Please check our wiki for help on navigating the form.

Horizon 2020

Call: H2020-LC-CLA-2018-2019-2020

(Building a low-carbon, climate resilient future: climate action in support of the Paris Agreement)

SECOND STAGE

Topic: LC-CLA-02-2019

Type of action: RIA

Proposal number: SEP-210597717

Proposal acronym: LANDMARC

Deadline Id: H2020-LC-CLA-2019-2

Table of contents

How to fill in the forms

The administrative forms must be filled in for each proposal using the templates available in the submission system. Some data fields in the administrative forms are pre-filled based on the steps in the submission wizard.

1 - General information

Topic	LC-CLA-02-2019	Type of Action	RIA
Call Identifier	H2020-LC-CLA-2018-2019-2020	Deadline Id	H2020-LC-CLA-2019-2

Acronym	LANDMARC
Proposal title	LAND-use based MitigAtion for Resilient Climate pathways

Note that for technical reasons, the following characters are not accepted in the Proposal Title and will be removed: < > " &

Duration in months	*48*
Fixed keyword 1	Feasibility of negative emissions for climate stabilisation
Fixed keyword 2	Ecosystem services provided by soils
Fixed keyword 3	Terrestrial ecology, land cover change
Fixed keyword 4	Land-based mitigation
Fixed keyword 5	Forest management planning
Fixed keyword 6	
Free keywords	*Land management, agro-forestry, BECCS, land use modelling, macro-econometric modelling, earth system models, in-situ and satellite monitoring*

Abstract

Roughly 30% of Nationally Determined Contributions (NDCs) under the Paris Agreement (PA) include land-based mitigation measures, but there are still significant uncertainties in their effectiveness to deliver negative emissions. Aside from the expected shortfall of all current NDCs to deliver on the below 2 oC ambition, this uncertainty adds to the risks to human wellbeing as a result of climate change. Land-use based mitigation technologies (LMTs) can play a crucial role in the global efforts to meet the PA goals and the Sustainable Development Goals (SDGs). Considering the land-climate-development interface, LANDMARC aims to assess the impacts of LMTs as net sinks for greenhouse gas (GHGs) by applying unique mixed-methods approach. LANDMARC assesses the potential and feasibility of LMTs in the AFOLU sector by: a) quantitatively assessing environmental, social-economic, co-benefits and trade-offs identified through a suite of monitoring tools and model system (including land use, climate and economic models) complemented by; b) qualitative assessments guided by stakeholder engagement. This mixed-method approach allows us to provide more detailed insights on the effectiveness and climate resilience of LMTs at different spatial scales (e.g. scaling up from local/national level to the regional/global level). These tools, services and approaches will contribute to land-based LMT decision support in the private sector and by policy makers. LANDMARC is an interdisciplinary consortium with expertise from ecology, engineering, climate sciences, global carbon cycle, soil sciences, satellite earth observation sciences, agronomy, economics, social sciences, and business. There is a balanced representation of partners from academia, SMEs, and NGOs from the EU, Africa, Asia and the Americas, which ensures a wide coverage of LMTs operating in different contexts (e.g. climates, land-use practices, socio-economic etc.) and spatial scales.

Remaining characters 42

Has this proposal (or a very similar one) been submitted in the past 2 years in response to a call for proposals under Horizon 2020 or any other EU programme(s)? ○ Yes ◉ No

Please give the proposal reference or contract number.	
xxxxxx-x	

Declarations

1) The coordinator declares to have the explicit consent of all applicants on their participation and on the content of this proposal.	☒
2) The information contained in this proposal is correct and complete.	☒
3) This proposal complies with ethical principles (including the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity — and including, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct).	☒

4) The coordinator confirms:

- to have carried out the self-check of the financial capacity of the organisation on http://ec.europa.eu/research/participants/portal/desktop/en/organisations/lfv.html or to be covered by a financial viability check in an EU project for the last closed financial year. Where the result was "weak" or "insufficient", the coordinator confirms being aware of the measures that may be imposed in accordance with the H2020 Grants Manual (Chapter on Financial capacity check); or	◉
- is exempt from the financial capacity check being a public body including international organisations, higher or secondary education establishment or a legal entity, whose viability is guaranteed by a Member State or associated country, as defined in the H2020 Grants Manual (Chapter on Financial capacity check); or	○
- as sole participant in the proposal is exempt from the financial capacity check.	○

5) The coordinator hereby declares that each applicant has confirmed:

- they are fully eligible in accordance with the criteria set out in the specific call for proposals; and	☒
- they have the financial and operational capacity to carry out the proposed action.	☒
The coordinator is only responsible for the correctness of the information relating to his/her own organisation. Each applicant remains responsible for the correctness of the information related to him and declared above. Where the proposal to be retained for EU funding, the coordinator and each beneficiary applicant will be required to present a formal declaration in this respect.	

According to Article 131 of the Financial Regulation of 25 October 2012 on the financial rules applicable to the general budget of the Union (Official Journal L 298 of 26.10.2012, p. 1) and Article 145 of its Rules of Application (Official Journal L 362, 31.12.2012, p.1) applicants found guilty of misrepresentation may be subject to administrative and financial penalties under certain conditions.

Personal data protection

The assessment of your grant application will involve the collection and processing of personal data (such as your name, address and CV), which will be performed pursuant to Regulation (EC) No 45/2001 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data. Unless indicated otherwise, your replies to the questions in this form and any personal data requested are required to assess your grant application in accordance with the specifications of the call for proposals and will be processed solely for that purpose. Details concerning the purposes and means of the processing of your personal data as well as information on how to exercise your rights are available in the privacy statement. Applicants may lodge a complaint about the processing of their personal data with the European Data Protection Supervisor at any time.

Your personal data may be registered in the Early Detection and Exclusion system of the European Commission (EDES), the new system established by the Commission to reinforce the protection of the Union's financial interests and to ensure sound financial management, in accordance with the provisions of articles 105a and 108 of the revised EU Financial Regulation (FR) (Regulation (EU, EURATOM) 2015/1929 of the European Parliament and of the Council of 28 October 2015 amending Regulation (EU, EURATOM) No 966/2012) and articles 143 - 144 of the corresponding Rules of Application (RAP) (COMMISSION DELEGATED REGULATION (EU) 2015/2462 of 30 October 2015 amending Delegated Regulation (EU) No 1268/2012) for more information see the Privacy statement for the EDES Database.

2 - Participants & contacts

#	Participant Legal Name	Country	Action
1	EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH	CH	
2	STICHTING JOINT IMPLEMENTATION NETWORK	NL	
3	AMBIENTA INGENIERIA Y SERVICIOS AGRARIOS Y FORESTALES S.L.U.	ES	
4	AGROINSIDER LDA	PT	
5	BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SUPERCOMPUTACION	ES	
6	ELEAF BV	NL	
7	UNIVERSITAET KASSEL	DE	
8	BIOCLEAR EARTH BV	NL	
9	CAMBRIDGE ECONOMETRICS LIMITED	UK	
10	STIFTELSEN THE STOCKHOLM ENVIRONMENT INSTITUTE	Sweden	
11	KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT-KNMI	NL	
12	OEKO-INSTITUT E.V. - INSTITUT FUER ANGEWANDTE OEKOLOGIE	DE	
13	BIORECRO AB	SE	
14	PT SUSTAINABILITY AND RESILIENCE	ID	
15	THE UNIVERSITY OF SUSSEX	UK	
16	Innovations for Sustainability Transitions Lab Ltd	CA	
17	International Centre for Tropical Agriculture	CO	
18	Cobra Collective CIC	UK	

2 - Administrative data of participating organisations

PIC	***Legal name***
999979015	*EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH*

Short name: ETH Zürich

Address of the organisation

Street Raemistrasse 101

Town ZUERICH

Postcode 8092

Country Switzerland

Webpage www.ethz.ch

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....yes

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....yes

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status.....06/01/2009 - no

SME self-assessment ..... unknown

SME validation sme.....06/01/2009 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (•) Male ( ) Female

First name: **Johan**

Last name: **Six**

E-Mail: **jsix@ethz.ch**

Position in org.: Professor

Department: The Sustainable Agroecosystems Group

☐ Same as organisation name

☐ Same as proposing organisation's address

Street: Universitätstrasse 2

Town: Zürich

Post code: 8092

Country: Switzerland

Website: https://sae.ethz.ch/

Phone: +41 52 354 91 84

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Jenny	Lieu	jenny.lieu@usys.ethz.ch	+xxx xxxxxxxxx
Agatha	KELLER	grants@sl.ethz.ch	+xxx xxxxxxxxx
Michael	Stauffacher	michael.stauffacher@usys.ethz.ch	+xxx xxxxxxxxx

PIC	***Legal name***
994451858	*STICHTING JOINT IMPLEMENTATION NETWORK*

Short name: JIN

Address of the organisation

Street	MEERKOETLAAN 27
Town	PATERSWOLDE
Postcode	9765 TC
Country	Netherlands
Webpage	http://www.jiqweb.org

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status.....03/11/1994 - yes

SME self-assessment ..... unknown

SME validation sme.....03/11/1994 - yes

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.

Sex: (•) Male ( ) Female

First name: **Eise**

Last name: **SPIJKER**

E-Mail: **eise@jin.ngo**

Position in org.: Senior Researcher

Department: STICHTING JOINT IMPLEMENTATION NETWORK

☒ Same as organisation name

☐ Same as proposing organisation's address

Street: Ubbo Emmiussingel 19

Town: Groningen

Post code: 9711

Country: Netherlands

Website: www.jin.ngo

Phone: +31(0)628064653

Phone 2: +31(0)507620930

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
935188835	*AMBIENTA INGENIERIA Y SERVICIOS AGRARIOS Y FORESTALES S.L.U.*

Short name: AMBIENTA

Address of the organisation

Street PLAZA CONSTITUCIÓN, 2

Town MONTEHERMOSO (CACERES)

Postcode 10810

Country Spain

Webpage www.ambientaing.es

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status.....31/12/2017 - yes

SME self-assessment .....31/12/2017 - yes

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.

Sex: (•) Male ( ) Female

First name: **Federico**

Last name: **Julian**

E-Mail: **fjulian.ambienta@gmail.com**

Position in org.: Director

Department: AMBIENTA INGENIERIA Y SERVICIOS AGRARIOS Y FORESTALES S.L.U

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: PLAZA CONSTITUCIÓN, 2

Town: MONTEHERMOSO (CACERES)

Post code: 10810

Country: Spain

Website: www.ambientaing.es

Phone: +34666169888

Phone 2: +34927675524

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
916942456	*AGROINSIDER LDA*

Short name: AGROINSIDER LDA

Address of the organisation

Street RUA CIRCULAR NORTE EDIFICIO NERE SAL

Town EVORA

Postcode 7005 841

Country Portugal

Webpage www.agroinsider.com

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status.....24/10/2016 - yes

SME self-assessment .....24/10/2016 - yes

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (•) Male ( ) Female

First name: **Jose Rafael Marques**

Last name: **da Silva**

E-Mail: **rafael@agroinsider.com**

Position in org.: CTO

Department: AGROINSIDER LDA

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: RUA CIRCULAR NORTE EDIFICIO NERE SALA 18

Town: EVORA

Post code: 7005 841

Country: Portugal

Website: agroinsider.com

Phone: +351962858425

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Mário	Luis	marioluis@agroinsider.com	+351927506135

PIC	***Legal name***
999655520	*BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SUPERCOMPUTACION*

Short name: BSC

Address of the organisation

Street Calle Jordi Girona 31

Town BARCELONA

Postcode 08034

Country Spain

Webpage www.bsc.es

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....yes

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status.....01/03/2005 - no

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.

Sex: (•) Male ( ) Female

First name: **Markus**

Last name: **Donat**

E-Mail: **markus.donat@bsc.es**

Position in org.: CLIMATE PREDICTION GROUP CO LEADER

Department: BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SU

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: Calle Jordi Girona 31

Town: BARCELONA

Post code: 08034

Country: Spain

Website:

Phone: +34 934054290

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Raffaele	Bernardello	raffaele.bernardello@bsc.es	+xxx xxxxxxxxx

PIC	***Legal name***
998872827	*ELEAF BV*

Short name: eLEAF bv

Address of the organisation

Street HESSELINK VAN SUCHTELENWEG 6

Town WAGENINGEN

Postcode 6703 CT

Country Netherlands

Webpage www.eleaf.com

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status.....31/12/2018 - yes

SME self-assessment .....31/12/2018 - yes

SME validation sme.....06/08/2008 - yes

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Ms

Sex: ○ Male ◉ Female

First name: **Annemarie**

Last name: **Klaasse**

E-Mail: **annemarie.klaasse@eleaf.com**

Position in org.: Project Manager

Department: ELEAF BV

☒ Same as organisation name

☐ Same as proposing organisation's address

Street: Hesselink van Suchtelenweg 6

Town: Wageningen

Post code: 6703CT

Country: Netherlands

Website: www.eleaf.com

Phone: +31 317 729 000

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
999852624	*UNIVERSITAET KASSEL*

Short name: UNI KASSEL

Address of the organisation

Street MONCHEBERGSTRASSE 19

Town KASSEL

Postcode 34125

Country Germany

Webpage www.uni-kassel.de

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....yes

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....yes

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status.....26/10/1971 - no

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (•) Male ( ) Female

First name: **Ruediger**

Last name: **Schaldach**

E-Mail: **schaldach@usf.uni-kassel.de**

Position in org.: Professor

Department: Center for Environmental Systems Research

☐ Same as organisation name

☐ Same as proposing organisation's address

Street: Wilhelmshöher Allee 47

Town: Kassel

Post code: 34109

Country: Germany

Website:

Phone: 49 561 804-6130

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Katrin	STEINACK	katrin.steinack@uni-kassel.de	+xxx xxxxxxxxx
ronny	FISCHER	ronny.fischer@uni-kassel.de	+xxx xxxxxxxxx

PIC	***Legal name***
996843490	*BIOCLEAR EARTH BV*

Short name: BIOCLEAR EARTH BV

Address of the organisation

Street ROZENBURGLAAN 13

Town GRONINGEN

Postcode 9727 DL

Country Netherlands

Webpage www.bioclearearth.nl

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status.....31/12/2009 - yes

SME self-assessment ..... unknown

SME validation sme.....31/12/2009 - yes

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (•) Male ( ) Female

First name: **Emiel**

Last name: **Elferink**

E-Mail: **elferink@bioclearearth.nl**

Position in org.: Senior Consultant

Department: BIOCLEAR EARTH BV

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: ROZENBURGLAAN 13

Town: GRONINGEN

Post code: 9727 DL

Country: Netherlands

Website:

Phone: +31 6 1497 84 71

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
987098094	*CAMBRIDGE ECONOMETRICS LIMITED*

Short name: CE

Address of the organisation

Street	COVENT GARDEN
Town	CAMBRIDGE
Postcode	CB1 2HT
Country	United Kingdom
Webpage	www.camecon.com

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status.....28/05/1985 - yes

SME self-assessment ..... unknown

SME validation sme.....28/05/1985 - yes

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title	Mr.	Sex	◉ Male ○ Female
First name	**Hector**	Last name	**Pollitt**
E-Mail	**hp@camecon.com**		
Position in org.	Director and the Head of Modelling at Cambridge Econometrics		
Department	CAMBRIDGE ECONOMETRICS LIMITED	☒	Same as organisation name
	☐ Same as proposing organisation's address		
Street	Covent Garden		
Town	Cambridge	Post code	CB1 2HT
Country	United Kingdom		
Website			
Phone	+441223 533100	Phone 2	+xxx xxxxxxxxx
Fax	+xxx xxxxxxxxx		

PIC	***Legal name***
999450268	*STIFTELSEN THE STOCKHOLM ENVIRONMENT INSTITUTE*

Short name: SEI

Address of the organisation

Street BOX 24218

Town STOCKHOLM

Postcode 104 51

Country Sweden

Webpage www.sei-international.org

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status.....01/01/1997 - no

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.

Sex: (•) Male ( ) Female

First name: **Francis**

Last name: **Johnson**

E-Mail: **francis.johnson@sei-international.org**

Position in org.: Research Leader on the Global Research Committee

Department: STIFTELSEN THE STOCKHOLM ENVIRONMENT INSTITUTE

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: BOX 24218

Town: STOCKHOLM

Post code: 104 51

Country: Sweden

Website:

Phone: +xxx xxxxxxxxx

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Natalia	Heini	natalia.heini@sei.org	+xxx xxxxxxxxx
Oliver	Johnson	oliver.johnson@sei.org	+xxx xxxxxxxxx

PIC	***Legal name***
999518944	*KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT-KNMI*

Short name: KNMI

Address of the organisation

Street UTRECHTSEWEG 297

Town DE BILT

Postcode 3731 GA

Country Netherlands

Webpage www.knmi.nl

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....yes

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status.....15/05/2008 - no

SME self-assessment ..... unknown

SME validation sme.....15/05/2008 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.

Sex: (•) Male ( ) Female

First name: **Folkert**

Last name: **Boersma**

E-Mail: **boersma@knmi.nl**

Position in org.: Research Scientist

Department: KNMI - R&D Satellite Observations

☐ Same as organisation name

☒ Same as proposing organisation's address

Street: UTRECHTSEWEG 297

Town: DE BILT

Post code: 3731 GA

Country: Netherlands

Website: https://www.knmi.nl

Phone: +31 30 2206 618

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
999519817	*OEKO-INSTITUT E.V. - INSTITUT FUER ANGEWANDTE OEKOLOGIE*

Short name: OEKO-INSTITUT E.V. - INSTITUT FUER ANGEWANDTE OEKOLOGIE

Address of the organisation

Street Merzhauser Strasse 173

Town FREIBURG

Postcode 79100

Country Germany

Webpage http://www.oeko.de

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status..... unknown

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Hannes**

Last name: **Boettcher**

E-Mail: **h.boettcher@oeko.de**

Position in org.: Senior Researcher

Department: Energy and Climate

☐ Same as organisation name

☐ Same as proposing organisation's address

Street: Schicklerstrasse 5-7

Town: Berlin

Post code: 10179

Country: Germany

Website: www.oeko.de

Phone: +4930405085389

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
936843073	*BIORECRO AB*

Short name: BIORECRO AB

Address of the organisation

Street FREJGATAN 1

Town STOCKHOLM

Postcode 11420

Country Sweden

Webpage www.biorecro.com

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status.....06/02/2018 - yes

SME self-assessment .....31/12/2016 - yes

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.

Sex: (•) Male ( ) Female

First name: **Henrik**

Last name: **Karlsson**

E-Mail: **henrik.karlsson@biorecro.se**

Position in org.: CEO

Department: BIORECRO AB

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: FREJGATAN 1

Town: STOCKHOLM

Post code: 11420

Country: Sweden

Website:

Phone: +46 70 712 75 69

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Timur	Delahaye	timur.delahaye@biorecro.se	+xxx xxxxxxxxx

PIC	***Legal name***
911113241	*PT SUSTAINABILITY AND RESILIENCE*

Short name: PT SUSTAINABILITY AND RESILIENCE

Address of the organisation

Street GEDUNG PASAR RAYA KUTA JL.RAYA TUBA

Town BADUNG

Postcode 80361

Country Indonesia

Webpage www.su-re.co

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status.....28/02/2018 - yes

SME self-assessment .....28/02/2018 - yes

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Takeshi**

Last name: **Takama**

E-Mail: **ttak003@gmail.com**

Position in org.: CEO

Department: PT SUSTAINABILITY AND RESILIENCE

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: GEDUNG PASAR RAYA KUTA JL.RAYA TUBAN 62 LANTAI 1/2A LINGKUN

Town: BADUNG

Post code: 80361

Country: Indonesia

Website: www.su-re.co

Phone: +628118408019

Phone 2: +628123831727

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Takeshi	Takama	nfo@su-re.co	+xxx xxxxxxxxx

PIC	***Legal name***
999852721	*THE UNIVERSITY OF SUSSEX*

Short name: UOS

Address of the organisation

Street SUSSEX HOUSE FALMER

Town BRIGHTON

Postcode BN1 9RH

Country United Kingdom

Webpage http://www.sussex.ac.uk

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....yes

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status.....19/09/2008 - no

SME self-assessment ..... unknown

SME validation sme.....19/09/2008 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title Ms

Sex ○ Male ◉ Female

First name **Guadalupe** Last name **AlvarezTinoco**

E-Mail **r.alvarez-tinoco@sussex.ac.uk**

Position in org. Research Fellow

Department University of Sussex Business School, SPRU - Science Policy Research Unit ☐ Same as organisation name

☒ Same as proposing organisation's address

Street SUSSEX HOUSE FALMER

Town BRIGHTON Post code BN1 9RH

Country United Kingdom

Website

Phone +44 1273 678810 Phone 2 +xxx xxxxxxxxx Fax +xxx xxxxxxxxx

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Lokendra	Karki	l.karki@sussex.ac.uk	+xxx xxxxxxxxx

PIC	***Legal name***
898703643	*Innovations for Sustainability Transitions Lab Ltd*

Short name: Innolab Space

Address of the organisation

Street	246 Schiller Place N.W.
Town	Calgary
Postcode	T3L1W8
Country	Canada
Webpage	https://www.innolab.space/

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....unknown

Non-profit .....unknown

International organisation .....unknown

International organisation of European interest .....unknown

Secondary or Higher education establishment .....unknown

Research organisation .....unknown

Legal person .....yes

Industry (private for profit).....unknown

Enterprise Data

SME self-declared status..... unknown

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Luis**

Last name: **Virla**

E-Mail: **ldvirlaa@ucalgary.ca**

Position in org.: Co-director

Department: Innovations for Sustainability Transitions Lab Ltd

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: 246 Schiller Place N.W.

Town: Calgary

Post code: T3L1W8

Country: Canada

Website:

Phone: +xxx xxxxxxxxx

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
936461960	*International Centre for Tropical Agriculture*

Short name: International Centre for Tropical Agriculture

Address of the organisation

Street	Km 17, Recta Cali-Palmira
Town	Cali, Colombia
Postcode	6713
Country	Colombia
Webpage	www.ciat.cgiar.org

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....unknown

Non-profit .....unknown

International organisation .....unknown

International organisation of European interest .....unknown

Secondary or Higher education establishment .....unknown

Research organisation .....unknown

Legal person .....yes

Industry (private for profit).....unknown

Enterprise Data

SME self-declared status..... unknown

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Peter**

Last name: **Läderach**

E-Mail: **p.laderach@cgiar.org**

Position in org.: Theme Leader

Department: International Centre for Tropical Agriculture

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: Km 17, Recta Cali-Palmira

Town: Cali, Colombia

Post code: 6713

Country: Colombia

Website:

Phone: +xxx xxxxxxxxx

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Johanna	Bernal	j.bernal@cgiar.org	+xxx xxxxxxxxx

PIC	***Legal name***
912574449	*Cobra Collective CIC*

Short name: Cobra Collective CIC

Address of the organisation

Street 21 Willson Road

Town Egham

Postcode TW20 0QB

Country United Kingdom

Webpage www.cobracollective.org

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status..... unknown

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: ○ Male ◉ Female

First name: **Bibiana**

Last name: **Bilbao**

E-Mail: **bibiana.bilbao@gmail.com**

Position in org.: Researcher

Department: Cobra Collective CIC

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: 21 Willson Road

Town: Egham

Post code: TW20 0QB

Country: United Kingdom

Website: http://www.cobracollective.org

Phone: +447835740559

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

3 - Budget

No	Participant	Country	(A) Direct personnel costs/€ ?	(B) Other direct costs/€ ?	(C) Direct costs of sub-contracting/€ ?	(D) Direct costs of providing financial support to third parties/€ ?	(E) Costs of inkind contributions not used on the beneficiary's premises/€ ?	(F) Indirect Costs / € (=0.25(A+B-E)) ?	(G) Special unit costs covering direct & indirect costs / € ?	(H) Total estimated eligible costs / € (=A+B+C+D+F+G) ?	(I) Reimburse-ment rate (%) ?	(J) Max.EU Contribution / € (=H*I) ?	(K) Requested EU Contribution/ € ?
1	Eidgenoessische Technische Hochschule	CH	873810	70000	127000	0	0	235952,50	0	1306762,50	100	1306762,50	1306762,50
2	Stichting Joint Implementation Network	NL	642758	26500	1500	0	0	167314,50	0	838072,50	100	838072,50	838072,50
3	Ambienta Ingenieria Y Servicios	ES	292400	53000	10000	0	0	86350,00	0	441750,00	100	441750,00	441750,00
4	Agroinsider Lda	PT	170000	94250	50000	0	0	66062,50	0	380312,50	100	380312,50	380312,50
5	Barcelona Supercomputing Center -	ES	360000	17000	0	0	0	94250,00	0	471250,00	100	471250,00	471250,00
6	Eleaf Bv	NL	319050	26200	0	0	0	86312,50	0	431562,50	100	431562,50	431562,50
7	Universitaet Kassel	DE	409899	18000	0	0	0	106974,75	0	534873,75	100	534873,75	534873,75
8	Bioclear Earth Bv	NL	238830	127200	105560	0	0	91507,50	0	563097,50	100	563097,50	563097,50
9	Cambridge Econometrics Limited	UK	186636	11000	0	0	0	49409,00	0	247045,00	100	247045,00	247045,00
10	Stiftelsen The Stockholm Environment	SE	286559	63500	0	0	0	87514,75	0	437573,75	100	437573,75	437573,75

11	Koninklijk Nederlands Meteorologisc	NL	126000	7000	0	0	0	33250,00	0	166250,00	100	166250,00	166250,00
12	Oeko-institut E.v. - Institut Fuer	DE	159275	18000	0	0	0	44318,75	0	221593,75	100	221593,75	221593,75
13	Biorecro Ab	SE	147060	14000	0	0	0	40265,00	0	201325,00	100	201325,00	201325,00
14	Pt Sustainability And Resilience	ID	75600	20000	0	0	0	23900,00	0	119500,00	100	119500,00	119500,00
15	The University Of Sussex	UK	250866	22450	0	0	0	68329,00	0	341645,00	100	341645,00	341645,00
16	Innovations For Sustainability	CA	50400	0	0	0	0	12600,00	0	63000,00	100	63000,00	0,00
17	International Centre For Tropical	CO	94500	23500	0	0	0	29500,00	0	147500,00	100	147500,00	147500,00
18	Cobra Collective Cic	UK	68400	27500	30000	0	0	23975,00	0	149875,00	100	149875,00	149875,00
	Total		4752043	639100	324060	0	0	1347785,75	0	7062988,75		7062988,75	6999988,75

4 - Ethics

1. HUMAN EMBRYOS/FOETUSES		Page
Does your research involve Human Embryonic Stem Cells (hESCs)?	○ Yes ◉ No	
Does your research involve the use of human embryos?	○ Yes ◉ No	
Does your research involve the use of human foetal tissues / cells?	○ Yes ◉ No	
2. HUMANS		**Page**
Does your research involve human participants?	○ Yes ◉ No	
Does your research involve physical interventions on the study participants?	○ Yes ◉ No	
3. HUMAN CELLS / TISSUES		**Page**
Does your research involve human cells or tissues (other than from Human Embryos/ Foetuses, i.e. section 1)?	○ Yes ◉ No	
4. PERSONAL DATA		**Page**
Does your research involve personal data collection and/or processing?	◉ Yes ○ No	40-52
Does it involve the collection and/or processing of sensitive personal data (e.g: health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	○ Yes ◉ No	
Does it involve processing of genetic information?	○ Yes ◉ No	
Does it involve tracking or observation of participants?	○ Yes ◉ No	
Does your research involve further processing of previously collected personal data (secondary use)?	○ Yes ◉ No	
5. ANIMALS		**Page**
Does your research involve animals?	○ Yes ◉ No	
6. THIRD COUNTRIES		**Page**
In case non-EU countries are involved, do the research related activities undertaken in these countries raise potential ethics issues?	○ Yes ◉ No	
Do you plan to use local resources (e.g. animal and/or human tissue samples, genetic material, live animals, human remains, materials of historical value, endangered fauna or flora samples, etc.)?	○ Yes ◉ No	
Do you plan to import any material - including personal data - from non-EU countries into the EU?	○ Yes ◉ No	

Do you plan to export any material - including personal data - from the EU to non-EU countries?	◯ Yes ◉ No	
In case your research involves low and/or lower middle income countries, are any benefits-sharing actions planned?	◯ Yes ◉ No	
Could the situation in the country put the individuals taking part in the research at risk?	◯ Yes ◉ No	
7. ENVIRONMENT & HEALTH and SAFETY		Page
Does your research involve the use of elements that may cause harm to the environment, to animals or plants?	◯ Yes ◉ No	
Does your research deal with endangered fauna and/or flora and/or protected areas?	◯ Yes ◉ No	
Does your research involve the use of elements that may cause harm to humans, including research staff?	◯ Yes ◉ No	
8. DUAL USE		Page
Does your research involve dual-use items in the sense of Regulation 428/2009, or other items for which an authorisation is required?	◯ Yes ◉ No	
9. EXCLUSIVE FOCUS ON CIVIL APPLICATIONS		Page
Could your research raise concerns regarding the exclusive focus on civil applications?	◯ Yes ◉ No	
10. MISUSE		Page
Does your research have the potential for misuse of research results?	◯ Yes ◉ No	
11. OTHER ETHICS ISSUES		Page
Are there any other ethics issues that should be taken into consideration? Please specify	◯ Yes ◉ No	

I confirm that I have taken into account all ethics issues described above and that, if any ethics issues apply, I will complete the ethics self-assessment and attach the required documents. ☒

How to Complete your Ethics Self-Assessment

5 - Call specific questions

Declarations on stage-2 changes

The full stage-2 proposal must be consistent with the short outline proposal submitted to the stage-1- in particular with respect to the proposal characteristics addressing the concepts of excellence and impact.

Are there substantial differences compared to the stage-1 proposal?	○ Yes	◉ No

Extended Open Research Data Pilot in Horizon 2020

If selected, applicants will by default participate in the Pilot on Open Research Data in Horizon 2020[1] , which aims to improve and maximise access to and re-use of research data generated by actions.

However, participation in the Pilot is flexible in the sense that it does not mean that all research data needs to be open. After the action has started, participants will formulate a Data Management Plan (DMP), which should address the relevant aspects of making data FAIR – findable, accessible, interoperable and re-usable, including what data the project will generate, whether and how it will be made accessible for verification and re-use, and how it will be curated and preserved. Through this DMP projects can define certain datasets to remain closed according to the principle "as open as possible, as closed as necessary". A Data Management Plan does not have to be submitted at the proposal stage.

Furthermore, applicants also have the possibility to opt out of this Pilot completely at any stage (before or after the grant signature). In this case, applicants must indicate a reason for this choice (see options below).

Please note that participation in this Pilot does not constitute part of the evaluation process. Proposals will not be penalised for opting out.

We wish to opt out of the Pilot on Open Research Data in Horizon 2020.	○ Yes	◉ No

Further guidance on open access and research data management is available on the participant portal: http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-dissemination_en.htm and in general annex L of the Work Programme.

[1] *According to article 43.2 of Regulation (EU) No 1290/2013 of the European Parliament and of the Council, of 11 December 2013, laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" and repealing Regulation (EC) No 1906/2006.*

LANDMARC: LAND use based MitigAtion for Resilient Climate pathways

#	Type	Participant organisation name	Country
1	University	Eidgenoessische Technische Hochschule Zuerich (ETHZ) (Coordinator)	CH
2	SME	Joint Implementation Network (JIN) (Co-Coordinator)	NL
3	SME	Ambienta Ingenieria y Servicios Agrarios y Forestales SLU(AMBIENTA)	ES
4	SME	Agroinsider LDA (Agroinsider)	PT
5	Research	Barcelona Supercomputing Center (BSC)	ES
6	SME	eLEAF B.V. (eLEAF)	NL
7	SME	BioRecro AB (BioRecro)	SE
8	University	Universitaet Kassel (UniKassel)	DE
9	SME	Bioclear Earth B.V.	NL
10	University	University of Sussex (SPRU)	UK
11	SME	Cambridge Econometrics Ltd. (CE)	UK
12	Research	Stockholm Environment Institute (SEI)	SE
13	SME	PT Sustainability and Resilience (Su-re.co)	ID
14	Research	Koninklijk Nederlands Meteorologisch Instituut (KNMI)	NL
15	Research	Oeko-Institut e.V. (Oeko)	DE
16	NGO	Innolab Space (ILS)	CAD
17	Research	International Center for Tropical Agriculture (CIAT)	IT
18	NGO	Cobra Collective CIC (COBRA)	UK

1. Excellence

1.1 Objectives

With the 2015 Paris Agreement (PA), the international community agreed to limit the rise in global temperature to below 2ºC.[1] Roughly 30% of Nationally Determined Contributions (NDCs) under the PA include Land-based Mitigation Technologies (LMTs) and practices. The IPCC 1.5 Special report also noted that all pathways that limit global warming by 1.5°C must consider negative emissions technologies[2]. However, even for ambitious mitigation scenarios, there will likely be a significant overshoot of greenhouse gas (GHG) emissions in the short run that would require large scale implementation of negative emissions solutions. At the same time, the responses of the natural carbon cycle and other feedbacks/side-effects to LMTs still include substantial risks and uncertainties.[3] Therefore, while LMTs have a key role in the global efforts to meet the PA goals and are also relevant for the Sustainable Development Goals (SDGs), like food security, sustainable use of land and water resources, and biodiversity, they require further research and more scientific understanding[4].

LMTs involve existing and novel practices in agriculture, forestry and other land use (AFOLU) sectors, as well as negative emissions technologies like bio-energy with carbon capture and storage (BECCS)[5]. The IPCC Special Report on Climate Change and Land[6] considers the sustainable use and management of land vital for combating climate change as well as for maintaining land productivity (i.e. food security) and biodiversity and for preventing land degradation. Climate change and transformations in landscapes have impact on vulnerable

[1] Jones, C. D. et al (2016). Simulating the Earth system response to negative emissions, Environmental Research Letters. IOP Publishing,11(9), 95012
[2] IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels, (Masson-Delmotte, V., et.al).
[3] Calvin, K.et al (2016). Implications of uncertain future fossil energy resources on bioenergy use ... Climatic change,136(1), p 57-68
[4] .Smith, P., Haberl, H., Popp, A. et al. 2013. How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals?. Global Change Biology 19(8): p 2285-2302
[5] EASAC (2018) Negative emission technologies: What role in meeting Paris Agreement targets? EASAC policy report 35
[6] IPCC (2019). Climate Change and Land: An IPCC Special Report. Available at: https://www.ipcc.ch/site/assets/uploads/2019/08/Fullreport-1.pdf

populations and affect the adaptive capacity and resilience of ecosystems and communities. Land use and management is strongly linked to the challenges and potential solutions for climate change[7]. For instance, the accumulation of biomass and carbon in forests can be increased through different options, including the prevention of forest fires, the control of pests and diseases, the appropriate silvicultural management, or the management of biodiversity[8].

Considering this land-climate-development nexus, the LANDMARC project aims to better understand the impacts of ***LMTs mitigation potential as net sinks for GHGs*** and their associated co-benefits by applying a unique mixed-methods approach that includes:

- a combination of ***remote sensing*** (satellite-based) and in-situ ***monitoring tools***;
- a set of ***models*** combining climate, land use, carbon cycle, ecosystem, and socio-economic systems;
- iterative and continuous ***stakeholder engagement*** to better understand LMT management practices and barriers to scaling[9]; and
- a comprehensive assessment of ***quantifiable*** and ***non-quantifiable*** environmental, and socio-economic ***risks, trade-offs*** and ***co-benefits***.

Typically, a top-down approach is used to model the global potential of LMTs[10], based on research community's assumptions.[11] This can provide useful insights to scale up LMTs over long time frames and can feed into global climate policies towards 2050 or 2100. However, to scale up LMTs and realise their mitigation potential, top down approach alone may not take into account nuanced barriers, practices and different types of policies across distinctive regions required to scale up LMTs[12]. Furthermore, a shorter time frame - decadal, annual or down to seasonal - is often needed when supporting the implementation of LMTs at the local or national level. Consideration of trade-offs and co-benefits may also be challenging at the global scale due to impacts or values that are specific to a region.

In LANDMARC, we will specifically apply a bottom-up method for *actual LMTs currently applied* across ***6 LMT categories*** including: (1) agriculture and agro-forestry; (2) forestry; (3) soils; (4) ecosystems (e.g. peatlands); (5) biogenic land-based wastes/management and; (6) bio-energy with carbon capture and storage (BECCS). The LMT categories will be studied in ***16 country case studies*** with the ***potential to scale up*** regionally in ***5 key continents:***

1. **Europe**: The Netherlands, Germany, Sweden, Switzerland, Portugal, Spain
2. **Asia**: Vietnam, Nepal, Indonesia
3. **Africa**: Kenya, Uganda, Burkina Faso, South Africa
4. **Latin America**: Colombia, Venezuela
5. **North America**: Canada

We have selected actual LMT locations rather than experimental cases to better reflect reality as some LMT experiments have yielded lower results compared to real farm yields[13]. Differences between experiments (or theoretical research assumptions for applying LMTs) and practice lie in the fact that LMT involve diverse management practices that depend on social, economic and climatic contexts. Additionally, land use managers (e.g., farmers, foresters) may already be working on nature conservation but are unaware of the climate mitigation potential of their lands. Synergies can be achieved between adaptation and mitigation efforts, but a lack of awareness and negative perceptions on the economic viability of LMT solutions for mitigation action, have meant that efforts in climate change adaptation - including biodiversity conservation, soil protection, and water saving measures - have not sufficiently advanced climate mitigation goals[14]. Therefore, LANDMARC will work from the bottom up through case studies to support incremental but important improvements in land management practices for GHG emission reductions as well as for economic and social gains.

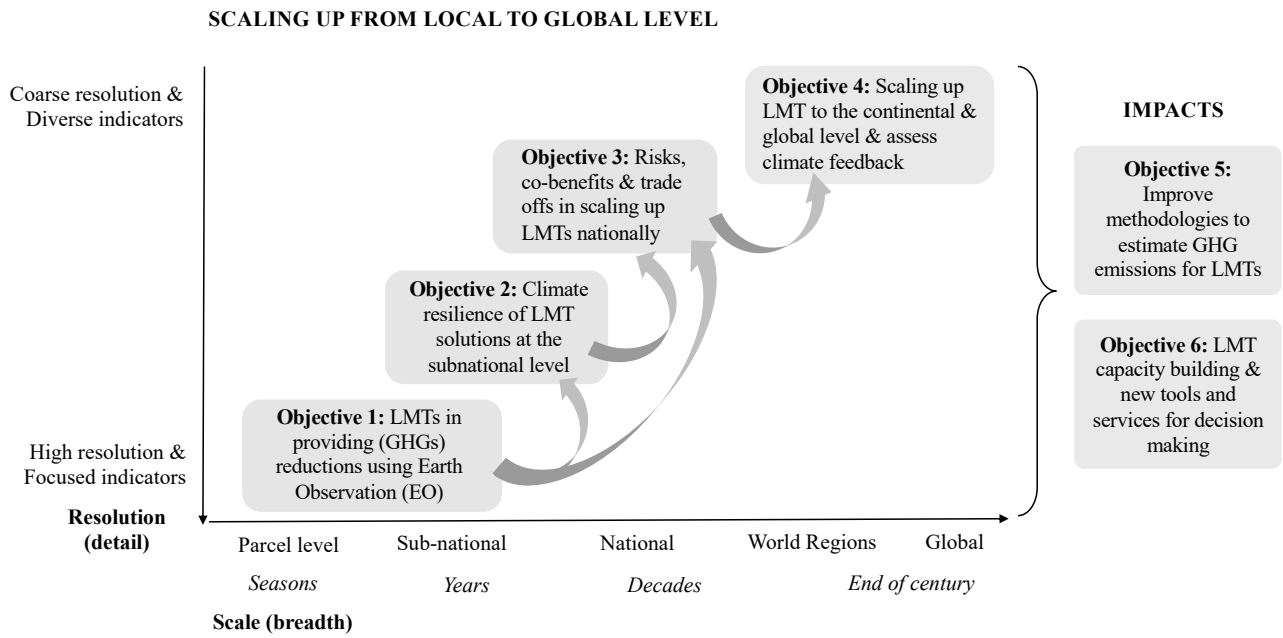
Having an improved understanding of land use management practices supported by Earth observation data can significantly impact the scaling up of LMTs and their mitigation potential.

[7] Popp, A., et al (2017). Land use futures in the shared socio-economic pathways. Global Environmental Change, 42, p. 331-345
[8] Gracia C., et.al. (2005).Evaluación preliminar de los impactos en España por efecto del cambio climático. Ministerio de Medio Ambiente.P.399-436.
[9] Stakeholder (SH) identified in LMT value chain (e.g. technological provides, end-users) and SH in the policy areas of LMTs
[10] See Lit review of LMTs in IAMs Sabine Fuss et al (2018). Negative emissions—Part 2: Costs, potentials and side effects. Environ. Res. Lett. 13.
[11] Harper, A. B. et al. (2018). Land-use emissions play a critical role in landbased mitigation for Paris climate targets. Nature communications.
[12] Cox, E.,et al. (2019). Beyond carbon pricing: policy levers for negative emissions technologies. Climate Policy, p. 1–13.
[13] White, R. et al (2017). A critique of the paper 'Soil carbon 4 per mille' by Minasny et al. (2017). Geoderma. 309
[14] The lack of awareness for climate mitigation potential in land use practices is observed by LANDMARC SMEs and NGO in Europe/ other regions

There are challenges to link specific high-resolution data and information at the local level directly to the global level. For this reason, we have developed objectives that explore the potential for LMTs at different spatial scales through a stepwise scaling up approach that links focused indicators informed by local level data and stakeholder knowledge (reflecting the social, economic and climate contexts of the respective level) into broader indicator sets and coarser resolution that allows for generalisability.

