CLAND CHALLENGE 1– LAND-BASED CLIMATE MITIGATION

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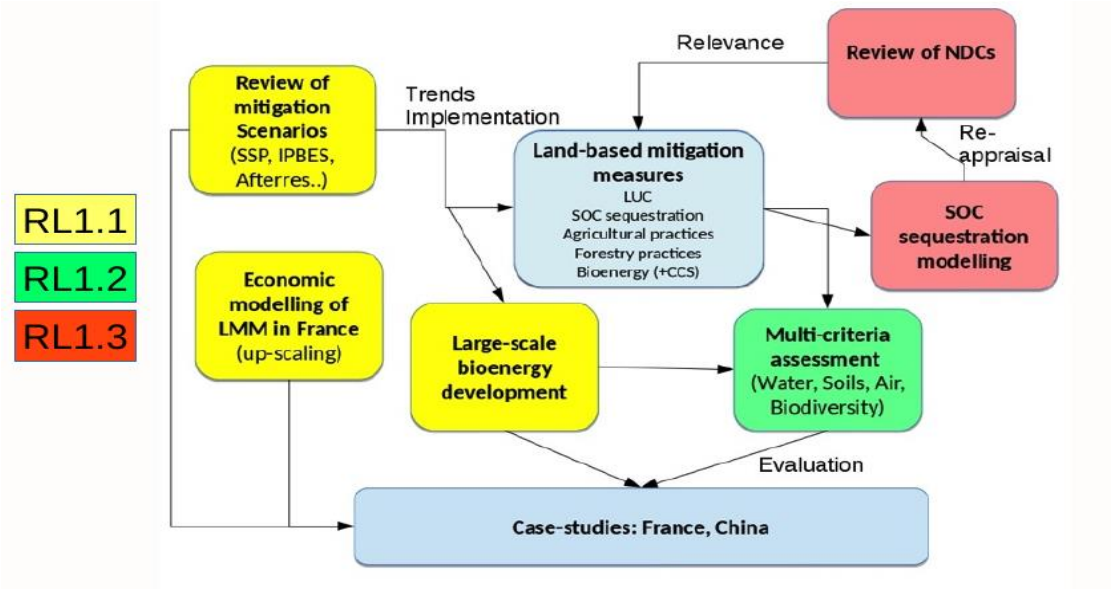

Schematic of workflow and research lines in Challenge 1

Disclaimer - this text has been written to implement the Challenge 1 as described in the proposal. After receiving expressions of interest from all CLAND teams, it is subject to adjustments.

All the young scientists hired in all the CLAND projects will be in a host team / lab for day-to-day supervision. Co-supervision by at least two teams in different laboratories organized by responsible for each research line. Co-supervision includes participation to regular progress meetings with the young scientists hired, official joint PhD supervision in the case of PhD students, discussing new ideas, joint writing of publications and visits in the co-supervising lab(s). At this stage, possible co-supervision were identified but we will wait for expressions of interests from all CLAND research teams to set the co-supervising scheme in each RL.

Research line 1.1 - Review and design of global and regional land-based mitigation scenarios

Overview

The plan of this research line is to first review the different types of land based mitigation measures (LMM) currently incorporated in future climate scenarios by integrated assessment models under different climate warming objectives (SSPs-RCPs) as part of in WP 1.1.1. The specific LMMs that will be reviewed are biofuels associated with CO_2 capture and sequestration known as BECCS, afforestation and reforestation, soil carbon storage, reduction of N_2O and of CH_4 emissions including the scale of deployment in each region, the timing of deployment and assumed costs in integrated assessment models. This analysis will be performed in collaboration with IIASA at global scale from the existing database of SSP-RCP simulations with a focus on two main regions Europe (with a zoom-over in France if possible) and East Asia (mainly China). Then the topic of BECCS will be specifically studied in WP 1.1.2 by performing a meta-analysis of the current yields of lignocellulosic plants in different regions and for different levels of fertilization / irrigation inputs. A global vegetation model will be calibrated against these data sets to calculate and compare the land use carbon debt associated with the deployment of BECCS from contrasted SSP-RCP scenarios and carbon mitigation achieved with this technology. The result of this detailed study will be compared with the output of integrated assessment models which likely have simpler assumptions on bioenergy feedstock yields. In WP 1.1.3, the abatement potential, cost and potential applicability of land-based mitigation will be calculated with a detailed socio-economic model for France with regional details building up upon previous national projects, and the results of this study will be compared with those of the global scenarios analysis of WP 1.1.1 and WP 1.1.2.

