil and water management; nutrient status and carbon availability; climate and hydrology. The emission control is complex and uncertain, which hampers scientific guidance for sustainable policy development. There is a clear need to refine existing mitigation measures, develop new ones and test solutions at field scales. Particularly sought after are solutions that both increase biomass production and reduce greenhouse gas emissions. These kinds of innovative production systems need to be supported by appropriate policies and governance models.

Project aims

- To integrate past and new knowledge into a more holistic understanding of peatland management and emission observation, control and mitigation
- To develop solutions how to rewet peatlands and still cultivate biomass (paludiculture)
- To test new and evaluate existing methods to reduce emissions and maintain biomass production on managed peatlands (drained sites)
- To develop methods for an integrated and holistic assessment of GHG mitigation (impacts, cost and benefits) improving national inventories and reducing uncertainties
- To advance the transition in land use towards lower environmental impact from use of peat soils

Approach

The overall approach in PEATWISE is to work on various technical methods to reduce GHG emission and environmental impacts. The project starts with a systematic review on peatland processes and characteristics, available mitigations options and good management approaches.

More information

www.eragas.eu/research-projects/peatwise

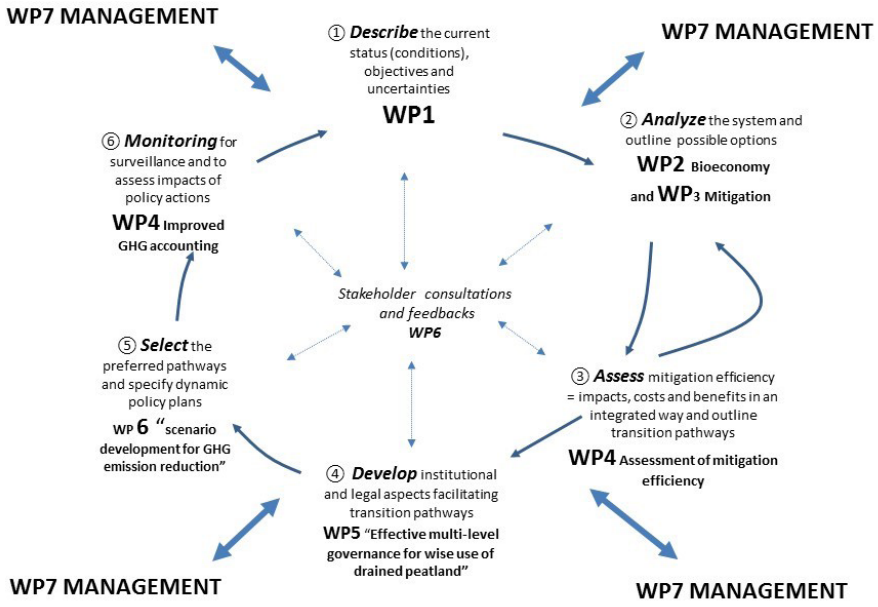

Figure 1. Overview of Work Packages and their interaction in the PEATWISE project

Cultivated peatlands are fertile but lead to green house gas emission. *Photo Örjan Berglund*

Peatlands are often used as grasslands. *Photo Hlynur Óskarsson*

Technical options and management solutions are studied and tested for some cases in WP2 (paludiculture) and WP3 (drainage, cultivation and forestry). In WP4, the options outlined in WP2 and WP3 are compared and assessed in a wider context including cost-benefit analyses and environmental impact assessments. WP5 assesses institutional and policy contexts and outlines smart options for future land use policies. In WP6, different scenarios for future peatland management are developed with stakeholders. Stakeholder communication and final result integration in a user friendly way are essential tasks of WP6.

Expected results and benefits

The project outputs will result in:

- more accurate knowledge on GHG emissions from different types of peat soils
- good examples of how to mitigate GHG emissions from peat soils including an assessment of related uncertainties
- information on managed peatlands including novel drainage techniques and shallow drainage guidance for farmers on future land use options and production systems
- information on cost effectiveness of mitigation measures, their monitoring and assessment
- better integration of stakeholder needs and scientific expert knowledge in the management process

The project will benefit:

- authorities responsible for greenhouse gas emission monitoring, control and policy
- farmers on solutions for land management and impact of measures
- wider public on the role of emission from peatlands and measures and options to control it

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MONITORING & MITIGATION OF GREENHOUSE GASES FROM AGRI- AND SILVI-CULTURE

ResidueGas

Project acronym ResidueGas

Project duration 01/11/2017 – 31/10/2021

Total requested budget € 1,376,000

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Improved estimation and mitigation of nitrous oxide emissions and soil carbon storage from crop residues

Challenge

The current estimations of N_2O emissions from crop residues are associated with some of the highest uncertainties in national GHG inventories. These uncertainties relate to: 1) the amount and N content of the returned residue; 2) the magnitude of N_2O emissions associated with the application of residues to soils; and 3) how this differs with crop species, soils, climate and management.