In LANDMARC we first explore the local ***potential of LMTs*** in Objective 1, then scale up to the ***subnational level*** in Objective 2, the national level in Objective 3, and finally to the ***regional/continent and global level*** in Objective 4. We then focus on ***impacts to improve GHG emission estimates*** in Objective 5, and ***LMT capacity building*** in Objective 6 (See Figure 1).

Figure 1: LANDMARC Objectives



Our six objectives are more specifically discussed below.

Objective 1: Determine the potential and effectiveness of LMTs in GHGs mitigation using Earth Observation (EO)

We will apply innovative approaches to assess changes in vegetation, land use and climatic conditions using different ***Earth Observation (EO) tools*** including 3 in-situ and at least 3 remote sensing techniques to ***monitor the potential and effectiveness of LMTs to reduce GHG concentrations*** and thus act as a ***net GHG sink*** based on measurements in soil, water, atmosphere and vegetation. We will apply techniques that ***directly measure carbon*** across our 16 case studies which includes: in-situ soil sampling and satellite atmospheric monitoring Orbiting Carbon Observatory 2 (OCO-2). The EO techniques used to evaluate and measure GHG reduction and negative emissions potential for LMT's include:

- ***GHG flux measurements*** (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O)), which will be applied in Europe and Africa;
- ***in-situ soil sampling*** for chemical (soil carbon), physical and biological monitoring. In-situ biological soil monitoring will be applied on a larger scale for LMTs than in previous studies, spanning 5 continents;
- ***satellite monitoring*** of biomass production using *Copernicus Sentinel1&2*, satellite monitoring of air quality (NO_2, HCHO) and vegetation fluorescence using TROPOspheric Monitoring Instrument (TROPOMI), remote sensing photogrammetry based in LIDAR for forest mass and biomass monitoring using 'Field Map', a combined remote sensing and in-situ tool. These techniques will be applied first in Europe, then where relevant, in the other 4 continents.

The last EO technique will be a newly developed remote sensing technique, the "CarbonMap" that will be developed by our SME partner, Agroinsider, to determine carbon sequestration potential using EO data. The tool will first be applied in Europe and expanded to other continents.

Objective 2: Improve climate resilience of LMT solutions at the local level for large-scale implementation

Together with local/national and regional/continental stakeholder communities[15] (aiming for at least ***300 stakeholders over a period of 4 years*** who are already working on LMT implementation), LANDMARC will provide support services to enable robust climate change risk assessment and management, by making use of the best available future climate change scenarios for the specific LMT solutions across 6 categories in 16 sub-national regions based within the case studies.

Climate change risk as well as the ***climate sensitivity*** of LMTs in the sub-national regions will be assessed by analysing the results from the Coupled Model Intercomparison Project, phase 6 (CMIP6, Eyring et al. 2016); which includes all climate models that will contribute to the next IPCC Assessment Report (AR6). For our 6 LMT categories, based on the CMIP6 model outputs, LANDMARC will develop ***16 climate risk assessments*** across the case studies by analysing how changes in ***climate patterns*** can affect LMT actions on timescales ranging from decadal to multi-decadal (accounting for their vulnerability, sensitivity and potential exposure). This provides essential information for planning future ***effective large-scale LMT implementation***. These local/regional climate vulnerability assessments provide valuable insights on boundary conditions that set the possible limitations for scaling up LMTs to national and regional levels.

The climate risk assessment process foreseen in LANDMARC relies on the engagement of local stakeholders, and aims to better embed climate change related risks in mainstream/conventional (project) risk management practices (e.g. International Corporate Social Responsibility risk management, or ISO 31000 – Risk Management). This risk assessment will be performed within a participatory setting and aims to ensure that climate change related risks are better included in project risk management practices. These practices can then be applied and scaled up across different continents.

Objective 3: Assess the risks, co-benefits and trade-offs of scaling up local LMTs nationally

We will assess the ***risks and co-benefits of scaling up local LMTs*** as potential net GHG sinks and the ***trade-offs*** with other s***ocial, economic and environmental goals*** and develop corresponding ***LMT policy portfolios*** to scale up locally implemented LMTs to the national level.

LMT actions could cause a range of potential non-climate impacts and these could be risks (negative unwanted side-effects), or co-benefits (positive side-effects). For example, a specific LMT solution could have a positive impact on air quality, but be unfavourable for soil quality or biodiversity. Aside from ecosystem and climatic risks and co-benefits of LMTs we also assess a range of other quantitative and qualitative ***socio-economic impacts*** including on local development goals and relevant SDGs (i.e. SDG7-9,11,14 &15). We will need to assess the trade-offs needed when attempting to address both climate change mitigation goals, other environmental goals and social-economic development goals.

Together with local stakeholders, LANDMARC will co-develop ***16 national LMT narratives (at least 2 scaling up scenarios per case study)*** that are used for a range of model simulations and qualitative risks, co-benefit assessments to consider the impacts of ***scaling up*** specific LMT solutions from the ***sub-national*** level to the ***national level***. These national scenarios will be both qualitatively and quantitatively assessed. We will also have ***16 quantitative assessments*** performed across case studies with a ***model system*** that combines several ***land use models (***DayCent, ALCES, LandSHIFT-National) that provide a mechanistic description of carbon dynamics and GHG emissions in response to LMTs, along with a ***macro-econometric model*** (E3ME), which assesses the social, economic and environmental impacts of scaling up LMTs.

We will also carry out ***16 risks and co-benefit qualitative assessments*** across our case studies using a method developed specifically for risk and co-benefit analysis. Including both the scenario modelling output and qualitative assessment, we will explore potential trade-offs between climate and other environmental and social-economic goals in country case studies.

Considering the trade-off assessment, we will develop ***16 LMT policy portfolios across the case studies*** based on existing policies and potential new policies to support the scaling up of LMTs at the parcel/sub-national

[15] Some key stakeholder communities consists of land use managers (e.g. forestry managers), land owners (e.g. farmers), local communities impacted by LMT practices, businesses implementing BECCs (waste facility), government bodies overseeing ecosystems and land use, environmental NGOs, and policy makers in climate, environment and economic policies),

level to the national level. These policy portfolios will inform EU and other continental policy portfolios and support scaling up potential (see objective 4).

Objective 4: Scaling up LMT solutions to the continental and global level to assess effectiveness

We will promote science in practice through collaborating and supporting the scaling up of LMT solutions in 6 LMT categories for assessing large-scale reductions in GHGs from continental to the global level and ***assessing feedbacks*** between ***LMT solutions*** and ***climate change impacts***.

Scaling up of selected LMTs is needed to assess their potential from 5 continents (Europe, Asia, Africa, Latin America and North America) towards a cumulative global impact. Engagement actions with stakeholders will be performed in all the LANDMARC case study countries (objective 3), while regional/continental engagement actions will be performed within 5 continents. With the help of a range of land-use, climate and economic models (i.e. LandSHIFT-Global, E3ME, EC-Earth3) we will co-develop ***5 continental narratives for LMT portfolios*** consisting of a collection of LMT solutions identified at the national level across the 6 LMT categories. This will be complemented by ***5 continental LMT policy portfolios*** based on the national LMT policy portfolios.

The outcomes of each continental scenario will contribute towards the global total for the LMT portfolio. A number of scaling constraints - derived from the empirical evidence from the national level, the planned regional/continental engagement activities and the climate change risk and sensitivity assessment (objective 2) - will be introduced into LANDMARC's model system to enable realistic simulations of the regional and global potential for selected LMTs and with different policy portfolios. The model system will provide detailed insights on the effectiveness of scaled-up LMTs in reducing atmospheric CO_2. This will be achieved taking into account climate change and natural variability as well as carbon and physical feedbacks of LMTs on climate focusing on timescales from decadal to multi-decadal.

Expected results will involve insights on the global scaling potential and scaling constraints for LMTs in different contexts such as different climatic zones, temporal scales and with policy portfolios. The results will be fed into ongoing national or EU policy processes, e.g. national governments developing and implementing LMT policies for their NDCs, and EU policies for "green direct payment" for sustainable land use, the EU Biodiversity Strategy to 2020, and the EU Forest Strategy and the European Commission's Thematic Strategy for Soil protection. Moreover, LANDMARC's decadal predictions will provide relevant and timely information for the UNFCCC's global stocktake occurring in 2023.

Objective 5: Improve current methodologies to estimate emissions and removals for LMTs

Within LANDMARC we aim to improve the state of the art for (satellite and in-situ) monitoring of emissions and removals from LMT activities (objective 1) as well as to improve predictive ability of process-based biogeochemical models for soil GHG emissions in response to LMT implementation (e.g. DayCent). LANDMARC will collect new scientific data and generate predictions at the national scale for 6 LMT categories over 5 continents to better inform LMT potential and feasibility and also ***provide support*** to at least ***16 different groups of local/national stakeholders*** (including farmers, land management practitioners, regional government (e.g. EU organisations), policy makers) in order to improve accuracy, reliability and complexity of the national GHG inventory reporting in the AFOLU sectors. The long time series (years to decades that resonates more with decision-making needs for implementation) and high spatial resolution data (starting from the parcel level at m^2) will be used to calibrate and validate emissions predictions in process-based models considering soil and climate dependencies.[16] Thus, our combined suite of EO measurements and models can increase the accuracy of emissions estimates through improvements of activity data, emission factors and an increase in the complexity of measurement processes and analyses to better represent specific GHG dynamics of LMTs.

Novel EO-based monitoring systems applied in different continents and advanced modelling will enable ***the 16 case study countries to report soil- and climate-dependent GHG emissions at higher levels of detail***, increasing certainty and complexity of National Greenhouse Gas Inventory Reporting (NIR) by moving ***from***

[16] For process base model see Olander et al (2011) Using Biogeochemical Process Models to Quantify GHG Mitigation from Agricultural Management Projects. Nicholas Institute for Environmental Policy Solutions Report NI R 11-03.

IPCC Tier 1 and Tier 2 towards Tier 3 approaches.[17] In addition, we will explore the potential for LMT project developers to benefit from LMT practices enabling them to claim carbon credits within (voluntary) carbon offset schemes (e.g. Gold Standard, Voluntary Carbon Standard, etc.). We will practically explore this opportunity in at least 1 LMT category in Europe (e.g. forestry in Germany) and another continent such as South America. In both cases there is a need to make use of robust, more reliable and lower-cost monitoring methods and protocols that will be further developed within LANDMARC.

In relation to NIR reporting the ambition is to provide reliable scientific evidence, data and methods to enable the case study country to advance at least one IPCC tier level for a specific land use category (e.g. wetlands, grasslands, forest land, crop land). For project-based emission reduction schemes, LANDMARC will develop at least two novel EO-data based monitoring methods to support new business models (e.g. new EO tools to provide an economic value to biodiversity and carbon potential sequestration) as well as land management practices for a specific LMT category. We will apply the new methods and practice in at least one country and assess the potential to scale up to the national and continental level. This effort will provide LMT projects with better prospects of generating alternative funding either via (voluntary) carbon offset markets or via article 6 of the PA on Cooperative Mechanisms.

Objective 6: LMT capacity building and develop new tools and services for decision making

To ensure that the LANDMARC project has a lasting impact, a range of ***capacity building and training activities*** will be offered in the 16 country case studies and at least ***16 new tools, or new applications of tools in new regions or new land use management practices*** will be developed to support (public and private) stakeholders in decision making at different scales.

The LANDMARC consortium includes SME partners that are already offering several EO based commercial services to land-use sectors (e.g. eLEAF, Bioclear Earth, Agroinsider, Ambienta). Within LANDMARC these partners will develop and offer a ***novel EO service for cost-effective monitoring*** of climate change risks and environmental impacts of land-based activities at higher temporal and spatial resolutions than larger models are able to provide.

We will arrange at least 20 national and continental engagement activities with stakeholders in LANDMARC, which can focus on the joint development of robust scaling scenarios for ***LMT solution and policy portfolios*** across the continents *and* provide relevant stakeholder groups at the national and continental level with some of the following: a) training and learning on how to make better use of existing EO data/information for current action and future planning to improve LMT applications at the decadal level and, where possible, consider a gender perspective in the work (see concept and impact section for details); b) implementing the use of the latest insights on LMT monitoring and reporting (i.e. guidance and support for transparent national inventory reporting, including global and free data sets e.g. Global Forest Watch); c) training and support for mainstreaming climate change risks in conventional risk management practices to improve emission reduction potential and aiming to reduce at least 1 social and/or economic risks; d) making better use of the latest climate change scenarios and support of using risk, co-benefit and trade-off analyses for LMT policy making; and e) develop LMT policy portfolios to support the scaling up of LMTs based on social, economic and environmental priorities at the national, EU and continental level.

1.2 Relation to the work programme

Table 1: Challenges addressed in LANDMARC for the LC-CLA-02-2019

Specific challenge	*Call: LC-CLA-02-2019*
include ***negative emissions*** to compensate for residual emissions and/ or temperature overshoot and highlight	LANDMARC will perform a broad ***assessment of*** the potential and effectiveness of ***a portfolio of land-based negative emission solutions*** (including agriculture, forestry, agro-forestry, BECCS, and enhanced weathering) at the local/national, regional/continental and global level. Objectives 1 to 3 cover the local/national level assessment work on the

[17] "IPCC describes three approaches to providing activity data involving land area. Approach 1 is not spatially explicit and simply uses net areas associated with managed land use. Approach 2 provides the matrix of changes between land uses. Approach 3 is fully spatially explicit. Remote sensing data are likely to be used to greatest advantage with Approaches 2 and 3. [...] IPCC methods require forest classification and associated stratification and the area of each stratum. IPCC methods are then applied at the level of the different carbon pools and the emissions and removals summed. IPCC methods do not necessarily require the existence of a formal national forest inventory" See https://tinyurl.com/y5httor2

Specific challenge	*Call: LC-CLA-02-2019*
the ***critical role of land use-based mitigation***	LANDMARC case studies (see Table 2), while Objectives 4 and 5 target the continental and global assessment work.
a need ***to quantitatively assess*** the ***potential***, ***effectiveness*** and ***impacts*** of negative emission technologies / practices and of land-use mitigation options	The LANDMARC project includes a dedicated work package ***to advance earth observation methods and practices*** for monitoring land-based (negative) emissions (Objective 1, by combining space-borne information from different satellite programmes with in-situ monitoring and observations). This will enable the further development and improvement of land-based GHG monitoring methods, tools and (commercial) services as well as the assessment of the ***effectiveness*** of LMT solutions. The LANDMARC project will also ***deploy a suite of climate, land-use and economic models*** (i.e. DayCent, LandSHIFT, E3ME, EC-Earth3, ALCES) to perform a robust ***impact*** assessment of LMT solutions scaled at different levels (at the local, national, continental and global level potential). Priority impacts that will be simulated with these models include, net GHG emissions, air quality, biodiversity, soil quality, biomass/yield production (i.e. food security), GDP, employment, land use conflicts (Objective 3).
in achieving the long-term goals of the ***Paris Agreement***, as well as ***linking*** these to what it would mean for ***concrete policy challenges***.	Specific policy challenges related to the PA generally focus on the ***barriers to implementation of specific LMTs*** within the forestry or agriculture sector that are part of the NDCs. Both the qualitative assessment (with stakeholders, including policy makers) and the quantitative assessments (with models) performed within LANDMARC will aid in informing policy makers and practitioners in their decision making. LANDMARC assessment work will address a range of policy challenges specific to managing transitions within the land use sectors. WP4 targets climate risks (tasks 4.1 and 4.3) and the climate sensitivity (Objective 2) of LMTs, while Objective 3 targets a range of socio-economic, climate change, environmental and other risks and side-effects of LMT scaling up. Those insights and results will be synthesised and fed into relevant (policy) decision making processes such as ***NDC (evaluation) processes, and EU regional goals*** (Objective 3 & 4) and the global ***NDC Partnership*** (see also section 2.2 Plan for the Exploitation and Dissemination of the project's Results**,** PEDR).
Scope	***Sub-topic b) Land-based mitigation***
Actions should provide a comprehensive analysis of various land-use based mitigation options at the ***global and regional level***,	The LANDMARC project builds upon existing (or links to) local/national level assessment work. This work covers both an extensive literature review on LMT solutions as well as a portfolio of different LMT case studies (see Table 2). In country case studies, LANDMARC applies a range of earth observation methods, land-use modelling (ALCES, LandSHIFT-National and DayCent models), and climate modelling (CMIP6, Objective 2). At the regional level (Europe, Latin America, Asia, Africa, North America) a series of engagement actions will be implemented that enable the development of robust scenarios for LMT scaling. These scenarios will be used for the continental and global level modelling done with LandSHIFT-Global (land use), EC-Earth3 (climate and carbon cycle) and E3ME (econometric model) (Objective 4).
large-scale reductions of greenhouse gases, in the context of ***trade-offs and/or co-benefits*** in relation to ***other pressures and goals***	Within LANDMARC a specific qualitative risk co-benefit and trade-off assessment will be performed with stakeholders for the different case studies at the local level (Objective 3) and scaling scenarios at the regional level (WP6). This will analyse the interlinkages between the proposed LMTs and other sustainable development goals (SDGs) (Objective 3), other local development priorities and (un)wanted side-effects. Part of these co-benefits and/or trade-offs will be quantitatively assessed with the help of the suite of land-use, climate and economic models within LANDMARC (Objectives 2,3&4)
and should ***analyse feedbacks between***	Within LANDMARC a range of ***novel land use scenarios*** will be simulated at different scales (local/national, continental and global) with the ALCES,

Specific challenge	*Call: LC-CLA-02-2019*
land-use based mitigation and climate change impacts.	DayCent and LandSHIFT land use models. These scenarios deploy a portfolio of LMTs for climate change mitigation, and result in changes in land use, land cover, fluxes of carbon and nitrogen and biomass growth, etc. Feedbacks between land-use based mitigation and climate change impacts are explored on the global scale by coupling the Earth System model EC-Earth3 with the land-use model LandSHIFT-G (Objective 4).
improve current methodologies to estimate emissions and removals associated with land use measures, also by ***leveraging observations*** from ***GEOSS*** and in particular the ***Copernicus*** programme	The earth observation work within LANDMARC (WP3) will make use of data/observations from different Copernicus satellite programs, including ***Sentinel 1&2 and S5P-Tropomi*** and will combine that with existing and new in-situ observations from case studies. These activities will aid in the ***validation, improvement and proper calibration of novel EO-based GHG monitoring algorithms, process-based models, protocols, tools and services*** for land-use activities. Our planned tasks: **i)** calibrate and validate satellite-based negative emission estimates, with in-situ and other EO data (Objective 1), **ii)** measure the effectiveness of LMTs and evaluate and improve current monitoring methodologies (Objective 5), **iii)** develop new EO business models for GHG monitoring of LMT actions such as the "Carbon Map' and 'Biodiversity Tool' (e.g. provide support for technological consulting service and add value to landowners) (Objective 6), **iv)** contribute to transparent GHG monitoring of LMTs, both for inventory accounting and project-based GHG monitoring (Objective 5), and **v)** parametrize, calibrate and evaluate predictive ability of DayCent process-based model for soil GHG emissions in various ecosystems and for a range of LMTs using in-situ and EO data.
international cooperation is encouraged and ***joint activities on cross-cutting issues***	International cooperation within LANDMARC is ensured in three different ways (Objective 6). ***First,*** the majority of the LANDMARC case studies build further upon or complement existing (inter)national research projects. For example, the Dutch peatland case study has important synergies with the ***CarbonConnects*** project and the Kenyan case study will liaise with the Regional Centre for Mapping of Resources for Development (RCMRD) and the International Institute of Tropical Agriculture (IITA). ***Second,*** there is a dedicated work package for regional/continental engagement to ensure that there are joint activities inside and outside of the EU with relevant stakeholders that will link to a range of existing international platform initiatives, including the NDC partnership, the Global Soil Partnership and its regional soil partnerships, the SDG Partnership, and the global network on sustainable land management (WOCAT). ***Third,*** a dedicated task (Task 1.6 in WP1 – Clustering and collaboration with other relevant projects/initiatives) within LANDMARC manages clustering activities with other relevant selected projects for cross-projects cooperation with other research projects and institutes.

1.3 Concept and methodology

(a) Concept

LANDMARC is a highly **interdisciplinary global** consortium with members in over 10 countries with expertise from ecology, engineering, climate science, global carbon cycle, soil sciences, satellite Earth observation sciences, agronomy, economics, social science, science-technology policy research, and business. We have a unique blend of climate mitigation and adaptation scientists, researchers and practitioners. This enables us to assess which aspects of LMTs mitigation potential is realistic given implementation contexts.

Together we bring in a suite of Earth systems monitoring tools and a model system as well as our experience working with stakeholders to: a) assess the ***technical potential of carbon sinks and GHG emissions reductions potential;*** b) evaluate the risks, co-benefits and 'economic' feasibility of implementing and scaling up LMTs;

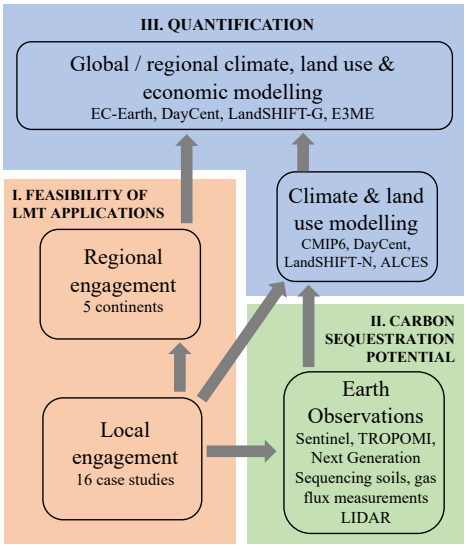
and c) explore what is socially realistic. This **mixed-method approach** allows us to use a range of tools and to provide more **detailed insights** at **national levels** to develop a robust portfolio of LMT solutions and policies that is scalable at the **regional/continental** and **global** level**.**

In LANDMARC, we will apply, from the **bottom up,** EO tools together with state of the art and ***new tools*** to engage with stakeholders working on the ground to gather both qualitative and quantitative data across our case studies. We combine this with efforts from scientists who model the world at the sub-national, national, continental and global level to make use of the ***valuable data collected on the ground*** over a period of 4 years to ***realistically scale up LMTs globally***. The LANDMARC will help to ***bridge gaps*** between **science** and ***practice*** using quantitative and qualitative research tools and methods. Here we describe our concept developed over the past year to systematically evaluate the feasibility of LMTs.

Three building blocks:

The LANDMARC concept is based on three building blocks (see Figure 2).

Figure 2: LANDMARC Three Building blocks



Building Block 1: Feasibility of LMT applications

The first building block cuts across all of our objectives and aims to evaluate the ***feasibility of LMT applications*** with *local* and *regional stakeholders* across the 5 continents for LMT implementation and scaling up. Effective engagement of key stakeholders in LMTs will enable a better understanding of LMT feasibility- that is, its potential and barriers to scaling up as well as the development of more robust data collection assessment work that. This a) helps develop better quality (and more feasible) LMT scaling up and implementation scenarios, and b) improves the uptake of research results and findings in policy and practice. Consulting stakeholders will occur through case studies and our regional engagement activities, which link the empirical data and research with the other building blocks in LANDMARC.

Rationale for geographical coverage of LANDMARC assessment work

For a robust assessment of the global potential of LMT solutions, proper account needs to consider regional differences and specific national contexts. For instance, regional land use management practices, traditions, economic conditions, climatic circumstances need to be appreciated for LMTs to work well. To ensure a proper coverage of all these variables at the global level, LANDMARC targets 5 of the key continents. Within these continents we also host a number of country case studies. The case studies selected in Europe represent a diverse range of LMT categories (e.g. agriculture, forestry, soils, ecosystem and BECCs) and different climatic regions (northern, central, and southern regions). In other continents of the world, we selected country case studies where LANDMARC partners have on-going collaborations with local stakeholders (e.g. land use manager, policy makers, business and government organisations). We also chose case studies with potential substantial LMT impacts locally and across continents (e.g. rice & coffee in Asia and forests in South America and Africa). Additionally, minimum data requirements need to be met, thus LMT cases in Asia, Africa and Latin America were also chosen on their data availability. In North America we selected a Canadian case

currently deployed with a BECCs potential, as Canada has strong technological developments in carbon capture and storage. See Table for LMTs explored within country case studies.

Table 2: LANDMARC LMT case study list

Country	Case study	Agriculture & agroforestry	Forestry	Soils	Other Ecosystems	Biogenic waste /management	BECCS
1. Spain	Evaluation and monitoring of carbon sequestration capacity and degraded agricultural lands refore-station program in Extremadura (1993-2008) and synergies with other social challenges including depopulation and masculinisation of rural areas.	X	X				
2. Portugal	Agroforestry. Montados. Integrated land use. Diversify crop production by alternating agricultural crops with forests.		X				
3. Switzer-land	Large scale biophysical assessment of organic cropping/reduced tillage and trade-offs between potential to mitigate net soil GHG emissions and maintain productivity in the long term.	X					
4. Germany	Developing an LMT concept for forest management and forest restoration and conservation in Germany including a national results-based finance mechanism for carbon accounting and crediting.		X				
5. Nether-lands	Impact of LMTs on peat soils and for Agroforestry and flux measurement and Advancements in GHG and biodiversity impact monitoring, and activation of carbon market for LMT solutions.	X			X		
6. Sweden	BECCs review of past BECC plant and upcoming new plant and potential across different regions.						X
7. Canada	Willow plantation on abandoned mine-sites for bio-energy generation and potential for CCS & BECCS innovations.	X					X
8. Colombia 9. Venezuela	Amazon, indigenous knowledge on forestry & fire management and application of remote sensing data to assess carbon sequestration potential and to explore wider impacts in the region e.g. Brazil.	X	X				
10. Nepal	Improve farm resilience and reducing emissions through sustainable rice management technologies (e.g. wet & dry rice cultivation) and explore the feminisation of the agriculture for LMT potential.	X					
11. Indonesia	Compost: Comparison of small, medium and large scale compost/biogas technologies on agricultural lands.	X				X	
12. Vietnam	New type of forages for degraded soils to capture more carbon, feed mix to mitigate emissions 'Livestock +' program & provision of Climate Information Services.	X					

Country	Case study	Agriculture & agroforestry	Forestry	Soils	Other Ecosystems	Biogenic waste /management	BECCS
13. Burkina Faso	Support the World Bank Forest Investment Program (FIP) to assess its investments (integrated policy to reduce GHG emissions from land use changes and forestry, and support women's economic activities for reforestation), link with the Forest Carbon Partnership.	X	X				
14. Kenya 15. Uganda	Strengthening carbon and water observatory rangeland in Kenya using a case study of ring-fencing in upper Ewaso Ng'iro North river basin & integrated soil fertility management.	X		X	X		
16. South Africa	Flux measurements South Africa: Eddy covariance flux measurement to calibrate and validate satellite Earth Observation estimates on the role vegetation can play in carbon sequestration.	X					

Note: For engagement with stakeholders within LANDMARC a range of different qualitative tools and methods will be applied (see last row in Table 3).

Building Block 2 – Assessing LMTs carbon sequestration and mitigation potential

The second building block supports the feasibility assessment of ***carbon sequestration potential*** and potential to mitigate emissions of soil N_2O and CH_4 (in selected case studies) through Earth observations (EO) (addresses Objective 1), including both remote sensing and in-situ monitoring of soils and vegetation as well as atmospheric monitoring. Within this building block, information on the state of Earth's physical, chemical and biological systems will be collected via a range of tools and instruments.

Within LANDMARC we will use different satellite EO data from Copernicus and other programs (including Sentinel 1, 2 and 5p-TROPOMI, OCO-2, LANDSAT, FPAR, MODIS), as well as in-situ data (LIDAR, soil/vegetation and gas flux data) from existing databases (e.g. https://scihub.copernicus.eu) and/or collected with the help of stakeholders. The remote sensing data focuses on e.g. land cover, vegetation fluorescence, air quality metrics, etc. In addition, we will perform our own in-situ measurements in different case studies with various techniques. These include gas flux measurements, ground water level measurements, stratified sampling, various soil chemical and physical analysis and soil biological analysis making use of next generation sequencing. With the help of a range of EO data analysis and processing techniques (e.g. AgroMap, PiMapping ®, Field-Map) this data will be converted into relevant information (e.g. NPP, NVDI, soil organic carbon stock, avoided emission fluxes) to assess the effectiveness and impact of LMTs and their potential for soil GHG emissions reduction. These techniques will also contribute to improving estimates of (negative) GHG emissions from Tier 1 to Tier 3 for national inventory reporting through the improvements of the models providing climate and soil dependent emission estimates nationally (e.g. via DayCent) (addresses Objective 5).

A combination of these EO tools (and data) will be applied within a total of 16 indicative case studies to better determine (see 1.3b for details on methods):

- the **net carbon sequestration potential** as well N_2O and CH_4 **mitigation potential** of different land-based mitigation solutions, and
- any **biological, -physical and -chemical side-effects** on e.g. biodiversity, biomass growth, and (air polluting) emissions

Building Block 3 – Quantifying negative emissions potential of LMT when scaled up

The third building block focuses on the ***quantification*** and estimation of the various impacts of large scale LMT implementations through a ***set*** of ***models***. For quantification purposes a range of climate, land-use, and economic models are applied to evaluate the potential impacts of LMTs locally and when scaled up, the impacts on social-economic system and on policies (addresses Objective 3) as well as feedbacks between LMTs and

the environment (climate, land, ocean) (addresses Objective 2). Within LANDMARC the following models (and a selection of qualitative tools and methods) will be deployed for assessing the impacts of scaling up LMT at the local, continental and global level (Table 3).

Table 3: Models and tools applied in LANDMARC: key features and impact parameters

Core model set	
DayCent	Biogeochemical land-use management[18]: a daily-time step, point- and process-based terrestrial ecosystem model of intermediate complexity widely used to simulate crop biomass and/or yields, soil carbon and nitrogen dynamics, N_2O emissions, nutrient dynamics and GHG fluxes in different plant/soil systems. It can simulate long-term ecosystem responses to changes in climate, land use and agricultural management practices in cropland, grassland, forest and savanna ecosystems[19],[20].
ALCES	Cumulative effects, land-use, economic performance: Simulates changes in landscape composition and related indicators (e.g., wildlife habitat & populations, ecosystem services, & economic performance) in response to land-use scenarios. ALCES tracks landscape composition in response to multiple drivers such as land use (forestry, agriculture, etc.), natural disturbance (e.g., fire, insects), and climate. Simulated landscape composition is applied to track indicator response through user-defined equations that can be based on empirical relationships or stakeholder preferences. The model is cell-based, with the cell size user-defined and allows for analysis ranging from municipalities[21] to large regions[22] (hundreds of thousands of km^2).
Land-SHIFT	Land-use change dynamics: LandSHIFT-N national, and LandSHIFT-G regional and global scale simulate land-use change dynamics and competition between different land-use activities on grid level[23],[24]. Grid cell size varies between 1 km^2 for national level applications and 5 arc-min in the global model version. The sub-modules include land-use activities such as settlement (URBAN), crop cultivation (AGRO), livestock grazing (GRAZE) and forestry (FOREST).
E3ME	Global macro-econometric: a global, macro-econometric model designed to address major economic and economy-environment policy challenges. E3ME[25] includes integrated treatment of the world's economies, energy systems, emissions and material demands, a new land use component, and an explicit model for financial sector. E3ME captures two-way linkages and feedbacks between these components, including both short and long-term impacts. E3ME can be used to address specific policy questions asked by governments; e.g. modelling global decarbonisation and quantifying socio-economic effects, including links to climate modelling.
EC-Earth3	EC-Earth3: the Global Climate Model version has three major components: the atmospheric model IFS (Integrated Forecasting System) Cy36r4, the ocean model NEMO 3.6 (includes the LIM3 sea-ice model) and OASIS3. The Earth System Model version of EC-Earth3 also includes a description of global carbon cycle with LPJ-GUESS dynamic vegetation model, PISCES ocean biogeochemistry model and TM5 global atmospheric transport model. EC-Earth3 can be used for climate predictions (months to a decade) or climate projections (decades to centuries), in response to changing external forcings such as GHGs, aerosols and land use change.
Climate scenarios for local and national analysis	
CMIP6	Climate projections from the Coupled Model Intercomparison Project 6 that includes all the

[18] Del Grosso, S. et. al. (2001). Simulated Interaction of Carbon Dynamics and Nitrogen Trace Gas Fluxes Using the DAYCENT Model., in Modeling Carbon and Nitrogen Dynamics for Soil Management., S. Hansen , M.J. Shaffer , and M. Liwang, Editors., CRC Press.
[19] Del Grosso, S. et al (2008) DAYCENT simulated effects of land use and climate on county level N loss vectors in the USA., in Nitrogen in the Environment: Sources, Problems, and Management, 2nd ed. , R.F. Follett and H. J.L., Editors. 2008, Elsevier Science Publishers: The Netherlands.
[20] Del Grosso, S., et al. (2002). Schimel, Simulated effects of dryland cropping intensification on soil organic matter and greenhouse gas exchanges using the DAYCENT ecosystem model. Environmental Pollution, 2002. 116: p. S75-S83.
[21] Carlson, M., et al. (2015). Exploring Cumulative Effects of Regional Urban Growth Strategies: A Planning Scenario Case Study from the Calgary Region of Western Canada. International Society of City and Regional Planners (ISOCARP) Review 11.
[22] Carlson, M., et. al (2019). Application of land-use simulation to protected area selection for efficient avoidance of biodiversity loss in Canada's western boreal region. Land Use Policy 82:821-831.
[23] Schaldach, R., et al. (2011). An integrated approach to modelling land-use change on continental and global scales. Environmental Modelling & Software, 26(8): p. 1041-1051.
[24] Koch, J., et al (2018). Analyzing the relationship between urbanization, food supply and demand, and irrigation requirements in Jordan. Science of the Total Environment 636: p. 1500-1509.
[25] Cambridge Econometrics (2019), 'E3ME Technical Manual v6.1', https://www.e3me.com/what/e3me/.

Core model set	
	climate models and simulations that will be considered in the IPCC-AR6.
Qual-itative methods	Data collection /survey tools (collect stakeholder perceptions and develop regional narratives) Climate CAFE[26], Scenario Integration[27], Multi-Criteria Assessments and methods (for trade-off analysis) from FP7 project (APRAISE) Policy Mix Analysis[28] (creating LMT policy portfolios), and H2020 project TRANSrisk risk analysis (evaluating barriers and negative impacts of scaling up clean technologies)[29] Stakeholder Mapping[30] (mapping the stakeholder network and their interactions to assess potential risks).

This model set will be used in specific combinations for the different modelling activities in relation to the LANDMARC case studies in WP3-5 and for the continental and global modelling done in WP7 (see section 3.1 work plan for more details).

Linkages with R&I activities that feed into LANDMARC

LANDMARC will build further upon or link with a range of existing national and international research and innovations. This will particularly focus on the collection of earth observation data with remote sensing and in-situ data sets that can be used for our LANDMARC EO work in WP3 in relation to the case studies. For this we can draw upon e.g. the in-situ and satellite data components from Copernicus and more local projects within case study countries such as CarbonConnects and Farm-Life in the Netherlands, and the Forest Carbon Partnership in Burkina Faso. Furthermore, for climate risk and sensitivity assessment with CMIP6 within WP4. In addition, the results of the 16 case studies). For the engagement activities with stakeholders at the local/national and continental level LANDMARC will make use of qualitative methods such as market system mapping, multi-criteria decision analysis, developed from other EU projects (e.g. CARISMA, TRANSrisk, and APRAISE-FP7).

From this conceptual description of the project and its three building blocks, we distil three main challenges, which are explained further in the next section:

Challenge 1: **Scaling up scenarios for LMT portfolios**: effectively integrate stakeholder knowledge in different model simulations to scale up from the local to national, regional/continental and global level.

Challenge 2: **Modelling integration and coupling in an interdisciplinary team**: effectively integrating stakeholders' knowledge in a novel model set of different model types operating across different spatial and time scales and linking them to earth system observations.

Challenge 3: **Assessing carbon sequestration and GHGs emission reductions potential of LMTs**: calibration and validation of remote sensing data with in-situ data from different sources and different spatial and temporal resolutions.

(b) Methodology

Figure 3 shows our stepwise method based on the three building blocks that address our objectives across different WPs and identified challenges (leaving out WP1&8 on coordination & dissemination). We study the feasibility of LMTs at the local case study level (WP2) and scale up to consider climatic risks at the sub-national level (WP3). We then scale up LMTs to the national level (WP5) and the country studies and complemented by regional/continental studies (via desk research) and stakeholder engagement are aggregated to the continental level (WP6). The global LMT potential is then the summation of all the continents (WP6).

Addressing Challenge 1: Scaling up (Objective, 1, 2, 3, 4, & 6)

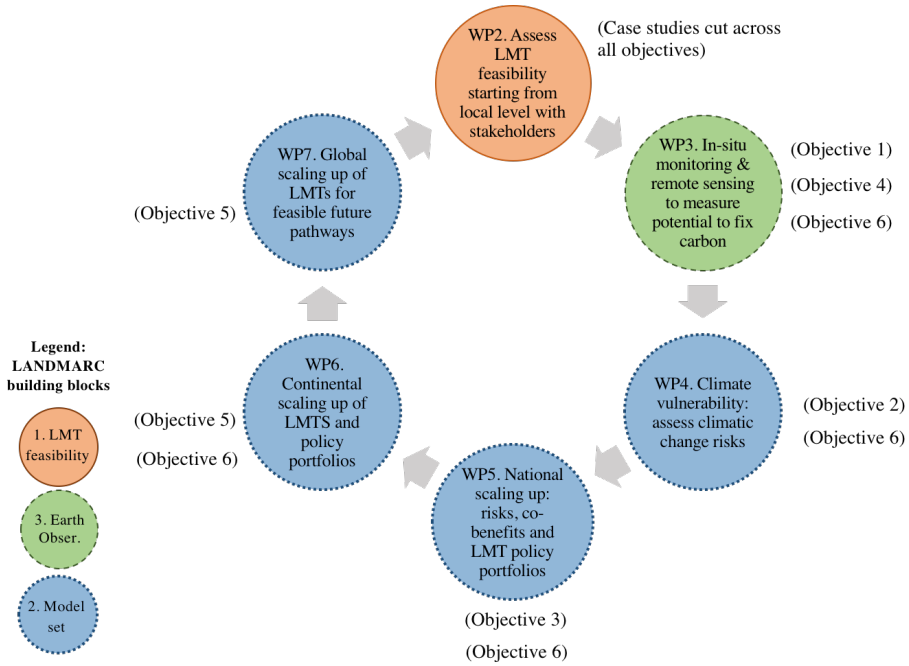
First, we will tackle Challenge 1: scaling up scenarios for LMT portfolios. LANDMARC partners have worked together to establish a common terminology of the scales. Figure 4 illustrates the scales we operate in

[26]Climate CAFE: Climate change adaptability of cropping and farming systems (FACCE-JPI): http://tinyurl.com/y5jl75hn
[27]Scenario integration: integrating qualitative and quantitative elements on developing future pathways: http://tinyurl.com/yyzsq6ms
[28] Lieu J, et al (2018). "Evaluating Consistency in Environmental Policy Mixes through Policy, Stakeholder, and Contextual Interactions". Sustainability. 10(6)
[29] Hanger-Kopp S, et al. A (eds) (2019). Narratives of Low-Carbon Transitions Understanding Risks and Uncertainties. London: Routledge
[30] Nikas A, et al. (2017). "Managing stakeholder knowledge for the evaluation of innovation systems in the face of climate change. Journal of Knowledge Management". Journal of Knowledge Management. 21(5), p. 1013-1034.

LANDMARC. We have identified various levels of scaling up, which include the: ***(1) local level*** to the (***2) subnational and (3) national level (countries)*** and ***(4) continents*** and the (***5) global level.***

We have developed a methodology to systematically scale up across each scale, in order to provide accurate and robust data to analyse the negative emissions potential for LMTs.

Figure 3: LANDMARC building blocks to support objectives and WPs



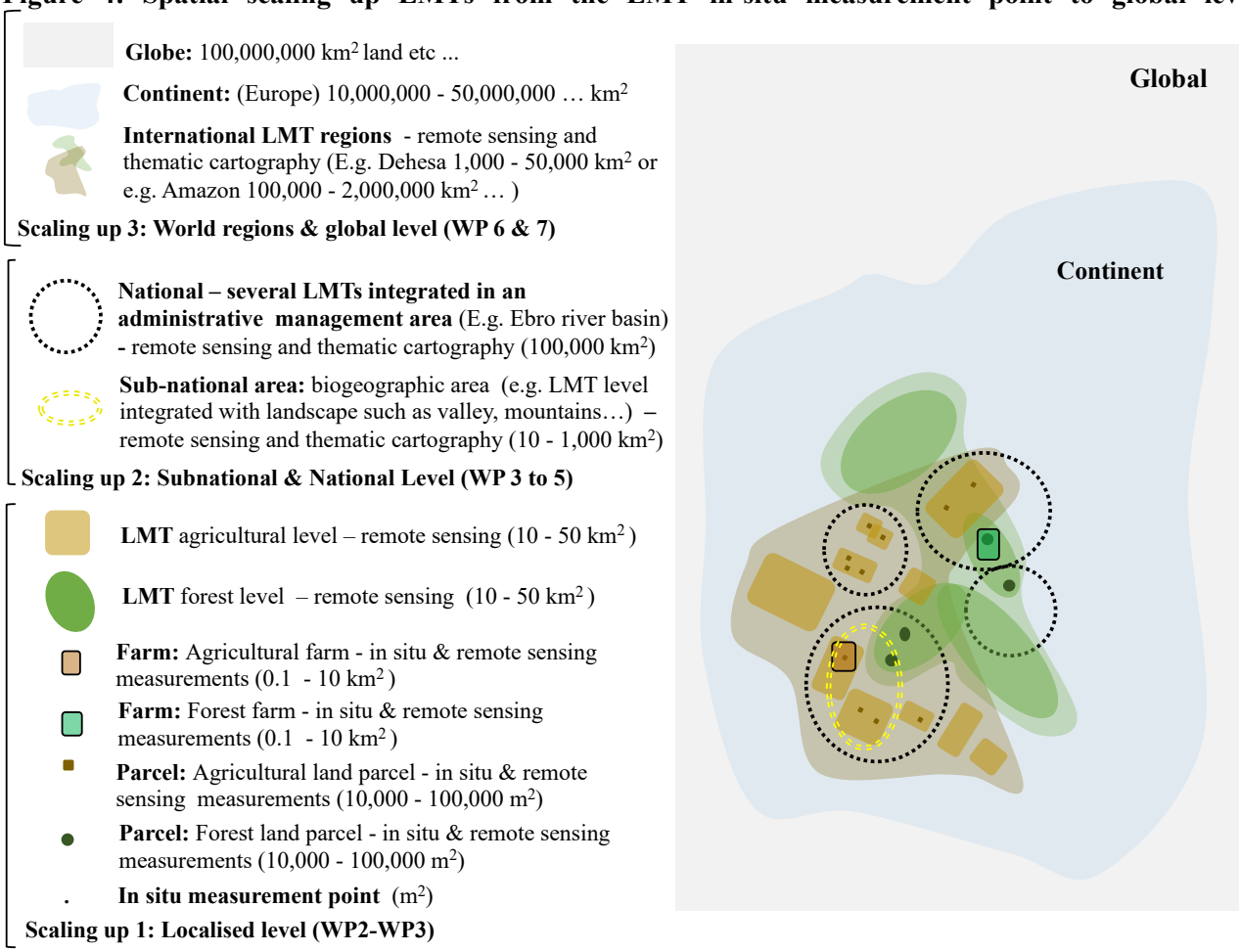
Considering the scientific carried out across WP2-WP7, we address these three challenges in our methods.