WP 1.1.1 Review of land based mitigation measures existing in global climate scenarios (CIRED, LSCE, other labs)

The IPCC SSP-RCP climate scenarios and possibly other scenarios like IPBES, OECD Representative Agricultural Pathways (RAPs) and other work (Afterres 2050) will be reviewed and analyzed to: 1) Identify all the land based mitigation options and underlying hypothesis included in the models that were used to compute the scenarios and 2) Evaluate the relevance / limits of these scenarios against independent literature estimates (e.g. sequestration potentials, national objectives, estimates of land suitable for LMMs that require new land area like afforestation and BECCS) over different regions of the globe, with a focus on France and China. The review of this WP will build on and contribute to on-going international efforts to characterize and test land-based climate mitigation in global scenarios.

Main collaborators:

CIRED: lead the analysis of SSP RCP scenarios database [TBC]

LSCE: will contribute from PhD of Y Quilcaille ongoing with CIRED, and collaborations with IIASA

ESE:

External collaborators (TBC)

IIASA for access and joint analysis of SSP RCP scenarios database for LMMs

PKU and Chinese Partners for national plans / targets of afforestation and C sequestration in China

Relation with other projects:

LUC4C: This project (2013-2017) provided six scenarios with spatially explicit LMMs from the IMAGE and MagPie land use models that included ADAFF-only (Afforestation), BECCS-only, and a mix of both over the period 2000-2100 out of which LMM carbon storage was estimated by Dynamic Vegetation Models and Integrated Assessment Models (Krause et al. 2017).

STIMUL: This project of BASC will develop land use scenarios for Europe with reduced N fertilizers application and the results of models calculating SOC will be analyzed

CSOPRA: This project funded by ADEME aims to estimate the soil carbon stocks for France using different model and thus reduce the uncertainties on the future projections

WP 1.1.2. BECCS and other 'alternative' mitigation measures in the context of SSP scenarios (ECOSYS, AGRONOMIE, GEOPS, SADAPT, LSCE …)

BECCS or bioenergy followed by capture of CO2 can be considered as an efficient LMM as long as the substitution of fossil fuel achieved does not exceeds additional CO_2 emissions (for instance from land use change) and N_2O emissions associated with the cultivation of these crops. Yet, the practical implementation of bioenergy / BECCS at a scale sufficient for climate mitigation remains highly debated, with 5 main research questions: 1) possible land scarcity, in particular the availability of so called 'marginal lands' where BECCS should be preferentially grown, 2) input amounts and costs in terms of water and nutrient requirements (Robertson et al. 2017, Smith et al. 2016), 3) risks of direct and indirect carbon losses from establishing BECCS or bioenergy on carbon rich ecosystems (Fargione et al. 2008, Mellilo et al; 2008), 4) achievable yields and 5) availability of geological sequestration resources. Thus, it is important to bring new independent science-based estimates to assess at least the questions 2, 3, 4 and 5 in this WP.

We will focus on bioenergy production potentials from woody and herbaceous lignocellulosic crops. The impact of lignocellulosic crops in terms of LMM will be considered based on a new compilation analysis of field trials from 376 sites (yields and inputs). The estimation of carbon losses known as carbon debt or possibly of gains from different implementations of lignocellulosic crops on different land use types will be done by compiling literature data and using the grid-based terrestrial ecosystem ORCHIDEE to simulate the global distribution of carbon losses compared to the substitution of fossil fuel by bio-energy over different time horizons for two contrasted SSP-RCP scenarios. Two scenarios with moderate / intensive BECCS deployment already available from the LUC4C H2020 project (http://luc4c.eu) will be tested, in which future BECCS growing areas were simulated by the MagPIE and IMAGE global land use socioeconomic models. Yields and carbon losses from BECCS in integrated assessment models for IPCC SSP scenarios will be compared to those results. To address question 5, we will analyze maps of geological C storage potential (GEOPS) compared with the distribution of BECCS growing areas from SSP RCP scenarios.