Project aims

- Propose a new and improved methodology to estimate N_2O emissions from crop residues for the most important cropping systems in Europe, for use in national emissions inventories.
- Assess the relative importance of crop residue management for total N_2O emissions and the soil C and N balance of agricultural systems across different cropping and residue management systems for various soils and for different climates, as a basis for the identification and implementation of mitigation strategies.

Approach

ResidueGas will, through reviewing existing findings and data, targeted experimental studies for Europe, and improved modelling, suggest a new method to account for N_2O emissions from residues. Furthermore, ResidueGas will evaluate the mitigation potential of combined effects on SOC storage and N_2O emissions from residue recycling and develop new software tools that will assist in identifying and quantifying these mitigation options. Evidence on controlling mechanisms will be used to improve biogeochemical models for simulating N_2O emissions and SOC storage, and to test these effects under field conditions.

The improved models will be used as the basis for developing a residue decision support system, which allows estimation of soil N_2O and SOC changes under characteristics crop rotations, soils and agro-environmental zones in Europe. Simulations will be aggregated into a meta-model that represent a simplified, but greatly improved approach to estimate residue effects on soil N_2O emissions and SOC stocks.

More information

www.eragas.eu/research-projects/residuegas

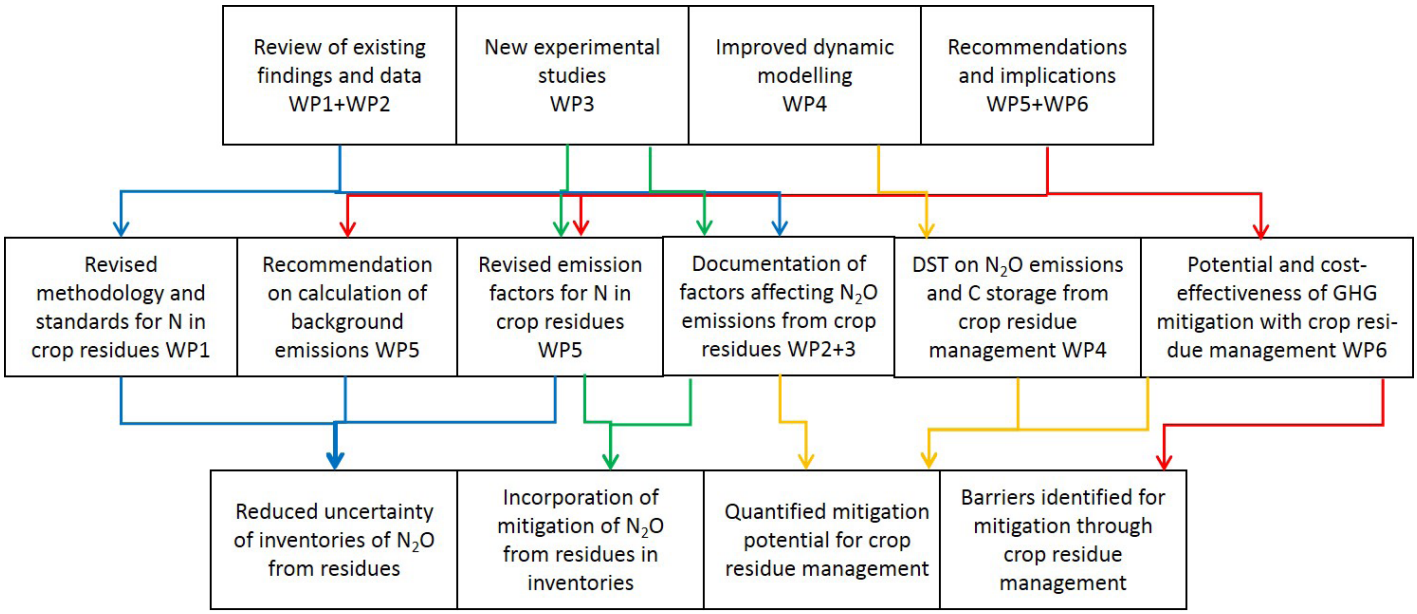

Figure 1. Activities in ResidueGas to achieve main impacts

Crop residues are often not homogeneously incorporated in the soil after ploughing

Grass-clover contributes nitrogen through biological fixations, which subsequently becomes a source for N_2O emissions.

Expected results and benefits

- Documentation of an improved methodology to quantify N_2O emissions from agricultural crop residues management, thus providing a basis to identify targeted measures for reducing these emissions. This includes a standard methodology for estimating the amount of N in residues, improved emission factors for different crop rotation systems in different soils and climates, and identification of the effects of residue quality and management on emissions.
- Quantitative information about crop residue management strategies with respect to their net greenhouse gas effect in terms of N_2O emissions, radiative forcing and soil C storage, which will be used to identify best practices for residue management.