1. Local level in-situ measurement point to LMT scale (Objective 1): We will collect data including soil biology and chemistry and biomass yield in the in situ measuring points for each LMT across case studies. At the parcel level, we will work closely with the affected stakeholders including farmers, and land management organisations/institutions. We will apply in-situ sampling (FieldMap), remote sensing (Agro Map, ETLook, Carbon Map) and air-quality (S5P TROPOMI) monitoring tools to provide a high level of precision on the ecological coverage, soil chemistry/biology, gas flux measurements (CO_2, CH_4, N_2O), biomass/crop yields etc. to be verified remote sensing tools. The information provided by these analyses give us more accurate insights on soil biodiversity and available substrate, their soil and climate dependency and dynamics which will allow us to assess the potential for negative soil emissions. Biomass production will be assessed for carbon sequestration potential using existing conversion equations and remote sensing tools.

2. Scaling up to the sub-national level (Objective 2 & 3): We will then explore LMT potentials at a sub-national level in case studies firstly by collecting EO data, which will be used to assess soil carbon sequestration and GHG emissions reductions potential (details on techniques in next section). Additionally, we will ***use all available in situ data*** (previous measurements as well collected within this project timeframe) and extrapolate data from the parcel to the sub-national level by the use of biochemical models (i.e. DayCent), to simulate changes in biomass/yields, carbon stock, soil N_2O and CH_4 emissions in response to LMTs implementation. The outputs from DayCent will be fed into the ALCES model to stimulate land use changes, and the economic impacts at the sub-national level. Estimates of biomass productivity informed by in-situ monitoring and remote sensing will help to identify sites for scaling up LMTs at the sub-national level, which can be considered in further scaling up with the LandSHIFT model.

Within the cases studies, we will consider broader climate change risks and the potential vulnerabilities based on the results from the CMIP6, evaluating how changes in climate patterns can affect LMT actions from a decadal timescale to support planning of LMT implementation and scaling up. Stakeholders will also be consulted to identify potential issues and land practices that might affect outcomes, for instance an impact crop yields or biodiversity. Where relevant in LMTs, we will include a gender perspective when addressing social-economic issues (e.g. Spain, Nepal, & Burkina Faso have a gender dimension in their LMT applications).

Figure 4: Spatial scaling up LMTs from the LMT in-situ measurement point to global level



(Note: the diagram is not drawn to scale and only 2 LMTs are listed as illustrations

3. Scaling up to the national level (Objective 3): We will consider country-wide contexts that may impact LMT implementation in each case study. Considering the *climate risks and sensitivity* assessment, we integrate knowledge and perspective of stakeholders to identify other types of co-benefits and risks and evaluate these trade-offs in the *implementation of LMTs*. While in-situ and remote sensing tools provide data on LMT potential for scaling up, LandSHIFT-N will help to identify feasible LMT sites for scaling up. We will also develop feasible narratives with stakeholders that will be used for scenario modelling in the models set (DayCent, LandSHIFT-N and ALCES and E3ME) to assess the environmental and socio-economic potential, trade-offs, and co-benefits of scaling up LMTs nationally.

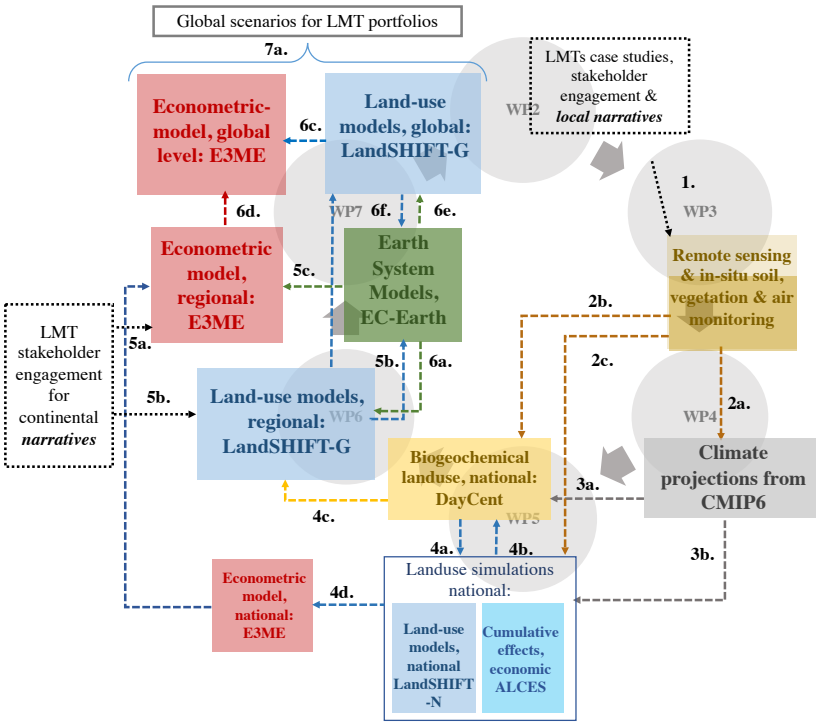
4. Scaling up to the continent level (Objective 4 & 6): We will cluster LMTs across several countries (e.g. forests and larger ecosystems) into ***LMT portfolios*** and assess the potential to scale up by extrapolating data from the country level (based on outputs from the DayCent, ALCES and LandSHIFT-N models) to the continental level. We will also consider changes in climate and apply the EC-Earth3 model at the decadal time scale to predict future near-term atmospheric CO_2, while considering natural climate variability within each continent. We also bring together stakeholders from LMT case studies using a variety of formats and methods (see WP6) to develop and assess future feasible continental narratives. In the socio-economic analysis of ***LMT policy portfolios***, carried out by E3ME, employment effects are a key result. We will include an assessment of potential gender dynamics in employment effects. The analysis will assess the extent to which LMTs are likely to affect different economic sectors, which are characterised by gender imbalances. Starting from these narratives we continue to scale up LMTs by creating LMT portfolios at the continental level.

5. Scaling up to the global level (Objective 4): We will compile the different continental LMT portfolios and run the models EC-Earth3, LandSHIFT-G and E3ME for global level analyses to assess LMTs' negative emissions potential and its GHGs emissions potential and possible climate feedback.

Addressing Challenge 2: Modelling integration (Objective 4 & 5)

While including a range of models can add a richness of detail, higher complexity of processes and greater certainty, there are challenges with integrating and coupling the models across different disciplines and scales. We have begun to make connections between the earth systems observations within our model system at the national & regional/continental level. Some of these first links were discussed above in scaling up. Figure 5 illustrates some of the outputs generated and the corresponding inputs required for the models in WP2-7.

Figure 5: Key inputs and outputs across tools and models



Legend:

1. Identify monitoring sites & engage with stakeholders
2a. Define boundaries for monitoring study localised sites and biogeographic area for vulnerability assessment
2b. In-situ soil sample & remote sensing data outputs as inputs to DayCent to inform carbon sequestration potential;
2c. Biomass productivity outputs to spatially allocate LMTs as inputs to LandSHIFT-N and ALCES
3a. CMIP6 output future climate scenarios at subnational/regional scale to assess climate change vulnerabilities and feed into national risk assessment for LMT implementation
3b. Assess LMT vulnerability and provide inputs to DayCent, ALCES and LandSHIFT-N
4a. DayCent outputs to ALCES & LandSHIFT-N: (CO_2, GHGs, yields on economic output, soil C, & data on external resources)
4b. LandSHIFT-N and ALCES output to inform DayCent (yields & economic output, GDP, CO_2, & GHGs)
4c. Outputs from DayCent, LandSHIFT-N and ALCES provide insights for E3ME scaling up to national and/or regional level
5a. & 5b. Stakeholder regional workshop to draft narratives for creating scenarios to upscaling LMT
6a. & 6c. EC-Earth regional outputs e.g. future atmospheric CO_2 to and LandSHIFT-G and E3ME regional level.
6b. LandSHIFT-G regional include LMTs to EC-earth
6d. E3ME regional scenarios scale up to global
6e. EC-Earth global outputs including future atmospheric CO_2 to LandSHIFT-G global level
6f. LandSHIFT-G to include LMTs to EC-earth;
7a. Calculate harmonised global scenarios for LMT portfolio. Global output: CO_2, other GHGs, yields, soil C, & data on external resources, and climatic scenarios impacts and feedbacks

The diagram begins on the top with WP2 and moves clockwise towards WP7. As we carry out the work in LANDMARC, we will identify more details (e.g. model inputs and outputs and specific integration methods) than those listed in Figure 5. We will document these details in the model set methods development tasks in WP5&7 (details in section 3.1). Aside from specific model linkages, the narratives developed at the local level scaled up to the national level and the continental narratives also serve as important connectors to link the model system across scales. The narratives are an important basis for developing LMTs scenarios used in the national and continental modelling and scaling up to global scenarios for LMT portfolios.

Addressing challenge 3: GHG Mitigation Potential (Objective 1 & 5)

We address the challenge of assessing carbon sequestration and soil GHG mitigation potentials of LMTs at local level through the calibration and validation of remote sensing data with in-situ data from different sources. Some of the details on how we will carry this out are indicated in WP3. We have case study partners working at the local level, some of which have collected data and work with stakeholders providing us with information and data that may not be available through national statistical offices. Furthermore, we will carry out in-situ monitoring combined with remote sensing and use this data in modelling to assess negative soil emissions potential. We have identified **8 EO techniques** (both **current** and **newly developed** techniques for LANDMARC) that include **in-situ monitoring** and **remote sensing tools to determine carbon sequestration and GHGS emission reduction potential.** These techniques will be applied at the local level and we will provide results before scaling up to the national and continental (regional) and global level.

Techniques 1-4: In-situ observations to evaluate carbon sequestration and GHG mitigation potential:

Technique 1: In-situ soil physical-chemical monitoring: the most reliable and inexpensive determination of carbon sequestration in soils is by measuring in-situ total organic carbon content across different periods and qualifying the difference over time. Due to the slow build-up of soil organic carbon, a couple of years between measures is required for significant differences to be detected. This method can be applied to all case studies where we have on the ground access.

Technique 2: In-situ soil biological monitoring: identifying the composition of soil microorganisms, can be used as a proxy for the quality of soil carbon stock and the expected carbon flows in soil. Molecular techniques such as Next Generation Sequencing are capable of identifying the community of microorganisms, additionally specific genes, for instance the oxidation of methane, can be targeted in a quantitative manner. This method is not frequently applied at the large scale for assessing LMT potential, thus one of the innovations in this project can be to carry out soil biological assessment across all case studies where we have on the ground access.

Technique 3: GHG Flux Measurements: we use a soil flux chamber method for measurements of gaseous fluxes, such as CO_2, CH_4 and N_2O, between soil and air. Flux chamber measurements provide an estimate of the amount of gas being emitted from a given soil surface area per unit of time. The flux data can then be used to develop emission rates for a given source (management) in predictive modelling and emission factors for LMTs. This method is expensive, labour and time demanding and thus not routinely applied. This method can be applied to one case study in Europe and Africa.

Techniques 4-8: Remote sensing technique to evaluate carbon sequestration potential:

Technique 4: Satellite monitoring of biomass production: Biomass production is closely related to the Net Primary Productivity (NPP) and the carbon uptake by vegetation, and will be used to improve the estimates of carbon sequestration in vegetation. Satellite earth observation algorithms can measure the biomass actually produced in a certain period of time. The biomass production is based on Monteith type parametric models that uses, among others, the vegetation index NDVI but also accounts for energy available for biomass growth (fPAR) and stress factors based on EO land surface temperature, relative humidity, solar radiation and air temperature. It is crop independent and can be calculated for all vegetation on any land surface at different scales, for example at parcel level using Sentinel-2 and Landsat imagery, and at regional level using MODIS and Sentinel3 imagery. This method can be applied in a few case studies.

Technique 5: Sentinel-5P TROPOMI: Sentinel-5P TROPOMI: measures the solar-induced fluorescence from reflecting off the earth surfaces, including biomass and also measures atmospheric concentrations of the air pollutants nitrogen dioxide (NO2) and formaldehyde (HCHO). This data will be used for the first time in LANDMARC to evaluate the potential of LMT for negative emissions while considering effects on air quality. Solar-induced fluorescence is a direct measure for carbon-capturing photosynthetic activity by vegetation. TROPOMI provides unique data on fluorescence, available with daily global coverage at an unprecedented resolution of 3.5x5.5 km^2. For all case study plots, we will collect and validate TROPOMI fluorescence against local in-situ information, to evaluate the potential of upscaling the fluorescence data as a proxy for changes in land cover, land use, vegetation characteristics, and carbon uptake on a global scale. Besides fluorescence, TROPOMI also measures atmospheric concentrations of the air pollutants nitrogen dioxide (NO2) and formaldehyde (HCHO). TROPOMI holds tremendous potential to detect both increases and decreases in air pollutant emissions that co-occur with carbon sequestration, such as substantial increases in biogenic emissions (more HCHO) and reductions in soil NOx (less NO_2) in response to e.g. reforestation. We will collect this data for the locations with in situ measurements for a few studies, to monitor whether LMT lead to co-benefits or co-penalties in terms of air quality.

Technique 6: Photogrammetry based in LIDAR remote sensing: The carbon sequestration potential of the forest mass monitored by the LIDAR can be calculated and evaluated, since this technology provides data on forest height, which together with the high resolution can estimate biodiversity. Using vegetation transformation equations, according to botanical species and tree size, a high precision estimate of the decarbonisation potential of the mapped forest can be calculated. We will apply two methods to estimate forest biomass, based on inventory data: 1) biomass expansion factors: transforms the volume of wood in dry matter weight of the tree; and 2) biomass estimation equations: relates the dry weight of the biomass with some variable of the tree, generally the diameter and the height. This technique can be applied in LMT forest cases, e.g. in Spain, based on the available data.

Technique 7: Field map technologies for monitoring: 'Field-Map' is a flexible technology solution typically used for National Forest Inventory programmes. It combines flexible real time GIS software with electronic equipment for navigation, mapping and dendrometric measurements[31]. 'Field-Map' technology can be newly applied to estimate carbon budgets and monitoring of forest carbon stock changes. The capacity of the Field-Map system to integrate information from different remote sensing sources with the in-situ measurements

[31] Martin C. et al. (2018). *Technological solution supporting NFI: Field-Map.* Field-Map.

ensures the maximum productivity of the inventory projects focuses on growing stock, biomass and carbon stock estimation. This technique can be applied in LMT forests and grassland cases.

Technique 8: "CarbonMap" tool based on SARs (Synthetic Aperture Radar Sensor): SAR transmits microwave signals at an oblique angle and measures the backscattered portion of this signal in order to analyse features on the surface. This tool will be developed by our SME partner, Agroinsider, using radar EO data that will map carbon existing carbon budgets and at the same time the carbon sequestration potential associated to each ground scatterer. This tool considers different types of radar ground scatterers (bare soil, pastures, agriculture systems, agro-forest systems, sparse- and dense-forest the) and in-situ measurements (carried out in case studies). The tool then relates the radar signals to a carbon budget and carbon sequestration potential. We can apply CarbonMap in agriculture, forestry, soils, and biogenic case studies.

When developing CarbonMap, we will consider a ***gender sensitive approach*** in terms of tool development and user experience. Women are under-represented in the science and technology sector and most technologies are developed by men[32]. While the number of women in science is increasing, particularly in Europe[33], there can still be biases in technology development that might not consider the different needs of women and men. Thus, we will put into place practices to include women and men in designing and testing the tool (see impact section 2.1 for more details on gender considerations).

1.4 Ambition

Gaps in practice and science: Many of LANDMARC's SME, research and NGO partners work with local national governments and land use managers in the EU and worldwide. Based on our combined field experiences, we have noticed that ***earth observation tools and monitoring services*** have not been systematically used to support the assessment of LMT emission reductions potential. Literature also acknowledges that the ***real potential*** of different ***land use management practices*** worldwide is still ***unknown***[34,35], including the potential benefit from ***learning within and across regions (e.g. continents).*** Additionally, there are very few studies that explore a ***range of policies*** (beyond carbon pricing) ***to promote LMTs*** in different regions[36]. Thus, we not only need a bottom up approach to learn from individual LMTs within countries but we also need to cluster individual ***LMTs as a portfolio***[37] across ***regions***. There is also a gap in bridging "long-term climate change mitigation models and the technological and institutional bottom-up evidence from the engineering and social science disciplines"[38]. Below, we discuss the state-of-the-art contributions and beyond where we address the temporal and scalar gaps identified in practice and science.

(a) State of the art:

Improving Earth Observations data and information (Objective 1):
While there are many EO tools applied for environmental monitoring needs within a specific sector (e.g. agriculture[39], wetlands[40], and forestry[41]) there are currently no systematic studies[42] to our knowledge that documents both in-situ and remote sensing applications to assess negative emissions and/or emissions reduction potential over a wide range of LMT categories worldwide. Within LANDMARC, we collect relevant in-situ data (e.g. vegetation, soil physical/chemical properties) from existing sources. We then couple it with new in-situ measurements and remote sensing data to test and evaluate the potential and quality of EO observations and algorithms to investigate constraints on carbon uptake resulting from LMT techniques. The detailed EO data collected and stakeholder engagement will also help identify feasible locations and can be used as inputs for the LandSHIFT model to more accurately scale up LMTs to the national and global scale.

Mainstreaming climate risk assessment in conventional risk assessment practices (Objective 2):

[32]Hearn, J. & Husu, L. (2013). Understanding Gender:Some Implications for Science & Technology. Interdisciplinary Science Reviews.36, p. 103–13.
[33]World Economic Forum. (2019). Gender equality in STEM is possible. Available at: https://tinyurl.com/y4zccqgd
[34]IPCC (2019). Climate Change and Land: An IPCC Special Report. Available at: https://www.ipcc.ch/site/assets/uploads/2019/08/Fullreport-1.pdf
[35] EASAC (2018) Negative emission technologies: What role in meeting Paris Agreement targets? EASAC policy report 35
[36] Cox, E.,et al. (2019). Beyond carbon pricing: policy levers for negative emissions technologies. Climate Policy, p. 1–13.
[37] Minx J C et al 2018 Negative emissions: Part 1—research landscape, ethics and synthesis Environ. Res. Lett. 13 063001
[38] Fuss S. et al (2018). Negative emissions: Part 2- Costs, potentials and side effects. Environ. Res. Lett. 13 063002
[39] Muller, A. et al. (2017).Strategies for feeding the world more sustainably with organic agriculture. Nat. Commun. 8, 1290
[40]Askaer, L. et al. (2011).Plant-mediated CH4 transport and C gas dynamics quantified in-situ in a Phalaris arundinacea-dominant wetland. Plant Soil. 343: p. 287-301
[41]Scott J Goetz et al (2015). Measurement and monitoring needs, capabilities and potential for addressing reduced emissions from deforestation and forest degradation under REDD+. Environ. Res. Lett. 10
[42] Pires,J.C.M. (2019).Negative emissions technologies. Science of The Total Environment, 672, p 502-514,

The discussion of risks in LMTs is often linked to the implementation of the LMT technologies and solutions and the risks associated with biodiversity loss[43] and scaling up LMTs[41,42,45]. Climate risks are also well explored in agriculture and food security as well as individual and community responses to climate risks[44]. However, we see a gap in assessing how climatic risks can impact the carbon emissions reduction potential of LMTs at the local level and when scaling them up. LANDMARC will assess the climate risk and sensitivity of LMT activities both qualitatively (together with stakeholders) and quantitatively (with climate models) to explore how changes in the climate (e.g. at the decadal timescale that resonates with stakeholders) might impact the potential for scaling up LMTs. The main aim is to ensure that climate change risk assessments and the latest climate change scenario results are embedded into conventional risk assessment and management practices of relevant local and regional stakeholders within the land use sectors.

Detailed assessment of LMT potential beyond individual technologies and countries (Objective 3 & 4)

BECCS is often a key technology studied within negative emission technologies with some discussion on afforestation and reforestation, enhanced weather, and direct air carbon capture and storage[38,45,38,45,46]. But there are very limited studies on land management practices and other LMTs such as usage of waste and residues from land-use activities. Thus, further studies are needed to explore LMT as a portfolio with a range of technologies across different LMT categories[36,47]. Additionally, the implementation of individual technologies cannot simply be added up to determine the total LMT potential due to the complex social, economic and environmental trade-offs when two or more LMTs are implemented, or when LMTs compete with other land uses options [47]. There are still knowledge gaps in understanding and overcoming barriers to implementing and scaling up LMTs and quantifying trade-offs in order to carry out more detailed modelling[38]. In LANDMARC, we will study a range of LMT categories in our case studies at the local level. For instance, DayCent is currently used to quantify N_2O emissions from agricultural soils for IPCC Tier 3 NIR reporting[48] in the USA[49]. However, a lack of research, experimental data and lack of validation under different environmental conditions have limited the application beyond singular countries. LANDMARC will allow us to evaluate the model performance and reliability of model predictions and conduct an ecosystem impact assessment at the local and national scales in a wider range of ecosystems (potentially include forestry) and for a variety of management practices, which have been seldom modelled with DayCent in the past. This will support wider application of this model for quantification of GHG impacts in the future and support Tier 3 reporting in other countries. We also apply the ALCES land-use model to assess trade-offs using social, economic and environmental indicators selected by both researchers and case study stakeholders. We then aggregate the country case study findings with our larger model sets to scale up LMT portfolios at the regional/continental level.

Stakeholder knowledge for LMT portfolio and scaling scenarios (Objective 3&4):

The IPCC 1.5 reports acknowledges that the potential for negative emissions linked to land use (i.e. LMTs) varies widely and there are currently very few pathways that explore LMTs other than afforestration and BECCs[50]. New 1.5°C pathways also need to explore both the technological potential of different LMTs as well as variations in scaling up. The challenges of scaling up negative emissions technologies have been observed in practice as well as in comprehensive scientific literature reviews[46,51]. The studies indicated that negative emission technologies need to be implemented from 2030 to 2050; yet there are presently significant challenges related to public acceptance that have not been well explored[51]. Thus we examine some of the key challenges

[43] de Vries, F. T. *et al.* (2013). Soil food web properties explain ecosystem services across European land use systems, *Proceedings of the National Academy of Sciences*, 110(35), p. 14296 LP-14301.
[44] See literature review in Chapter 3 of Chapter 4 of the IPCC (2019). Climate Change and Land: An IPCC Special Report. Available at: https://www.ipcc.ch/site/assets/uploads/2019/08/Fullreport-1.pdf
[45] Buy G et al, (2015). Mapping Carbon Emissions & Removals for the Land Use, Land Use Change & Forestry Sector. UK Centre for Ecology & Hydrology. Available at: https://tinyurl.com/yyrofart
[46] Minx J C et al 2018 Negative emissions: Part 1- Research landscape, ethics and synthesis Environ. Res. Lett. 13 063001
[47] Locatelli, B., Pavageau, C., Pramova, E. and Di Gregorio, M. (2015). Integrating climate change mitigation and adaptation in agriculture and forestry: opportunities and trade-offs. *Wiley Interdisciplinary Reviews: Climate Change*, *6*(6), 585-598.
[48] US-EPA (2019) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017. EPA 430-R-19-001, Washington, D.C., p. 675.
[49] DayCent has been extensively parameterised and tested in the US for a wide range of environmental conditions, management practices. Olander, L.P., Haugen-Kozyra, K. (2011) Using Biogeochemical Process to Models to Quantify Greenhouse Gas Mitigation from Agricultural Management Projects. Technical working group on agricultural greenhouse gases (T-AGG) supplemental report. Duke University, USA.
[50] IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels, (Masson-Delmotte, V., et.al).
[51]Nemet G. et al. (2018).Negative emissions—Part 3: Innovation and upscaling Environ. Res. Lett. 13 063003

of public acceptance in different LMT categories at the local to regional/continental level through consulting stakeholders in order to gain a more realistic understanding of scaling up scenarios.

In fact, one of the state-of-the-art features of the LANDMARC project is the clear link and engagement with both local/national stakeholders (through the case studies in WP2) and regional/continental stakeholders (WP6). Co-development is accepted as a state-of-the-art practice in many research disciplines[52]. However, we continue to observe that modelling work is primarily driven by the research-community, which tends to be based on generic scenarios that make general assumptions on human behaviour worldwide. For instance, generalisations on the take up of certain LMTs and land-use management practices which do not hold true at the local level[53]. These methods are important for assessing long term emission reductions potential and global impacts, but a bottom up method of assessing LMT feasibility should also be carried out across regions to complement top down approaches.

LANDMARC will work with stakeholders through a series of engagement activities to develop narratives that are feasible for stakeholders that can feed into modelling scenarios rather than only applying the SSPs. This will deliver robust local, national, regional/continental and global scenarios that will better reflect the ***real LMT scaling potential*** given the stakeholders' understanding of the local and regional/continental contexts and barriers to LMT implementation. These co-created scenarios will link with quantitative assessments within LANDMARC for land use, economic and climate modelling.

Additionally, the gaps that exist between science and practice linked to land use emerge from a mismatch between the knowledge holders (usually researchers or decision makers who are aware of the land management practices needed for climate mitigation) and the land use managers (who work on the ground and are unaware of land use mitigation potential). Thus, through its case studies (see Table 2) LANDMARC will work on knowledge transfer between science and practice. In fact, there are positive synergies when working closely with stakeholders who are already engaged in agricultural or forestry practices. For instance, conservation of soil against erosion, prevention of forest fires, biodiversity conservation, ecosystems restoration are LMTs in themselves, but still unknown in terms of their potential for mitigation.

(b) Beyond state of the art:

Improving GHG accounting for sustainable land management technologies (Objective 5):
There is a range of state-of-the-art research initiatives that aim to inform practitioners in AFOLU sectors and policy makers on the climate impact of various sustainable land management technologies. For example, the Carbon Benefits project and WOCAT (World Overview of Conservation Approaches and Technologies) are already trying to link IPCC tier 1 and 2 level emission factors and methodologies to the global database of sustainable land management. LANDMARC will contribute to these efforts by providing relevant research data and information from the LANDMARC case studies. This will be done with the help of the earth observations calibration and validation done within the LANDMARC case studies. This work fosters the development of new earth observation business models such as providing tools that help assess the economic value of biodiversity (Biodiversity Tool) and carbon sequestration potential (Carbon Map) for GHG monitoring of sustainable land management technologies. These EO database services will enable the development and usage of IPCC Tier 3 estimates for land based negative emissions solutions, instead of Tier 1 and 2 level methods.

Advance science and data availability on the impacts of climate change on soil quality & biodiversity (Objective 1):
The land degradation assessment of IPBES[54] on soil biodiversity states that: *'The current status of national to global biophysical data and its availability for land degradation and restoration is unacceptable. Only with new, intensive, focussed programmes at national and international levels will biophysical research and applications to control degradation advance.'* The LANDMARC project will contribute to the further advancement in this area of research by deploying in-situ soil microbial analysis (Task 3.2 of workplan) to all LANDMARC case studies within different continents. LANDMARC partner BCE will use next generation

[52] Doukas, H. et al. (2018), 'Understanding Risks and Uncertainties in Energy and Climate Policy', Springer International Publishing.
[53] Keywan, R. et al, (2017) The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. Global Environmental Change. (42), p. 153-168.
[54]The IPBES assessment report on land degradation and restoration. Montanarella, L., et al. (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany

sequencing (DNA NGS) technology to assess soil microbiological properties. Such properties can consistently predict processes of C and N cycling across land use systems and geographic locations, and in some cases can be better predictors of these processes than land use[55]. By better embedding soil biodiversity data and observations within global models, we will improve the accuracy of explaining soil-related (negative) GHG emissions, which is often inadequately reflected within climate models.

Advance science and data availability on climate change impacts on vegetation performance & air quality (Objective 1):
Land-use changes are known to result in changes not only in the fluxes of greenhouse gases, but also impact air quality (NO_2, HCHO, CO, SO_2). Examples include the development of tar sands in Canada, responsible for a massive increase in air pollution measurable from space, and deforestation often accompanied with fires and air pollution emissions. In addition, novel remote sensing data on solar induced fluorescence will aid to better assess vegetation performance and carbon uptake.[56] The unique high spatial resolution of S5P-TROPOMI (3.5x5.5 km^2) combined with its daily global coverage, enables the systematic monitoring of new and existing LMT applications such as proposed here. The reforestation (Spain) and peat soil LMT (Netherlands) are particularly interesting to investigate for the changes that can be anticipated for HCHO (from more biogenic emissions) and in NO_2 (via changes in soil NOx emissions).

Unlocking the potential of the carbon markets for LMT finance (Objective5):
LANDMARC will aid in the development of novel LMT monitoring services and methodologies. These methodologies have the potential for usage within the monitoring plans that LMT projects that need to get access to finance through the voluntary carbon offset markets. Currently there are no existing schemes available to incentivise negative emissions: even though there are proposal to revise the ETS but this has not been applied in practice[57]. While the carbon markets have experience with negative emission solutions in the forestry sector (e.g. afforestation and reforestation methodologies under CDM and REDD+) and some potential applications for BECCS under cap-and-trade schemes, there is only minimal application to date of LMTs within agriculture, agro-forestry and natural conservation areas. Aside from the (voluntary) carbon offset markets as an LMT finance opportunity, LANDMARC will also seek to scale up LMTs under article 6 of the PA on Cooperative Mechanisms (art 6.2 and 6.4 in particular).

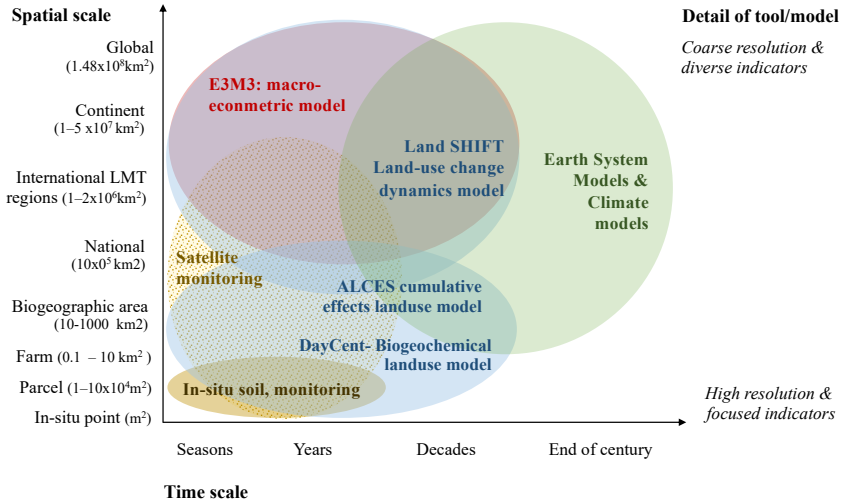
Systematic coupling and integration of unique model sets for LMT scenario development (Objective 3&4):
A new methodological approach is developed in LANDMARC that allows us to upscale information on LMT implementation from the local to the national level and LMT portfolios at continental and global scale level. For this purpose, we combine different simulation models (namely ALCES, DayCent, LandSHIFT, CMIP6, EC-Earth3, E3ME) to portray the societal and environmental processes that are relevant for the implementation of LMTs on different scales (see Figure 6). Consulting stakeholders on all levels together with scenario techniques ensure that findings on lower scale levels are integrated in the modelling exercises on higher scale levels[58]. In contrast to fixed-wired rather inflexible Integrated Assessment Models (IAMs)[59] [60], which has its strengths for global scenario modelling, our bottom-up approach aims to bring together models that were developed for applications on the specific scale levels with an appropriate level of detail and aims for more transparency by documenting the exchange of information between the models.

At the same time, the LANDMARC model set is more advanced and provides more certain predictions than the sub-modules of aggregated global models. Our economic model, E3ME covers all areas of the economy and has the potential to explore LMT portfolios and climate policies beyond a carbon tax, which is typically used in economic policy options for optimisation models, which can be helpful to determine the resources needed to reach an agreed target[61]. On the global level, we apply a full Earth System model (coupled with a

[55] de Vries, F. T. *et al.* (2013) 'Soil food web properties explain ecosystem services across European land use systems', *Proceedings of the National Academy of Sciences*, 110(35), p. 14296 LP-14301.
[56] Köehler, P., et al. (2018). Global retrievals of solar-induced chlorophyll fluorescence with TROPOMI: First results and intersensor comparison to OCO-2. Geophysical Research Letters, 45, 10,456– 10,463
[57] Cox, E.,et al. (2019). Beyond carbon pricing: policy levers for negative emissions technologies. Climate Policy, p. 1–13.
[58] Zurek, M. B. and Henrichs, T. (2007). Linking scenarios across geographical scales in international environmental assessments. *Technological forecasting and social change*, *74*(8), p. 1282-1295.
[59] Popp, A. et al. (2014). Land-use transition for bioenergy and climate stabilization: model comparison of drivers, impacts and interactions with other land use based mitigation options. Climatic Change, 123(3-4), p. 495-509.
[60] Doelman, J. C., et al. (2018). Exploring SSP land-use dynamics using the IMAGE model: Regional and gridded scenarios of land-use change and land-based climate change mitigation. Global Environmental Change 48: p. 119-135.
[61] Cox, E.,et al. (2019). Beyond carbon pricing: policy levers for negative emissions technologies. Climate Policy, p. 1–13.

land-use model) for analysis, which requires a higher level of detail that is not covered in some IAMs[62]. This allows us to analyse climate-land interactions with greater detail both on decadal and centennial time scales.

Figure 6: Tools and models applied at each scale



2. Impact

The overarching impact of LANDMARC will be that it offers concrete assessment on the potential of climate change mitigation via scaling up LMTs continental and globally Thereby, it contributes directly to meeting Paris Agreement targets, for which negative emissions, including via LMTs, are indispensable. This impact will be energised by LANDMARC as project partners, within their countries, will offer direct input to NDC development and partake in NDC drafting and review activities (see Section 2.2). Below, specific impacts on science, technology development, policy making, socio-economic decision making, etc., are further explained.

2.1 Expected impacts

Expected impact 1: contribute to major international scientific assessments such as the IPCC reports and the IPBES, as well as to national and EU impact assessments of possible mitigation options

Biodiversity

New scientific data and results on the impact of LMT scaling on soil quality/ biodiversity (Objective 1&3)

In-situ sampling on chemical, physical and biological soil properties will be done within LANDMARC in 16 countries in 5 continents for a minimum of three years. The data collected will aid in improving the quality and availability of global biophysical data for land degradation and restoration (i.e. currently a major gap according to IPBES, 2018 in their assessment report on land degradation and restoration[1]). LANDMARC will put a specific emphasis on microbial soil analysis with DNA next generation sequencing technology to better understand the impacts of changes in land management on micro-organisms (i.e. soil biodiversity). Microbiological soil properties can consistently predict changes in carbon and nitrogen cycling across land use systems and geographic locations, and in some cases can even be better predictors of these changes than land use[2] itself. This data will be used within LANDMARC to ensure a detailed representation of soil biodiversity data and observations within global land use models (e.g. LandSHIFT). This will improve the quality and accuracy of estimating regional/continental and global mitigation potential of LMT solutions.

Biomass production, carbon uptake & food security

New scientific data and results on the impacts of LMTs on photosynthesis performance and the carbon uptake of terrestrial vegetation (Objective 1&3)

LANDMARC will collect and apply Sentinel 5P TROPOMI satellite data at world-class level high spatial and temporal resolution on solar-induced chlorophyll fluorescence (SIF) for at least 10 of the 16 LANDMARC case studies. This data will be calibrated and validated with newly collected in-situ measurements and with existing or new remote sensing observations (e.g. from OCO-2) in order to convert them into useful

[62] Gillingham, K., et al. (2018). Modeling uncertainty in integrated assessment of climate change: A multimodel comparison. *Journal of the Association of Environmental and Resource Economists* 5(4): p. 791-826.

information for the EU and other national or regional/continental impact assessments of alternative land management policies and strategies (e.g. agriculture, forestry, and nature conservation policies) and their associated impact on carbon sequestration potential and food security.

Air quality

New scientific results and data from an experimental application of high resolution atmospheric monitoring of diffuse emissions of air pollutants (Objective 1)

A novel application of TROPOMI satellite observations on air pollution emissions will be piloted in relation to at least two LANDMARC case studies for which in-situ gas flux measurement data and other relevant remote sensing and in situ data is available. TROPOMI observation data on nitrogen dioxide (NO2), formaldehyde (HCHO) carbon monoxide (CO), methane (CH_4), will be evaluated with in-situ data on gas flux emissions of soils so as to better understand any trade-off effects of carbon sequestration activities. These results and data will feed into environmental impact assessments of regional climate, land use, forestry policy frameworks within the 5 LANDMARC continents.

Climate change mitigation and adaptation

New scientific data and results on future climate change impact and the exposure of LMT scaling in 16 countries and 5 continents (Objective 4)

The climate modelling work within LANDMARC with CMIP6 and EC-Earth3 will result in new scientific publications including novel scenarios and model simulations (with EC-Earth3, LandSHIFT, DayCent and/or ALCES) accounting for changes in land use and land cover and their feedback on climate. These scenarios will be co-developed together with local stakeholders (in 16 country case studies) and regional stakeholders on the 5 continents. The climate change impact assessment is based upon a qualitative definition of *climate change risks* (climate hazards, like floods, droughts) and a collection of data on the *climate sensitivity* (e.g. drought resistance of crops) of land use activities aimed to store more carbon or minimize CH_4 and N_2O emissions from land. This assessment, together with new scenario modelling results will be fed into the IPCC assessment process and it will inform the EU and its member states on potential improvements in their respective Adaptation Strategy.

Our case studies also explore important current global climate change challenges such as the increasing frequency and severity of forest fires (which in recent months have affected Amazonas, Siberia, Africa, Gran Canaria Island[63]) and the importance of biodiversity and native forests in climate change mitigation, due to their ability to fix carbon in trees and forest soil. For instance, an LMT with significant potential is forest fire prevention. In LANDMARC we will explore how indigenous fire management practices in Columbia and Venezuela and the Mosaic Project Spain's Extremadura forests can promote learning across regions for both climate adaptation (build resilience) and mitigation activities (reduce emissions through fewer fires).

Expected impact 2: developing a comprehensive medium-to-long term vision and analytical framework on pathways to achieve climate neutrality[1] in the perspective of reaching the PA goals

Society

Novel land use scenario pathways to achieve the PA goals (Objective 3&4)

Robust mid-to-long term strategy making will benefit from the improved Earth observations and climate change scenario modelling (see above). This allows for an estimation of the 'technical' carbon sequestration potential of LMT solutions. However, LANDMARC will also develop novel scaling up LMT scenarios with relevant stakeholders in order to adequately consider a broad range of socio-economic issues (e.g. economic impact, market barriers, regulatory barriers, conflicting policy objectives, etc.) related to scaling up LMT solutions. The outputs from this process (both the *methodological framework* and *results*) will be published and shared in relevant national and regional/continental platforms (e.g. local and global NDC and SDG Partnerships as well as the EU 2050 long-term climate strategy) to enable policy makers, investors and other market actors to ex-ante assess and identify key implementation issues and market barriers for land based negative emission solutions. These results also contribute to the further development of global and/or regional

[63] BBC 4 August 2019. Siberia wildfires: Russians battle to contain the blazes. Available at: https://tinyurl.com/y6kyw38j; CNN 2019 August 27. Fires are raging in the Amazon forest. Available at: https://tinyurl.com/yyr2cals; BBC Amazon fires: Angola and DR Congo 'have more blazes'. 2019 August 26. Available at: https://tinyurl.com/y55hekhn; Euronews. 2019 August 15. There have been three times more wildfires in the EU so far this year. Available at: https://tinyurl.com/y6rjsqey; Pais 2019 August 13. After razing 1,500 hectares, Gran Canaria fire now stabilized. Available at: https://tinyurl.com/y3mxxg3p

reference scenarios (e.g. Shared Socio-economic Pathways, SSPs).

LANDMARC will also achieve a greater impact from a bottom-up approach, by identifying 'influencers', or leaders on the ground to implement LMT solutions. For instance, influencers in two EU funded projects in Spain, 'EIP AGRI Operational Group Grasslands' and 'EIP AGRI Operational Group Cereal & Water Management' (both coordinated by AMBIENTA- see Table of LOI, letters 5&6) are interested in collaborating with LANDMARC. These influencers are open to innovation and invest in agricultural or forestry innovations, and are highly concerned about economic, social, environmental and climatic aspects. In addition, they have organised data of their farms, which can be shared with SMEs or researchers. The data collected by influencers and other stakeholders, together with those provided by remote sensing for example, can help to improve the analysis of different LMT practices.