Others Land Management Mitigation options (LMM) are not considered explicitly (to the best of our knowledge) in global integrated assessment models scenarios providing SSP-RCPs. We will considerer LMM that include 'agro-ecological' agricultural practices (with a focus on soil C storing practices, i.e., intercropping, conservation agriculture, agroforestry, organic wastes application or practices resulting in a reduction of N inputs, organic agriculture), forest management (intensification, use of faster growing species), land use changes (afforestation, land sparing). A large review of soil carbon sequestration practices is already available (Soussana et al. 2017) and will be completed by additional data. Technical potentials and possible deployment scale will be compared to what exists

in SSP-RCP simulations obtained from WP 1.1.1. For China and France, the two national study cases, more detailed national data will be collected

Main collaborators:

AGRONOMIE: previous work on the synthesis of biofuels yields;

ECOSYS: contribution to review of LMM increasing soil C and allowing to substitute mineral N fertilizers C.Chenu, S. Houot (?) ; B.Gabrielle for BECCS and bioenergy yields

GEOPS: Thomas Blaise analysis of geological storage potentials collocated with BECCS spatial distribution.

LSCE: implication through data compilation of BECCS yields

External collaborators (TBC):

INRA BIONUTS Bordeaux (T Nesme) : Organic farming future deployment

ETHZ: New maps of current and high / low future deployment based on suitability criteria for conservation agriculture

Relation with other projects:

MAGIC H2020 : this project will provide pan-European data on the yields of lignocellulosics grown on marginal land, and a detailed mapping of these lands.

The EU2020 AGFORWARD project aims to promote agroforestry practices in Europe that will advance rural development i.e. improved competitiveness, and social and environmental enhancement. It provided a map and typology of agroforestry systems in EU (Den Herder et al. 2017)

Etude 4p1000 INRA. (Sept 2017-Aug 2019). This expert assessment will identify the agricultural practices that will allow to increase French soil carbon stocks (agriculture and forestry), their possible combinations and will examine environmental consequences, agronomic feasibility, economical aspects, and constraints to development. It just begun and will mobilize literature review and modelling.

Inter-cropping ? Agronomie ?

WP 1.1.3. Cost-effectiveness of land-based management options to mitigate agricultural GHG emissions in France (ECOPUB, ECOSYS)

This task will 1) to assess the mitigation potential and cost of the French agricultural sector, including soil carbon storage; 2) analyse the cost-effective allocation of mitigation options; iii) to analyse the impacts of policy measures on the implementation of these mitigation options. The LMM deployment in the given areas will be built accounting for the economical context and the context of urbanization, the present trends and acceptability of agricultural and forestry practices, as well as biophysical constraints (soil CEC, soil pH, slopes, etc.).

- We will use i) a model allocating mitigation options so as to minimize the total cost of mitigation for a given abatement target; ii) micro-economic farm-based models. We work at the scale of mainland France with a regional resolution (minimum). We will perform sensitivity analysis to parameters such as abatement potential, cost and potential applicability.

- We will also address the barriers and levers to the adoption of the land-based mitigation measures by farmers, apart from the pure technical implementation cost, to better assess their potential deployment and to improve the design of cost-effective policies
- We will build on the results and network of previous or ongoing studies (e.g. the INRA study on the French agricultural sector mitigation potential (Pellerin, Bamière et al (2013)), the "4/1000" INRA study on the potential contribution of the French agricultural and forest sectors) and projects (e.g. BANCO (REACCTIF n° 15-60-C0024)), as well as with WP2 results. Links can be made with RL 2.1 (e.g. yield data accounting for climate change impacts) and challenge 3 (e.g. land use scenarios for agricultural areas, policy design, up-scaling at EU level).

Expected results: Marginal Abatement Cost Curves (MACCs) giving the unit cost of saving one t of CO2 eq. as a function of the nation-wide abatement potential of each LMM at the French and region levels, maps of mitigation potentials or abatement costs, policy design.

Main collaborators:

ECOPUB (lead): Laure Banière

EcoSys: Claire Chenu, Benjamin Loubet?