ResidueGas considers four primary impacts:

1. Reduced uncertainty of inventories of N_2O from residues,
2. Incorporation of mitigation of N_2O from residues in inventories,
3. Quantified mitigation potential for crop residue management, and
4. Barriers identified for mitigation through crop residue management.

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FACCE ERA-GAS

MONITORING & MITIGATION OF GREENHOUSE GASES FROM AGRI- AND SILVI-CULTURE

RumenPredict

Project acronym	RumenPredict
Project duration	01/10/2017 – 30/09/2020
Total requested budget	€ 1.592.000

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Predicting appropriate GHG mitigation strategies based on modelling variables that contribute to ruminant environmental impact

Challenge

Livestock are responsible for approx. 37% of methane (CH_4) and approx. 65 % of nitrous oxide (N_2O) released into the environment. Many factors govern CH_4 and N output, including the rumen microbiome, diet and host genomics. RumenPredict aims to enhance understanding of the rumen microbiome in relation to diet and host genomics, allowing future recommendations for breeding and nutrition, coupled with the ability to predict animal phenotype.

Project aims

- To test the key hypothesis that animal phenotype (nitrogen use efficiency and GHG emissions) is defined by the interaction between host genome and rumen microbiome.
- To develop and validate promising feed based mitigation strategies.
- To define minimum requirements for conducting and reporting rumen microbial omics data in order to develop consistent, reliable datasets for analysis of samples generated in RumenPredict and those beyond this project.
- To test the existing hypothesis that key genes are upregulated in the rumen/buccal microbiome of high methane emitting ruminants and that these genes could be used as biomarkers to predict GHG emissions in ruminants.
- To utilise the information generated within RumenPredict to forecast nitrogen and methane losses from ruminants.

Approach

We will address the objectives of the project by:

- Developing robust and standardised methods to study the rumen and buccal microbiome.
- Phenotyping over 1000 ruminants (Including beef and dairy animals) and correlating data to the rumen and buccal microbiome.
- Developing dietary strategies to manipulate the rumen microbiome in order to improve upon ruminant phenotype.
- Validating gene based markers for predicting ruminant phenotype.

More information

www.eragas.eu/research-projects/invent

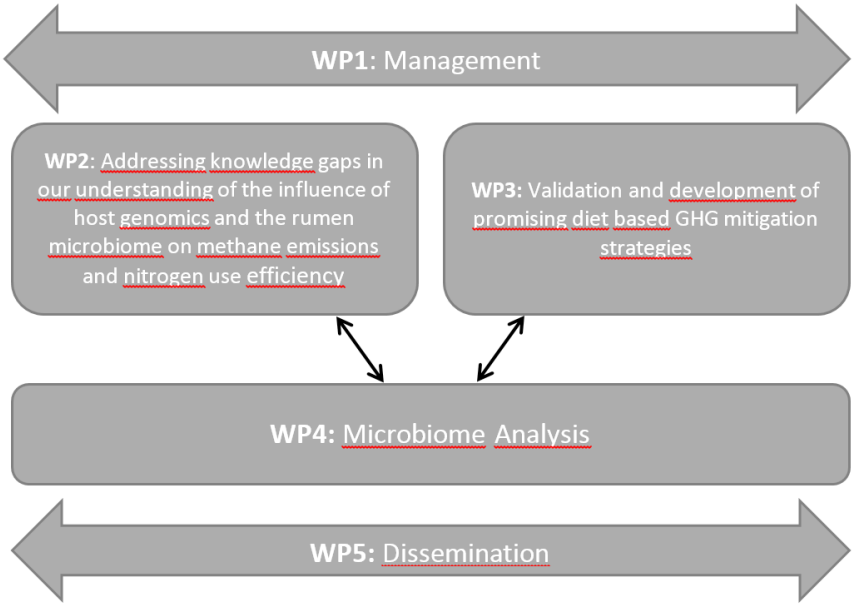

Figure 1. Workpackages of the RumenPredict project

RumenPredict Kick-off meeting

Expected results and benefits

The expected results deliverables are as follows:

- Integration of microbial and host genomic interaction models with the RumenMine database to allow researchers globally to test predictions for their geo-climatic conditions.
- Sets of genes (microbial and host genomic) with proven function that contribute to the low or high emission phenotype in ruminants that will serve as new targets in existing methane mitigation research programmes.
- Rumen manipulation techniques with demonstrated efficacy in vitro or small scale animal trials, ready for product development.

Ultimately this will allow RumenPredict partners to make recommendations to stakeholders with respect to breeding and nutritional strategies to beneficially programme the rumen microbiome in order to enhance animal production and reduce environmental methane output. We will also benefit the sector through developing gen based marker tools allowing prediction of animal production and methane output.

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