Sustainable development

Presentation of results of the integrated impact assessment on the co-benefits and trade-offs of scaling up LMT pathways (Objective 3)

LANDMARC will provide an empirical evidence base (through the 16 LMT case studies) on the various climate, ecosystem, as well as socio-economic impacts of local LMT actions. The LANDMARC modelling system is used to quantify a range of impact categories (see above), including: i) Climate change mitigation and adaptation, ii) Biodiversity, iii) Biomass production, carbon uptake and food security, iv) Air quality, v) Economy, (vi) Society. The engagement with stakeholders to co-create viable LMT scaling pathways enable a robust analysis of the co-benefits and trade-offs of LMT solutions both at the local/national and the regional/continental to global level (carried out in WP5). The results from this quantitative assessment will be complemented by a qualitative assessment focussing on the scoring/weighting of the different SDGs (SDG 5 Gender equality, SDG8 Decent work and Economic Growth, SDG Industry innovation and infrastructure, SDG13 Climate action, SDG 12, Responsible Consumption and Production SDG 15 life on land) and 'social goals' (e.g. culture, and the role gender equality) relative to each other. This integrated impact assessments will be guided by multi-criteria decision / trade-off analysis (with the help of ALCES and/or MCDA) and will provide robust empirical experience and evidence inputs for policy decision making.

The main benefit of this approach is that it offers insights on both negative and positive impacts (rather than the net figure), as in practice a positive net impact may still not lead to LMT implementation due to social resistance on the negative impact alone. Thus, these assessments can consider aspects that are not typically included in aggregated models alone, such as supporting women's economic activities as an instrument to stimulate forest protection and create an interest in reforestation, as seen in the Burkina Faso case study. These issues are important in capacity building for decision makers, who need to be made aware of gender issues. In the case of Burkina Faso, decision makers can follow a "Community and Gender Driven Development" approach where investments target activities that support local development (at the village and community level) and also enhance forest and woodland management and carbon sequestration potential. These gender sensitive approaches observed in case studies can also be implemented more widely in different regions.

Additionally, we will have new modelling results on the macro-economic impacts of pathways for LMT scaling up. Macro-econometric modelling (with the E3ME model) within LANDMARC will be performed for 5 continents and at least two global pathways for scaling up a portfolio of LMT solutions. The modelling results provide an indication of the continental and global macro-economic impact of scaling up LMT in terms of e.g. global GDP, investments, employment, imports, exports. This kind of metrics are generally highly influential within policy decision processes. Results from this assessment will be published and shared within relevant economic fora and policy planning and evaluation processes.

Policy

Results from the national/continental LMT policy portfolios can help support the development and testing of a policy decision support framework for scaling sustainable land management strategies (Objective 3,4& 6)

LANDMARC will develop a conceptual design for a policy decision support framework for scaling and implementation of sustainable land management technologies and practices at the regional level (e.g. continent, EU), but will include bottom-up elements as well to adequately capture varying sustainable development priorities and local contextual factors. This multidisciplinary decision support framework will be user friendly for practitioners and can integrates the use of scientific results and data from Earth observations and a suite of models as well as socio-economic aspects. These elements combined provide an analytical framework for

validating and evaluating the feasibility of novel land use, land use management pathways for achieving the PA goals at the national, regional/continental and global level.

Expected impact 3: improved ex-post, spatially explicit monitoring of the mitigation performance of the land sector

Monitoring

Advancements in monitoring and accounting of land based emission sources and sinks in National GHG Inventory reporting (Objective 5)

The combined Earth observation work (remote sensing and in-situ monitoring) in LANDMARC will provide scientific results and relevant data for more accurate monitoring of GHG emissions from land-use activities. LANDMARC results are expected to contribute to the advancement of all IPCC Tier methods (Tier 1,2 and 3) that countries use to determine GHG emissions from land use activities. This effort will also feed into the work done by the IPCC Task Force for National Greenhouse Gas Inventories (TFI) on improving the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry.

- ***Tier 1***: LANDMARC provides data and results on land cover classifications (using existing data, or provide updates for specific areas) to apply emission factors to different land types (e.g. forest land, croplands, wetlands, grasslands, settlements, other land).
- ***Tier 2***: Country-specific land cover classifications (e.g. move from forest land to "dry forest land" and "shrubland") that fit the country-specific emission factors. Contribute to the determination of country-specific emission factors with stock change methodologies.
- ***Tier 3***: Use both in-situ measurements and satellite estimates to monitor stock changes, and upscale the results using the LANDMARC Earth observation system.

New business models to determine climate and ecosystem performance of land-use activities (Objective 5)

LANDMARC will collect and process Earth observation data at high spatial resolutions for all 16 case studies. Based upon that, new business models - that provide data and information services on the GHG- and/or ecosystem performance of their land management activities – can be developed. The new business models can quantify the use of land economically, and assess the economic value of the carbon sequestration potential. Information can then be provided to the owners and their land could potentially gain value. Existing business models do not yet include a dedicated ***'CarbonMap"*** tool that can be used at the parcel, forest or project level to determine changes in carbon stocks in or GHG emission fluxes from soils and/or vegetation. Within LANDMARC tool will be developed by key EO partners (including eLEAF, Agroinsider, Bioclear Earth).

Additionally, we will apply a ***gender lens*** when developing ***new business models*** in LANDMARC. LANDMARC approaches gender issues related to land use management in different case studies. The serious problems of depopulation of the rural environment that affect large areas of Europe, for example Western Spain and Central Portugal, have also added a component of masculinization of these territories, which does not help to face the challenge. Young women emigrate to the cities due to a lack of good opportunities in rural areas[64]. Agricultural and forestry technology and innovation offer interesting opportunities in rural areas to attract young talent, for both women and men, that can revitalize these areas, through the generation of new business models based on digitalization (e.g. development of CarbonMap tool), which enhances the value of the LMTs. In fact, these rural areas have high potential in quantitative terms to support mitigation measures with management approaches that can draw in innovative talent later. The comparison between different case studies provides insights on regional issues linked to gender and land use mitigation potential. For example, the opposite phenomenon is occurring with the feminisation of agriculture in Nepal, due to the increasing out migration of men. This has placed immense pressure on Nepalese women, their well-being and their households. Thus, if tools, land management practices and strategies are appropriately developed with the different needs/challenges faced by women and men, they can offer opportunities to support local economies, particularly in rural populations with new businesses and jobs.

Expected impact 4: enhanced international cooperation and increased capacities

Local

Enhanced local/national cooperation (Objective 3&6)

[64] de La Torre A. (2018). Las chicas escapan de un mundo rural que no colma sus aspiraciones Available at: https://tinyurl.com/y6ztvpvp

Each of the case studies will perform local/national level assessment work together with relevant local stakeholders according to the LANDMARC workplan. For the Netherlands case study for LMTs in peat lands and agro-forestry, the Dutch case study leaders already established agreements with the CarbonConnects project, the Frysian Environmental Federation (via Letter of Intent; LoI, see Section 5) and two regional water boards (LoI). For the Nepal case study on LMT solutions in rice cultivation the Ministry of Agriculture and Livestock Development provided a LoI to collaborate with LANDMARC. For the Spanish case study an LoI was provided by EIP Agro Grupo Operativo Ecopraderas, while in South Africa the Department of Plant and Soil Sciences from the University of Pretoria and the Council for Scientific and Industrial Research (CSIR) agreed (by LoI) to collaborate with LANDMARC by sharing Eddy Covariance data from agricultural systems. The other LANDMARC case studies have established similar (in)formal agreements with local stakeholders working on LMT development and implementation. Also, within LANDMARC a series of stakeholder mapping and engagement activities is foreseen, aimed at expanding the existing stakeholder base.

Regional /continental and global

Enhanced regional/ continental / global cooperation (Objective 4, 5&6)

The LANDMARC project focuses on 5 continents with several case studies within these continents. To be able to perform the regional assessment work within LANDMARC, stakeholders at the national level will also collaborate and support the co-creation of robust LMT scaling pathways for their region and continent. As part of this effort we have 5 continental clusters in Europe, Asia, Africa, South America and North America.

Aside from the existing collaborations of the LANDMARC partners within their own networks - e.g. partner CIAT, the International Centre for Tropical Agriculture is already active within 73 countries in Africa, Asia and Latin America, while SME partner eLEAF is already active in over 50 countries worldwide (see section 4.1 partner profiles) - LANDMARC will organise a series of engagement activities at the regional level to collaborate with regional stakeholders, policy makers, stakeholders from agriculture and forestry, etc. within the area of the development and implementation of NDC strategies, meeting SDGs and/or regional policy strategies for sustainable land and resource management.

Extra expected impact

Finance

Activate the (voluntary) carbon offset markets for LMT solutions (Objective 5)

In addition to contributing to 'improved ex-post, spatially explicit monitoring' of LMT activities LANDMARC also aims to use its newly generated knowledge/results in the design of innovative methods to develop monitoring protocols for LMT projects that want to claim their emission reduction performance. LANDMARC will provide guidance and support to relevant local/national or regional stakeholders both in relation to (voluntary) carbon offset markets (like the Gold Standard) REDD+ and Article 6 of the Paris Agreement on Cooperative Mechanisms. Promoting the inclusion of LMTs in such schemes can unlock additional funding for these activities.

2.2 Measures to maximise impact

2.2.a. Dissemination and exploitation of results

The outline of the **Plan for the Exploitation and Dissemination of the project's Results (PEDR**) is presented below. The full PEDR will be developed by Month 6. It will contain the strategic vision of the Consortium on exploitation and dissemination of the project's achievements and output for maximum impact, with a detailed description of measures and channels. The PEDR will be updated every six months.

PEDR Objectives

With the PEDR, the consortium will ensure effective dissemination and exploitation of the project's outputs for maximum impact, through the availability of the gained knowledge for all interested organisations. The PEDR aims to:

- Pave the way for the assimilation of the results across the relevant communities, ensuring that the results and outputs developed within LANDMARC will be disseminated and exploited during the project and after its completion.

- Establish synergies and boost new collaboration with external parties (e.g. networks, projects, platforms, associations, cooperatives), both at the local/national and regional/continental and global level, potentially multiplying the impact of LANDMARC's results effect.
- Contribute to knowledge building and best practice diffusion through engagement actions and dissemination activities within the LANDMARC case study countries, and 5 continents.

It is thereby acknowledged that target groups will have preferences with respect to the way in which knowledge is presented to them for effective use. The PEDR will thus facilitate the role of LANDMARC in the interface between research and ultimate users: ensure that users' knowledge needs are reflected well in LANDMARC research questions and that LANDMARC results can be effectively interpreted and used by users (e.g. policy makers and other practitioners).

Users and beneficiaries of the LANDMARC results

This knowledge (and background research data and databases, e.g. with EO data) created within LANDMARC will be shared at the local/national level, as well as the regional/continental and global level.

- Advancements to the general public and policy makers will be disseminated within relevant platforms, such as the IPCC Task Force on National Greenhouse Gas Inventories, the executive agencies in different countries/continents responsible for national GHG inventory accounting,
- NDCs coordinators in our case study countries, as well as other countries through the Global NDC Partnership will obtain results via scientific publication into IPCC assessments reports and events,
- Scientific advancements will be shared through relevant journals, conferences and workshops, and disseminated within relevant scientific and policy platforms like IPBES, DG CLIMA, DG AGRI, as well as more regional and local (environmental) impact assessment work and existing (online) data platforms and repositories (e.g. GEOSS, soil databases and research databases/repositories).
- Via scientific publications the LANDMARC outcome will be valuable input for ongoing and future assessment work by the IPCC, such as the semi-regular Assessment Reports and future Special Reports (similar to the recently completed Special Report on Climate Change and Land).
- Contributions to the private sector will be shared through our own LANDMARC partners who aim to further develop/use the EO business models (i.e. CarbonMap Tool). Any novel GHG accounting (incl. monitoring) protocols that will be developed within LANDMARC for LMTs will be made available to different (voluntary) carbon markets (e.g. Gold Standard, VCS). These can be used to add monetary value to certified LMT-based emission reductions. Moreover, the protocols can be used for calculating emission reductions of LMT-programmes under NDC and which can form a basis for cooperation between Parties under Article 6 of the Paris Agreement (both direct bilateral cooperation, Art.6.2, and new sustainable development mechanism, Art. 6.4).
- Serving a wider audience of climate-interested people.
- The stakeholder engagement activities within LANDMARC involves a two-way interaction, where LANDMARC will both obtain relevant data, results, and insights from local and regional/continental LMT stakeholders as well as feedback (preliminary) research and/or assessment results into these communities. We will target dissemination activities within the 5 continent and 16 case study countries.
- All stakeholders involved in the AFOLU sectors (i.c. forestry and agriculture) are amongst the target audience and potential beneficiaries, varying from private sector investors, solution developers, resource managers, policy makers and to NGOs. To substantiate this engagement and way of disseminating LANDMARC results, a total number of 21 Letters of Intent (LoI) have been provided by local and regional stakeholders with an expression to collaborate with LANDMARC (see Table 4 and Section 5 for LoI).

Table 4: Letters of Intent

#	Organisation	Country / region
1.	Meteorological, Climatological, and Geophysical Agency (BMKG)	Indonesia
2.	Ministry of National Development Planning (BAPPENAS)	Indonesia
3.	World Bank Group	Burkina Faso
4.	University of Pretoria, Faculty of Natural and Agricultural Sciences	South Africa
5.	EIP Agri Operational Group Ecopraderas	Spain

#	Organisation	Country / region
6.	EIP Agri Operational Group Cereal Agua	Spain
7.	Economic and Social Commission for Asia and the Pacific (UNESCAP)	Asia – Pacific
8.	University of Evora, Agriculture department	Portugal
9.	International Institute of Tropical Agriculture (IITA)	Kenya
10.	Stockholm Exergi	Sweden
11.	Mzuzu University, Department of Geosciences	Malawi/Africa
12.	Frisian Environmental Federation (FMF)	The Netherlands
13.	Ministry of Agriculture and Livestock Development	Nepal
14.	Council for Scientific and Industrial Research (CSIR)	South Africa
15.	University of Bern, World Overview of Conservation Approaches and Technologies (WOCAT)	Global
16.	International Centre for Tropical Agriculture (CIAT)	Africa, Asia, Latin America
17.	Portuguese Society of Soil Science (SPCS)	Portugal
18.	Water Board – 'Aa en Maas'	The Netherlands
19.	Chelsey Greene - Independent Env. Consultant	Canada
20.	Universidad Simon Bolivar (USB)	Venezuela
21.	Water Board - ' De Dommel'	The Netherlands

These local and regional collaborations enhance the direct dissemination impact of LANDMARC, and can act as a multiplier to open up other networks and platforms for dissemination and exploitation of results.

2.2.b. Dissemination and exploitation of results and measures to enhance the impact

Table 5 below provides an overview of the planned dissemination actions for each of the expected results per main category (linked to expected impacts, see section 2.1 above).

Table 5: Intended impact & results *(linked to expected section 2.1 Impacts 1-4 and additional/+impacts)*

Impact #	Result	Dissemination through[65]:		Target groups[66]
Impact 1: Climate change mitigation and adaptation (Objective 3&6)	Environmental impact assessment	Scientific journals & conferences	e.g. Mitigation and Adaptation Strategies for Global Change (Springer), Agriculture, Eco-systems & Environment (Elsevier), European Geosciences Union General Assembly, European Meteorological Society Annual Meetings (EMS), ScienceBrief	Research community, Policy makers (e.g. DG CLIMA), regional governments, water boards, insurance companies, banks,
Impact 1: Bio-diversity (Objective 3&6)	Environmental impact assessment	Scientific journals & conferences	e.g. Wageningen Soil conference, Annual Congress on Soil, Plant and Water Sciences, Global Soil Biodiversity Conference	Research community, policy makers, nature conservation associations,

[65] **Relevant platform to share LANDMARC results in countries***:* Africa Agriculture Science week / Africa Climate Week; American Geophysical Union Annual Fall Meetings; Annual GCEP conference; Earth System Governance Project: European Climate Change Adaptation conference; European Geosciences Union Annual General Assemblies; European Meteorological Society annual conferences; Forstwissenschaftlichen Tagung (Forest Science Conference), Global Canopy Programme:;Global Landscapes Forum; Global Landscapes Forum; Global science conference on climate smart agriculture; Global Sustainable Rice Conference; International conference on Achieving Net Zero; International Conference on Agriculture; International Negative CO2 conference, Sweden; International Rice Congress; International Union of Forest Research Organizations World Congress; Nepal Agricultural Co-operative Central Federation Ltd.; Nepal Forum of Environmental Journalists; NGO Federation of Nepal; Side event at UNFCCC COP/SBSTA; Soil Biodiversity Conference; Soil Food Week; SUMERNET, Sustainable Mekong Research Network; Swedish International Agricultural Network Initiative; Symposium on Climate Change Adaptation; Wageningen Soil conference

[66] See some targeted groups signing the letters of support (Table 4)

Impact #	Result	Dissemination through[65]:		Target groups[66]
Impact 1: Biomass production, carbon uptake of & food security (Objective 2&4)	Land use, productivity and performance assessment	Scientific journals & conferences	e.g. Africa Climate Week, Global science conference on climate smart agriculture, UN World Soil Day, Global Environmental Change (Elsevier),	Research community, policy makers (e.g. DG AGRI), agro-food multinationals,
Impact 1: Air quality (Objective 1)	Environmental impact assessment	Scientific journals & conferences	e.g. Air Quality, Atmosphere & Health (Springer), Aerosol and Air Quality Research (open access), Atmospheric Pollution Research (Elsevier),	Research community, policy makers (e.g. DG ENV), national environmental assessment agencies
Impact 2: Society (Objective 6)	Lessons from co-creation of viable LMT pathways	Scientific journals, conferences and policy	e.g. Regional Climate Weeks (Latin America & Caribbean, Asia-Pacific, Africa),	Research community, wider audience (general public),
Impact 2: Economy (Objective 3&6)	Economic impact assessment	Scientific journals & conferences	e.g. Land Use Policy (Elsevier)	Regional, national and local policy makers,
Impact 2: Sustainable development (Objective 3&6)	Integrated co-benefits and trade-off analysis	Scientific journals, conferences and policy	e.g. Conference on Climate Change and Development in Africa, Journal of Sustainable Development (CCSE)	Research community, wider audience (general public),
Impact 2: Policy (Objective 3&6	Policy decision support framework	Scientific journals, conferences and policy	e.g. Sustainable Mekong Research Network events, Earth System Governance conference,	Regional, national and local policy makers, water boards,
Impact 3: Monitoring 1: (Objective 5)	Advancements in GHG inventory accounting	Policy / market platforms	e.g. International Journal of Greenhouse Gas Control (Elsevier), Meetings by the IPCC Task Force on National Greenhouse Gas Inventories	National executive environmental agencies,
Impact 3: Monitoring 2: (Objective 6)	New EO business models	Policy / market platforms / events	e.g. Smart Farming Conference, Global Forum for Innovations in Agriculture (GFIA), Agriculture and Food Summit	Farming and forestry associations, agro-food cooperatives,
Impact 3: Local (Objective6)	Local engagement	Policy / market platforms	e.g. IRRI newsletter, Forest Carbon Partnership Facility newsletter, Bodemacademie (newsletter),	Local policy makers, farmers, forest managers, general public,
Impact 3: Regional / global (Objective4)	Regional engagement	Policy /market platforms	e.g. Global Sustainable Rice Conference, Women in Food & Agriculture summit, International Peatland Society (IPS blog)	Local, regional policy makers, farmers, forest managers,
Additional impact : Finance (Objective5)	Activate carbon market / art 6 of PA	Scientific journals, conferences & policy / market platforms	e.g. (Side-)Events of the International Emissions Trading Association (IETA), Carbon Forum North America, Climate Policy (Taylor & Francis),	Policy makers, investors, bank, AFOLU sector associations,

The table provides specific examples of relevant conferences, journals, events, or newsletters that can be used for dissemination of LANDMARC to specific target audiences (e.g. science, policy, market, society). During the initial stages of LANDMARC more specific dissemination channels and opportunities will be shortlisted in order to align them with the work plan (section 3), work progress and conference/journal planning cycles.

Dissemination general timeline

Given the nature of the LANDMARC project as a Research and Innovation Action, most scientific publications are expected to be published in the second half of the 48-month project, given its dependence on research data collection and processing. However, preliminary results, non-scientific newsletter articles, blogs, interventions and/or presentations at workshops/conferences/meetings, policy briefs, etc. will also be developed during the first half of the project.

The PEDR's outline of dissemination activities will be initially drafted at the start of the project, with inputs from all consortium partners at the kick-off meeting. Here case study leaders, regional platform and WP leaders will be asked to provide their planning regarding dissemination actions. Case study leaders will provide a case study implementation and dissemination plan as an input, just as WP leaders who will provide input for the project management plan (and the dissemination plan). More specific exploitation opportunities and efforts will be determined periodically during project implementation.

The PEDR will be finalised by Month 6 with the following topics (with updates every six months):

- Listed objectives of the exploitation and dissemination activities,
- Subjects of dissemination,
- Target audience and the corresponding dissemination methods and tools,
- Indicative timing of dissemination activities,
- Cooperation on dissemination and exploitation with external partners and existing platforms, and
- Distribution of responsibilities for dissemination and rules for planning and performing of dissemination activities (e.g. partner roles).

Dissemination activities will follow principles and best practices that have already been tested successfully in other EU-funded projects, e.g., the project's results/reports will be duly reviewed by relevant partners and Advisory Board members before these are published or disseminated; all public project results being made accessible from the project website; research and analysis undertaken will factor in sound scientific practice principles, as well as policy requirements and needs.

2.2.c. Exploitation of key results

The **exploitation** of project results and findings will involve the integration of research data, outputs and business models, in other platforms, projects, repositories, projects. Below a first outline is presented on the way in which LANDMARC intends to exploit key research results. During the inception phase of LANDMARC a more detailed exploitation roadmap will be developed.

- *Partaking as resource person or advisor in the case study countries' NDC formulation and response to Global Stocktake*

Under the **Paris Agreement and the Global Stocktake**, for reaching the temperature limitation goals, negative emissions are indispensable. Therefore, LANDMARC will be at the heart of one of the key global solutions for reaching the Paris Agreement goals. For that, LANDMARC demonstrates how and where negative emissions can be realised through land-based solutions, while meeting societies' expectations on technical reliability, economic affordability and social acceptance. We communicate this directly to the NDCs coordinators in our case study countries, feed, via scientific publication, into IPCC assessments on that, and support the EU in organising international collaborations, finance stream and technology transfer between EU Member States and other Parties. This will be the ultimate impact of LANDMARC: project results are submitted to the NDC coordinator of the case study country, opening to the possibility of inviting the LANDMARC partner to become, temporarily, member of the NDC coordination or support team. It also requires a careful attribution of our stakeholders: while our main stakeholder policy contact may be the ministry of Agriculture, our findings are less probable to be included in the NDC, if the NDC is written by the Ministry of Economic Affairs.

- *Contributions to major scientific assessments, and ongoing research efforts*

To ensure the uptake of LANDMARC climate change and land use modelling results in the IPCC assessment process, LANDMARC will approach relevant researchers that are part of the author teams for relevant IPCC reports (e.g. LANDMARC partner KNMI and BSC have researchers appointed as Lead Authors in AR6).

Advancements in climate change modelling and land use modelling will feed into follow-up and ongoing projects pursued by LANDMARC partners (e.g. BSC, KNMI), such as CCiCC (H2020-821003). In addition, relevant research data will be made available as well via relevant channels (e.g. like Zenodo).

- *Development of new Earth observation business models and assessment tools*

Key partners within LANDMARC will put efforts in developing a new *CarbonMap Tool* that can be linked to existing earth observation data, monitoring and information systems (e.g. Field-Map, PiMapping). The development and possible future inclusion of this tool within existing commercial services to AFOLU sectors will ensure further exploitation of LANDMARC results.

LANDMARC will field test WOCATs Climate Change Adaptation Module that has recently been developed and will aid in the further improvement and development of that module by providing feedback and support to WOCAT. This effort will make this module more suitable for effective and efficient usage for future use by researchers, practitioners and/or policy makers.

- *Ensure the uptake of improved GHG monitoring and accounting for National Inventory Reporting and (voluntary) carbon credit markets*

New results in this area will be published in relevant journals and dissemination channels. Project partner Oeko Institut, has an adequate network in this area, given their past and ongoing research and advisory work on GHG monitoring such as the "Independent Monitoring: Building trust and consensus around GHG data for increased accountability of mitigation in the land use sector" ***commissioned by DG CLIMA*** (Service Request No CLIMA.A.2/ETU/2014/0008).

- *Contribution to continued effort to promote the uptake of sustainable land management technologies*

LANDMARC has established a collaboration with WOCAT (by means of an LoI), to include data, results and descriptions of the 16 LANDMARC case studies in the Global SLM database. WOCAT is a global network on Sustainable Land Management that promotes the documentation, sharing and use of knowledge to support adaptation, innovation and decision-making in SLM.

- *Contribution to further develop and promote land based negative emission solutions in carbon markets*

LANDMARC will develop novel monitoring methods that LMT project developers can use to get access to the (voluntary) carbon markets as a source of additional finance. For example, in the Netherlands, these new monitoring methods (if applicable) will be submitted to the Advisory Board of the Dutch Green Deal National Carbon Offset Market ('Nationale Koolstofmarkt'). If approved by the advisory board this opens the possibility for LMT projects in the Netherlands to start claiming carbon credits.

Follow-up envisioned after the project

The PEDR will have in place a plan of actions for after LANDMARC will have concluded, building on consortium partners best efforts to exploit the results of the project for at least two years after the end of the project. In this respect, we envision the following follow-up activities:

- The project website will be kept operational for two years after the project, mainly in the form of a low-maintenance repository of project documents (project website transforming into project repository);
- LANDMARC volunteers to take over the co-ordination of www.ClimateChangeMitigation.eu, the online portal of EU-funded research and coordination and support activities (supported originally by CARISMA, and now managed by DEEDS, see also above).
- Moreover, project results will remain posted on relevant existing global dissemination portals, such as the SDG Partnership Platform (https://sustainabledevelopment.un.org/partnerships/);
- Project data, and databases developed within LANDMARC will be made available (as far as IPR, GDPR restrictions allow) in relevant public repositories (e.g. GEOSS portal, soil databases, etc.)
- Results of the project will be used in further research activities dealing with just transition scenarios;
- Publications will be made available in the public domain, validating the added significance and positive impacts of the LANDMARC in line with our geographical coverage (see above).

As explained above, the ultimate continuation of the LANDMARC work will be through continued use of case study methods (e.g. EO, modelling and stakeholder-based participative analysis) in countries strategic national processes, such as under UN Development programmes or the UNFCCC i.c. NDCs and follow up responses to the Global Stocktake reviews.

2.2.d. Management of analytical data

LANDMARC will set up a user-friendly open platform, in the form of a project website, for collecting and sharing: (i) publications; (ii) events; and (iii) research findings, results and outputs.

All the raw background data that is collected throughout the project and data processing results is used for analytical and assessment purposes (e.g. EO data, input and output data for land use, climate change and economic modelling or (modified) SSP reference scenarios) will be made available in an open-source format platform, unless protected by Ethics requirement and privacy regulation (See below under 'strategy for knowledge management and protection and Section 5).

The management of the research data generated and collected by the project (insofar as this data is not already publicly available in open access platforms) will be facilitated by a dedicated online repository and file sharing system, with access for project members, to enable the internal dissemination and sharing of all relevant collected project data within the different WPs and tasks. The project's data will use open standards and formats that are compatible for various land-use, climate and economic modelling activities (E3ME, LandSHIFT, DayCent, CMIP6, EC-Earth3), and can be used by other research projects or embedded within other data repositories (e.g. GEOSS) or inventories (e.g. soil data inventories by ESDAC or national inventories). LANDMARC will actively seek which data sets can be uploaded to other external data-repositories. For example, the data from the soil sampling activities in LANDMARC will be offered to relevant authorities that manage resource inventories (e.g. soil databases).

Further details regarding the archiving of all data sets generated or collected in the project will be described and agreed in the *Data Management Plan* that will be developed by month 6 of the project.

2.2.e. Strategy for knowledge management and protection

All the project outputs will become freely accessible on our website. The project will take part of the *Open Research Data pilot in Horizon 2020*, with three broad exceptions:

- Information that personally identifies stakeholders, unless they give explicit permission;
- Information that is deemed politically sensitive of any of our stakeholders; and
- Information that is deemed commercially sensitive by partners.

Partners will store this exempted information in password-protected systems and limit the transfer of such information over public infrastructure to the bare minimum.

We intend to publish the project's output in form of, among others: peer-reviewed scientific publications, policy papers, reports, short articles, blogs, etc. For peer-reviewed scientific publications, we will use both the '*green*' (e.g. posting the final manuscripts of scientific papers on the project website and through other research networking and pre-publication websites, such as SocArXiv, FigShare, and Zenodo) and '*gold*' open access – the latter in case of major outputs in the most impactful open access journals, as far as our communication budget will allow it; resources have been allocated for this type of communication.

LANDMARC will aim at following the EC Recommendation on access to and preservation of scientific information. The project results will be published under the *Creative Commons Attribution License* and databases will be published under the *Open Data Commons Attribution License*. The project will also adhere to the EC Guidelines on *Open Access to Scientific Publications and Research Data* in Horizon 2020.

2.2.f. Protection / Intellectual Property Rights (IPR)

The Consortium Agreement (CA) will be following the standard rules as outlined in the DESCA model for Horizon 2020. This defines the main approach regarding the ownership, protection and access to key knowledge like IPR and data. This approach will allow us, collectively and individually, to pursue market opportunities arising from the project's results. Some of the major aspects covered are indicated below:

- *Confidentiality.* Each partner will treat information from other partners as confidential unless otherwise stated and not disclose it to third parties unless the information is publicly available.

- *Open access to publications.* Any proposed publication or communication by one of the parties is required to be submitted for the prior consent of the other partners. All publications will be either gold or green open access in accordance with the H2020 requirements.
- *Pre-existing know how.* Each partner is and remains the sole owner of its IPR over its pre-existing know-how. The partners will identify and list in the CA the Pre-Existing Know-How over which they may grant access rights for the project. The partners agree that the Access Rights to the Pre-existing Know-How needed for carrying out their own work under the project shall be granted on a royalty-free basis.
- *Ownership and protection of Foreground.* The ownership of foreground will belong to the partner/s generating it. Protection will be done appropriately. When the Foreground is the result of a work carried out by two or more partners, joint ownership will be agreed between the partners.
- *Patents.* Partners who own knowledge suitable for patenting are encouraged to make applications for patents or similar forms of protection and shall supply details of such application to the other partners.
- *Use and dissemination.* If dissemination of knowledge does not adversely affect its protection or use and subject to legitimate interests, the partners shall ensure further dissemination of their own knowledge as provided under the Grant Agreement and the CA, which will be signed by all partners.

2.2.g. Communication activities

Key communication actions and indicative targets are provided in the table below.

Table 6: Key Communication actions

Communication actions
Website
The project website will constitute the main communication tool as it provides easy access to a broad audience around the world. The website will be designed following the best practice guidelines for EU project websites, will be visually attractive, user-friendly, and use visual media e.g. videos/animations. ***Target: 20,000 visits over the 4-year project duration***
LANDMARC newsletter and newsletter articles
Newsletters about the project will be produced for distribution in relevant events and meetings for raising awareness about the project and trigger the interest of stakeholders to visit the website and stay informed about the project's progress. All partners will distribute to their relevant networks. An electronic version of the newsletters will be available on the project website and also target dissemination through e-mails. ***Target: 4 newsletters that reach more than 10,000 people overall.***
Press Releases
Press releases will be produced regularly making use of a range of services and publications aiming at increasing awareness about the project's objectives, progress and outcomes. ***Target: 8 press-releases put up to CORDIS wire (or equivalent) leading to publication of at least 20 articles in websites, the press and specialised publications like research.eu***
Videos
At least one introductory video providing an introduction to the project and its' objectives will be developed and one and one soil sampling training video will be produced. ***Target: The video will be viewed by more than 3,000 people***
Social Media
LinkedIn and Twitter accounts operated by partner BioRecro will be used mostly to for interaction with professionals. Other media such as YouTube will be used to target the general public. ***Target: The social medial activity will reach more than 30,000 people***
Participation to Events
There will be participation and presentations at international conferences, workshops, trade fairs and other events in order to present the project and transfer the knowledge generated in it. Some relevant conferences/events are: **https://globalcsaconference.org/**, **https://www.regionalclimateweeks.org/**, ***Target: The project will be represented in more than 25 relevant international/regional events***
Project events

Communication actions
There will be several project-related events organised throughout the LANDMARC project as part of WP2 and 6. Within WP6 at least 10 regional/continental events in total will be organised, while in WP2 in each case study country (#15) at least one event / workshop / Focus group meeting will be (co-)organised. ***Target: Our events will be attended by more than 500 people***
Publications
Scientific publications in high impact peer-reviewed journals. Other publications in specialised press. ***Target: More than 16 publications***
Networking
Networking with existing platforms (such as WOCAT, Global/Regional Soil Partnerships, NDC Partnership, etc), and other relevant projects (such as CarbonConnects). Synergies will be sought in joint use of several communication channels, such as organization of common events etc. ***Target: There will be interactions with at least 10 other relevant projects or initiatives***
Wider audience of climate-interest people:
Layman language articles (not technical summaries), presentation at local public events, etc. based on research outputs of LANDMARC for information of a wide international audience with people interested in climate change solutions (through e.g. www.ClimateChangeMitigation.eu portal). ***Target: 32 items (2 items per case study) at least***

3. Implementation

3.1 Work plan — Work packages, deliverables

The LANDMARC workplan contains 8 WPs (see Table 3.1a for breakdown, Figure 7 PERT chart to illustrate WP connections and Figure 8 Gantt chart for deliverable, milestone and task details). Aside from the work packages on project management and coordination (WP1) and communication, dissemination, knowledge transfer and exploitation of results (WP8), we have four work packages (WP2-5) that will operate mainly at the local level in relation to a range of LANDMARC case studies (see Table 2). WP2 provides a platform for engaging with local stakeholders that are already working on the further development and implementation of LMT solutions within their country (i.e. LANDMARC case studies). This engagement work comprises out of assessing the local potential for LMT solutions, collecting relevant data for the LANDMARC assessment work, as well as for sharing knowledge, results and ensuring a lasting impact of the LANDMARC work at the local level. WPs 3-5 provide the resources for performing scientific research, developing methodological guidance for the assessment of land based negative emission solutions. WP3 deploys earth observation data techniques to assess the effectiveness of LMT solutions. WP4 tests how robust the mitigation impact of LMTs can be within a changing climate and what measures can be taken to improve the climate resilience of LMT solutions at the local level. WP5 goes beyond the climate change mitigation and adaptation dynamics of LMT solutions at the localised level and explores a range of sustainability impacts that LMTs can have at the national level that could either foster (co-benefit) or limit (trade-off) the scaling of LMT nationally.

As a means of ensuring a more regional impact in the different continental (e.g. Latin America, Europe, Asia, Africa, North America) WP6 provides the basis for developing continental narratives and scenarios based on work carried out at the local/)national level and link LANDMARC results to other climate policies and processes such as LMT emissions monitoring, NDC strategy development and SDG interlinkages. In addition, WP6 engagement actions also provide high quality input for the development of robust scenarios/narratives for the (climate, land-use and economic) modelling work planned in WP7 on assessing the global scaling potential for a portfolio of LMT solutions. Both the results from the global potential and impact assessment as well as the regional development platform work will also be fed back into the local and national level decision making on LMT implementation.

The work plan is structured in such a manner that knowledge (data, insights and observations) from the local case study work (WPs 2-5) are used on the continental level (WP6) to better understand LMT scaling dynamics across continents. These continental scenarios will be used as a basis for scenario analysis to assess the global scaling potential of a portfolio of LMT solutions (WP7). Through WP8 the key results and findings are disseminated at these three spatial scales (local/national, regional/continental, and global).

Figure 7: PERT chart of the LANDMARC project

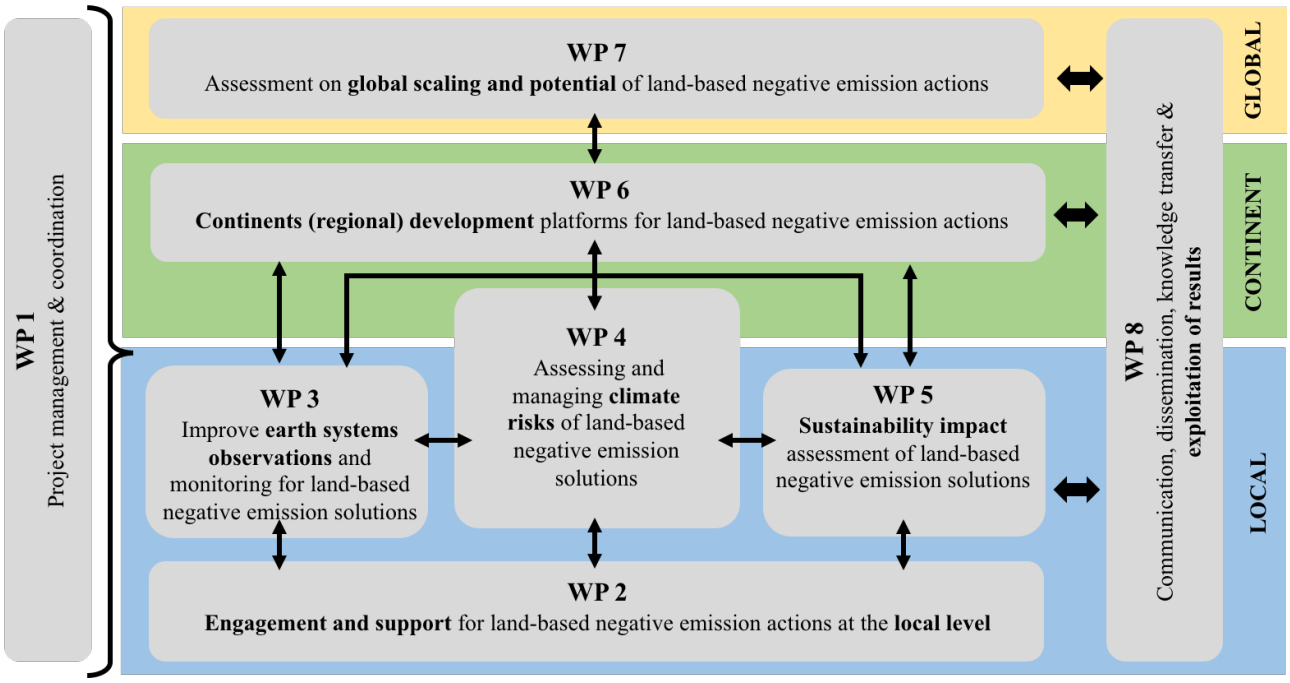


Table 3.1a: List of work packages

#	WP Title	(Co) Lead # and Name	WP PM total	Start month	End month
1	Co-ordination and project management	1. ETHZ & 2. JIN	88	1	48
2	Supporting local LMT actions	2. JIN	100	1	48
3	Improving Earth Systems Observations: asses and measure potential to fix carbon.	4. AMBIENTA	142	1	46
4	Assessing the climate risks of LMT solutions	5. BSC	101	6	42
5	National scaling up of LMTs and policy portfolios	1. ETHZ	118	1	40
6	Continental engagement for global Impact	10. SEI	127	1	48
7	Global scaling of LMT	7. Uni Kassel	88	1	48
8	Communication, dissemination, knowledge transfer & exploitation	15. SPRU & 13. BioRecro	91	1	48
		Total person months	**855**		

Figure 8: GANTT CHART

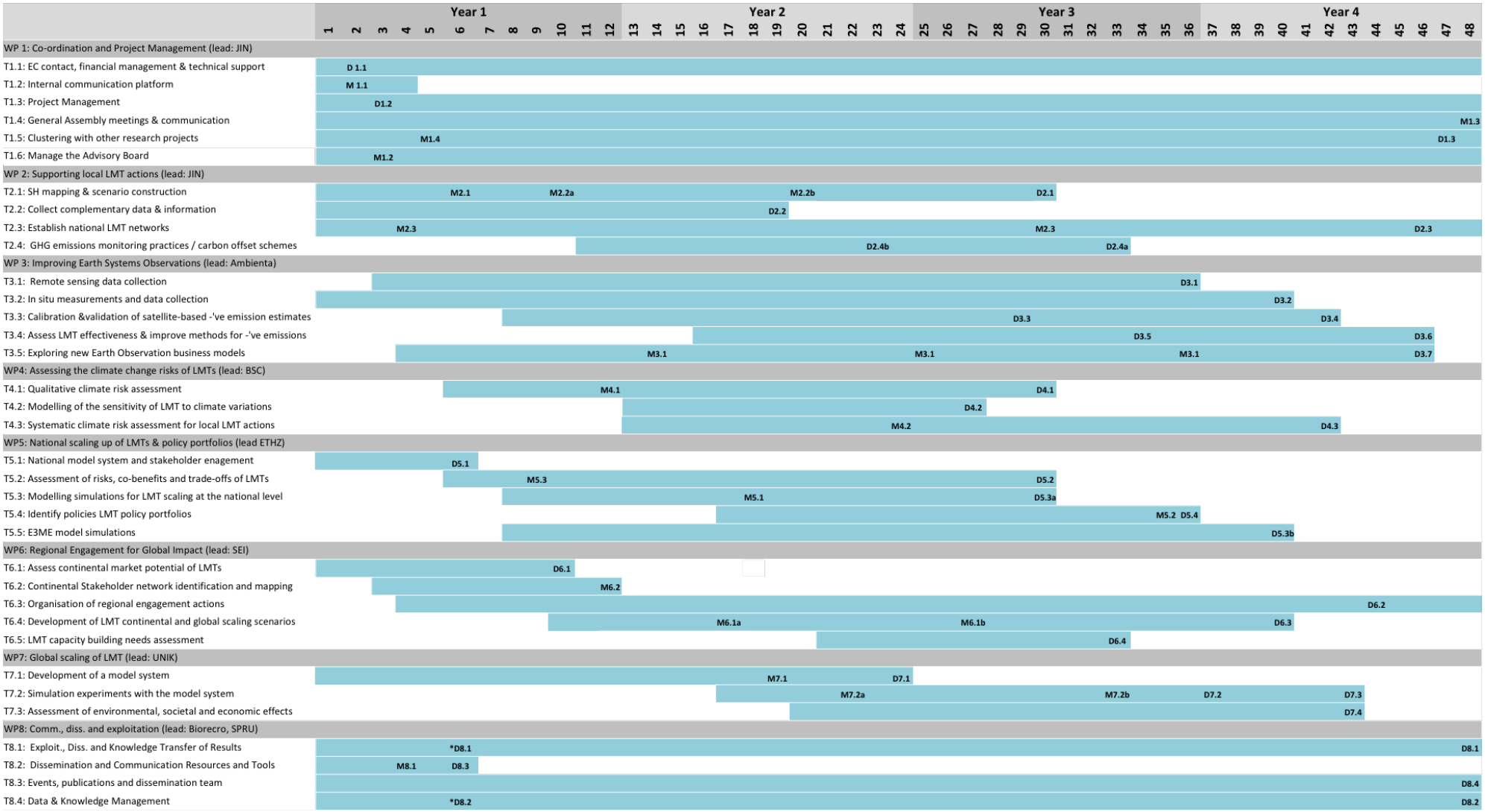


Table 3.1b: Work package description

Work Package 1

WP #	1																	
Title	Scientific coordination and project management																	
Start month	1								**End month**			48						
Partner#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Short name	ETHZ	JIN	Ambienta	Agroinsider	BSC	eLEAF	Uni Kassel	Bioclear	CE	SEI	KNMI	Oeko	BioRecro	Se-re.co	SPRU	Innolab	CIAT	COBRA
Person months	19	30	4	4	4	3	4	3	2	4	1	2	1	1	3	1	1	1

Objectives

- Efficient project management ensuring progress in line with the budget and the schedule
- Risk management and overall strategic project guidance
- Project administration, fulfilling all contractual and reporting obligations
- Building and maintaining effective communication channels within the consortium
- Ensure proper collaboration and exchange of knowledge and results with other relevant (EU) research projects and initiatives

Description of work

The project management and scientific coordination will be split between ETHZ and JIN. ***ETHZ*** will administer the contract with the EC including financial reporting, provide IT support to set up internal communication platforms and knowledge data and management platforms. Within the scientific work, ETHZ will co-ordinate the model integration across partners and oversee the collaboration between quantitative and qualitative methods across WPs. ***JIN*** will administer the day to day activities of the project (e.g. project planning, control, and quality) and oversee the governance of the project including the project decision making bodies. Within the scientific work, JIN will coordinate internal communications with partners (section 3.2).