External collaborators (TBC):

Relation with other projects:

BANCO – REACTIFF (ADEME) : Laure Bamière compléter

ETUDE 4 per mille from l'INRA (Coord. S Pellerin): (see above description). This study aims to review the literature and perform some simulations over France to identify the possibility of the application of the 4 per mil objectives in France.

Research Line 1.2. Multi-criteria assessment of selected land-based mitigation measures

Overview

This research line will focus on the environmental and ecological impacts of developing land-based mitigation, while the efficiency and GHG abatement potentials of candidate LMM measures are addressed in RL1.1. Most of the literature on LMM focuses on the latter aspects while their impacts other than GHG emissions are often only qualitatively addressed, if at all (Smith et al 2016; IPBES paper?) although they are likely to be significant when LMM are deployed at a relevant scale (Olin et al., 2015; Koh and Ghazoul, 2010).

Limitations imposed by natural resources, e.g. the availability of water and nutrients to grow biomass and of N to bind with increasing soil organic C pools (van Groenigen et al., 2017) or water to grow biomass feedstock for BECCS (Smith et al., 2016) is also acknowledged but still debated for lack of an adequate evaluation framework. Other constraints may be positive or negative effects on ecosystem services provided by agroecosystems and forests (e.g. biodiversity habitat, erosion control, water quality and quantity regulation). Research Line 1.2 will review the state-of-the-art on the main impacts of LMM and the methodology available to assess them through an international workshop supplemented by ad'hoc meta-analyses and simulation work in a first WP (121). Data, knowledge and guidelines issued from this WP will be passed on to a second WP for application to the two cross-cutting case-studies of Cland. This will provide insight into the potential impacts of large-scale LMM deployment scenarios in two contrasting socio-economic and biophysical contexts.

WP 1.2.1 Impacts of land based mitigation measures (ECOSYS, ESE, ….)

This WP will build upon and extend the results of WP112 dealing with the potentials of LMM but will focus on the environmental impacts of those LMM options that appear most promising in terms of abatement potential. The following criteria and constraints will be taken on board: water and nutrient demands and limitations, air quality, soil quality and erosion, water quality, biodiversity and ecosystem services.

This will be done for the context of the two case studies of Challenge 1 (France and China), using both available data gathered by CLAND teams and published literature analysis. A focus will be laid on options relevant to the case-studies and not well covered in current literature. Here, more than a qualitative review, we will use classical meta-analysis approaches to provide a quantitative LMM evaluation. regarding the environmental impacts which are less commonly evaluated in the literature such as:

- Air quality (emissions of NOx and NH3 from soils)
- Water use (both soil moisture impacts of soil-based LMMs and water use of plant-based LMM)
- Biodiversity and ecosystem services (positive and negative impacts)
- Nitrogen and phosphorus budgets (positive and negative impacts)
- Erosion (positive and negative impacts)

And including trade-offs and co-benefits (e.g. reduced erosion, soil fertility). Meta-analysis may have limitations given the expected scarcity and diversity of available data. We will organize an international workshop involving all interested CLAND research units and external participants to benchmark the available literature and define useful indicators and methods (whether based on the ecosystem services framework, life-cycle assessment, foot-printing etc…) to be used in WP 1.2.2. The ability of biophysical models (land-surface models or more specialized models of crops or forests)

that capture the efficiency of LMM will be tested for assessing, with appropriate model combination their impacts (on water resources, biodiversity, air pollution). Impacts on biodiversity and ecosystem services will be tackled in coordination with Cland Challenge 2, where changes in animal production systems are also assessed in France from this perspective. At international level, coordination with ongoing efforts at IPBES will also be sought via the participation of lead-authors of the ongoing Europe and Central Asia Assessment at the workshop. The methodological framework for ecosystem services and nature benefits to people assessment of ECA-IPBES report (to be published in 2019), will be integrated.

Main collaborators:

ECOSYS (lead) - will lead the organization of the workshop with support from the CLAND management team and co-supervise PhD work on data collection and guideline definition,

ESE will coordinate with ongoing work at IPBES (in particupar Europe and Central Asia ongoing assessment) and contribute to workshop on aspects related to biodiversity and ecosystem services

AGRONOMIE

SADAPT

BIOGER

LATMOS

HBAN

External collaborators (TBC):

[Que fait t"on pour Chine? Y a t'il des travaux de ce type en cours ?]