Task 1.1: Administer the contract with the EC and oversee financial and legal issues (Task lead: ETHZ)

This task consists of compiling cost statements, as well as compiling the project's inception report (explaining the methodology and tasks ahead), the intermediate report (evaluating the project progress towards the internal targets and deadlines) and the final report (the final outcome of the project summarizing the key messages and overall work) for the EC. Specific financial and administrative activities include:

- Follow-up any issues related to the Consortium Agreement (CA)
- Represent the beneficiaries towards the European Commission, being the intermediary for any communication between the Commission and any beneficiary
- Receive the financial contribution to the project on behalf of the beneficiaries and administer its allocation, in accordance with the Grant Agreement (GA), the consortium agreement and any decisions taken by the General Assembly, keeping all relevant records
- Ensure that partners are aware of and fulfil their Grant Agreement responsibilities and reporting duties
- Stay in close contact with the EC representatives informing them about the progress of the project
- Develop the periodic and final technical and financial reporting to the EC based on GA requirements
- Manage any ethical issues that might arise in relation to the implementation of LANDMARC (***D1.1***)
- If any amendments to the GA are necessary, they will be dealt with as part of this task
- Ensure that procurement processes guidelines as set by the EC are met to ensure effective and efficient collaboration with contractors (to be supported by ETHZ' procurement office)
- Supporting the handling of intellectual property rights (IPR) issues (see section 3.2)

Task 1.2: Setup of an internal communication platform (Task lead: ETHZ) This task will set up an internal communication system that is user friendly and will act as a primary consortium channel (***M1.1***). The platform, which uses off-the-shelf software (e.g. Alfresco, Slack) and is password protected, has a calendar feature to communicate meetings and deadlines, a chat forum to exchange knowledge, a repository to share documents, work in progress, templates and final deliverables, as well as a project management feature to assign tasks and monitor progress. The internal communication platform is aimed at sharing reports in progress and deliverables, but the research data will be stored in a separate secure repository and supported by ETHZ's IT infrastructure. (See Task 8.4 for data management).

Task 1.3: Project Management (Task lead: JIN)

Role of partners: JIN will be the task leader and will be responsible for all activities. All WP leaders participate to the Scientific Management Committee. All partners will be members of the General Assembly and appoint experts for the quality control

This task covers the management of the project, including the following activities:

- Project planning and controlling - detailed work plan preparation and progress monitoring
- Day-to-day project coordination by the *Coordination Team* as described in Section 3.2
- Establishment of the *General Assembly* (comprising of all LANDMARC partners) to meet on an as needed basis for wider consortium issues (e.g. annual consortium meetings, midterm review etc) or to resolve any issues that requires consensus across the consortium
- Establishment of the *Scientific Management Committee* (comprising of WP leads and Continental Network Leads- See WP6) – meeting monthly online group meetings, described in Section 3.2, to discuss the scientific progress quality control – e.g. peer review by 2 members
- Maintain the relations with the European Commission and with other key actors
- Development, regular update and implementation of the risk management strategy
- Develop an ethical protocol within inputs from WP leads to guide research practices within LANDMARC and with stakeholders in our case studies, particularly children and vulnerable groups.
- Develop risk management plan: mitigating and managing potential risks (see section 3.2 for details on project risks). Projects milestones are used to check the progress of WP, and regular contact for monitoring individual WPs and case studies. The internal communication system described in Task 1.2 helps to keep track of deviations from the work plan before the milestone checkpoints. We will develop a contingency plan if any WP or case study fall behind schedule for unforeseen reasons. Should a milestone not be reached, JIN will prepare a plan to bring the WP back on track.

Internal (on-line) meetings: Internal on-line meetings to report on project activities will be held remotely through conference software (e.g. GoToMeeting, Discord). Relevant representatives of the different consortium partners will attend these meetings. Minutes and/or recordings of these internal meetings will be kept. More information on the internal communication structure and management are provided in section 3.2.

Task 1.4: General Assembly meetings and consortium communication (Task lead: JIN)

Role of partners: JIN will be the task leader and will be responsible for all activities, chairing all meetings and developing all meeting minutes. All partners will participate in this task, hosting meetings, participating in all meetings and telephone conferences as required.

The General Assembly will be meeting once every year to discuss the progress, identify problems and their solutions and to define the finer details of the work-programme for each partner for the following 12 months period. First a kick-off meeting will be organised in Brussels, Belgium and then three more general assembly meetings will follow, hosted by different partners.

In between the general assembly meetings, there will be technical meetings whenever required as part of the other work packages, bringing together smaller teams cooperating in specific tasks. In addition, regular internal communication (as described in section 3.2) will be maintained through:

- Daily e-mail exchanges and bilateral telephone calls
- Monthly telephone conferences between the coordinator and the leaders of the tasks that are running at each moment to monitor project progress and deal with possible problems.

Use of an internet-based communication platform and file repository set-up by ETHZ to provide the consortium members with a platform for communication, which is well documented, quick and structured, allowing all partners to follow the progress of all tasks in the project

Task 1.5: Clustering and collaboration with other research projects (Task lead: JIN/ETHZ)

Within this task LANDMARC ensures the engagement with a range of existing research and/or outreach initiatives that could a) feed data, results into, or b) could benefit from results/output from the LANDMARC project. Several of such ***project-to-project collaborations*** have already been established in the proposal preparation stage. Such collaborations generally involve data sharing and feedbacks. Other collaborations are more implicit through ongoing research programs in which some partners operate. For example, LANDMARC partners KNMI and BSC are both partners within the EC-Earth consortium. A series of other intended collaborations have already been confirmed through our Letters of Intent (see section 2.2 and section 5), such as with the WOCAT Global network on Sustainable Land Management.

Given the multidisciplinary nature of the LANDMARC project, and giving that the work plan is transcending borders, sectors and technologies, this task will focus on engaging with present and past research projects working on similar issues in order to leverage existing knowledge and know-how. In addition to that, this task will seek to engage with similar research projects in an effort to ***align the activities for communication, dissemination and exploitation*** of results to enhance overall impact (e.g. co-hosted events, co-publications).

Task 1.6: Establish and Manage the Advisory Board (Task lead: ETHZ & JIN)

The Advisory Board (AB) that will be established will include representatives of the key target groups. Candidates for the AB will be recruited via the networks of and nominated by the consortium partners, and/or affiliated stakeholders/partners that operate in the different continents in which LANDMARC is active. The input from the AB members will be requested on the various stages of the project development. Key documents will be sent to them for feedback and there will be further interaction with them in dedicated meetings and through their participation to project events. The LANDMARC partners already nominated potential AB members, some of which also provided a Letter of Intent expressing their interest to be in LANDMARCs Advisory Board and informally consulted them to ask if they would be open to take a position in the AB. Also, AB members will also be recruited from other relevant EU and other research projects to also foster cross-learning and cross-project collaboration. During the project implementation the partners aim to recruit the right board members for the task at hand (i.e. area of expertise and/or access to external networks). The idea is to have around 3-5 permanent AB members that can follow LANDMARC for the full four years, and hold 3-5 flexible AB positions, to be able to obtain the right kind of expertise/knowhow required at a given time within the LANDMARC project.

Deliverables
D1.1: Ethics conformance statement (M2)
D1.2: Project management plan: a) implementation plan, b) internal communication plan, c) quality control plan, and d) risk management (M3)
D1.3: Overview report on results of cross-project collaborations (M47)
Milestones
M1.1: Internet based communication platform and repository (M2)
M1.2: Confirm members of the advisory board (M3)
M1.3: Record / repository of all project meeting materials and minutes (M48)
M1.4: Inventory of projects for cross-project collaboration (M5)

Work Package 2

WP #	2									**Lead**	JIN						
Title	Assessment of local LMT scaling potential																
Start month	1									**End month**	48						
Partner#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Short name	ETHZ	JIN	Ambienta	Agroinsider	BSC	eLEAF	Uni Kassel	Bioclear	CE	SEI	KNMI	Oeko	BioRecro	Se-re.co	SPRU	Innolab	CIAT	COBRA
Person months	8	19	10	9	1	7	0	2	0	8	0	3	1	8	8	3	6	7

Objectives

- Assess the national scaling potential of LMT actions in case study countries
- Develop national scenarios / narratives for further scaling of LMT actions
- Support the effective engagement with local LMT stakeholders for executing the assessment work and data collection needed within WPs 3-5
- Develop local / national LMT networks within all case study countries that serve as a platform for exchange of knowledge, data, experiences and results from LANDMARC and other relevant LMT actions

Provide capacity building support to enable the further scaling and uptake of local/national LMT actions (e.g. to generate additional market based funding via the carbon market)

Description of work

This work package mainly serves as a platform for interacting with local stakeholders who are working on the implementation of LMT actions within their country and serves the collection of relevant data and inputs needed for WP3-5 assessment work.

Task 2.1: Stakeholder engagement and scenario construction (JIN)

Subtask 2.1.1: Stakeholder and network mapping (Task leader – JIN, and all case study leaders)

For each case study a basic stakeholder mapping exercise will be performed, to analyse and validate if all relevant stakeholders are 'on the radar' of the respective case study leader and are sufficiently engaged with the LANDMARC work programme. This task also includes maintaining a stakeholder registry which keeps track of the various stakeholder interactions that have occurred.

Subtask 2.1.2: Scenario development (Uni-Kassel and case study leaders)

This task provides the resources to test selected cases (~3 LMT case studies) to enable the co-development (with local stakeholders) of robust scenarios for LMT implementation before applying land use models (LandSHIFT-N, DayCent and ALCES) to all case studies. These scenarios are needed to enable land-use modelling in WP5 (Task 5.2 & 5.3) and feed into the regional/continental scenario /development in Task 6.4.

Task 2.2: Collecting complementary data and information (Co-lead: Ambienta, BSC and ETHZ)

This task provides the case study leaders with the resources to execute the literature review and collection of biophysical and economic data needed for WP 3 (Earth Observation), WP 4 (climate risk and sensitivity) and WP 5 (cumulative effects impact assessment). The Task lead partners from WP 3-5 will provide guidance and support to case study leaders for collecting relevant data at required temporal and spatial resolution and define minimum requirements for that data set. This includes in situ (e.g. soil physical/and chemical) data, Earth Observation (EO) data on climate/weather/land use (e.g. land cover, vegetation type and growth, temperature, and precipitation) and cost data (e.g. LMT investment and operational costs). The leaders of WP3-5 will perform a quality and usability check of all data provided. Different data gathering methods will be applied, depending on the local circumstances this can entail literature review, inventorying (local) database inventories (data mining), and (stakeholder) surveys.

Task 2.3: Establish national LMT networks (Lead: JIN + case study leaders)

The LANDMARC consortium will develop and maintain an informal local/national LMT networks for each case study country. These networks will serve as a platform to collect additional data, literature, and disseminate and exchange relevant results, insights and experiences with a broader group of national LMT stakeholders (i.e. that go beyond the initial set of stakeholders involved in the LMT project itself). Depending on the national context, and the quality of existing (in)formal social infrastructures (e.g. branch organisations,

think-tanks, scientific/industry conferences, etc.) LANDMARC will either develop and maintain i) a new network for the duration of the project, or ii) liaise/engage with existing LMT networks/platforms for example within the agriculture, forestry, water sector or within ongoing policy planning platforms (e.g. NDC strategies). The main aim of these local networks is to expand and improve the local impact of the LANDMARC project, its expected results and LMT actions in general. Within this task case study leaders will be supported to organise and (co-)host a series of local engagement actions. Such actions can include the preparation and execution of (semi-)structured interviews, the organisation of expert sessions, an online survey, a webinar, workshops, hosting a policy dialogue, and other basic (in)formal exchanges.

Task 2.4: Support uptake of transparent GHG emissions monitoring practices and promoting LMT finance through carbon offset schemes (Task lead: Oeko-Institut and JIN)

The task will provide guidance and support on transparent reporting and accounting of GHG (negative) emissions from effective implementation of LMT. Novel monitoring and accounting protocols will have to be designed in order to effectively capture mitigation contributions, ensure permanence of mitigation effects and avoid double counting, for example between mandatory accounting based on National Inventory Reporting (NIR) and (voluntary) offset project monitoring schemes (e.g. Gold Standard, VCS) and/or via Article 6 of the Paris Agreement (on Cooperative Mechanisms). This will address on the one hand requirements for LMT accounting emerging from international climate policy, such as the further elaboration of modalities, procedures and guidelines relevant for mandatory accounting of LMTs under the Paris Agreement and relations to voluntary carbon offset markets to generate additional funding for LMT projects. The task will thus ensure that the LMT solutions presented by the project in the case studies can seamlessly be integrated into international and national climate policies and will contribute to unlocking the potential of carbon offset market for LMT finance. Expected outputs from this task include e.g. an improved GHG monitoring protocol for land-based emissions, capacity building and training sessions on GHG monitoring and carbon offset market or support LMT in project design.

Deliverables (brief description and month of delivery)
D2.1: Case study scaling scenario report (M30)
D2.2: Case study integrated online data repositories (M19)
D2.3: Results from local network engagement actions (M46)
D2.4a: Activity report on improved GHG monitoring practices (M33)
D2.4b: Guidance report for role of carbon offsetting schemes and Art. 6 PA for LMT finance (M23)
Milestones
M2.1: Stakeholder and network mapping results (M6): excel for internal use
M2.2: Draft report with national scaling scenarios (M10, 20)
M2.3: LANDMARC case study narrative leaflet/brochure (M4 announcement + M30 intermediate results)

Work Package 3

WP #	3																	**Lead**	AMBIENTA
Title	Improving Earth Systems Observations: asses and measure potential to fix carbon																		
Start month	1																	**End month**	46
Partner#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Short name	ETHZ	JIN	Ambienta	Agroinsider	BSC	eLEAF	Uni Kassel	Bioclear	CE	SEI	KNMI	Oeko	BioRecro	Se-re.co	SPRU	Innolab	CIAT	COBRA	
Person months	2	4	40	25	0	22	0	28	0	0	11	10	0	0	0	0	0	0	

Objectives

Work package 3 focuses on more accurate and cost-effective monitoring of the LMTs' potential to sequester carbon from the atmosphere, which is an important step in order to support strategic planning and decision-making at multiple scales.WP3 pursues the following objectives:

- Improve methodologies to estimate GHG gas fluxes through a suite of tools: both in-situ and remote sensing data on soil, water, atmosphere, vegetation, GHG concentrations and proxies for GHG fluxes, and air quality, at the best available spatial resolutions. This includes the reduction of in-situ monitoring costs by integrating in-situ with remote sensing tools.
- Monitor and analyse the effectiveness of LMTs and support the scaling up of LMTs using above methodologies.
- Through an increase in the accuracy of soil and biomass measurements, using in situ and remote sensing tools, and an improvement in the calibration of the results obtained by combining new and existing data from stakeholders, move from Tier 1 to Tier 3 in the carbon sequestration estimates of the LMTs studied.
- Develop cost-effective monitoring tools and services to support land-based LMT strategic planning and decision making.
- Business model: formulate a roadmap towards commercialisation of the developed methodologies as a tool or service for land owners and decision makers.

Description of work

We will work with the different case studies to establish and test efficient monitoring methodologies and analysis of the effectiveness of the different LMTs, and its impact as a carbon sink. This work package provides inputs to WP5, WP6 and WP7. A descending order will be followed in the planning (sub-national, LMT, farm ...), and ascending in the monitoring and analysis (point, parcel, farm ...) in the territorial scale.

Task 3.1. Remote sensing data collection (Task leader: Agroinsider)

To provide historical and up-to-date operational data to establish the baseline and measure change at a wide range of spatial and temporal scales in order to measure LMTs and their impact as net sinks, we will collect remotely sensed data of drones, photogrammetry, LIDAR, Copernicus Sentinel-2 and Sentinel-1, 5P-TROPOMI, OCO-2, MSG, Suami NPP VIIRS, Landsat in order to:

- Generate time-series of CH_4, CO, NO_2 and HCHO column densities from TROPOMI coinciding with the specific locations of the case studies back to January 2018, for CO_2 from OCO-2, and from SCIAMACHY and OMI back to 2002 and 2004 (KNMI).
- Apply the existing Solar-Induced Fluorescence (SIF) retrieval algorithm to generate TROPOMI data record, and extract from this a time-series of cloud-cleared SIF estimates (KNMI).
- Collect and quality assure time-series of vegetation optical depth (KNMI).
- Collect and analyse time series of Sentinel-2, Landsat, MODIS, SUOMI NPP VIIRS and MSG data for a few selected case studies as input for the ETLook algorithm (eLEAF)
- Data collection of biomass and soil management systems via drone.(Ambienta)
- Analysis of georeferenced orthophotographs, taken with different types of sensors (Color, IR, LIDAR ...) of different years, for spatial evaluation of biomass changes and its biodiversity, establishing relationships with the potential of carbon sequestration.(Agroinsider, Ambienta)
- Apply the ETLook algorithm to generate monthly and annual biomass production data for selected case studies (eLEAF)

Task 3.2. In situ measurements and data collection (Task leader: Bioclear)

The necessary field data for calibration of the models of evaluation of the effectiveness of the LMTs, obtained in-situ, or received by the stakeholders of each case study, are fundamental to improve the level of accuracy of the monitoring. In this sense, in the different case studies, existing information will be collected, or in cases where it does not exist, it will be obtained to complete the necessary information:

- Inventory of forest biomass and biodiversity with new technologies (FieldMap), capable of optimizing the process of inventory and analysis of forest and agricultural data in the forestry and agroforestry case studies. (Ambienta)
- Forest biomass monitoring and traditional "in situ" data collection of the forest parameters chosen to

determine forest carbon deposits. Aerial biomass, radical biomass, decomposing organic matter, dead wood, soil organic matter are measured. (Ambienta)

- Soil analysis in terms of chemical, physical and biological properties including the percentage of organic carbon, the microbial community composition and diversity with a focus on microorganisms related to the production of GHGs. (Bioclear).
- Collect existing Eddy Covariance flux data from scientists in South Africa to calibrate the ETLook algorithm.

Task 3.3. Calibration and validation of satellite-based negative emission estimates (Task leader: eLEAF)

Within this task in-situ and EO remote sensing data from the various LANDMARC case studies will be integrated and interpreted both to calibrate and validate the fitness-for-purpose of the remote sensing and field observations to detect negative emissions. A mixed, well-designed use of the monitoring and variable tracking systems of land-use management, offers great possibilities in transferring information from the field for a better scaling up of LMTs (e.g. carbon storage capacities of soil and vegetation). The estimates made in tasks 1 and 2 and their integration with land use planning allow reaching Tier 3 accuracies in the carbon sequestration measurements of the different LMTs (forest land, croplands, wetlands, grasslands, settlements, and other land).

- Definition of LMTs representative areas, at the farm level, agricultural or forestry, via remote sensing, and taking of field data or obtaining them from stakeholders, for the establishment of relationships and patterns between spatial images and data on the ground.
- Comparison of ground-assessed negative emissions (e.g. biomass stock, soil carbon content, fluxes) to changes in satellite-derived proxies from Task 3.1 for selected use cases (eLEAF and KNMI)
- Sensitivity study of LMT case studies to relate carbon sequestration to detectable changes in satellite and field observables. Account for the spatial and temporal scale at which changes occur, and assess the changes to be expected at the Earth's surface (DayCent model) and within the atmosphere (DayCent coupled to WRF-Chem atmospheric model) (KNMI).
- Improve the flux components of the ETLook algorithm using existing Eddy Covariance flux measurements, for example in South Africa (in collaboration with local scientists)

The results from monitoring (WP 3) and scaling up LMTs potential (WP 5) will be integrated to derive improved (negative) emissions estimates for LMT activities. In this sense, WP 3 works to reduce the economic cost and increase the precision of satellite-based LMT and in-situ measurements monitoring techniques.

Task 3.4. Assess the effectiveness LMT and improve current methodologies to estimate negative emissions (Task leader: KNMI)

The effectiveness of LMTs is assessed by estimating the impact of LMTs on negative emissions, either measured in-situ and using remote sensing modelling. A land-atmosphere interaction model that operates at small scales (DayCent) will be used (together with the atmospheric model WRF-Chem) to predict:

- What to anticipate to measure on the ground or in situ (in terms of avoided CO_2 emissions)
- What to anticipate to measure from space (in terms of changes in SIF, vegetation OD, CH_4).

The task is completed with the following activities:

- Analysis of the integrated model-observation system' (from tasks 3.1-3.3) applied in 5 case studies in LANDMARC to estimate negative emissions
- Determine the effectiveness of LMTs in the selected case studies by comparing biomass production and carbon sequestration in vegetation in areas with, prior to, and without LMT implementation.
- Determine the effectiveness of LMTs in the selected case studies by comparing the different LMTs and carbon sequestration in soil.

Task 3.5. Exploring new Earth Observation business models related with negative emissions and land use management monitoring (Task leader: AMBIENTA)

The results and insights from the previous tasks feed into the further development of business models linked to existing EO data and information services like PiMapping®, and Agromap. These new business models provide stakeholders from agriculture and forestry with more accurate (IPCC Tier 3 level) time series and (near) real-time data and information on the status and development of the carbon stock in soil and vegetation together with other GHG or GHG enabling emissions (e.g. N_2O and CH_4) at the plot-level/subnational level.

- **'GHG monitoring and information service':** supporting land use activities using EO information to land-use practices and their net GHG performance.
- **Carbon Map tool:** Development of a carbon markets service a WEBGIS carbon calculator tool, building on Task 3.1 and Task 3.2. Impact potential users: market carbon business players; land policy makers; and environmental services in order to quantify and monitor implemented LMT actions.
- **Biodiversity tool:** Environmental data service to study the landscape and biodiversity using optical and radar imagery (Task 3.1) validated with biodiversity measurements (Task 3.2) Impact potential users: environmental services and land policy makers in to quantify and monitor implemented LMT actions.

Deliverables (brief description and month of delivery)

D3.1: Remote sensing data collection; data for the case studies will be available via the web-portal (M36)

D3.2: In situ measurements data collection report - Chemical, physical and biological soil and vegetation data connecting the data to the LMT and its effectiveness. Data collection from 16 case studies (M40)

D3.3: Prototype model-observation system to estimate negative emissions (M29)

D3.4: Calibration and validation report (M42)

D3.5: Best management practices guide for LMT and negative emissions. Based on LMTs negative effectiveness estimation across the different case studies. (M34)

D3.6: LMTs monitoring effectiveness to estimate negative emissions Report across case studies. One partial report per case study and a complete document comparing the results obtained in all the case studies. (M46)

D3.7: Digital agriculture and forestry tools for LMT negative emissions monitoring. (M46)

- EO data based 'GHG monitoring and information service'
- Carbon tool (development of carbon markets services).
- Biodiversity tool (Environmental data services).

Milestones

M3.1: New Earth Systems tools: 1st, 2nd, 3rd, final versions developed (M14, M25, M36)

Work Package 4

WP #	4																	**Lead**	BSC
Title	Assessing the climate sensitivities and risks of LMT solutions																		
Start month	6																	**End month**	42
Partner#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Short name	ETHZ	JIN	Ambienta	Agroinsider	BSC	eLEAF	Uni Kassel	Bioclear	CE	SEI	KNMI	Oeko	BioRecro	Se-re.co	SPRU	Innolab	CIAT	COBRA	
Person month	5	10	6	15	43	2	2	0	0	3	5	2	0	2	2	2	1	1	

Objectives

- Support to local stakeholders to perform more robust climate risk assessments for their LMT activities,
- Advance the quality, availability, and spatial disaggregation of future climate scenarios for better use in decision making processes (i.e. to improve climate resilience of LMT actions),
- Improve the accuracy and quality of CMIP6/EC Earth modelling in relation to land use change dynamics and the climate sensitivity of LMT actions (e.g. how plants/soils react to climate change).

Description of work

While LMTs are aimed at climate change mitigation, the IPCC 1.5 degree report has clarified that even if we succeed to meet PA mitigation targets, the world will have to adapt to already ongoing climate change and its impacts. In fact, (un)anticipated climate events (e.g. floods, droughts, heat, storms) or events due to specific

climate conditions and compound drivers (e.g. forest fires) could harm the effectiveness of LMT solutions (i.e. stored carbon being released). To make LMTs more climate resilient ('climate proof'), we will enhance access to future climate scenarios that are tailored to the 'relevant region' in which the activities take place (e.g. a river basin, a country or a larger region), and to specific sensitivities of LMT types.

This WP aims to improve the quality and spatial disaggregation of future climate scenarios with the help of climate modelling (CMIP6; specific EC-Earth3 simulations), to inform about climate-related sensitivities and risk of LMT implementations. This can aid local stakeholders in developing more robust adaptation plans in relation to LMT activities. On top of that, this WP will provide support to local LMT stakeholders in developing adequate climate risk management plans. For this, the three main tasks will be implemented.

Task 4.1: Qualitative climate risk assessment *(Task leader: JIN)*

Within this task we aim to mainstream climate risk management within conventional risk management practices (e.g. ISO 31000 or ICSR risk assessment). This task supports the LMT case study leaders (WP2) and their local stakeholder network to perform a (qualitative) climate risk assessment. The key focus is on climate hazards e.g. droughts, floods, sea level rise. In this task we will provide case study leaders with guidance on how to perform a climate risk assessment in a participatory fashion with local stakeholders.

This support will focus on which type of stakeholders need to be mobilized for such an assessment, how to operate and monitor a risk management process, as well as on how to interpret and make better use of available climate data and climate scenarios (see Task 4.3) within decision making processes. The basic methodological steps will be based on the insights gained from a Good practice Climate Risk Assessment (publication forthcoming) that JIN has developed for the Netherlands Enterprise Agency (RVO) to support water projects (funded via the Fund Sustainable Water by the Dutch government) in developing countries to make water management projects more climate resilient. On top of that this task will make use of the WOCAT Climate Change Adaptation Module to enable the assessment of climate risks and sensitivity.

This task runs in parallel with Task 5.2 assessment (in terms of the engagement activities planned with stakeholders in WP2), where a broader risk assessment (i.e. co-benefits and trade-offs of LMTs) will be performed. The results from this task will be used by local case study stakeholders to further develop and implement climate risk management and adaptation plans for LMT actions. Its key lessons and reported results will also be shared within the regional engagement actions (in WP6).

Task 4.2: Better understanding and modelling of the sensitivity of LMT to climate variations (*Task leader: Agroinsider*)

While the qualitative risk assessment (Task 4.1) mainly targets the climate hazards for LMT actions in different case studies, this task aims to get a better understanding of the climate sensitivity of LMT solutions to climate variations (e.g. within what temperature ranges are specific LMT vegetations still viable?). In addition to a literature research on the climate sensitivity of specific soil and vegetation types, this task will also perform a quantitative analysis of site-specific data from WP 3 (Tasks 3.1 and 3.2) and remote sensing data (e.g. from TROPOMI, FPAR, Sentinel, MODIS) to link proxy measure of biomass and carbon sequestration to climate observations. The goal of this analysis is to better understand climate conditions that favour or compromise the different LMT solutions in their effectiveness as carbon storage.

The results from this task will inform the Task 4.3 climate model analysis regarding climate-related sensitivities of LMTs for the climate (change) risk assessment. The main output of this task is to provide thresholds for Task 4.3, which will analyse the large database of climate scenarios for the risk of these thresholds to be exceeded at the LMT sites that already exist, and that are considered for global upscaling.

Task 4.3: Systematic climate risk assessment for local LMT actions (*Task leader: BSC)*

This task will perform a comprehensive assessment of a range of existing and specifically produced climate scenarios, to identify climatic impacts or even hazards posing risk to LMT implementation. This will then guide decisions regarding which types of LMT is most suitable in which regions. For this, the risk of climate-related hazards will be assessed under current and future climate conditions over the coming decades through late 21st century with a large ensemble of climate simulations available from the CMIP6, and simulations with LMT implementations performed with the EC-Earth3 Earth System Model.

Global climate and Earth System Model simulations typically have spatial resolutions of 50-100km, and simulated climate at small spatial scales of grid cells are subject to substantial unpredictable variability.

Therefore, on the one hand, aggregation over larger areas is usually necessary to analyse robust changes in climate, in particular climate extremes (Fischer et al. 2013[67]). On the other hand, the local climate risk at the scale of LMT implementations is also affected by specific local climate characteristics such as the local climate variability. In order to better inform LMT stakeholders on climate risks at higher spatial resolutions, the climate model data will therefore be matched with local observational data (including suitable data provided by local case studies (WP3), complementing high-quality climate data archives) using advanced multi-variate bias-correction techniques.

Using thresholds describing the sensitivity of different LMT implementations (from Task 4.2), the large set of global climate scenario simulations will be analysed for the risk of such thresholds to be exceeded under current and expected future climate conditions. This analysis will focus on locations of existing LMT cases, and potential LMT sites considered for global upscaling (WP7). Outcome of this analysis will be a risk atlas specifying the climate-related risk and anticipated risk changes at the considered LMT sites, to guide decisions regarding the most effective implementation and management of LMT.

Complementing the analysis of CMIP6 climate scenarios with specific EC-Earth3 simulations that include land-use changes related to (upscaled) LMT implementations, and their interactive carbon cycle effects (from WP7), will allow to investigate the extent to which the LMT implementations themselves will affect the climate risk to LMT, and to attribute climate risk changes to general climate warming, land-use changes related to LMT, and mitigation of climate risk due to capturing carbon through LMT.

Deliverables (brief description and month of delivery)

D4.1: Climate risk assessment and initial risk management plan for LMT solutions (M30)

D4.2: Report summarising the sensitivity of different LMT approaches to climate variations (M27)

D4.3: Atlas documenting the climate risk to LMT implementations at the existing case studies and sites considered for global upscaling (M42); will be a scientific paper presenting the comprehensive and systematic climate risk and sensitivity assessment for local LMT actions under current/expected future climate conditions

Milestones

M4.1: First training session for case study leaders on climate change risk assessment good practices and guidance (M12)

M4.2: Preliminary climate risk assessment of LMT implementations. This will be a report on the climate risk in the available climate scenarios and based on the preliminary understanding of climate-related sensitivities early in the project to provide information to stakeholders (M24)

Work Package 5

WP #	5																	**Lead**	ETHZ
Title	National scaling up of LMTs and policy portfolios																		
Start month	1																	**End month**	40
Partner#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Short name	ETHZ	JIN	Ambienta	Agroinsider	BSC	eLEAF	Uni Kassel	Bioclear	CE	SEI	KNMI	Oeko	BioRecro	Se-re.co	SPRU	Innolab	CIAT	COBRA	
Person months	49	6	3	4	1	2	20	1	8	3	0	3	1	3	7	3	2	2	

[67] Fischer, E.M., Beyerle, U. and Knutti, R., 2013. Robust spatially aggregated projections of climate extremes. Nature Climate Change, 3, 1033–1038

Objectives

This WP focuses on the national scale. It will assess LMTs and practices and evaluate current LMT policies and potential policy portfolios that can support the scaling up LMTs at the national level. Based on the former WPs, we could derive a 'technical potential' of LMTs in case study countries, and in this WP we combine that with social, economic and environmental opportunities and limitations of scaled up LMT implementation. This helps us to assess a *realistic* potential from a society's perspective. For that, we will:

- Qualitatively evaluate ***risks and co-benefits and trade-off analysis*** of LMTs currently applied at the case study level that impact local LMT stakeholders including social well-being, sense of community, livelihoods and the connection to the land.
- Run model ***scenarios to scale up LMTs*** at the national level (environment, negative emissions potential and wider impacts on the environment, society) through applying land use models (DayCent, ALCES and LandSHIFT) and the economic model E3ME.
- Explore existing policies promoting LMTs and practices at the national scale and identify policy gaps for potential new ***LMT policy portfolios*** to promote scaling up LMTs at the national level while considering local needs and priorities.

Description of work

Task 5.1: Development of National model system and stakeholder engagement (Lead: ETHZ)

A model-system for national-scale analysis will be conceptualized and implemented to feed earth observations data (WP3) into the DayCent land use model and subsequently into ALCES and LandSHIFT-N. We will apply DayCent and ALCES potentially to most case studies where suitable data is available. More advanced modelling will be done for case studies that have more detailed data over longer periods of time, with DayCent and ALCES in 1-3 case studies. We will then apply LandSHIFT-N in several case studies (around 3 case studies), where the LMT potential may be larger and have national impacts. Finally, we will apply the economic model E3ME in several case studies to test some LMT policy portfolios at the national level. We will include stakeholder knowledge and preferences in the model set, primarily through ALCES' interactive model. The models will simulate LMTs scenarios co-developed with local stakeholders in Task 2.1. We will align the model system with Task 6.1 which focuses on continental- global model system integration. Therefore, relevant models' outputs (e.g. yields, productivity, input costs) at national scale will be integrated with modelling at the continental scale.

Task 5.2: Assessment of risks, co-benefits and trade-offs of LMTs (Lead: ETHZ)

This task supports the assessment of key risks, co-benefits and trade-offs of LMT scaling up to the national level. We will first apply an existing framework developed and tested within the H2020 TRANSrisk project[68] to identify and analyse with stakeholders key socio-economic and environmental risks, co-benefits and, thus, trade-offs associated with scaling up LMT. Within this task the methodological framework, training guidance and support for the WP2 case study leaders will be provided. WP2 provides the stakeholder platform for this qualitative assessment. We will align this task with Task 4.1, for climate change risk assessment to ensure we are synergetic with the stakeholder engagement carried out across case studies.

Risks are broadly defined as '*potential negative impacts*' and are further sub-divided into environmental, social, economic, political, policy risks. This exercise will help to make explicit risks that are typically overlooked because they are not quantifiable and to help address risks more specifically in order to scale up LMTs. Co-benefits are seen as 'opportunities for *positive potential impacts'* and stakeholders will identify the potential co-benefits of LMTs including environmental, social, economic, political, policy co-benefits. Specifying both positive and negative impacts is important as risks and benefits may not affect or accrue to the same population groups and people negatively impacted by a measure could develop social resistance to an LMT option even though the net impacts for society may be small.

We will then assess trade-off of **risk and co-benefits** identified in Task 5.2.1 when applying LMTs, and accounting for SDGs (e.g. SDG 5 Gender equality, SDG8 Decent work and Economic Growth, SDG Industry innovation and infrastructure, SDG13 Climate action, SDG 12, Responsible Consumption and Production SDG 15 life on land). We will apply qualitative tools, including multicriteria decision analysis, MDCA, to

[68] Hanger-Kopp S et al. (eds) (2019). Narratives of Low-Carbon Transitions Understanding Risks and Uncertainties. London: Routledge:

weigh the risks and co-benefits in participatory settings to help us assess the trade-offs not merely based on expert knowledge but considering stakeholder needs and priorities in order to meet broader environmental, social and economic goals.

Task 5.3 Modelling simulations for LMT scaling at the national level (Lead: ETHZ)

Sub-task 5.3.1: DayCent simulations (Lead: ETHZ)

'Assess LMT impact on soil GHGs mitigation potential and other ecosystem services'

We will apply an ecosystem process based DayCent model to most case studies with sufficient in situ monitoring data to carry out a local and national assessment of LMTs on production/yield, soil organic carbon dynamics, net soil GHG emissions and N leaching. This will also allow us to evaluate the model performance and reliability of model predictions for ecosystems and management practices, which have been seldom modelled with DayCent in the past. Furthermore, we will select 2-3 case studies for more 'in-depth analysis' where the long-term robust dataset is available (e.g. Swiss case study) for more detailed ecosystem assessment. The local assessment will draw on the biophysical data that are already available or will be collected within the WP3 in the case studies. The data comprise of time series measurements of yields/productivity, soil organic carbon and soil GHGs subjected to various LMTs applications. These data will be complemented by data collected in WP2 including data from scientific articles and reports to improve crop/tree parametrisation in the model (C, N and lignin contents, shoot/root ratio, above/belowground C allocation, harvest index). Following the calibration and evaluation, the model will run for developed scenarios until 2050 to assess LMT potential.

In the next step we propose to extrapolate results from selected case studies (Task 2.1.2) to (sub) national scale and evaluate LMTs across a range of location-specific soil and climatic conditions. The spatial modelling will be done with the approach described in De Gryze et al, 2011 and Lee et al., 2012 & 2015[69]. We will use the data collected in WP2 including soil and historical climate spatial GIS databases that represent the key driving variables for scaling up. Spatial land use pattern for individual LMT scenarios from the ALCES model will be used to determine the spatial distribution of areas for LMT implementation and other land uses (e.g. forest or arable agricultural areas). The same spatial databases will be used by LandSHIFT-N (Task 5.3.2) for the national scale assessment. The spatial databases will be intersected with a common grid cell size and LMT scenario simulations (as developed with stakeholders in Task 2.1) will be conducted by DayCent for each grid cell, which is assumed to be homogenous in terms of the biophysical and management controls. Net soil GHG emissions will be derived from annual changes in soil organic carbon content, N_2O and CH_4 emissions using 100-year time horizon global warming potentials (IPCC, 2014). The emissions reductions potential associated with implementing LMTs will be assessed in respect to a reference scenario.

Sub-task 5.3.2: LandSHIFT-N simulations (Lead: Uni-Kassel)

'Potential sites for scaling up LMTs'

We will adapt the spatial land-use model LandSHIFT-N to run land use change scenario simulations for around three country case studies for upscaling up LMTs selected in Task 2.1.2. LandSHIFT-N operates on a raster with the high spatial resolution of 1 km² [70] and is used to identify suitable sites for the establishment of LMTs considering biophysical conditions and competition to other land-use types such as settlement and agriculture and nature conservation. For this purpose, it will be enhanced by a new model component to spatially allocate LMTs within a country. Important criterion of the site selection is the local potential to store additional carbon of specific LMTs as calculated with the DayCent model (Task 5.3.1). Simulations will be done until the year 2050 (or 2100) based on the scenarios developed in task 2.1.2.

The main outcomes are new information about the national carbon sequestration potential and changes in other land-based other greenhouse (based on DayCent results) taking into account developments of

[69] De Gryze, et al. (2011). Assessing the potential for greenhouse gas mitigation in intensively managed annual cropping systems at the regional scale. Agriculture, Ecosystems & Environment, 144(1): p. 150-158.

Lee, J., et al (20120). Simulating switchgrass biomass production across ecoregions using the DAYCENT model. GCB Bioenergy,4(5): p. 521-533.

Lee, J., et al (2015). Potential regional productivity and greenhouse gas emissions of fertilized and irrigated switchgrass in a Mediterranean climate. Agriculture, Ecosystems & Environment. 212: p. 64-74.

[70] Göpel, J., et al. (2018) Future land use and land cover in Southern Amazonia and resulting greenhouse gas emissions from agricultural soils. *Regional environmental change 18*(1): p.129-142.

agricultural, nature conservation and settlement area but also about risks such as additional water extraction for irrigation or biodiversity loss due to the transformation of ecosystems without protection status. Similar to WP7, we will assess land-use impacts on species diversity with the Biodiversity Intactness Index[71]/[72]. Irrigation water requirements will be assessed with the CROPWAT approach[73].

Sub-task 5.3.3: ALCES simulations (Lead: ETHZ)

'Cumulative effects assessment of LMTs considering stakeholders' knowledge and needs'

This task combines with qualitative analysis carried out in Task 5.2 and specific quantitative data to assess trade-offs of LMT using ALCES software. We will apply ALCES, a cumulative effect model that simulates changes in landscape composition and related indicators in response to LMTs and other drivers such as natural disturbances, and climate change. All case study leads will be trained (M5.1) to use the ALCES software at the start of the project. This land-use model can track the composition of landscapes using cells at user-defined resolutions and feed into the LandSHIFT-N or inform scaling up at the continental level.

An important role of ALCES will be communicating scenario outcomes via web-based dashboards made up of dynamics maps and graphs. The dashboards can be utilized during stakeholder workshops and distributed to other interested parties including policy makers. Feedback received from stakeholders can be used by case study leads to modify the scenarios, by revising assumptions or incorporating additional scenarios and/or indicators to assess the outcome of particular (policy) decisions. Case studies will have the potential to assess the cumulative effects of the multiple land uses (e.g. agriculture, recreation, forestry) and natural disturbances and simulate carbon inputs and emissions associated with land use sectors.

The ALCES tool, also has the capacity for comprehensive simulation of co-benefits as is required for trade-off analysis across case studies[74]. Customized equations (based on stakeholder input and literature) will integrate simulated changes in landscape composition and other variables (e.g., climate, physical geography, resource production, etc.) to track the response of indicators (e.g., ecosystem services and economic performance, etc.) relevant to the assessment of risks and co-benefits, as identified during Task 5.2.1. This quantitative assessment can complement the qualitative assessment of risks, co-benefits and trade-offs.

Task 5.4: Identify current policies/policy barriers and develop novel LMT policy portfolios (Lead: CE)

This task will: a) identify existing LMT policies, and policy barriers that directly or indirectly promote negative emissions, across different policy areas (climate, agriculture, development, waste, energy, economic etc.); and b) develop and propose new policies and policy frameworks to support scaling up LMT.

This task will build on the results from Task 5.2 risk, co-benefit and trade-off assessment, as it will provide information on potentially relevant policy domains in which trade-offs or co-benefits are expected. Depending on the case study country context and LMT development status, this work may contribute to different parts of the policy process (e.g. policy design, agenda setting, policy implementation, policy evaluation, policy redesign[75]). The novel proposed LMT policy portfolios to support the scaling up of LMTs at the national level will be presented and further discussed with relevant local stakeholders within relevant local platforms and ongoing dialogues on e.g. NDC implementation and/ or SDGs. This policy work will also feed into WP6, that hosts a discussion on continental policy frameworks for LMT scaling.

Task 5.5: E3ME model simulations (Lead CE)

In this task the E3ME model will be applied to a limited set of LMT case studies. (2-4). These limited model simulations will also serve as a pilot test, for the mode extensive E3ME modelling at the regional and global scale (Task 7.3. These case studies will be selected through Task 2.1.2. Overall, the policy portfolios created in Task 5.4, at the national level can serve as a database and will serve as a pilot test for further modelling work to be carried out at the continental level and their impacts evaluated in WP6 for assessing LMT potential though the E3ME modelling work.

[71] Scholes, R. J. and Biggs, R. (2005). A biodiversity intactness index. Nature 434(7029): 45.

[72] Koch, J., Schaldach, R. and Goepel, J. 2019. Can agricultural intensification help to conserve biodiversity? A scenario study for the African continent. Journal of environmental management 247: 29-37.

[73] Schaldach, et al. (2012). Current and future irrigation water requirements in pan-Europe: An integrated analysis of socio-economic and climate scenarios. Global and Planetary Change, 94, p. 33-45.

[74] Carlson, M. and B. Stelfox. 2014. Alberta oil sands development and risk management of Canadian boreal ecosystems. In: J.E. Gates, D.L. Trauger and B. Czech (Eds.) Peak Oil, Economic Growth, and Wildlife Conservation. Springer, New York, New York.

[75] Lieu et al. 2018.Evaluating Consistency in Environmental Policy Mixes through Policy, Stakeholder, and Contextual Interaction. Sustainability. 10(6),

Deliverables (brief description and month of delivery)
D5.1 Development of a national model system (M6)
D5.2 Results from the risk, co-benefit and trade-off assessment (Month: 30)
D5.3 Model run outputs from model sets DayCent, LandSHIFT-N, ALCES and E3ME (Month: 30, 40)
D5.4 LMT policy portfolios for national and regional policy making: scientific papers (Month: 36)
Milestones
M5.1: First national scenario runs (M18)
M5.2: LMT policy portfolio database (M35)
M5.3: ALCES software training (M9)

Work Package 6

WP #	6											**Lead**	SEI					
Title	Regional Engagement for Global Impact																	
Start month	1											**End month**	48					
Partner#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Short name	ETHZ	JIN	Ambienta	Agroinsider	BSC	eLEAF	Uni Kassel	Bioclear	CE	SEI	KNMI	Oeko	BioRecro	Se-re.co	SPRU	Innolab	CIAT	COBRA
Person months	9	4	5	6	3	5	12	2	9	36	0	3	2	8	8	2	8	5

Objectives

There is a need to bridge the gap between national (and sub-national) developments and global climate change mitigation action and sustainability developments (SDGs, NDCs etc.). We do this by introducing a 'regional perspective' within 5 continents to support the quantitative evaluation of scaling up LMT scenarios at the continental and global level, and to support continental level policy efforts for mainstreaming sustainable, climate resilient land management practices.

To achieve this goal, WP6 will address the following specific objectives:

- Provide a regional (within the 5 continents) knowledge sharing platform to promote the implementation and expansion of LMTs in different continents
- Co-design robust LMT development and implementation scaling scenarios for LMTs at the continental and global scale
- Foster regional cross-border cooperation for LMT strategy, policy development and capacity building within and across the different continents

Description of work

This WP will connect insights on the impacts of LMT scaling at the national level gathered in WPs 2-5 to the continental and global level. A robust subset of continental and global LMT scaling scenarios is needed for a continental and global level potential and impact assessment of LMT solutions with the help of simulation models (WP7). Thus, continental scenarios will be developed for LMT portfolios. Specific scaling up, and implementation (market and policy) barriers, as well as conflicting policy goals (e.g. SDGs) and new policy mixes will be identified (feeding in from WP5) to ensure development of more realistic scenarios (which will lead to more realistic quantitative assessments of the global potential). This work will be carried out in Asia, Africa, Europe, Latin America, and North America.

Task 6.1: Assess the regional/continental market potential of LMTs (Task lead: SPRU)

This task consists of a literature review targeting sustainable land management practices and/or LMT applications, barriers and associated policies for each LANDMARC continent considering inputs at the national levels in WP2&5. This task fills in the gap of regions not covered in the case studies (e.g. regions within continents such as South Asia and East Asia) to ensure that we do not overlook LMT potential in other areas within each continent. We will also coordinate with *Task1.5: Clustering and collaboration with other research projects* to identify synergies with on-going projects in the area to complement knowledge gaps. This task will provide a first understanding of feasible portfolios of continental LMT solutions and will inform the development of continental/global scaling scenarios in Task 6.3.

The task primarily consists of desk research and limited stakeholder interviews with regional/continental experts. The outputs of this literature review will inform us on the current state of the art on LMT implementation and scaling potential within the continent. This task links closely to and will also inform Task 2.1 where LMT scaling scenarios are developed at the national level by the case study leaders.

Task 6.2. Continental Stakeholder and Network Identification and Mapping (Task lead: ETHZ)

This task builds further on the stakeholder mapping performed within Task 2.1.1 that targets local and national level LMT stakeholders within the LANDMARC case study countries. In order to ensure proper continental engagement, this task aims to connect with relevant stakeholders and existing stakeholder networks/platforms. This mapping will be done for the 5 continents of EU, Asia, Latin America, Africa and North America. Within each continent, LANDMARC will have one or more focal case studies. The main aim is to map and build a continental network by liaising with relevant existing projects and engagement processes, such as via the Global Soil Partnership and its regional soil partnerships for Asia, Europe, etc., the NDC Partnership, SDG partnership, WOCAT, CIAT, and the various engagement actions by the Group on Earth Observations (GEO). LANDMARC partners already have informal links with most of the aforementioned stakeholder networks and will try to explore what kind of collaborations will be possible (e.g. shared events e.g. in relation to Task 6.3, dissemination/communication). For each continent, LANDMARC will appoint a Continental Network Lead.

This task also includes maintaining of a stakeholder registry which keeps track of the various stakeholder interactions that have occurred. Moreover, the task leader will provide templates for stakeholder groups and will reach out to stakeholders when needed and to engage with them early on for the workshops.

Task 6.3 – Organisation of continental engagement actions (Task lead: SEI)

Within this task, a series of engagement activities with relevant continental stakeholders are organised. These not only serve to test and refine LMT scaling scenarios (Task 6.2) but also serve communication, dissemination, capacity building and provide a platform for cross-project collaboration. Within each of the 5 continents, a series of engagement actions will be organised, which will be first informed by Task 6.1 (literature review) of the potential LMTs in the continents. Next we will carry out an online survey and interviews on LMT portfolios. Based on the on-line survey results and literature review, we will develop the first set of LMT scaling scenarios (Milestone 6.1). These scenarios will be presented, discussed and analysed in the planned continental workshops. Where available, initial model results from 5.1. and 7.1. will also be presented to stakeholders to enrich and stimulate discussions. After the workshops, feedback received from stakeholders and results from the discussions will be used as input to more refined model work in WP7 (Task 7.2). Where possible, follow-up activities with stakeholders will be carried out such as webinars in order to guarantee continuous feedback loops and engagement.

We will aim to embed the continental engagement actions (e.g. workshops) within the wider international climate change governance agenda to create linkages with climate action networks such as ICLEI Asia, APAN (Asia) or REGATTA (Latin America) and to ensure that synergies and maximisation of resources are sought in close collaboration with Task 6.4. These continental engagement actions thus do not only serve to develop robust scaling scenarios, but will also enable policy dialogues, and trigger advancements in regional NDC / SDG implementation strategies. As a result, this task will actively seek to (co-)organise its workshops as part of continental UNFCCC climate weeks or similar high-level events within the region in order to increase the project's visibility and impact.

Moreover, where relevant, gender issues will be explored by consortium partners as well as external stakeholders and boundary partners in the workshops. The LANDMARC consortium will draw on the expertise of SEI's Asia office where Dr. Bernadette Resurrección is a renowned expert on gender issues.

Task 6.4 Development of LMT continental and global scaling scenarios (Task lead: CE & Uni Kassel)

With inputs from task 6.1 and enabled by task 6.3 and the scenario-construction efforts on the national level (Task 2.1), this task will develop a set of continental and building on that, global scenarios for the implementation of LMT portfolios (see Section 1.2, Challenge 1: Scaling up scenarios for LMT portfolios). These scenarios will not only reflect the specific biophysical, and land-use characteristics, but will also address scaling challenges identified by the climate change risk and sensitivity assessment in WP4 and expected socio-economic trade-offs in cooperation with WP5. The identified environmental factors and constraints serve as a basis to parameterize the new model component for spatial allocation of LMTs within the LandSHIFT[76]. A first set of scenarios will be developed to facilitate preliminary simulation runs of the global models (WP7, Tasks 7.2 & 7.3). Together with the scenarios, these modelling results will serve as input to the continental stakeholder workshops in Task 6.3.

Insights gathered in these workshops will then be brought back to the researchers, post-workshop in order to amend, update and refocus the different elements of the continental and global scenarios. These updated scenarios which will then be used as a basis to carry out final model runs and impact analyses in WP7 (Tasks 7.2 and 7.3). This feedback loop from researchers to continental stakeholders and back will provide for vital information and ensure that LANDMARC modelling efforts use realistic assumptions and parameters and, secondly, that final modelling results deliver useful information to decision makers and provide the basis for regional policy engagement under task 6.5.

Task 6.5: LMT capacity building needs assessment (Task lead: SEI)

In order to tailor the continental engagement actions to the (urgent or perceived) needs of relevant stakeholders within the continent, a capacity building needs assessment will be performed. This Task will provide LANDMARC partners with a better understanding of which capacity, knowledge and resource gaps are there in relation to the implementation and scaling up of LMT solutions within the continent. Both the case study leaders (WP2) and the Continental Network Lead in LANDMARC will provide inputs for this, and additional inputs (e.g. via interviews, or an online survey) from the different stakeholder groups liaised with LANDMARC, and identified through stakeholder mapping (Tasks 2.1 and 6.3) will be collected. The results of these needs assessments will be used to develop attractive programs for the local and continental stakeholder engagement actions within LANDMARC. Results from this task will also be disseminated to relevant (inter)national bodies and platforms, like the NDC Partnership, FAO, World Bank, UNDP, UNEP, IPCC to inform the design of new capacity building funding programs.

Deliverables (brief description and month of delivery)
D6.1: Literature review and assessment of regional and continental LMT potential (M10)
D6.2: Report with results from continental engagement actions (M44)
D6.3 Final report on continental and global LMT scaling scenarios. (M40)
D6.4: Report on regional and continental LMT capacity building needs assessment (M33)
Milestones
M6.1: Draft report with continental and global scaling scenarios (M17, 27)
M6.2: Continental stakeholder mapping and network Repository (M12)

Work Package 7

WP #	7	**Lead**	UniKassel
Title	Global scaling of LMT		
Start month	1	**End month**	48

[76] O'Neill, B. C., Kriegler, E., Ebi, K. L. et al. (2017). The roads ahead: Narratives for shared socioeconomic pathways describing world futures in the 21st century. Global Environmental Change 42: 169-180.

Partner#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Short name	ETHZ	JIN	Ambienta	Agroinsider	BSC	eLEAF	Uni Kassel	Bioclear	CE	SEI	KNMI	Oeko	BioRecro	Se-re.co	SPRU	Innolab	CIAT	COBRA
Person months	6	4	12	0	25	0	28	0	10	3	0	0	0	0	0	0	0	0

Objectives

The overall aim of WP7 is to analyse continental and global scenarios for the large-scale implementation of LMTs and to assess their potential for carbon sequestration and mitigation of climate change as well as their economic and environmental impacts. Specifically, WP7 has three objectives:

- Development of a model system that combines a global land-use model with an earth system model
- Simulation experiments using the model system to analyse the LMT scenarios developed in Task 6.4 in regard of effects on land-use change, the carbon cycle and atmospheric processes
- Assessment of the effects on economic development (e.g. GDP, jobs) as well as on potential conflicts and/or synergies of LMTs with other types of land use (e.g. agriculture) and the preservation of biodiversity

Description of work

Task 7.1: Development of a model system (Task Lead: Uni Kassel / BSC)

A model-system that includes the main components: the EC-Earth3 Earth System Model (ESM) and the LandSHIFT-G land-use model will be implemented and tested.

The EC-Earth3 GCM (Global Climate Model) version 3.3 comprises three major components: the atmospheric model IFS (Integrated Forecasting System) Cy36r4, the ocean model NEMO 3.6[77] (Madec et al., 1998), which also includes the LIM3 sea-ice model[78], and OASIS3 that couples the main components. IFS is an operational global meteorological forecasting model developed and maintained by the European Centre of Medium-Range Weather Forecasts (ECMWF). NEMO is a state-of-the-art modelling framework for the ocean used for oceanographic research, operational oceanography, seasonal forecasting and climate research studies. The ESM version 3.3 of EC-Earth3 includes additional components to represent the carbon cycle, also coupled via OASIS3: LPJ-GUESS dynamic vegetation model[79], PISCES ocean biogeochemistry model[80] and TM5 global atmospheric transport model[81]. LPJ-GUESS is used to simulate the evolution of the land vegetation, agricultural production[82] and carbon fluxes, PISCES is used to simulate ocean biogeochemistry and CO_2 fluxes with the atmosphere and TM5 is used for atmospheric chemistry and transport of trace gases such as CO_2. In this project we will use the T255-ORCA1 configuration, which corresponds to a spatial resolution of 80 km in the atmosphere/land and 100 km in the ocean, and 3x2 degrees with 10 vertical levels, CO_2-only configuration for TM5.

LandSHIFT-G is a dynamic and spatially explicit land-use model for global scale analyses. In LANDMARC it operates in yearly time-steps and at a spatial resolution of 5-arc-min. The model simulates land-use change taking into account driving factors such as population, agricultural production as well as biomass productivity of agricultural systems under climate change. Similar to EC-Earth3, biomass productivity of agricultural and forest systems will be calculated with LPJ-GUESS. Model output comprises global maps of land-use / land-cover change and land-use intensity. In LANDMARC, LandSHIFT-G will be enhanced by a new component to spatially allocate different types of LMTs (e.g. afforestation or changes in cropland management) to

[77] Madec, G., et al. (1997). Ocean general circulation model reference manual. Note du Pôle de modélisation.
[78] Vancoppenolle, M., et al. (2009). Simulating the mass balance and salinity of Arctic and Antarctic sea ice. 1. Model description and validation. Ocean Modelling 27(1-2): p. 33-53.
[79] Smith, B., et. a. (2014). Implications of incorporating N cycling and N limitations on primary production in an individual-based dynamic vegetation model. Biogeosciences 11, p. 2027–2054.
[80] Aumont, O., et al. (2015). PISCES-v2: an ocean biogeochemical model for carbon and ecosystem studies. Geoscientific Model Development Discussions 8(2).
[81] Huijnen, V., et al. (2010). The global chemistry transport model TM5: description and evaluation of the tropospheric chemistry version 3.0. Geoscientific Model Development 3: p. 445-473.
[82] Lindeskog, et al. (2013). Implications of accounting for land use in simulations of ecosystem carbon cycling in Africa. Earth System Dynamics 4(2): p. 385-407.

"suitable" locations. Here we build on the work from WP5 where a high-resolution version of the model (LandSHIFT-N) is developed for national-scale analysis.

Technically EC-Earth3 and LandSHIFT-G will be combined by a soft-coupling approach, i.e. they will remain separate pieces of software that interact with each other according to the workflows of the simulation experiments described in Task7.2. We will implement interfaces for data exchange between the models and a procedure to initialize both models with consistent datasets.

Task 7.2: Simulation experiments with the model system (Task Lead: BSC /Uni Kassel)

Objective of the simulation experiments is to explore the land-climate-carbon-cycle interactions under the scenarios developed in Task 6.4 with emphasis on the effects of LMTs on the carbon cycle (e.g. by increasing carbon uptake from soil and vegetation).

Future climate is the result of 2 components: a) change in atmospheric radiative forcing, and b) the natural variability of the climate system. EC-Earth3 can be used to simulate future climate conditions by prescribing the radiative forcing based on future emissions and land-use scenarios. These simulations do not attempt to phase the model with the observed natural variability of the climate and are thus useful only in a statistical sense on centennial timescales. The model, however, can also be used to predict near-term (up to a decade) climate if, besides the radiative forcing, the natural variability is also taken into account. This is achieved by constraining the simulation's initial state towards the observed climate through data assimilation of observations. Both types of simulations can be performed including a full description of the carbon cycle to simulate prognostically atmospheric CO_2 and thus, including climate carbon feedbacks[83,84].

To better understand the effects of LMT implementation on the carbon cycle on centennial and decadal timescales, two sets of simulations will be carried out with the model system developed in Task 7.1:

(1) Future Climate projections (present- 2100)

We will perform 3 simulations corresponding to one baseline scenario (Middle-of-the-road SSP2-4.5)[85] which will serve as a reference against which we will compare the other 2 simulations corresponding to two LMT-inclusive scenarios developed in Task6.4. In order to assess the impact of LMT implementations on total carbon uptake and climate, only the land use will differ across the three simulations while the rest of anthropogenic drivers (e.g. emissions from fossil fuel combustion, aerosols etc.) will be the same as in the baseline scenario. Land-use change trajectories within the scenarios are calculated by LandSHIFT-G (based on the regional and global scenarios from Task6.4). To account for natural variability, we will perform a minimum of 3 ensemble members for each simulation. Data exchange between EC-Earth3 and LandSHIFT-G takes place in 5-years intervals where land-use data within EC-Earth3 is updated and in turn, information on changing biomass productivity is returned to LandSHIFT-G.

(2) Future decadal predictions of climate and atmospheric CO_2 (2022/2032)

We will perform decadal predictions of future climate and atmospheric CO_2 covering the period 2022-2032. This exercise will allow quantifying what would be the near-term potential impact of LMT implementation, offering relevant insights for the UNFCCC global stock-take to take place in 2023. The predictions will be initialized from reconstructions that will be carried out at BSC within the framework of the H2020 project "Climate-Carbon Interactions in the Coming Century" (CCiCC). Analogously to future climate projections, we will use the SSP2-4.5 scenarios for all anthropogenic emissions while the land use calculated by LandSHIFT-G will reflect potential LMTs implementations. In this case, the baseline scenario will also be available from the CCiCC project. A minimum of 10 ensemble members will be performed for each of the two LMT-inclusive scenarios. In contrast to the future climate projections, LandSHIFT-G will calculate the time-series of land-use maps a-priori for the whole simulation period of the EC-Earth3 simulations.

A first set of simplified simulation runs will be carried out using the preliminary continental scenarios from WP6 (Task 6.4). Model results feed into the refinement of the scenarios (Task 6.2 and 6.3). Final simulation runs are then conducted based on the updated scenarios.

[83] Séférian, R., et al. (2018). Assessing the decadal predictability of land and ocean carbon uptake. Geophysical Research Letters, 45(5), 2455-2466.
[84] Jones, L., et al. 2015. Ensuring climate information guides long-term development. Nature Climate Change 5(9): 812.
[85] O'Neill, B. C., et al. 2017. The roads ahead: Narratives for shared socioeconomic pathways describing world futures in the 21st century. Global Environmental Change 42: 169-180.

Task 7.3: Assessment of environmental, societal and economic effects (Task Lead: CE)

The aim of task 7.3 is to go beyond the analysis of the effectiveness of LMTs, e.g., to remove additional carbon from the atmosphere and to assess economic effects as well as potential trade-offs with the protection of biodiversity and conflicts with other land uses such as agriculture and settlement activities. Main input data for this analysis are the simulation results from Task 7.2. that will be analysed on the global and continental level.

We will use the E3ME model to analyse the socio-economic impacts of LMT policies. E3ME is a macro-econometric model with global coverage designed to address major economic and economy-environment policy challenges. E3ME features integrated treatment of the world's economies, energy systems, emissions and material demand. This enables it to capture two-way linkages and feedbacks between these components. The model is characterised by a high level of disaggregation, enabling detailed analysis of sectoral and country-level effects in a global analysis. Assessment of the potential socio-economic impacts of different scenarios will enable us to identify co-benefits and trade-offs of the LMT portfolios/policies. This will provide valuable information for policy makers and stakeholders in designing and implementing LMTs, particularly highlighting wider-policy considerations, e.g., employment effects. We will assess how LMT policies interact with other national energy/environmental policies. We will explore the extent to which the socio-economic effects of LMT policy are dependent on the wider policy environment; this can be achieved by modelling LMT scenarios under different 'baselines' of climate policy action (e.g. consistent with 4, 2, and 1.5 degrees).

Based on the calculated land-use maps from LandSHIFT-G we will further assess the additional loss or gain of species diversity (as one element of biodiversity) due to the implementation of LMTs compared to the baseline scenario. As a method we utilize the Biodiversity Intactness Index as already explained in Task 5.3.2. We use methods of spatial data analysis (e.g. Geographic Information Systems) to identify conflicts with other land use types (cropland, pasture, settlement) due to the additional land demand from LMTs. Here we will consider both direct and indirect land-use changes by comparing the modelled land-use maps of the baseline scenario with the "LMT inclusive" scenarios.

The results serve as input to a comprehensive evaluation of benefits and drawbacks of regional, continental and global LMT implementation and feeds back into the engagement activities in WP2 and WP6 and will be further disseminated through WP8 activities. Similar to task 7.2, the analyses will be carried out (in a simplified way) for the preliminary scenarios and then in full extent for the updated final scenarios.

Deliverables (brief description and month of delivery)

D7.1: Short report on testing preliminary scenario simulations (M24)

D7.2: Results from the centennial climate projections and LMT-effects on global carbon cycle (M37)

D7.3: Results of the decadal climate predictions and LMT-effects on global carbon cycle (M 43)

D7.4: Economic and environmental effects of LMT implementation (M43)

Milestones

M7.1: Implementation and test of the model system finished (M19)

M7.2: Simulation runs in preliminary (M22) and final version (M33) finished.

Work Package 8

WP #	8											**Lead**	SPRU & BioRecro					
Title	Communication, dissemination, knowledge transfer and exploitation																	
Start month	1											**End month**	48					
Partner#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Short name	ETHZ	JIN	Ambienta	Agroinsider	BSC	eLEAF	Uni Kassel	Bioclear	CE	SEI	KNMI	Oeko	BioRecro	Se-re.co	SPRU	Innolab	CIAT	COBRA

Person months	7	12	6	5	3	4	4	2	3	2	1	2	14	6	14	1	3	2

Objectives

- Promote the project activities and results beyond the consortium to relevant stakeholders
- Ensure efficient data and knowledge management, facilitating open access to appropriate results.
- Capture key messages and outcomes, based on knowledge generated through the LANDMARC project, for active knowledge transfer to key target users
- Optimise post-project uptake by knowledge transfer activity required to ensure objective and measurable short and long-term project impacts.

Description of work

Task 8.1 Plan for Exploitation, Dissemination and Knowledge Transfer of Results (PEDR) (Task Lead SPRU and input from all partners)

A first full plan for dissemination, exploitation and knowledge transfer will be developed by month 6 and will be evaluated and updated (D8.1) periodically at least at 12-month intervals. A draft outline for the PEDR is provided in section 2.2 and will serve as a basis for the PEDR. The PEDR will adopt EC best practice communication guideline principles and defines the objectives, target end users, planned tools and channels, responsibilities and resources as well as metrics for measuring impact.

This task will also ensure that the knowledge generated by the project is transferred to users in a measurably impactful way. With input from the consortium, WP8 will develop detailed Knowledge Transfer Plans for LANDMARC Knowledge Outputs depending on their respective type, application, condition of IP and end user target audiences. Because transferable knowledge will emerge throughout the duration of the project this process will be conducted a minimum of 4 times over the course of the project, in line with the review of the main Dissemination, Exploitation and Knowledge Transfer plan. This will be done in close cooperation with the consortium partners (e.g. case study leaders, and WP leaders) as well as with external partners (e.g. through linkages with other H2020 projects, Advisory Board member networks, etc).

Task 8.2 Portfolio of Dissemination and Communication Resources and Tools (Task lead BioRecro)

A portfolio of communication and dissemination tools and channels will be developed to aid external communication of the project, its activities and results.

- A project logo, a brochure, PowerPoint and newsletter template and other promotional material.
- A project public website for general dissemination of project results and progress
- An introductory project video will be commissioned to quickly present the project on the website and social media channels
- Annual newsletters and specific articles informing stakeholders on the progress of the project will be produced and sent to specialised press, relevant stakeholders, and will also be distributed to events
- Press releases and promotional articles will be produced and distributed regularly
- Social Media channels such as LinkedIn and Twitter will be used to promote LANDMARC activities and results widely via dedicated LANDMARC accounts and via the partnerships existing accounts. A specialised agency will be subcontracted to ensure maximum impact from the social media activity
- Offering to take over the hosting of the www.ClimateChangeMitigation.eu portal. This portal was set up under the H2020 CARISMA project (completed in July 2018), and is currently managed by the DEEDS H2020 project that will end in September 2020. By that time the LANDMARC project will request to take over the hosting of this knowledge dissemination platform (*by JIN*).

Task 8.3 Events, publications and dissemination team (Task lead BioRecro)

Subtask 8.3.1 LANDMARC dissemination team (JIN, ETHZ, SEI, BioRecro)

In order to find the most interesting stories and news with the highest potential of spreading/impact, a small team will be created within the consortium. The team will follow work packages 2-7, paying particular attention to the stakeholder mapping exercises at the national (Task 2.1) and continental level (Task 6.2). All

case studies closely and in recurring meetings choose and develop the stories and news that are communicated externally to primary and secondary target audiences for each WP/case study respectively.

Subtask 8.3.2: Events and publications

In addition to the stakeholder engagement activities organised within WP2 (e.g. narrative construction, data collection) and WP6 (regional LMT networks), this task promotes the further dissemination of (intermediary/final) results/outputs of the LANDMARC project. Aside from the development of relevant (scientific) publications, the project partners will participate in major relevant conferences and other events in order to present the project and disseminate its results and achievements. There will be continuous efforts to identify additional relevant conferences and events. The scientific papers will be published in high impact peer-reviewed international journals making the obtained results available to the scientific community and the industry. These papers will be made Open Access Publications (Green or Gold); budget has been allocated to the relevant partners to cover these costs. Other non-scientific publications (e.g. policy briefs, press releases, news articles, short notes, presentations, etc.) will be identified and developed by the dissemination team in collaboration with the consortium partners.

Subtask 8.3.3: Monitoring of dissemination actions

For each dissemination activity, success will be measured and monitored throughout the project on a set scale. This ensures tangible results throughout the duration of work. In order to monitor, and if needed adjust, the dissemination activities of LANDMARC a set of metric measures will be used. The success metrics (e.g. journal articles >20, excellent; 11-20, good; 5-10, moderate, <5, poor) will be presented evaluated during every General Assembly meeting. In addition to monitoring the success of all dissemination actions, also a repository will be maintained for storing all materials to enable sharing within the consortium and if and when relevant with external actors shared, a media register will be maintained by the task coordinator to keep track of all events attended, publications, etc. and measure it's success.

Task 8.4 Data & Knowledge Management (Task lead: SPRU)

Role of partners: SPRU will be the task leader and will cooperate closely with JIN, BioRecro and ETHZ. All other partners will provide input.

A Data & Knowledge Management Plan (DKMP) (D1.2) which identifies potential data repositories and provides an overview of the type and volume of data potentially collected and generated by the project as well as outlining how the project will respond to the principles of FAIR: Findable, Accessible, Interoperable, and Reusable Data. The DKMP will be developed early in the project in coordination with input from the technical WP leaders and will provide support on GDPR issues throughout the projects' duration. The data collected across the project will be stored in ETHZ's server and the IT infrastructure will be supported by ETHZ.

This DKMP will be regularly updated as the project progresses. The DKMP will include information on:

- the handling of research data during & after the end of the project
- what data will be collected, processed and/or generated
- which methodology & standards will be applied
- whether data will be shared/made open access and
- how data will be curated & preserved (including after the end of the project).

The DKMP will link closely with Exploitation, Dissemination and Knowledge Transfer Plan (Task 8.1) to ensure that re-usable project data is flagged up to potential users outside of the project.

Deliverables (brief description and month of delivery)

D8.1: Plan for the Exploitation, Dissemination and Knowledge Transfer of Results (M6, final version M42)

D8.2: Data Knowledge Management Plan (M6, final version M48)

D8.3: Portfolio of Dissemination Resources and Tools (M6)

D8.4: Overview of project publications and participation to events (M48)

Milestones

M8.1: LANDMARC project website online (M4)

Table 3.1c: List of Deliverables

#	Deliverable name	WP #	Lead participant	Type	Dissemin-ation level	Delivery months
D1.1	Ethics conformance statement	WP1	ETHZ	R	PU	2
D1.2	Project management plan: a) implementation plan, b) internal communication plan, c) quality control plan, and d) risk management	WP1	JIN	DEC	PU	3
D1.3	Overview report on results of cross-project collaborations	WP1	ETHZ	DEC	CO	47
D2.1	Case study scaling scenario report	WP2	JIN	R	PU	30
D2.2	Case study integrated online data repositories	WP2	AMBIENTA	R	PU	19
D.2.3	Results from local network engagement actions	WP2	JIN	R	PU	46
D.2.4a	Activity report on improved GHG monitoring practices	WP2	Oeko-Institut	R	PU	33
D2.4b	Guidance report for potential role of carbon offsetting schemes and Art. 6 PA for LMT finance	WP2	JIN	R	PU	23
D3.1	Remote sensing data collection; data for the 16 cases will be made available via the web-portal	WP3	AGROINSIDER	OTHER	PU	36
D3.2	In situ measurements data collection report – 16 case studies	WP3	BIOCLEAR	R	PU	40
D3.3	Prototype model-observation system to estimate negative emissions	WP3	eLEAF	OTHER	DEM	29
D3.4	Calibration and validation report	WP3	eLEAF	R	PU	42
D3.5	Best management practices guide for LMT and negative emissions.	WP3	AMBIENTA	R	PU	34
D3.6	LMTs monitoring effectiveness to estimate negative emissions Report	WP3	KNMI	R	PU	46
D3.7	Digital agriculture and forestry tools for LMT negative emissions monitoring.	WP3	AMBIENTA	OTHER	DEM	46
D4.1	Climate risk assessment and initial risk management plan for LMT solutions	WP4	JIN	R	PU	30
D4.2	Report summarising the sensitivity of different LMT approaches to climate variations	WP4	Agroinsider	R	PU	27
D4.3	Atlas documenting the climate risk to LMT implementations	WP4	BSC	R	PU	42
D5.1	Development of National model system	WP5	ETHZ	R	PU	6
D5.2	Results from the risk, co-benefit and trade-off assessment	WP5	ETHZ	R	PU	30

#	Deliverable name	WP #	Lead participant	Type	Dissemin-ation level	Delivery months
D5.3	Model run outputs from model set	WP5	ETHZ	R	PU	30, 40
D5.4	LMT policy portfolios for national and continental policy making	WP5	CE	R	PU	36
D6.1	Literature review and assessment of continental LMT potential	WP6	SPRU	R	PU	18
D6.2	Report with results from continental engagement actions	WP6	SEI	R	PU	40
D6.3	Final report on continental and global LMT scaling scenarios	WP6	UniKassel	R	PU	40
D6.4	Report on continental LMT capacity building needs assessment	WP6	SEI	R	PU	20
D7.1	Short report on testing preliminary scenario simulations	WP7	UniKassel	R	PU	24
D7.2	Results from the centennial climate projections and LMT effects on global carbon cycle	WP7	BSC	R	PU	37
D7.3	Results from the decadal climate predictions and LMT effects on global carbon cycle	WP7	UniKassel	R	PU	43
D7.4	Economic and environmental effects of LMT implementation	WP7	CE	R	PU	43
D8.1	Plan for the Exploitation, Dissemination and Knowledge Transfer of Results	WP8	SPRU	R	PU	6, 48
D8.2	Data Management Plan	WP8	SPRU	R	PU	6,48
D8.3	Portfolio of Dissemination Resources and Tools	WP8	BioRecro	R	PU	6
D8.4	Overview of project publications and participation to events	WP8	BioRecro	DEC	PU	48

3.2 Management structure, milestones and procedures

Project Management Team

The collaboration in the project is ensured by a comprehensive work plan consisting of 8 interlinked Work Packages 38 deliverables spread out over 16 partners. The project will be jointly managed by ETHZ and JIN, whereby ETHZ will be the formal co-ordinator of the project, including taking responsibility for financial reporting and technical coordination of the model integration/coupling. JIN will manage and supervise the execution of the work plan and will coordinate all the local and regional engagement actions within LANDMARC. The reason for this co-leadership is that ETHZ has extensive experience and adequate financial and administrative capacities with regards to coordinating EU projects.

While having had a key role within the preparation of this project (e.g. driving the consortium composition and workplan development during both stage I and II), JIN – as an SME – does not have full time access to such institutional support and resources, but has extensive experience with coordination of technical work within previous EU projects; both as a project coordinator and as WP or task leader. Out of the 17 EU funded projects JIN has participated in since 2001, seven were coordinated by JIN while in other EU projects JIN operated as a WP leader. As an SME, JIN has always proven to be able to respond quickly to changes or events occurring throughout project implementation.

The combination of ETHZ's strong institutional capacities with JINs flexibility and experience with the technical coordination of research projects will establish a strong project management team. This dual leadership means that ETHZ will thus formally submit intermediate and final reports which are prepared in

co-operation with JIN based on inputs from partners. More details on the division of tasks and responsibilities between ETHZ and JIN are described in WP1.

Management structure
The management structure of the project consists of the Project Management Team, the Executive Board, Work package leaders, a General Assembly, and an external Advisory Board.

1. **The Project Management Team (PMT)** is responsible for daily management, as well as financial and administrative reporting. The PMT has a:
   a. **Project coordinator:** Dr. Jenny Lieu will lead from ETHZ under Prof. Johan Six's Sustainable Agroecosystems Group. ETHZ will be the formal coordinator of the project and responsible for timely delivery or project outputs, deliverables and intermediate and final reports.
   b. **Project management:** Mr Eise Spijker (JIN) will manage the day-to-day execution of the workplan. To support this role, JIN will appoint dedicated staff members, Mr Erwin Hofman and Dr Wytze van der Gaast, to support this task. JIN's team will build further on experience with EU-funded project co-ordination since 2001 (seven multi-year projects: PROBASE, ENTTRANS, APRAISE, INTERREG IVa – Green gas, POLIMP, ENSPOL, BIOTEAM, PUBLENEF).

The PMT will supervise the schedules for milestones and deliverables and review whether milestones and deliverables are in line with the grant agreement (quality management). It will also organise the review of deliverable texts by partners and/or Advisory Board members. It will support the consortium with administrative aspects for interim and final reporting.

2. **The Executive Board (EB)** is the supervisory board for the execution of this project. The EB will consist of the PMT and all WP-leaders and will meet every two months through videoconferencing. The EB will be chaired by the **Project Manager** (Eise Spijker). The EB will conduct operational management of the project and support the necessary decisions in coordinating and administrating the project. The EB is responsible for the implementation of the entire project. Decisions made will be based on majority voting, and the Project Manager will be responsible for the final decisions. In cases of conflicts of conflicting points of view within the project, the EB is the second mediating body. The quorum will be set at 4 members. In case a participant is leader of more than one WPs, the vote for that participant will weight as one. The quorum will be set to 5 members.

3. **Work Package Leaders (WPLs)** are responsible for the detailed coordination, planning, monitoring and reporting of the work package and for the coordination of the tasks within the work package and with the other work packages in the project. The participants, in particular the task leaders, in the WP will report to their responsible WP-leader every two months in short progress reports. These reports enable the WP leader to be well prepared for the bimonthly EB meetings.

4. **The General Assembly (GA)** is the general body of the consortium representing all partners in LANDMARC. The GA will be formed to discuss overarching research and dissemination issues. The GA is also the voting body to decide on issues impacting the entire project. We may vote on issues such as shifting funds across partners. This format has been used in the project TRANSrisk and was successful in creating consensus. The GA will meet at least 4 times during the project. A first kick-off meeting will be scheduled within three months from the project start followed by annual and final GA. The PMT will prepare and chair the meeting. The GA will also be called to convene (i.e. via video conference) to discuss and vote on ad-hoc issues as needed.

5. **Advisory Board (AB):** In order to have a fresh eye on project progress and consult for advice both on content and enhancing impact, LANDMARC will organise an Advisory Board, with 10 permanent representatives and 4 flexible positions. AB members will be experts in identifying the potential for land use, land-use change and forestry options as sources for negative emissions, while observing contextual factors and preferences during design and implementation of actions. Permanent members will be able to track the progress made within LANDMARC, while non-permanent members will be recruited to help broaden the scope of our work (e.g. to consult in countries or regions we do not carry out case studies in). The goal is to regularly consult board members for feedback on topic selection during the start of the project, implementation of actions and formulation of policy recommendations. The AB will also be

invited to review deliverables. Some tentative members to be selected include academics, practitioners and policy makers:

Regional/Global:

- *Mr. Juan Chang:* Green Climate Fund (GCF), Deputy Director and Mitigation Coordinator of the Mitigation and Adaptation Division, Principal Specialist in Forests and Land Use
- *Ms. Aneta Slaveikova Nikolova*, Environment Affairs Officer, Environment and Development Division, UNESCAP, Asia and Pacific
- *Dr Carlos Méndez,* Vice-Chair of Workgroup II at IPCC and Director of Climate Change National Communications and GHG Inventory in Venezuela
- *Mr. Philippe Dardel*, Senior Natural Resource Management Specialist at The World Bank

National:

- *Prof. Rachel Creamer,* Chair of the Soil Biology Group in Wageningen University, the Netherlands
- *Dr. Adrian Ely,* Senior Lecturer at Science Policy Research Unit, University of Sussex, UK, Deputy Director at the STEPS Centre Social, Technological and Environmental Pathways to Sustainability
- *Dr. James Kushe,* Senior Lecturer, Mzuzu University, Department of Geosciences, Malawi, Africa
- *Mr. José Luis del Pozo,* Forestry Service Chief, Extremadura Spain
- *Prof. Christina Hoicka,* Assistant Professor in Sustainable Energy Economics, Faculty of Environmental Studies, York University, Canada
- *Mrs. Carmen González Ramos* Director for the Center of Scientific and Technological Research of Extremadura (CICYTEX), Spain

Conflict Resolution: Technical issues/conflicts within given contractual commitments that do not involve a change of the Grant Agreement, a change of budget and/ or a change of resources/ overall focus will be discussed/ solved at the WP level first. During the project execution, the required agreements will be reached first by informal contact, followed by official confirmation via electronic mail, and whenever necessary through letter or agreed written minutes.

Communication among stakeholders: All technical documentation generated by the project will be exchangeable in electronic format, according to a set of guidelines to be agreed and will be described in the Internal communication and quality control plan (D1.2). Exchange of information will mainly occur through the project's website, a web project document repository, and by e-mail and file transfer over the Internet. The basis of the project's internal communication will be the adoption of mailing lists, specifically one dedicated to technical development matters and a closed one for administration purposes. Sub-lists will also be incorporated in the communication procedure to enhance WP operation and to address specific project issues. A Data management plan will be completed under WP1 to ensure that confidentiality and privacy legislation (e.g. EU's General Data Protection Regulation for Data Storage) will be observed.