Relation with other projects:

ETUDE 4 per mille , INRA (Coord. S Pellerin & L. Bamière) will evaluate the impacts of the analyzed LMM to ecosystems and their services for mainland France

WP 1.2.2. Deployment and multi-criteria evaluation of LMM scenarios in case studies (ESE, SADAPT …)

This WP will not focus on a particular measure (such as SOC storage) but will evaluate scenarios involving various sets of LMM to provide a balanced and objective multi-criteria appraisal useful for policy making purposes. The assessment will be based on the environmental impact indicators developed in WP 1.2.1 and the meta-analysis results about LMM performance in terms of GHG abatement and SOC storage (WP1.1.2). A suite of tools will be proposed to quantify the benefits or drawbacks of the different considered LMM. Mitigation scenarios will be either produced by the economic model of WP113, in the case of France, or based on empirical marginal abatement cost curves such as given by the McKinsey (2009) consultancy. Thus, economical impacts will be also taken into account in the definition of the indicators.

Obviously, the outcome of LMM deployment will give be highly dependent on local conditions, which warrants scaling up from local to regional or national scales so as to be useful for land managers and policy makers. Thus, once the relevant multi criteria indicators have been defined in each case-study, we will work on up scaling methods taking into account the availability of geo-referenced input data.

Main collaborators:

S-adapt

ESE

Ecosys : Benoit ?

Ecopub: L. Bamière

External collaborators (TBC):

Relation with other projects:

IPBES-Europe and Central Asia Assesment.

Research line 1.3 - Evaluation of NDCs in the AFOLU and agriculture sector and their mitigation potential.

At COP21, 128 countries proposed a land use and management (LUM) section in their INDC, concerning both mitigation and adaptation. The associated measures make up circa 25% of the total GHG emissions reductions. NDCs are not very detailed at the moment (depending upon countries) about the LMMs that will be used to reach proposed targets. They also differ in their structure, with some countries (like the USA and Australia) proposing a net-net approach whereby the net GHG national balance of a target year in the future must be reduced by a certain fraction compared to the one of a base year, some countries (mainly tropical countries with forest carbon stocks) proposing reduced / avoided emissions or increased sinks with respect to a self-defined baseline, and others (like China and India) having relative or absolute targets in terms of carbon intensity or forest carbon stocks without giving a quantitative translation of these objectives in terms of net future GHG emissions. In general, the AFOLU sector concerning forests and land use is part of many NDCs, whereas the agricultural sector is not the focus of NDCs because of potential food security tradeoffs of agricultural LMMs. This WP will provide a thorough analysis of the NDCs for the AFOLU sector and compare them with national plans and targets. The potential contribution of agriculture will be estimated based on the reports / plans of some countries for this sector (e.g. the French government objective to cut agricultural emissions by 20% of the 1990 values by the year 2026), encompassing their economic, social and environmental impacts, as well as propose a re-appraisal of their mitigation potential based on the findings of RL1.2. This will be done in collaboration with the L-IPSL Climate Services (C. Guivarch, O. Boucher) specific sub-project on the NDCs that will address mainly energy related emissions, while CLAND will work on AFOLU mitigation and explore the additional role of agriculture.

In the first phase, we propose to review the Nationally Determined Contributions reported to the UNFCCC at the COP21 for the LUM sector in different countries and calculate their impact on GHG emissions, radiative forcing, and climate change for the horizon 2030-2035. The calculation from emissions to radiative forcing and climate change will be performed with a compact Earth System Model (Gasser et al. GMD 2017) that includes natural and anthropogenic sources and allows the separate attribution of the climate effect of each emission (per sector / per time period) at the scale of broad regions, including for climate feedbacks on the biogeochemical cycles of CO2, N2O and CH4 (see also Ciais et al. Nature Climate Change 2014). This work will be undertaken through strategic collaborations with IIASA and JRC (land use scenarios for Europe) with a focus on France and Europe, and for other countries through the Global Research Alliance project (ref).