Online meetings: Regular and ad-hoc meetings will be held during the project lifecycle. Regular online meetings will be held in order to ensure that all procedures are understood and implemented in the proper way. The project manager is responsible for the meeting formation (agenda of the meeting) and the communication of the meeting details (time, place). Meeting minutes will be compiled and distributed to all participants. Ad-hoc meetings may be organised in case of an emergency or a conflict resolution as specified in the escalation procedure. Aside from the envisaged online group meetings/calls for the different management bodies within LANDMARC, the PMT also will host dedicated online group meetings for i) case study leaders, ii) modelling partners, iii) internal training sessions.

Case study leaders meeting (host JIN): These online meetings will be organised to enable case study leaders from WP2 to share their experiences with the implementation of specific tasks within the LANDMARC workplan. Based upon the initial case study implementation plans (developed by all case study leaders), all case study leaders will be invited to provide short pitch presentations to elaborate on status and progress regarding their work. Specific questions and/or challenges (e.g. obtaining local data, problems with stakeholder engagement) that pop-up during these calls will be forwarded to the respective WP leaders. The objective of these meetings is to foster mutual learning, so that task implementation can be more effectively and efficiently executed. This minimizes the burden on external stakeholders.

Model integration and requirements meeting (host ETHZ); These meetings have the objective to provide modelling partners in LANDMARC (e.g. CE, BSC, UNIK, ETHZ) with a platform to discuss in more detail

the various options and challenges regarding scenario modelling and model integration/coupling. Especially, during year one of project implementation (where most data collection and relatively few modelling work occurs), these meetings will serve to tackle or avoid any upcoming issues with model coupling, data compatibility and quality issues.

Continental network lead meetings (host SEI and JIN); LANDMARC will operate within 5 continents, and will appointed 'Continental network leads' (in WP6) that will keep an eye on regional developments and liaise with relevant regional activities and events where there is a possibility to a) collaborate, b) disseminate and communicate results, or c) to enhance the exploitation of project results and project impact.

Internal training and support meetings (host JIN with respective task lead); Throughout the LANDMARC workplan there are a number of tasks that require some form of training/support (e.g. Tasks 3.1 and 3.2, Task 4.1, and Task 5.1) for partners. By co-hosting and jointly preparing these training and support meetings with JIN these meetings will be set up with a clear objective and output in mind. This will ensure a more effective framing of the various tasks within the overall work planning and could foster operational synergies between some tasks. During the kick-off meeting, the meeting frequency for these online meetings will be determined by the GA. The determined meeting frequency can be adjusted after year one to better serve the needs.

Measurement of Project Progress: Reports to the Commission will ensure the proper implementation of the project objectives both from the consortium's perspective as well as the Commission's. The project follows the HORIZON2020 guidelines for project reporting. The PMT is responsible for administrative, financial planning and technical reporting. Significant deviations from the workplan will be notified to the EC in due time. Official review meetings will be held on an annual basis as indicated in the contract (1 full day officially dedicated review meeting with reviewers). Formal sub-reviews will be convoked when needed, on specific areas, with the participation of external reviewers, is envisaged.

Table 3.2 a: List of milestones

No.	Milestone name	WP	Month due	Means of verification
M1.1	Internet based communication platform and repository	1	4	Creation of platform (e.g. Alfresco) and all members with log-in profile and on-line training session to use platform
M1.2	Record / repository of all project meeting materials and minutes	1	48	Report / data / materials file
M1.3	Confirm members of the scientific Advisory Board	1	3	Announce Advisory Board members to consortium and set up first on-line meeting
M1.4	Inventory of projects for cross-project collaboration feed into D1.3	1	5	Create a list of projects and make initial contacts with project leads
M2.1	Stakeholder and network mapping results	2	12, 36, 45	Excel file in repositories
M2.2	Draft report with national scaling scenarios	2	8	Report
M2.3	LANDMARC case study leaflet/brochure	2	4, 30	2 leaflets produced per case study
M3.1	New Earth Systems tools: 1st, 2nd, 3rd, and final versions	3	14, 25, 36	Pilot tool to be tested and presented to the consortium and case study leads
M4.1	Training for case study leads on climate change risk assessment	4	12	Training from WOCAT and/or JIN in person or virtual given to train case study leads
M4.2	Preliminary climate risk assessment of LMT implementations	4	24	Presentations from all case study leads on climatic risk assessment with synthesized documentation
M5.1	First national scenario runs	5	18	First model run outputs for use in engagement actions
M5.2	LMT policy portfolio database	5	35	Upload onto LANDMARC website

No.	Milestone name	WP	Month due	Means of verification
M5.3	ALCES software training	5	9	Online training session completed
M6.1	Draft report with regional and global scaling scenarios	6	17, 27	Crucial input for continental and global modelling in WP7
M6.2	Continental Stakeholder mapping and network repository	6	12	By task leader
M7.1	Implementation and test of model system finished	7	19	Internal/external quality control/review
M7.2	Simulation run results (preliminary and final)	7	22, 33	Use of preliminary results in continental workshops in WP6
M8.1	LANDMARC project website online	8	4	Publish website publicly

Table 3.2b: Critical risks for implementation

Risk description (low/medium/high)	WP	Proposed risk-mitigation measures
Data leak or hack of internet-based data management and storage system (low)	1	The data system will be managed by ETHZ, which has a secure platform which is backed up regularly. We will also ask partners to password protect documents that are sensitive in case they are not stored on ETHZ's server and on partners' computers.
Work packages and/or tasks become separate mini-projects, unconnected to the larger project (low)	1	Ex-ante measure: During the proposal stage (both for stage 1 and II) weekly online partners meetings, as well as one group meeting in De Bilt, the Netherlands have been organised to discuss and prepare the workplan and the interlinkages between various tasks/WPs The internal communication structure with dedicated online meetings, as well as the case study implementation plans (that span across different WPs), will ensure a good interconnection and synergies within the work. Also, the different case studies are cross-cutting and will link to most of the WPs and individual tasks, which will reinforce ties between different activities.
IPR conflict between Task 3.5 (exploring new business models) partners (low)	1	IPR issues are dealt with according to Consortium Agreement and consortium management procedures.
Low involvement of local stakeholders in LANDMARC case studies (low)	2	As a preventive measures the LANDMARC case studies have been developed prepared in conjunction with local stakeholders. A large majority of case studies have also been previously developed by projects thus synergetic ties already have been created with stakeholders (20 Letters of Intent signed during proposal stage).
Stakeholder fatigue or over-consultation for research projects (low)	2, 6	Internal (online) meetings are set up to ensure that LANDMARC tasks that require some form of engagement with stakeholders are aligned and synergies are identified. Ensuring cooperation with other (local and regional) platforms, and other research projects, both for data collection and dissemination actions. Also, LANDMARC intentionally opted to host a portfolio of 16 case study, considering that this would spread risks of possible non-delivery in e.g. 1-3 case studies.
Secondary data: Insufficient and/or too low data availability and data quality to perform assessment work, e.g. linking datasets in terms of scale (temporal & spatial) will be challenging (low)	3, 4	Effective engagement and networking with local stakeholder and researchers is planned to ensure access to data and be aware of data limitations. As a fallback proxy data-sets or robust estimation assumptions will be made. Also, LANDMARC intentionally opted to host a portfolio of 16 case study, considering that this would spread risks of possible non-delivery in e.g. 1-3 case studies.

Risk description (low/medium/high)	WP	Proposed risk-mitigation measures
Primary data: own in-situ and remote sensing data collection fails (low)	3,4	For most satellite earth observation systems that will be used, we can fall back to alternative systems. For in-situ data collection (e.g. soil sampling in all case study setting) Task leader Bioclear provides proper sampling protocols (incl. instruction video) as well as proper parcel mailing instructions to all case study leaders or appointed partners.
Bias resulting from gender inequality/imbalances in stakeholder engagement actions (low)	2, 6	As a preventive measure stakeholder assessment and mapping will be performed and will be analysed on potential gender bias risks. With direct engagement actions (e.g. interviews and workshops), project partners will aim to have a balanced stakeholder base. In (online) surveys any potential gender related biases will be analysed and if needed reported.
Venezuela case study may present risks due to political instability and difficulties in transferring funds (low-medium)	2, 5	COBRA, a UK based NGO has worked for over a decade in Venezuela, and the case study lead is a Venezuelan Professor living in the UK who is also a Professor at Universidad Simón Bolívar, in Venezuela, working over a decade in the region and has established strong ties and trust directly with researchers who will be subcontract and paid through COBRA. See LoI Table 4; Letters of Intent #20.
Challenges in case study non-modellers for applying tools, software and methods that are new to them (e.g. ALCES, a land use model) (medium).	5	Dedicated (internal) training will be provided at the appropriate time (i.e. before the work on that task starts) either by internal or external experts (e.g. WOCAT, ALCES) in using the resp. software, tool or method.
Challenges in getting existing and new case study data in-time (e.g. in-situ monitoring data needed to timely to run DayCent model (low)	3,5	During the projects' inception phase the WP partners that rely on data/information inputs from the local and/or continental engagement activities for earth observation, modelling work etc. will make a joint effort in specifying data requirements and develop data collection guidance/templates. After that data collection priorities will be assigned so as to not overload data collection partners.
Local and/or continental stakeholders may not participate in activities in non-EU continents	6	Involve regionally strong players including CIAT and the Advisory Board members WOCAT to mobilise stakeholders or liaise with ongoing events
Co-development of continental scenarios may be challenging due to wide global coverage (low)	6	Apply different methods of engaging stakeholders including surveys and work closely with national case study leads to mobilise local networks. Also, a regional capacity building needs assessment performed at the continental level will aid in the development of an appealing/attractive program (e.g. for a workshop). Partners in LANDMARC have been selected that have strong local network and/or physical local presence.
Model set integration and model may be more challenging due to interdisciplinary team (low)	3, 5, 6, 7	Consortium has been working together already for 8 months, meeting regularly on a weekly basis to create a common language and to learn the basic components of each other's tools, models and methods and partners have been open and receptive to
Insufficiently balanced resources resulting in lack of resources for some activities, and surplus in others (low).	All	Partner allocations have followed task descriptions. Necessary re-allocations between partners can be decided in project coordination meetings.
Disagreements among consortium partners (low)	All	We been working very synergetic, co-writing the entire proposal. Also, we have built our consortium communication and management structure on consensus and will apply conflict resolution in line with Consortium Agreement.
Untimely completion of tasks / deliverables (low)	All	Close monitoring of progress by PM to support monitoring of tasks and deadlines Setting internal deadlines to review progress

3.3 Consortium as a whole

The LANDMARC consortium comprises out 18 partners including: 3 universities, 8 SMEs, 5 private research centres, and 2 NGOs. The call specific challenge and sub-topic b target land-based negative emission solutions and the quantitative assessment of their potential contribution to the PA and NDC implementation. Such assessments require advancements in ***earth observation*** work (to assess and monitor the effectiveness), as well as in earth systems, land-use and economic modelling (i.e. to ***quantify*** the local, continental and global impacts and potential of LMTs). International collaboration as well as robust LMT scenario development (to be used for modelling) require ***engagement*** with local and regional stakeholders working on LMT development and implementation (see section 1.3a).

Key Earth Observation partners

A range of earth observation tools and resources will be deployed within LANDMARC (***project objective 1***). Key partners in this effort are **eLEAF**, **Agroinsider**, **Ambienta**, **KNMI** and **Bioclear Earth**. KNMI is a partner within a number of major Copernicus satellite programs, including Sentinel 5-p (Tropomi), while Bioclear is an expert on soil analysis and runs projects on soil quality improvement and management. Partner Ambienta is an SME providing a range of engineering and consulting services to land use sector stakeholders and is a regular user of EO remote sensing and in-situ data information services within their projects. Both Agroinsider and eLEAF are SMEs providing commercial EO data and information services to the agriculture and forestry sectors. These 5 partners cover a broad range of remote sensing and in-situ monitoring skills needed to better assess the technical potential of different LMT solutions (WP3).

Key climate risk and sensitivity assessment partners

In order to analyse the future climate change risk and sensitivity of LMT solutions (***project objective 2***), the LANDMARC project makes use of the climate change modelling skills and expertise of partners **BSC** and **KNMI**. Both partners are involved within the CMIP6 and EC-Earth programs and have a proven track record in climate change scenario modelling both targeting international scientific assessments (e.g. IPCC) and feeding into local climate change adaptation and resilience decision support processes. Partner **JIN** has robust experience with performing project or technology risk assessments (e.g. through the H2020 TRANSrisk project). Within LANDMARC, JIN will lead the task 4.1 (qualitative climate risk assessment), which benefits from the insights from the 'good practice assessment study on climate change risk assessment' that JIN has executed on behalf of the Dutch government (Netherlands Enterprise Agency).[86]

In order to map the various co-benefits and trade-offs of LMT solutions (***project objective 3***) at both the local/national, regional and global scale the qualitative assessment that requires engagement with relevant stakeholders will be hosted in WPs 2 and 6, while the quantitative assessment will be performed in WPs 5 (national level modelling), and 7 (regional and global level modelling).

Key local/national, regional and global stakeholder engagement partners

Key partners for the local/national and regional and global level engagement actions will be several consortium partners that already have a strong foothold/experience working within one or more of the LANDMARC case study countries and continents. All case studies will build upon previous research projects or upon existing stakeholder networks both within the relevant countries and continents. These include, **ETHZ (Switzerland, Kenya/Uganda), JIN** (Netherlands), **Ambienta** (Spain), **eLEAF** (Burkina Faso, South Africa), **Agroinsider** (Portugal), **SEI** (Kenya), **Su-re.co** (Indonesia), **SPRU** (Nepal), **CIAT** (Vietnam), **Oeko-Institut** (Germany), **Bioclear Earth** (Netherlands), **BioRecro** (Sweden), **COBRA** (Colombia-Venezuela) and **Innolab Space** (Canada). This effort at the case study country level will be coordinated by partner **JIN** who has led dedicated stakeholder engagement WPs and tasks within previous EU projects (e.g. TRANSRISK), and was invited in 2018 as a speaker to the H2020 SC5 infodays to provide a presentation on Co-design, end-users, stakeholder involvement. The regional engagement actions (WP6) will be led by partner **SEI** who have a strong regional presence through their regional offices in Nairobi, Bangkok, Stockholm/HQ and Bogota. SEI has a longstanding track-record with hosting science-policy dialogues and supporting decision making processes towards sustainable development.

[86] A series of interviews on climate change risks assessment practices was conducted amongst beneficiaries of the Dutch Sustainable Water Fund program. The core objective of the assignment was to analyse if and to what extent the assessment of climate change risks is an integrated part of the existing project risk assessment and management practices.

Key national, regional and global modelling partners

The quantitative assessment of LMT scaling within LANDMARC comprises three main branches of models, including climate change modelling, land use modelling and macro-econometric modelling. Key consortium partners in this effort are BSC, UNIK, CE, and ETHZ. **BSC** has extensive experience in climate change scenario modelling within CMIP6 (to be applied to LANDMARC case studies) and EC-Earth (to serve for modelling feedback effects from land-use change modelling), while the centre for environmental systems research from partner **UNIK** will use their experience and expertise in modelling large-scale land-use systems with LandSHIFT. Partner **ETHZ** will contribute to LANDMARC by applying the DayCent biochemical ecosystem model to a range of LANDMARC case studies by integrating case study earth observation data and co-ordinating efforts to support the application of the ALCES model through a subcontractor. Partner **CE** will use the global macro-econometric model, E3ME, to serve the regional and global impact assessment of LMT solutions in order to evaluate the global LMT scaling from a more socio-economic perspective.

In order to improve methodologies to estimate GHG emissions and removals in relation to LMTs (***project objective 5***) we combine the expertise of LANDMARCs earth observation key partners (i.e. **Ambienta, eLEAF, Agroinsider, Bioclear Earth** and **KNMI**) with the expertise of **Oeko Institut**. Our partner O**eko Institut** is well equipped to make use of novel insights in GHG monitoring based upon EO measurements within existing National GHG Inventory accounting practices. Oeko Institut recently (2018) completed research for DG CLIMA on GHG accounting for the land use sector[87]. Also partner **JIN** has a long track record with providing research, consulting and advisory services on developing baselines (EU FP5 PROBASE), monitoring protocols and full project design documents for JI, CDM projects. JIN also supported the development of the Dutch JI and CDM tender programmes (ERUPT and CERUPT). Currently (2019) JIN is the official secretariat of a Dutch partnership initiatives that promotes the development of a National Carbon Offset market.

For the continental and global scaling activities within LANDMARC (***project objective 4***), we combine the expertise, networks and skills of a range of consortium partners involved in local/national, continental and global engagement activities (i.e. **ETHZ, JIN, Ambienta, eLEAF, Agroinsider, SEI, Su-re.co, SPRU, CIAT, Oeko Institut, Bioclear Earth, BioRecro, COBRA**, and **Innolab**) with the modelling and impact assessment expertise of the LANDMARC key modelling partners (i.e. **BSC, UNIK, ETHZ**, and **CE**). Within this effort partners **SEI** and **UNIK** will have a leading role in ensuring a proper co-creation of continental and global scaling scenarios for LMT portfolios (SEI) as well as performing simulations of these scenario within the LANDMARC model system (UNIK). Both lead partners, will benefit from previous projects where co-creation approaches have been combined with simulation modelling. **SEI** as well as some other partners (i.e. **SPRU, JIN, ETHZ, CE**) will benefit from the experience gained in the H2020 TRANSRISK project. UNIK has done extensive modelling work based upon co-creation inputs in a number of projects including CABIOCIAL and PRODIGY.[88]

To provide support to stakeholders (e.g. LMT practitioners, policy makers) for (policy) decision support at different levels (***project objective 6***), the combined skills, networks and expertise of all LANDMARC partners will be required. As this is a cross-cutting project objective, the LANDMARC:

- Earth observation partners will target the (further) development of EO data based (commercial) services and business models (e.g. Carbon Map, Biodiversity Tool),
- Local/national and continental engagement partners will bridge the gap between science and policy by providing research results and tailored training sessions based on a regional assessment of capacity building needs; and
- The modelling partners will provide input and results contributing to major scientific assessments.

In addition, for the communication, dissemination and exploitation of results, lead partners include **SPRU**, **BioRecro** and **JIN**. SPRU has a strong track-record in 'translating' research results to policy makers (e.g. policy briefings), while BioRecro has skilled staff that will enable LANDMARC to better exploit the potential of new (social) media channels for effective communication and dissemination. JIN has a long tradition in making research results available to a wider non-scientific audience. Already since its inception 1994 JIN

[87] 'Independent Monitoring: Building trust and consensus around GHG data for increased accountability of mitigation in the land use sector', commissioned by DG CLIMA (2018)

[88] Resp. CABIOCAL - Carbon Sequestration, Biodiversity and Social Structures in Southern Amazonia, and PRODIGY - Process-based and Resilience-Oriented Management of Diversity Generates Sustainability, both funded by the The Federal Ministry of Education and Research, abbreviated BMBF

develops and edits its own Magazine, the Joint Implementation Quarterly, and JIN was also one of the founding partners of the ClimateChangeMitigation.eu portal within the H2020 CARISMA project.

The scientific and project management co-ordinating team will consist of ETHZ and JIN. The ETHZ team working on LANDMARC has significant experience in land use sectors within Europe and in Africa. ETHZ will support the bridging of quantitative methods (model sets) with qualitative methods. JIN has extensive experience working on EU projects since FP5 and has been working closely and developing methods for stakeholder engagement within EU and at an international capacity with the United Nations, developing toolboxes to support climate mitigation and adaptation actions. Both co-ordinators in ETHZ and JIN have working well together since 2009 and have both lead EU projects ranging between 3-7.3 million.

Together ETHZ and JIN have been leading the proposal stage synergistically and have built a positive working collaboration across the consortium. This is evident in the high attendance during weekly meetings over the past months of the proposal stage. The team also met in person in De Built, Netherlands in July to discuss the integration of the work packages, tools and models. Partners were enthusiastic and eager to carry out scientifically robust and meaningful work that can have a positive impact on the environment and society.

3.4 Resources to be committed

LANDMARC is carried over a period of 4 years with a total of **847 work person months** (WPM) (see Table 3.4 a for details) with a total budget of €7 062 988,75 and we are requesting **€6 999 988,75** from the European Commission as €63.000,00 will be provided as in-kind contribution through our Canadian partner InnoLab Space who is not eligible for funding under H2020 rules.

Table 3.4a: Summary of staff effort

#	Partner	WP 1	WP2	WP 3	WP4	WP5	WP 6	WP7	WP 8	Totals
1	ETHZ	19	8	2	5	49	9	6	7	**105**
2	JIN	30	19	4	10	6	4	4	12	**89**
3	Ambienta	4	10	40	6	3	5	12	6	**86**
4	Agroinsider	4	9	25	15	4	6	0	5	**68**
5	BSC	4	1	0	43	1	3	25	3	**80**
6	eLEAF	3	7	22	2	2	5	0	4	**45**
7	Uni Kassel	4	0	0	2	20	12	28	4	**70**
8	Bioclear	3	2	28	0	1	2	0	2	**38**
9	CE	2	0	0	0	8	9	10	3	**32**
10	SEI	4	8	0	3	3	36	3	2	**59**
11	KNMI	1	0	11	5	0	0	0	1	**18**
12	Oeko	2	3	10	2	3	3	0	2	**25**
13	BioRecro	1	1	0	0	1	2	0	14	**19**
14	Su-re.co	1	8	0	2	3	8	0	6	**28**
15	SPRU	3	8	0	2	7	8	0	14	**42**
16	Innolab	1	3	0	2	3	2	0	1	**12**
17	CIAT	1	6	0	1	2	8	0	3	**21**
18	COBRA	1	7	0	1	2	5	0	2	**18**
	Total	**88**	**100**	**142**	**101**	**118**	**127**	**88**	**91**	**855**
	% of WP	*10%*	*12%*	*17%*	*12%*	*14%*	*15%*	*10%*	*11%*	*100%*

WP1 makes up a total of 10% the work person months (WPM) and is co-lead by ETHZ and JIN. Together the WPMs between JIN and ETHZ is equivalent to a full-time position to ensure that at any given point in time a co-ordinator is available to manage the project and address issues. Each work package lead or major task lead is allocated one more WPM to account for the extra coordination required. Smaller partners are allocated fewer WP months as their main efforts will primarily be related to carrying out WPs.

WP2 accounts for 12% of the WPM in LANDMARC and is led by JIN, where the bulk of the case studies work is carried out (partners working on case studies are listed in consortium section 3.3). The majority of the work will consist of collecting data to support the subnational and national work in WP 3, 4, & 5 and to a limited degree the continental work in WP6. Some modelling partners (CE, BSC, KNMI) do not have case studies and therefore are not allocated any time in this WP.

WP3 is take up the most WPMs, amounting to 17% of the total WPM and is led by AMBIENTA. All our earth observation work is carried out in this WP and partners are also developing new tools (e.g. CarbonMap and Biodiversity tool). The SMEs and KNMI are allocated all the time as they will be carrying out the work which require an extensive amount of time as they will be supporting all case studies. All case study partners will support WP3 requirements including in-situ sampling through WP2 WPMs but are not allocated time specifically within WP3 as they are not directly carrying out the EO work.

WP4 comprises of 12% of the total WPM and is led by BSC. BSC will be carrying out all the modelling work required in the WP and also will co-ordinate the climate vulnerability risk assessment across all case studies. Each case study is allocated time to carry out the work.

WP5 takes up 14% of the overall WPM and will be led by ETHZ who will carry out all the modelling work for DayCent and coordinate the application of ALCES across case studies as well as qualitative risk , uncertainty and trad-off analysis. Case studies will also be applying a risk, co-benefit and trad-off analysis as well as developing policy portfolio and are allocated time accordingly. Some modelling partners CE will be directly involved in the policy portfolio analysis even though they do not have case studies. UniKassel will also support the modelling work with its LandSHIFT model applied across some case studies.

WP6 is the second most intensive WP with 15% of the total WPM led by SEI. The resource allocated will help ensure that we can scale up from the national level to continental level combining desk research and stakeholder engagement across continents to create continental narratives to develop modelling scenarios. Smaller partners with strong reginal ties (CIAT, Su-re.co and COBRA) are given extra person months to facilitate the continental stakeholder engagement to ensure that the scaling up scenario modelling reflect the issues within specific regions. Model partners (UniKassel, BSC and CE) will be closely involved in the process to ensure that stakeholder inputs are integrated in the continental scenario development.

WP7 accounts for 10% of the WPM and is led by UniKassel who will carry out most of the global modelling work. Other global models including CE's E3ME model and BSC earth systems model will be central to this WP. Case study lead will not be involved in this WP but some partners working at the continental level including SEI will be involved for the global modelling to support scaling up to the continental/global level. This WP requires fewer WP months compare to other WP as it will not require extensive case study or stakeholder engagement work.

WP8 takes up 11% of total WP months and is co-lead by SPRU and Bioreco to bring in the strengths of an academic institution and SME. JIN also has a large role due to their strong links with stakeholder engagement and their experience in dissemination. All partners will be involved in supporting the communication and dissemination, and communication work in WP1, 2, 4 & 5 where stakeholder engagement occurs. Exploitation (where the uptake of research results occur) will be stronger emphasised in WP3 for the application of EO tools and WP4 the vulnerability risk assessment.

Table 3.4b: 'Other direct cost' items

We have indicated other costs that exceed 15% of partner's total personnel costs below:

3. ETHZ	Cost (€)	Justification
Travel	12000	(€1000x 8 flights for consortium meeting for two members; €2000 x2 for flights to Kenya/Uganda)
In-situ sampling	200	Mailing costs for in-situ samples
Software	3300	ALCES software for case study work
Publications	4000	~ €2000 per publication- sharing costs with partners
Equipment	15500	€3500 for stakeholder engagement (€3000 X4 per LANDMARC consortium meeting once per year over 4 years)
Advisory Board	30000	Flights for the Advisory Board (AB)and accommodation and travel ~€1000/advisory board member x 30 across 4 years
Sub-contracting	128000	€90000: sub-contract cost to support case study partners to run the ALCES model and training case study lead; €38000 subcontracting for dissemination and exploitation e.g. WOCAT
Audit	5000	Project audit and report
Total	**198000**	

3. AMBIENTA	Cost (€)	Justification
Travel	3000 2500 1500 2000	Attendance at consortium coordination meetings in Europe Field visits case study agroforestry Spain for monitoring Field visits case study forestry Germany for monitoring Participation in international conferences
Equipment	35000 3300	FieldMap technologies (software, hardware and equipment) for forestry in situ monitoring in Spain and Germany ALCES modelling and licence
Other goods and services	3500 200 10000 2000	Stakeholders engagement. Agroforestry Spain case study, and EIP AGRI Operational Groups Ecopraderas and Cereal Agua in Spain. Agroforestry Spanish case study sampling Soil sampling (courier and parcel service + soil analysis) – 100 units Audit costs
Total	**63000**	

4. Agroinsider	Cost (€)	Justification
Travel	28000	Agroinsider needs to give support to several regional case studies outside of Europe. ~ €7000 per year.
SH engagement	3500	2 Workshops with stakeholders; includes venue food and local travel costs
Equipment	5250	Agroinsider estimates to spend with equipment (Laptops and small field equipment) around €5250 over 4 years
Cloud computing	25000	Agroinsider needs to contract a DIAS provider from ESA and the cloud computing associated to the EO data processing (estimates €6250/year)
Software	25000	Agroinsider needs to contract some specific and specialized software developers for particular developments outside of its core business (estimates €6250 per year).
In-situ sampling	200	Field samples
Software	3300	Software ALCES license
Expert consulting	50000	Environmental/Agro-Forestry Science Expert – €25000 for 4years Business and User Experience Tools Expert – €25000 for 4years
Audit	4000	Project audit and report
Total	**144250**	

8. Bioclear	Cost (€)	Justification
Travel	8000	4 partner meetings by 2 persons: public transport, flight, hotel, meals. Travel cost to Dutch case study sites.
Other goods and services	115200	Biological sampling costs: assessment, handling and kit (144 samples (12 sets of samples x 4 years x 3 times per year) X €800)
Subcontractor	105560	Subcontractor: Flux chamber measurements on case study site peat in Netherlands for 2 locations.
Audit	4000	Project audit and report
Total	**326328**	

14. Su-re.co	Cost (€)	Justification
International Travel	6000	Three trips to Europe for general assembly meetings.
Regional Travel	2,000	Four trips to Bangkok or Hanoi for regional workshops and meetings
Travel	2,500	Meeting and research trips within Indonesia. €625 per year.
Workshops	6,000	Three 2-day-workshops/policy dialogue in Bali for venue & food
Software	3,500	ALCES licensing fee (€3300) & in-situ sampling courier costs (€200)
Total	**20,000**	

17. CIAT	Cost (€)	Justification
Travel	3000	Two trips from Hanoi to Europe to attend project meetings (including accommodation)
International conferences	3000	Two trips to attend international conference (including accommodation)
In country travel in Vietnam	5000	In country travel in Vietnam. 1250 EUR per year, which is an equivalent of abut 100 EUR per month.
Publications	3000	Open access and editing cost for publications
3 Stakeholder Engagement	3000	Cost for venue, food and beverages for three workshops (1000/ each venue)
Stakeholder Engagement	6500	Cost for local travel to attend workshops. Three workshops with each approximately 25 participants.
Total	**23500**	

18COBRA	Cost (€)	Justification
Travel	11000	Stakeholder engagement in remote areas in Venezuela and Colombia which results in expensive transportation due to the lack of accessibility (€550 x 20 stakeholders)
Conferences	5000	Travel between America and Europe for knowledge dissemination of several members of the research group in international conference
Equipment	2000	Computing equipment capable of operating in remote areas with access to back-up power and internet connection
In-situ sampling	200	In-situ sampling mailing costs
Software	3300	ALCES licences
Publications	2000	Open source journal fees
SH engagement	4000	Stakeholder workshops organized with indigenous communities in remote areas. Workshop materials (€200), travel and accommodation (€400 for 8 stakeholders), video recording and editing (€600)
Other goods and services	30000	Costs associated with subcontracting of experts in remote sensing and data analysis and reporting and support stakeholder engagement in Colombia & Venezuela (€15000/contractor/country over 4 years)
Total	**57500**	

Section 4: Members of the consortium

Table 4.1. List of participants

#	Type	Participant organisation name	Country
1	University	Eidgenoessische Technische Hochschule Zuerich (ETHZ) (Coordinator)	CH
2	SME	Joint Implementation Network (JIN) (Co-Coordinator)	NL
3	SME	Ambienta Ingenieria y Servicios Agrarios y Forestales S.L.U. (AMBIENTA)	ES
4	SME	Agroinsider LDA (Agroinsiderer)	PT
5	Research	Barcelona Supercomputing Center (BSC)	ES
6	SME	eLEAF B.V. (eLEAF)	NL
7	SME	BioRecro AB (BioRecro)	SE
8	University	Universitaet Kassel (Uni Kassel)	DE
9	SME	Bioclear Earth B.V.	NL
10	University	University of Sussex (SPRU)	UK
11	SME	Cambridge Econometrics Ltd. (CE)	UK
12	Research	Stockholm Environment Institute (SEI)	SE
13	SME	PT Sustainability and Resilience (Su-re.co)	ID
14	Research	Koninklijk Nederlands Meteorologisch Instituut (KNMI)	NL
15	Research	Oeko-Institut e.V. (Oeko)	DE
16	NGO	Innolab Space (ILS)	CAD
17	Research	International Center for Tropical Agriculture (CIAT)	IT
18	NGO	Cobra Collective CIC (COBRA)	UK

Participant No. 1: ETH Zurich, Switzerland

Partner description: The Swiss Federal Institute of Technology (ETH-Zurich) is one of the world's leading international universities for technology and the natural sciences. It is well-known for its excellent education, ground-breaking fundamental research and for transferring its research results into practice. It offers researchers an inspiring working environment and its students a comprehensive education. Founded in 1855, ETH Zurich today has some 18,000 students from over 100 different countries, 3,800 of whom are doctoral students. About 500 professors teach and conduct research in the areas of engineering, architecture, mathematics, natural sciences, system-oriented sciences, and management and social sciences.

The Institute for Environmental Decisions (IED) is a cutting-edge transdisciplinary research and teaching institute at ETH Zürich, one of the world's leading research universities. Our research and outreach inform policy- and decision-makers, as they seek to identify strategies to enhance the environmental sustainability of human activities. The research and teaching activities of IED lie at the interface between natural science, social science and decision-making. IED researchers closely collaborate not only with other researchers across ETH and beyond, but also with public and private institutions and civil society.

IED was founded in 2006 by four groups in the department of Environmental Science and merged the institutes of Human-Environment Systems and Agricultural Sciences. IED's composition shows that our research and teaching are problem oriented, rather than being defined by an academic discipline. It is a transdisciplinary and interdepartmental institute and has since grown to include: the Departments of Environmental Systems Science (D-USYS), Health Sciences and Technology (D-HEST), Management, Technology and Economics (D-MTEC), and Humanities, Social and Political Sciences (D-GESS).

The Sustainable Agroecosystems Group at ETH-Zurich is the unit of ETH-Zurich that is participating in this project. This group is part of the Institute of Agricultural Sciences within the Department of Environmental Systems Science. The research of the group focuses on the feedbacks between agroecosystem management options (e.g., tillage, cover cropping, green manuring, etc.), global change (e.g., climate and land use change), and biogeochemical cycling. More specifically, the group studies the complex interactions between plants, soil, soil biota, and the carbon and nitrogen cycles in agroecosystems of Europe and Africa. The general approach is to integrate field sampling, laboratory analyses, and mathematical modelling to investigate whole system dynamics under current and future environmental conditions. The group is involved in current EU-funded projects: LANDMARK and DIVERFARMING.

TdLab was founded in 2013 under D-USYS with an aim to strengthen the interface between science and society, specifically through the conceptualisation and testing of educational and research approaches to tackle complexities of sustainable development. Our lab brings together lecturers and researchers from diverse disciplinary, professional and cultural horizons including environmental scientists, psychologists, sociologists, philosophers, engineers, geographers and anthropologists. Our team supports and develops research projects by: proposing expertise in problem framing and knowledge integration; providing conceptual input, tools and critical reflection on how to run inter- and transdisciplinary collaboration; and integrating knowledge and values from different scientific perspectives and other societal actors.

Legal entity: University

Role of ETH in the project:
ETHZ's role in the project is Leader of Work Package 5, and focal contributions to Work Packages 2, 3.

Involved personnel:
Prof. Dr. Johan Six (male): Full Professor with 20 years' experience working on sustainable agroecosystems focussed on Africa and Europe. His current research focusses on assessing and understanding the sustainability of agroecosystems and the resilience of food systems. He has fulfilled leadership roles in various large interdisciplinary research projects (e.g. LANDMARK, DIVERFARMING, RUNRES). He has published over 300 articles in ISI-ranked journals.

Dr Jenny Lieu (female) is a Researcher with the Transdisciplinarity Lab at ETH Zürich. She was the lead Principal Investigator TRANSrisk, a Horizon 2020 project that is evaluating risks and uncertainties of low-carbon transition pathways at national, regional and global levels. She has a diverse research interest in energy and climate policy and innovation. Her research experience is in policy evaluation; new urbanism developments in Calgary, Canada; policy learning and transfer in the development of China's renewable energy policy; technological development of the fast breeder nuclear power reactor in the UK, and gender issues in science and technology. Jenny has also provided consultancy services, producing strategic recommendations for energy and environmental infrastructure firms and conducting policy analysis for international institutions.

Dr Bin Bin J. Pearce (female) is a lecturer, curriculum developer, and post-doc researcher at ETH Zurich in the Department of Environmental Systems Science. Her focus is on developing tools and methods that foster students' ability to perceive and resolve complexity in the real world with clarity and creativity. She is a part of the teaching team for a yearlong course for first-year Bachelor students, "Umweltproblemlösen" (Environmental Problem Solving) and for a Masters-level course called "Transdisciplinary Case Study". She is also the coordinator and coach for the Transdisciplinarity Lab Winter School "Science meets Practice", a training program for PhD students. She completed her Bachelor and Master s study in environmental engineering Stanford University and obtained her PhD from the Yale University School of Forestry and Environmental Studies.

Dr Magdalena Necpalova (female) is a post-doctoral researcher in biogeochemical modelling in the Sustainable Agroecosystems research group at ETH Zurich. She is interested in biogeochemical cycling within cropland and grassland agro-ecosystems. Her main research focus has been on quantifying the climate change mitigation and adaptation potentials associated with the adoption of alternative agricultural management practices in comparison with conventional management (i.e., effects on soil GHG emissions/removals, crop

yields and productivity) and thus assessing the sustainability of the agricultural systems at various spatial and temporal scales.

Relevant publications to the call content:

- Pittelkow, C.M., X. Liang, B.A. Linquist, K.J. van Groenigen, J. Lee, M.E. Lundy, N. van Gestel, **J. Six**, R.T. Venterea, and C. van Kessel. 2015. Productivity limits and potentials of the principles of conservation agriculture. Nature, 517:365-368.
- Pittelkow, C.M., B.A. Linquist, M.E. Lundy, X. Liang, K. J. van Groenigen, J. Lee, N. van Gestel, **J. Six**, R.T. Venterea, C. van Kessel. 2015. When does no-till produce more? A global meta-analysis. Field Crops Res., 183:156-168.
- Lundy, M.E., C.M. Pittelkow, B.A. Linquist, X. Liang, K. van Groenigen, J. Lee, **J. Six**, R.T. Venterea, C. van Kessel. 2015. Nitrogen fertilization reduces yield declines following no-till adoption. Field Crops Res., 183:204-210.
- Blaser, W.J., J. Oppong, S. P. Hart, J. Landolt, E. Yeboah and **J. Six**. 2018. Climate-smart sustainable agriculture in low-to intermediate shade agroforests. Nature Sustainability, 1: 234–239.
- Garland, G., E. Frossard, **J. Six**, E. Bünemann, A. Oberson, R. Chikowo, S. Snapp. 2018. Phosphorus cycling within soil aggregate fractions of a highly weathered tropical soil: A conceptual model. 2018. Soil Biol. Biochem. 116:91–98.

Relevant previous projects or activities, connected to the subject of this proposal:

- Members of the ETH team act(ed) as overall project coordinator of the following projects:
- The rural-urban nexus: Establishing a nutrient loop to improve city region food system resilience (RUNRES). **J. Six**, A. Odindo, C. Okafor, M. Schut, and S. Shibru. *Swiss Development Cooperation*. Funded for 4,330,000 CHF. (05/2019 – 04/23).
- Enabling sustainable cassava starch yield increase through appropriate smallholder mechanization, scheduled planting/harvesting and the use of decision support tools. **J. Six**. *Engineering for Development – Sawiris Foundation*. Funded for 228,258 CHF. (02/2018 – 01/2022).
- Assessing the role of organic value chains in enhancing food system resilience (OrRes). **J. Six**, R. Chavez, B. Kopainsky. *Mercator Foundation - World Food Systems Center*. Funded 284,709 CHF. (08/17-07/21).
- Integrated soil fertility management for climate smart intensification of maize-based cropping systems in Kenya. **J. Six**. *Swiss National Foundation*. Funded for 332,683 CHF. (06/17-05/21).
- Nitrified Urine Fertilizer- Solutions oriented community development. **J. Six**, E. Lieberherr, A. Oberson-Dräyer. *Mercator Foundation - World Food Systems Center*. Funded for 249,726 CHF (04/16-03/19).

Description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work:

The Sustainable Agroecosystems Group has state-of-the-art laboratory facilities to support the research programme with soil, water, plant, air and microbiological analyses. The laboratories maintain a key interest in sustainable food production from a soil's perspective. ETHZurich is a premier University that has a wealth of equipment and capacity to perform any analyses useful to answer any scientific question. With regard to soils, facilities for chemical, physical and biological characterisation of soils are plentiful.

Participant No. 2: JIN Climate and Sustainability (JIN), Netherlands

Description of the participant

Stichting Joint Implementation Network, t/a JIN Climate and Sustainability (JIN, www.jin.ngo) was established in 1995 with the objective to enhance international information exchange about climate change policies and measures. The initial focus of JIN's activities was on greenhouse gas emissions trading mechanisms to increase cost-effectiveness of climate change mitigation (JI, CDM). As GHG emissions trading expanded towards energy security and sustainable development, JIN's project portfolio was extended to low-emission technology transfer within sustainable growth contexts. These projects are carried out for national and subnational governments, the European Commission, UNDP, UNFCCC, and UNEP, among others. As a tool for information exchange on its projects and international policy developments, JIN

publishes the JIQ Magazine ('Joint Implementation Quarterly'). JIN is officially accredited as observer during UNFCCC negotiation sessions.

Through the EU research projects PUBLENEF (H2020; completed January 2019), ENSPOL (IEE; completed August 2016), POLIMP (FP7; completed April 2016), BIOTEAM (IEE; completed March 2016), APRAISE (FP7; completed September 2014), ENTTRANS (FP6; completed December 2007) and PROBASE (FP5; completed December 2002), which JIN has coordinated, the JIN team has extensive experience with project management and coordination tasks. In addition, JIN has been a partner in ten other EU-funded projects on climate change mitigation, environmental and climate policy making and energy efficiency. JIN has extensive experience in communication, dissemination and stakeholder engagement in the framework of EU-funded projects, among others as dissemination and stakeholder engagement work package leader of the Horizon 2020 project CARISMA, which included the establishment of the portal www.ClimateChangeMitigation.eu, and TRANSrisk.

Since September 2018, JIN has been an affiliated partner of the Global Center on Adaptation (hosted by the Netherlands), which acts as co-facilitator, together with the World Resources Institute (WRI), of the Global Commission on Adaptation, which is (co-)chaired by Ban Ki-moon (former UN-SG), Bill Gates (Bill and Melinda Gates foundation) and Kristalina Georgieva (CEO World Bank). JIN's role in the Global Center is to build up a knowledge hub at the Center's office in Groningen.