WP 1.3.1 Review Land based mitigation measures in NDCs (LMD, INRA-International Affairs, other labs)

Overview

This task will review the measures currently proposed in the NDCs in the land use sectors subdivided into 'AFOLU' and 'agriculture' (non-CO2 emissions and CO2 emissions non related to ecosystems) : relevance, scientific soundness (in particular evaluation methodology). Specific effort will be placed on the analysis of baseline scenarios (with current policy or no mitigation) declared by countries or extrapolated from recent years (Grassi et al. 2016) and on the comparison with LMM mitigation scenarios from WP2, both from bottom up technical potentials and socio-economic models. Their

potential to mitigate climate change will not only be assessed based on GHG emissions but also by factoring in biophysical effects using simple empirical response functions limited to land cover change (Alkama et al. 2016), as response functions for land management changes are more difficult to assess (as addressed in WP2). This will be done based on a set of harmonized, state-of-the-art methodological guidelines will be drafted to assess LUM-based measures, based on the consortium's expertise and the findings of WP2.

Main collaborators:

LMD : O Boucher

External collaborators:

Relation with other projects:

GICN project of the L-IPSL Climate services: 'Groupe Interdisciplinaire sur les Contributions Nationales' this project started in preparation of the COP21 is designed to provide to the French MEDD ministry with science based evidence on NDCs translated into GHG emissions for different countries

VERIFY: This H2020 project (2018-2021) will develop scientific methods to monitor GHG fluxes and the effectiveness of GHG emissions reductions using atmospheric and land based observations and models

WP 1.3.2 Re-appraisal of NDCs and evaluation of how SOC sequestration could additionally contribute to NDCs (LSCE, ECOSYS, INRA International Affairs)

A re-appraisal of selected NDCs will be proposed to emphasize the key measures or uncertainties of the LUM sector in various national contexts. SOC sequestration is often presented as a valuable option to store C in the long term, but the evaluation of LMMs aiming at increase the soil C storage are complex and already highly debated. The difficulties are mainly due to methodological aspects (how measure a slight change when the spatiotemporal variability of soil C is high, how take into account the long term fate of the newly stored C, etc.) (Minasny et al., 2017). Thus NDCs aiming at increase soil C storage might be much more difficult to assess and a gap of knowledge, methods and tools has to be filled rapidly to answer the societal demand. Thus, a focus will be placed on options involving soil organic carbon sequestration in NDCs. In particular, we will evaluate how much C emission of a given country should be reduced if we assumed that all the effort will be put in increasing SOC sequestration. Then, we will evaluate the amount of SOC sequestration needed to fully compensate the GHG emission and the effective SOC sequestration calculated using mechanistic modeling. Up to now, no clear consensus on how SOC dynamic should be modeled emerged from the literature (Luo et al., 2016; Schmidt et al., 2011, Dignac et al., 2017). Therefore, for a given SOC sequestration target (necessary if one wants to compensate GHG emissions solely by SOC sequestration needed) we will evaluate by how much the C inputs have to increase (or the C outputs have to decrease) to reach the objective. This will be done with different C dynamics models (SYMPHONY, RothC, ORCHIDEE, etc.). Even though, assuming that all the GHG emission can be compensated through SOC sequestration appears unrealistic, this WP will allow to evaluate the uncertainties related to SOC sequestration due to different representation in different models. This task is difficult to perform on a gridded area since generally, SOC dynamic models are not always spatialized. Therefore we will perform idealized simulations for a given location with a large set of models. Then, to perform national or global evaluations, we will perform the same type of work but with a subset of model able to run on a spatial grid. In particular, we will use different versions of

ORCHIDEE using different SOC sub-models (the classical CENTURY scheme, or having priming or carbon/nitrogen interactions in the soils, etc.). This will be done in collaboration with the SOC sequestration flagship of the GRA and for pastures (possibly also for arable crops) in collaboration with FAO (LEAP partnership), the 4 per 1000 research program and the GRA.

The corresponding results will be presented at international workshops with countries representatives, e.g. under the auspices of the GRA, of the CIRCASA CSA etc. If possible, workshops will be organized with multilateral agencies, including FAO GEF, FIDA and the Green Fund. In relation with other tasks, the assumptions made in NDCs concerning soil carbon sequestration will be reviewed and discussed.

CLand research units involved:

LSCE (B. Guenet)

Ecosys (C.Chenu)

Main collaborators:

LSCE (B. Guenet, ..)

Ecosys (C.Chenu)

External collaborators (TBC):

Infosols : French soil databases, same inverse modelling activity at the scale of mainland France. Manuel Martin

JRC : LUCAS soil survey of EU soils, modelling of the evolution of EU SOC stocks by implementing C-storing practices (Lugato et al. 2014).

S. Manzoni, Univ Stockholm. SOC dynamics models acounting for microbial physiology and priming effect.

U. Beijing, secondment and possible cofunding of PhD3

Relation with other projects:

Store Soil C: this project, funded by ANR (dec 2017-2020) aims to quantify the SOC storage potential in soils. It will (i) develop indicators to estimate the size of SOC kinetic pools for modeling purposes, (ii) compare different methods to estimate the SOC storage potential at the scale of two territories, (iii) evaluate the stability of the carbon recently stored.

Csopra: This project funded by ADEME aims to estimate the soil carbon stocks for France using different model and thus reduce the uncertainties on the future projections

DEDYCAS: The overall objective of DEDYCAS is to determine the driving forces of carbon storage in soils, so as to introduce these processes in several operational models predicting the carbon cycle. Ultimately, the results will be integrated into the global model ORCHIDEE and produce new global carbon cycle simulations (1990-2100) including deep carbon.

Imbalance-P: This large scale project deals with global phosphorus limitations in cultivated and natural ecosystems, of relevance for this WP being a gridded soil CNP decomposition model

GRA- SOC models intercomparison : This project aims to inter-compare and benchmark a set of SOC models and calibrate models parameters by comparing the simulated results with the observed soil C data from long term bare fallow sites (field experiments in which there are no plants and hence OC inputs are not renewed).

SYMFONY compléter

Proposed allocation of CLAND resources

Challenge 1			Host unit	Secondment unit	Lab & entity receiving the funds for the recruitment	TIMELINE							
						2018 Jan. - June	2018 July Dec.	2019 Jan. - June	2019 July Dec.	2020 Jan. - June	2020 July Dec.	2021 Jan. - June	2021 July Dec.
RL1.1	WP 1.1.1	post doc	CIRED and LSCE	LSCE and CIRED									
	WP 1.1.2	post doc	Agronomie	Ecosys (Eco&Phy)									
	WP 1.1.3	PhD	EcoPub										
RL1.2	WP 1.2.1	PhD	Ecosys (Eco&Phy)	ESE? Agronomie ?									
	WP 1.2.2	PhD	ESE ?	Sadapt ? EcoPub ?									
RL1.3	WP 1.3.1	post doc	LMD (GICN group)	J. F. Soussana (INRA)									
	WP 1.3.2	PhD	LSCE	Ecosys (soil)									

Summary and explanation for the funding from CLAND in RL1.1

- A first postdoc will be recruited on WP 1.1.1 to work on existing LMM mitigation in climate scenarios followed by the compilation, harmonization and synthesis of LMM data in WP 1.1.2. A joint supervision will take place between LSCE, ECOSYS and AGRONOMIE.
- A PhD student will be recruited by ECOPUB to work on WP1.1.3 on … This grant will be equally shared between CLAND and …

Summary and explanation for the funding from CLAND in RL1.2

- PHD1 working on meta-analysis and harmonization of LMM impacts, co-supervision ESE-??. ***
- PHD-2 based at ESE – co-supervision SADAPT)- a discuter avec Voir lien avec RL2.2 sur nouveaux systemes de production

PhD-1 on data gathering and synthesis of environmental impacts of LMMs ESE-Ecosys

PhD-2 on up-scaling of environmental impacts of LMMs ESE-Sadapt ?

Summary and explanation for the funding from CLAND in RL1.3

1.3.1. : Postdoc 2 – 12 person months based at LMD (GICN group on NDCs) with co-supervision by JF. Soussana (INRA International Affairs), CIRED, LSCE

1.3.2 : PhD 3: lead LSCE (B. Guenet) secondment EcoSys (C.Chenu) with Beijing University

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