Legal entity: Non-profit

Role of the partner in the project:
JIN's profile matches several aspects of the LANDMARC work plan. Aside from the role as project coordinator (scientific co-lead with ETHz) in WP 1, JIN will also be involved in WPs 2, 4, 5 and 7. The involvement in WP2 focusses on (Task 2.1) coordinating and supporting the stakeholder engagement activities for all the LANDMARC case studies in collaboration with the case study leaders. In addition, Task 2.2 within the Netherlands JIN will also support the data gathering and stakeholder engagement for the Dutch LMT case studies. In WP4, JIN will coordinate the activities regarding the qualitative climate vulnerability assessment (Task 4.1). Within WP5 the human impact assessment, JIN will have a role in co-developing the scenarios used for economic modelling (Task 5.2), as well as aid the (qualitative) assessment of co-benefits and trade-offs of LMTs (Task 5.1). On top of that JIN will also make its contributions to WP7 on communication, dissemination and exploitation of the results.

Involved personnel:
Prof. Catrinus Jepma (male) is chairman of JIN, and is professor of energy and sustainability at the University of Groningen. He has vast experience in energy policy and markets, environmental impact and policy issues, energy efficiency measures and energy technologies. He is listed as an author of more than fifty publications. He has a long-term experience in lecturing, research and coordination. Aside of his academic work, he guides policy makers and project developers regarding emissions trading projects, as well as large experience in the field of renewable energy and alternative energy sources. As coordinating lead author of the Working Group III of the Intergovernmental Panel on Climate Change (IPCC) from 1993 to 2007, he shared the Nobel Peace Prize awarded to IPCC in 2007.

Dr. Wytze van der Gaast (male) is senior researcher at JIN. He has expertise in carbon accounting procedures and methods based on greenhouse gas emission reduction projects: project/sector/country-level carbon emission factors, baseline scenarios and additionality of emission reductions. As a regular advisor to the UNFCCC secretariat he has produced background papers for the UN Technology Executive Committee on Technology Needs Assessments, development and transfer of technologies for mitigation and adaptation in light of countries' economic, environmental and social priorities. In light of that, he has also focussed on Low Emission Development Strategies in relation to NAMA and NAP formulation and, green growth best practice, through collaboration with the Global Green Growth Institute, with a specific focus on embedding low-emission and energy efficient measures in countries' socio-economic priorities and planning.

He participated as researcher, coordinator WP/task leader in several EU research projects on GHG accounting (PROBASE), technology transfer (ENTTRANS), low-emission transition pathways (TRANSrisk), policy interactions (APRAISE), identifying climate policy knowledge gaps and building an interface between research and practice (POLIMP and CARISMA). Through these projects, he has been involved in EU-level

case study analysis on the impact of policy interactions and policy context changes on effectiveness (and efficiency) of energy and environmental policies and what this implies for knowledge of how efficacious policy instruments are in different policy making contexts. He has finalised his PhD at the University of Groningen on International Climate Negotiation Conditions – Past and Future. He is currently affiliated, on a part-time basis, with the Global Center on Adaptation. He runs the technical support unit for the Dutch Green Deal private-public cooperation on a national carbon market.

Eise Spijker (male) is a senior researcher at JIN on market and innovation system analysis, low-emission transition pathways, bio-energy, sustainable agriculture, emissions trading and policy interactions. He is co-editor of the JIQ Magazine. He participated as researcher, WP/task leader in several EU research projects on technology transfer (ENTTRANS), low-emission transition pathways (TRANSrisk), policy interactions (APRAISE), energy efficiency directive (ENSPOL), supporting public authorities with implementing energy efficiency policies (PUBLENEF) and acted as coordinator of EU projects on sustainable biomass to energy pathways (BIOTEAM) and Dutch-German project on cross-border trade in green gas certificates (INTERREG IVa). He performed extensive work on the sustainability (social, economic and environmental) impact evaluation of bio-energy / bio-economy pathways (LCA assessments). He provided a series of conference / industry network presentations on the topic of low emission transition pathways in the livestock sector (Chili, Indonesia, Sweden, 2017), and on Integrated Manure Management in the Netherlands (2016) for the Dutch Nutrient Platform, the Dutch Green Gas NL foundation (Groen Gas NL). He is currently (2018) involved in two EU-funded research projects on the risk and uncertainties of low-emission transition pathways (TRANSrisk) and on enhancing the capacity of local public authorities to plan and implement sustainable energy savings policies and measures with SME's and in the built environment (PUBLENEF).

Relevant publications

- Eise Spijker, Annela Anger-Kraavi, Hector Pollitt & Dirk-Jan van der Ven (forthcoming): *Evaluating integrated impacts of low-emission transitions in the livestock sector*. Environmental Innovation and Societal Transitions, Elsevier.
- Jakob Mayer, Wytze van der Gaast, Eise Spijker, Gabriel Bachner (forthcoming): *Qualitative and Quantitative Risk Assessment for Expanding Photovoltaics in the Netherlands*. Environmental Innovation and Societal Transitions, Elsevier.
- Wytze Van der Gaast (2017). *International Climate Negotiation Factors: Design, Process, Tactics*. Springer International Publishing. http://www.springer.com/gp/book/9783319467979.
- Wytze Van der Gaast & Katherine Begg (2012). *Challenges and Solutions for Climate Change*. Springer-Verlag London. http://www.springer.com/gp/book/9781849963985.
- Vasileios Rizos, Arno Behrens, Wytze van der Gaast, Erwin Hofman, Anastasia Ioannou, Terri Kafyeke, Alexandros Flamos, Roberto Rinaldi, Sotiris Papadelis, Martin Hirschnitz-Garbers & Corrado Topi (2016). "Implementation of Circular Economy Business Models by SMEs: Barriers and Enablers", *Sustainability* 8(11), 1212. http://www.mdpi.com/2071-1050/8/11/1212.

Relevant projects or activities

- **PUBLENEF** (2016-2019): PUBLENEF aims to assist European Union Member States in implementing effective and efficient sustainable energy policies (with the focus on energy efficiency) and empower them to make use of the best practices and policy processes implemented in other Member States at the national, regional and/or local level. Specific objectives of PUBLENEF include to assess and learn from existing energy efficiency policy implementation practices in EU countries, regions, and cities; to strengthen the networking opportunities for relevant public agencies; and to develop and adjust tools for public agencies to help them to implement energy efficiency policies. http://jin.ngo/projects/14-projects/132-publenef
- **CARISMA** (2015-2018): The CARISMA project, funded by the EU's Horizon 2020 Programme, addressed a range of aspects related to successful implementation of technologies and policy for climate change mitigation. Earlier research and practice has already established a strong knowledge base on feasibility of mitigation options and pathways. Hence, CARISMA's efforts focussed on issues related to scaling up options within different country contexts. While decision-makers, both in the private and public sector, often have a good understanding of costs and potentials of options for mitigation, especially when implemented as a stand-alone project or small-scale programme, the consequences of large-scale

implementation of options, in longer timeframes, in different social contexts, are often less clear. Within CARISMA, JIN's role was WP leader on the stakeholder engagement throughout the project: stakeholder mapping, attribution, organising meetings, interviews, etc. JIN furthermore carried out analysis on how policy interactions between climate and energy are considered in the context of EU's National Energy and Climate Plans (NECP).

- **TRANSrisk** (2015-2018): Transitions Pathways and Risk Analysis for Climate Change Mitigation and Adaption Strategies. EU Horizon 2020 project with the objective to explore low emission transition pathways and analyse risks related to these. TRANSrisk brought together in one research team quantitative researchers (i.c. modellers) and qualitative researchers with the goal to organise, for a set of case studies in Europe and beyond, iterative processes, whereby stakeholder preferences and concerns were communicated as research questions with modellers. After that, the modelled outcomes were communicated with stakeholders to help them obtain a clearer picture of risks and socio-economic impacts of scaled up climate change mitigation measures. This helped stakeholders assess what would be acceptable climate policies, given their own preferences. Within TRANSrisk JINs main role involved leading the work package on stakeholder engagement, as well executing two case studies in the Netherlands (one on the impacts of scaling solar pv, and one on assessing the impact of low-emission transition pathways in the livestock sector). http://jin.ngo/projects/14-projects/48-transrisk.
- **GreenEcoNet** (2013-2016): GreenEcoNet is building the first European-wide SME knowledge-exchange platform on a green economy. As an EU FP7 project it was concluded in 2016, after which a few partner took the initiative to establish a spin-off organisation, based in the Netherlands. The platform combines an online hub, including a searchable database of good practices, case studies and tools, with a series of in-person dialogues and workshops. Through our activities we will connect SMEs, policy-makers and researchers in order to explore the opportunities, challenges and innovations required for the transition to green economies at a practical level. http://jin.ngo/projects/14-projects/51-greeneconet
- **BIOTEAM** (2013-2016): The BIOTEAM Intelligent Energy Europe project on 'Optimizing Pathways and Market Systems for Enhanced Competitiveness of Sustainable Bio-Energy', coordinated by JIN aims to help public and private stakeholders gain better insights on how bioenergy markets work and how private business decisions and EU and national policy instruments (e.g., NREAPs, fiscal instruments, feed-in schemes, land-use/forest management policies, etc.) affect bioenergy pathway competitiveness and sustainability (i.e. environmental, economic and social). The BIOTEAM project targeted public and private sector stakeholders in six EU countries (Finland, Germany, Italy, the Netherlands, Lithuania and Poland) and focussed on providing information and evidence used for policy making and investment decision making (e.g. bioenergy policy incentives, choice of biomass feedstock, investment size of bioenergy production plants) aiming towards more sustainable pathways (www.sustainable-biomass.eu).

Participant No. 3: AMBIENTA Ingeniería y Servicios Agrarios y Forestales S.L.U. (AMBIENTA), Spain

Description of the participant

AMBIENTA (www.ambientaing.es) is a private Spanish SME, founded in 2006, with a great deal of experience in all kinds of engineering activities for the protection of the rural and natural environments, and in the agriculture and forestry sectors. It is comprised of a strong, experienced, dynamic and well qualified group of multidisciplinary professionals. AMBIENTA´s philosophy envisions a world in which economic and social development must go hand in hand with the conservation and improvement of natural resources.

AMBIENTA business is based on three pillars that interact with each other:

- engineering and consulting;
- works and services implementation; and
- research, development and innovation.

These give the company a multidisciplinary and innovative character, with permanent feedback between the three strategic lines, which improves the growth of AMBIENTA in both its technical competence and experience.

AMBIENTA has several classifications with the Spanish public administrations (K 6 4 - O 6 3 - E 1 1 - E 4 1 - E 5 1 - E 7 1), which certifies, for example, technical and financial solvency to contract works and services of up to 2.4 million euros per year, in terms of ecosystem restoration, landscape management and forestry. (https://ambientaing.es/index.php/obras-y-actuaciones).

AMBIENTA has accredited the quality, through evaluation and external certification, for the ISO 9001:2015 Standard and the ISO 14001:2015 Standard. Regarding the management of research, development and innovation, AMBIENTA has an R & D & I Management System that meets the requirements of the UNE 166002:2014 and UNE 166006:2018 standards for activities of agricultural and forestry engineering and services related to the development of technologies and processes (https://ambientaing.es/index.php/calidad).

AMBIENTA has a vast experience in delivering environmental & engineering services to the agriculture and forestry industry, and working hand to hand with stakeholders. AMBIENTA main fields of job and topics are related to:

- Environmental economics and land use management.
- Forestry and ecosystem restoration. Forestry fire prevention.
- Forest and natural resources monitoring, planning and management.
- Environmental education programs and training courses.
- Landscape management and biodiversity conservation.
- EIP Agri Operational Groups coordination (Ecopraderas, CerealAgua).
- Environmental engineering and consulting, spatial planning and ecosystems management.
- Technical office, rural development and agronomy consulting.
- Nature conservation, services in protected areas and in Natura 2000 Network.
- Climate change adaptation in agriculture and forestry.
- Engineering and services applying nature-based solutions in urban management.
- Hydrology, watershed management, rivers and banks restoration.
- Works and services in the natural environment.
- Innovation, research and development of new technologies, models and tools:
    - Hydrological modeling, G.I.S., and watershed management.
    - Natural and rural development and new financing models for nature conservation.
    - Hydrological and forestry risk management. Forestry fire prevention. Flooding risk evaluation.
    - Grasslands management.
    - Soil conservation and erosion control.
    - Environmental processes. Natural resources management and forestry.
    - Research to develop new agricultural patents.

Legal Entity: SME

Role of partner in the project:
AMBIENTA profile matches several aspects of the LANDMARC work plan. Aside from the role as WP3 Earth Observations partner leader, AMBIENTA will also be involved in case studies leadership such as forestry, agroforestry and grasslands. AMBIENTA will integrate his tasks working with stakeholders and providing data for modelling. AMBIENTA will work also in tasks related to new business models and market approach related with Land-use based mitigation technologies and Earth Observation for a better carbon fixation and climate change mitigation in forestry, agriculture, agroforestry and grasslands management. For communication and dissemination tasks AMBIENTA will have a role working with stakeholders in promoting the project, and transferring knowledge with farmers, foresters and stakeholders with interest in carbon fixation and land use management.

Involved personnel:

Mr. Federico Julián (male): MSc Forestry Engineer. MSc Agricultural Engineer. MSc Thesis Environmental Economics. With more than 16 years of experience in environmental engineering, agronomy and forestry, he has accumulated a vast knowledge of technical, socioeconomic and commercial aspects of river basin and ecosystems management. He has directed more than 40 environmental engineering projects, several of which integrate aspects of land use management (rivers and watershed management, forestry, wildfire prevention, ecological corridors, natural resources monitoring, planning and evaluation, application of new technologies to agriculture and natural resources management, agroforestry management, climate change adaptation...) He is currently AMBIENTA Technical Director, and responsible for the internationalization strategy of the company in Chile and the EU. Mr. Julián has previously participated and managed several Spanish Research and Innovation projects in the field of natural resources management, natural protected areas and river restoration (Gescuencas, Evarhis, Prateco, Datagrass…). Currently he is coordinating EIP Agri Operational Group Ecopraderas and EIP Agri Operational Group Cereal Agua in Spain. Both innovative projects are related with land use management, applying multi-stakeholder approach, and have interesting partners (farmers associations, public administrations, technological centers, universities) that act as stakeholders in agriculture. His experience as project manager and also coordinating these two Operational Groups is considered a great asset to LANDMARC.

Ms. María del Carmen Martínez (female): MSc Agricultural Engineer, BSc Forestry Engineer. 9 years of solid experience in agroforestry research and engineering projects. She has a significant academic background focused on the scientific field and the R&D sector, having participated in different research programs of agricultural and forestry species and environmental management and planning. She has excellent skills and experience in botanic, natural protected areas, ecosystem services management and as a project engineer, the result of her double academic training in agricultural engineering and forestry. Quality that makes it contributes a global and integrating vision of the ecosystems and agricultural forest environments, including a deep knowledge of the elements that make it up. On another level, she emphasizes her efforts to expand her training by carrying out courses related to her professional work, as well as her determination to tackle the tasks that are presented to them in an effective and decisive manner. Currently she develops her work in AMBIENTA coordinating Datagrass R&D project, for grasslands monitoring using new technologies, supporting Operational Group Ecopraderas and managing the Quality Department of AMBIENTA. Her experience is considered a great value to LANDMARC for land use management monitoring and providing data for modelling.

Ms. Ana María de Hoces (female): PhD Hydrology**,** MSc Forestry Engineer, MSc Environmental Hydraulic. More than 14 years of experience in hydrology and agroforestry research and engineering. Her work started in DAPSA public company, working four years with photogrammetry monitoring applied to CAP control in Andalusia. She developed her PhD in agroforestry hydrological research in IAS-CSIC, working with erosion modelling in agricultural olive catchments in the South of Spain. Later she has researched also for three years in several agroforestry ecosystems in Extremadura (Spain). First she worked for the Dehesa Observatory in CICYTEX, and later with the SME CIDEX S.L., where she was responsible for the Pinarex research project, for the enhancement of non-woody pine forests resources such as resin, which was introduced in Durban XIV FAO World Forestry Congress. She has also been a teacher for three years of Vocational Training in product design. Recently she has been incorporated as technical support for the EVARHIS project in AMBIENTA, working with risk management in natural catchments. Her experience is considered a great value to LANDMARC for agroforestry and hydrological aspects in land use monitoring, modeling and management.

Mr. Álvaro Santiago Julián (male): MSc Environmental Sciences. CEO of AMBIENTA and final responsible person for the project in front of the European Commission. He has more than 12 years of entrepreneurial experience managing and administrating AMBIENTA. He coordinates the commercial department in Spain and the internationalization of AMBIENTA in Chile. He is also responsible for the company's finances. Apart from his technical knowledge in environmental sciences and ecosystems resilience, his main contribution to the project will be his knowhow and experience in financial and commercial management to be applied to LANDMARC new business model and the market approach. His understanding of the commercial and marketing aspects of the market of environmental engineering and services will be a valuable support for the market study and also for stakeholders engagement, working with farmers and forester and transferring new land use management approach since an economic perspective.

Relevant publications

- Julián Fuentes, Federico; Schnabel, Susana; Vázquez Pardo, Francisco; Cienfuegos Caldera, Benigno; Vicente Parra, Raquel. *Gescuencas. Assessment system for natural resources integral management in watersheds. Case study in Tietar river basin in La Vera (Spain).* ISBN 978-84-617-4044-4 Badajoz 2016.
- de Hoces Rodríguez, Ana ª. *Analysis of runoff and erosion generated in an olive grove.* PhD Thesis. 2011. University of Córdoba.
- Julián Fuentes, Federico. *Geographic Information Technologies in spatial analysis. G.I.S. application to river restoration. River environmental integration in the city of Cabra (Spain).* Ana Nieto Masot. (Ed) Universidad de Extremadura. ISBN 978-84-617-6760-1 Cáceres 2016.
- Julián Fuentes, Federico; Martínez Bautista, María; Martín Fuentes, Roberto; Pineda Vadillo Javier. *Social perception for decision making in natural resources management.* II International Congress of Territorial Planning and Environmental Management. 2017 Cáceres (Spain).
- Julián Fuentes, Federico; Carbajal Tradacete, Javier; Poyato Salamanca, Rafael. *Watershed management for fighting against erosion and drought in olive groves in Andalusia*. VI Iberoamerican Erosion Control Congress. VI CICES 2012. Granada (Spain).

Relevant projects or activities

- **GESCUENCAS R&D Project. Natural Resources Integral Management Evaluation System in Watersheds. 104000 hectares. Budget 851.015,72 €. 2018 EU Seal of Excellence. (2014-2018).**
  - **Concept**. Gescuencas is based on the conceptual development of a system for assessing the environmental quality of rural hydrological basins based on environmental indicators and socioeconomic determinants, based on a hydrological model on the one hand, and on G.I.S. on the other. Regional and national public entities, and international organisms, in charge of the environmental protection of river basins, generally known as river Basin Authorities, need for an integrated and efficient tool to assist the decision making process in regards to their actuations. Floods, droughts, forest fires, and other types of hazards are the results of inefficient river management generating growing social concern about climate change and substantial economic losses. Gescuencas is an innovative solution which integrates smart technologies for the protection of the natural environment of rivers. The result is a software platform interpretation tool that integrates all the relevant environmental, economic and social aspects that need to be considered. The integration of smart technologies for the efficient field data collection and interpretation further reduces the costs of data acquisition and monitoring. Today, after 0.9 M€ R&D investment, a prototype of the Gescuencas platform has already been tested successfully. Results of the pilots have been published raising wide interest among river Basin Authorities and other Environmental Authorities worldwide.
  - **Objectives.** Develop a research focused on creating an environmental assessment system that is a useful technique for the integral management of natural resources at watershed scale and close to the market.

- **PRATECO R&D Project. Investigation of new techniques for grassland´s seeds production, harvesting and management. Budget: 612.890,80 €. (2014-2016).**
  - **Concept**. Traditionally, the world market for leguminous pastures has been supplied with seeds produced mainly in Australia. These species have been the basis of many pasture improvement programs in the Mediterranean Climate zones spread throughout the world with very favorable results. In the last years, the lack of a technological renewal of the system of harvesting in these species, has caused that they lose force in the market, due to the environmental problems that their collection generates.
  - **Objectives.** Developing an integral process for grasslands leguminous seeds harvesting management, mechanization and optimization for their multiplication, as well as the investigation of the species suitable for this, in order to optimize technically and economically the production of grass leguminous species, with the objective of regeneration of grasslands and alimentary contribution of the different livestock huts, so that the result is motor for the rural economy of the region. The secondary objective of the project is the detailed design and construction of a seed harvester of conventional plants that enables the production of certified weed-free seed with minimal damage to the plant.

- **Ecosystem restoration and forestry in Iberian "dehesas". Budget: 425.900,00 €. (2013-2016).**

- **Concept**. Dehesa is an agro-ecosystem of great ecological value in Western Iberian Peninsula, because of the high biodiversity that it has and its environmental, economic and social importance. The excessive and intensive use on dehesas, climate change, and a poor phytosanitary status of many of them, has prevented the natural regeneration of their trees, decreasing the number of trees to an insufficient amount for the perpetuation of the system to long term. For these reasons, the governments of the western regions of Spain, through co-financing with European Union funds, are developing the improvement of this ecosystem investing in dehesas restoration, conservation and climate change adaptation.
- **Objectives.** Dehesa ecosystems management, restoration and conservation with different ecological techniques such as planning, monitoring, engineering, forestry, planting young individual trees or rural infrastructures improvement.

- **EVARHIS R&D Project. Opportunity cost modelling and using ecosystem resilience and services for hydrological forest risk assessment. Budget 298.255,65 €. 2018-2019.**
  - **Concept**. EVARHIS is the design and validation of a new technological tool for harnessing the resilience of ecosystems and economic valuation of their services to society. It is based on the concept that a territory which maintains a large proportion of its occupied land uses ecosystem in its optimum state is more resilient and have greater responsiveness to risks of forest hydrological disasters. EVARHIS specifically focuses in the risks of forest fires, floods, erosion and desertification. The added value of this approach may impact on ecological aspects, without forgetting social, economic and cultural values of the populations in the territories defined by the basin, understood as a unit of environmental and economic management. EVARHIS provides a conceptual development and relies on multidisciplinary research with a pilot line in the basin of the Rivera de Acebo, North of Extremadura (Spain), in Sierra de Gata. EVARHIS also moving towards new technologies that rely on hydrological, mathematical, financial and cartographic models.
  - **Objectives.** EVARHIS aims to integrate several areas of knowledge and bring existing problems in the territory related to the probability of occurrence of forest hydrological risks, the economic values associated with ecosystems, and its ability to address these risks. For this we have chosen the watershed as a unit of territorial management. There are worrying data on the increase in recent decades, intensity and frequency of occurrence of natural disasters in areas scattered throughout the world. The owners of affected residential and agricultural areas, face enormous damage caused by these disasters. Therefore, the economy becomes increasingly important when assessing these damages and cover again. On the other hand, it is known that environmental quality and ecosystem services in a given area have a great influence on the amount of damage after a natural disaster and the probability of occurrence of these. EVARHIS wants to go one step further and take advantage of information organized in the territory on its natural resources, to advance variables and economic, social, legal, cultural tools as well as the prevention or probability of risk of hydrological natural disasters forest, and evaluate and assess resilience and responsiveness to these phenomena by land ecosystems.

- **Technical Assistance for Supporting Management and Conservation of Tajo International Natural Park. Budget 86.064,25 €. (2012-2014).**
  - **Concept**. Tajo International Natural Park was declared in 2006 with the purpose of protecting and conserving their ecosystems and natural values. The protection, use and management of Tajo International Natural Park is established in *Law 8/1998, of June 26, on the conservation of nature and natural spaces of Extremadura*, as amended by *Law 9/2006, of December 23*, in the Natural Resources Management Plan of Tajo International Natural Park and in the other planning instruments and norms that they develop in application of the provisions of said law. Tajo International Natural Park has an area of approximately 25.088 hectares.
  - **Objectives.** Engineering, consulting and services to support management and conservation tasks for the sustainable development of the Tajo International Natural Park.

Description of significant infrastructure:

- Two (2) offices and facilities in the Southwest of Spain as work centres and for the holding of follow-up meetings of the project.

- All-terrain vehicles. Agriculture and forestry machinery.
- Technological equipment: printers, photocopiers, scanners, photography and video cameras, field measuring equipment for surveying, office supplies, computers, mobiles and tablets, binoculars, etc.
- Software technologies, including sub-centimetre precision GPS, in situ monitoring technologies, specialized software licenses for geo-referenced database management, hydrological modelling, CAD design, text processing, spreadsheets, G.I.S., budget programs, etc.

Participant No. 4: Agroinsider (AI), Portugal

Description of the participant

AgroInsider (www.agroinsider.com) is a "**seal of excellence**" (EU-H2020) spinoff from the University of Évora (Portugal) and it was founded in 2015 in order to provide large-scale Precision Agriculture services available to all farmers, agronomists and companies, with accessible pricing ranges differentiated by scale and specific needs of each farming operation. With a long experience in the field of Precision Agriculture and Agro-business, rooted in more than **15 years of Academic research and proprietary crop data models**, Agroinsider powers the Earth Observation data obtained by Copernicus Sentinel Satellites, namely Sentinel 1 (S1) and Sentinel 2 (S2). Making use of big data, proprietary algorithms and data models, Agroinsider is able to provide decision support tailor-made reports to farmers and different type of stakeholders, which have the following benefits:

- Soil smart sampling and soil quality studies: smart soil nutrition – S1
- Monitoring and Inspection of parcels: reduction of operational risks – S1 & S2
- Soil-Plant-Water processes optimization: reducing waste and maximizing output – S1 & S2
- Spatial and temporal spectral biodiversity analysis: spatial and time structures of land occupation – S1 & S2
- Biomass and yield forecasts and carbon inventories: decision support – S1 & S2

Agroinsider have identified that satellite optical data, currently being used by the best PA companies around the world, is not enough to obtain the best results. Agroinsider in the last 4 years developed proprietary AgroRadar algorithms that process Copernicus EO Synthetic Aperture Radar (SAR) data (Sentinel 1A and 1B), which has the advantage, when compared to other remote sensing technologies, to be available in good and bad weather conditions, giving us the ability to obtain more precise and detailed agronomic information in cloudy geographies where normally agriculture and biomass production (forest) has a great importance.

Legal entity: SME

Role of partner in the project:

In LANDMARC activities Agroinsider will play an important role in providing:

- EO data for monitoring and inspect LMTs.
- Development of a Carbon tool in order to promote carbon markets services.
- Development of a Biodiversity tool in order to promote environmental data services.

Involved Personnel

Prof. José Rafael Marques da Silva (male) is partner of Agroinsider, and is Prof. of Geomatics and Precision Agriculture at the University of Évora (Portugal). He has a vast experience in Precision Agriculture technologies: i) agriculture inputs optimization; and ii) biomass and yield estimation, considering the usage of optical and radar remote sensors. He is listed as an author of more than sixty publications. He has a long-term experience in lecturing, research and coordination. Aside of his academic work, he promotes technology transference promoting startups and developing projects with company's in the Agro-Tech World.

Eng. Francisco Marques (male) is graduated in Agronomy and has a master degree in Agronomical Engineering. He has experience in working with Precision Agriculture processes mainly with remote sensors and soil geoelectric sensors. Regularly develop studies on soil fertility and plant nutrition, crop development evaluation, water stress patterns, yield estimates, biomass estimates, soil and plant smart sampling and soil and plant studies using remote sensors.

Eng. Luis Paixão (male) is graduated in Natural Biophysics Engineering – Environmental Management and Planning and has a Master degree in Geographical Information Science and Systems. He has a large experience in Land Occupation Cartography, Agro-Forest management, Fuel Management, National Forest Inventories. Currently develops research in remote sensing with applications to Precision Agriculture, namely in crop monitoring and inspection, plagues and diseases and soil-water-plant interactions. Knowledge in Python and R scripting aiming at GIS and statistical batch data processing.
Eng. **Filipe Vieira** (male) is graduated in Informatics Engineering and has a master degree on Computer Science. He has a vast experience has a software architect and developer, web fullstack, webgis systems expert, web servers, mobile applications, desktop applications, and databases.

Relevant publications

- SERRANO, JOÃO; SHAHIDIAN, SHAKIB; MARQUES DA SILVA, JOSÉ R. (2019); Evaluation of Normalized Difference Water Index as a Tool for Monitoring Pasture Seasonal and Inter-Annual Variability in a Mediterranean Agro-Silvo-Pastoral System. Water 11(1):62; doi:10.3390/w11010062
- SERRANO, JOÃO; SHAHIDIAN, SHAKIB; MARQUES DA SILVA, JOSÉ R. (2018); Monitoring Seasonal Pasture Quality Degradation in the Mediterranean Montado Ecosystem: Proximal versus Remote Sensing. Water 10(10): 1422; doi:10.3390/w10101422
- MACEDO, FABRÍCIO L.; SOUSA, ADÉLIA M. O.; GONÇALVES, ANA CRISTINA; MARQUES da SILVA, JOSÉ R.; MESQUITA, PAULO A. & RODRIGUES, RICARDO A. F. (2018). Above-ground biomass estimation for Quercus rotundifolia using vegetation indices derived from high spatial resolution satellite images. European Journal of Remote Sensing VOL. 51(1): 932–944.
- CICORE, PABLO; SERRANO, JOÃO; SHAHIDIAN, SHAKIB; SOUSA, ADELIA; COSTA, JOSÉ L.; MARQUES DA SILVA, JOSÉ R. (2016). Assessment of the spatial variability in Tall wheatgrass forage using LANDSAT 8 satellite imagery to delineate potential management zones". Environmental Monitoring and Assessment 188(9): 1-11.
- SERRANO, J., SHAHIDIAN, S., MARQUES DA SILVA, JOSÉ R., CARVALHO, M. (2016). Monitoring of soil organic carbon over ten years in a Mediterranean silvo-pastoral system: potential evaluation for differential management. Precision Agriculture. (DOI: 10.1007/s11119-015-9419-4).

Relevant projects or activities

- "**AGREE** - Agriculture and Energy Efficiency", Ref. 289139; KBBE.2011.4-04. Financed by European Commission under the 7th Framework Program, AGREE had the objective of showing the potential of short term energy efficiency gains and their long term impact. Environmental effects of savings on direct and indirect energy use in agriculture was integrally considered, as energy use efficiency also implies reduction of greenhouse gas emissions. Because energy savings in agriculture depend highly on the agri-environment (climate), AGREE considered south-eastern, south-western, north-eastern and north-western European agro-production systems (Finland, Germany, Greece, the Netherlands, Poland and Portugal). Evidence from energy saving potential and corresponding environmental and economical effects on country level were brought to the transnational level to identify an agenda for transnational research and educational collaboration to increase the learning curve on energy use efficiency in agriculture.
- "**ENERGY.2009.5.2.2** - Collaborative project - Integrated infrastructure for CO2 transport and storage in the west MEdiTerranean – with the objective to study the techno-economic feasibility of integrating carbon transport and storage infrastructures in the West Mediterranean (Portugal, Spain and Morocco)", 2009-2012.
- "**GAISAT** - Smart agriculture based on satellite imagery (Task 2.1.3). INNOACE, "Open and Smart Innovation in EUROACE", 0049_INNOACE_4_E.", 2017-2019. The Sentinel 1 and 2, Copernicus satellites, are being used in this project in order to understand their value for managing agriculture and natural environment assets.
- "**CARTS** - Canopy Adjusted Real Time Spraying – Precision Viticulture. Financed by Portugal 2020", 2015-2017. Sprayer development considering differential spraying adjusted to canopy volume.
- "**THINKING WINES** - The use of spectral proximal sensors in the improvement of vineyard production processes. Financed by the Portuguese regional research Program (PRODER 46106)", 2012-2014. The

use of proximal and remote sensors in monitoring and inspect biomass and crop vigor with the objective in optimizing crop input factors.

Relevant infrastructure

AGROMAP it's a powerful software and infrastructure, developed by the Agroinsider company, that develops automatically the following tasks:

- Upload any geographic unit that exists interest in monitor and inspect around the world;
- Automatically AGROMAP will look for all Sentinel 1 and Sentinel 2 images that intersect the geographic units uploaded previously and will process it in order to obtain: a) a clorophile index; b) a water content in leaves index; c) a soil quality index; and d) a canopy density index;
- Automatically will cut the images in order to store only the area of interest;
- Automatically will calculate, for each index, all the descriptive and spatial statistics associated to it;
- Automatically will create 2 and 3 clusters for each geographic unit and for each index in observation and automatically will select smart sampling points taking in consideration the differences on spectral signatures;
- In any browser and with a smart phone connected to the internet, all the registered users can follow in the field: a) the satellite indexes values; b) the different clusters (2 or 3); and c) the suggested sampling points.
- The user can register specific coordinates where he took some samples in the field (soil, plants, fruits, water…) and at the same time can take some georeferenced photos and voice comments about any phenomenon that he wants to register in the database.

The AGROMAP tool is a powerful tool because: i) can detect a lot of soil-water-plants anomalies in agriculture parcels; ii) can divide parcels or different geographic units in different management zones; iii) can produce and develop smart sampling strategies; iv) can forecast yield considering benchmark curves for each crop type; v) can forecast biomass/carbon considering benchmark curves for each soil occupation; vi) can calculate the spatial structure of any region being observed and with this calculate different spectral bio-diversity indexes; vii) can detect changes in land occupation; viii) can record events in the field, etc.

Participant No. 5: Barcelona Supercomputing Center, Spain

Partner description:

The Barcelona Supercomputing Center-Centro Nacional de Supercomputación (BSC, https://www.bsc.es) combines unique high performance computing facilities and in-house top research departments on Computer, Life, and Earth sciences, and in computational applications in science and engineering. It is the main provider of public supercomputing services in Spain, coordinating the Red Española de Supercomputación and representing Spain in international initiatives such as PRACE (http://www.prace-ri.eu/). The Earth Sciences (ES) Department focuses on the atmosphere-ocean-biosphere system and is structured around four groups with more than 100 researchers and support staff. It is a highly productive scientific entity that has published more than 220 research peer-reviewed articles over the last 5 years, many in high-impact journals.

Within the ES Department, the Climate Prediction Group (CPG) aims at developing a climate forecast system based on the Earth System Model EC-Earth. The CPG also performs regular assessments of the system's predictive capacity and compares it with other operational and quasi-operational systems in the world. The CPG has a long experience in seasonal to decadal climate prediction, which has been reflected in its active participation to several European projects with a strong component on climate prediction (see a list below). Of particular importance for the group was the FP7 project SPECS, led by the BSC, in which specific, innovative global forecast system experiments were coordinated to test hypotheses for the improvement of seasonal to decadal predictions. The CPG currently participates in 10 European and 7 national projects, of which the H2020 project CCiCC is of particular relevance to this proposal as it focuses on predictions of the global carbon cycle. The group has been expanding its research activities on climate and carbon cycle prediction, and contributed to the development of the CMIP6 version of EC-Earth, and is now strongly contributing to the CMIP6 simulations provided by the EC-Earth consortium. The group coordinates EC-Earth's contribution to

DCPP (Decadal Climate Prediction Project) and OMIP (Ocean Model Intercomparison Project) and is one of two groups supporting EC-Earth's participation to C4MIP (Coupled Climate-Carbon Cycle Model Intercomparison Project). In addition, members of the group are currently testing several techniques to produce optimal initial conditions for decadal predictions of climate and global carbon cycle.

Legal entity: Public body/Research Organization

Role in the project:
In the LANDMARC project, BSC will be primarily responsible for providing fully coupled climate simulations including all earth system components to assess the efficacy of LMT implementations (in WP7), and for assessing climate-related sensitivities and risks that may harm the LMT implementations in a changing climate (in WP4).

Involved personnel:
Dr. Markus Donat (male): is co-leader of the Climate Prediction group at the BSC, and an internationally recognised expert in studying climate extremes and climate variability, mechanisms driving or amplifying extremes, and climate model evaluation focussing on their fidelity to simulate climate extremes. Markus has published more than 70 peer-reviewed journal articles since 2010, nine of these in *Nature*-family journals, and has contributed to the IPCC 5th Assessment Report. His work has been cited 4,300 / 3,216 times (according to Google Scholar / Scopus as of 22nd August 2019), and he has an h-index of 30 / 29 (Google Scholar / Scopus). Markus is Associated Investigator with the Australian Research Council Centre of Excellence for Climate Extremes, and Associated expert with the World Meteorological Organization (WMO) Commission of Climatology (CCl) Expert Team on Data Development and Stewardship. Based on his achievements he has been awarded the World Climate Research Program (WCRP) / Global Climate Observing System (GCOS) International Data Prize 2017. Dr Markus Donat will be the Principal Investigator and the main contact person for the LANDMARC project at BSC.

Dr. Pablo Ortega (male): has a PhD in physics from the Universidad Complutense de Madrid (Spain) and accumulated six years of postdoctoral experience in several European research centres: LSCE (France), LOCEAN (France) and University of Reading (UK). He co-leads the climate Prediction Group of the BSC since September 2017. He has a broad expertise in decadal climate variability and predictability in the North Atlantic region, with a particular focus on the role of the Atlantic Meridional Overturning Circulation and its driving mechanisms. His research activities include the development of new ocean initialization strategies, the realization and analysis of perfect model experiments, and the investigation of physical mechanisms and climate impacts through the development of process-based studies. He currently supervises the work of 8 postdocs and 2 PhD students and leads the BSC activities in three Horizon 2020 projects (APPLICATE-727862 as workpackage leader; INTAROS-727890 and TRIATLAS-817578), a Belgian project (PARAMOUR-EOS-30454083) and an ESA contract (CMUG-3-TECHPROP).

Dr. Raffaele Bernardello (male): has a PhD in Oceanography from the Universitat Politecnica de Catalunya-BarcelonaTech. He is a senior researcher in the climate prediction group at BSC where he coordinates all the activities related to the global carbon cycle. His expertise and research interests are in the broad context of the interactions between climate dynamics and global carbon cycle. As part of his Marie Skłodowska-Curie fellowship, Dr. Bernardello worked on the assessment of the decadal predictability of biogeochemical properties in the upwelling systems of the Atlantic Ocean. He has participated to three national projects (Spain: OAMMS-CTM2008-03983; UK: BATMAN-NE/K015613/1; USA: NOAA-NA10OAR4320092), one FP6 project (SESAME-36949) and one ESA project (ENVISAT-A0290). At present, Dr. Bernardello supervises two postdoctoral researchers, one PhD student and one Msc. student. Dr. Bernardello is the PI of a Spanish project (DeCUSO-CGL2017-84493-R) dedicated at investigating the decadal predictability of carbon uptake in the Southern Ocean, serving at the same time as PI for BSC in the H2020 project CCiCC (H2020-LC-CLA-821003) focused on predictability of atmospheric CO2 in support of the Paris Agreement, and participates in the TRIATLAS project (H2020-BG-2018-817578) on marine biogeochemistry predictability. As an external collaborator, Dr Bernardello is involved in the UK project CUSTARD with focus on Southern Ocean biogeochemical processes.

Dr. Etienne Tourigny (male): has a PhD in Meteorology from the Instituto Nacional de Pesquisas Espaciais (INPE-CPTEC, Brasil) and a M.Sc. in Atmospheric Science from the Université du Québec à Montréal (UQAM). Dr. Tourigny has a strong multi-disciplinary background, having studied physics, computer science, atmospheric science and biosphere-atmosphere interactions. He has professional experience in the Information Technology sector, before transitioning to the climate research field where he developed his expertise in the field of climate seasonal prediction, having studied the impacts of ENSO on precipitation anomalies in the tropical Americas. He contributed to the development of the Brazilian Earth System Model (BESM) at INPE – CCST acquiring in the process a very strong expertise in vegetation and fire modelling as well as in high-performance computing. After joining the climate prediction group at BSC, he obtained a Marie Skłodowska-Curie fellowship. Dr. Tourigny is developing a new research line on seasonal to decadal predictions of wildfires while, at the same time, actively contributing to the development of the CMIP6 version of the EC-Earth ESM.

ICREA Research Prof. Francisco J. Doblas-Reyes (male): is the Director of the Earth Science Department at BSC. Prof. Doblas-Reyes has more than 20 years of experience in weather and climate modelling, climate prediction, as well as in the development of climate services. He has worked at several internationally-recognized institutions like INTA (Spain), CNRM (France), ECMWF (UK) and IC3 (Spain). At ECMWF, he worked on seasonal climate forecasting in two ground-breaking European projects: FP5 DEMETER (00024) and FP6 ENSEMBLES (505539). For his work in seasonal forecasting Prof Doblas-Reyes was awarded the Norbert Gerbier-MUMM International Award from the UN World Meteorological Organization (WMO) in 2006. He serves in several panels of the World Climate Research Programme (WCRP) and the World Weather Research Programme (WWRP), he is a lead author of the IPCC and a member of the European Network for Earth System modelling HPC Task Force. Moreover, Prof. Doblas-Reyes has either led or participated in numerous national and European FP4, FP5, FP6 and FP7 projects, including the coordination of FP7 project SPECS (308378). Currently, Prof. Doblas-Reyes is the principal investigator or co-investigator in five Horizon 2020 European projects (including PRIMAVERA-641727), one national project (CLINSA-CGL2017-85791-R) and he is leading a Copernicus action (C3S_512). At the same time, he supervises numerous postdoctoral scientists and software engineers and has obtained 50 Million hours of computing time for the High Resolution Ensemble Climate Modelling project through the PRACE network. Overall, Prof. Doblas-Reyes has authored and co-authored more than 100 peer-reviewed papers on climate modelling and prediction, as well as climate services, and currently has a total of 13011 citations with a h-index of 52.

Relevant publications to the call content:

- Seneviratne, S. I., M. G. Donat, A. J. Pitman, R. Knutti, R. L. Wilby (2016), Allowable CO2 emissions based on regional and impact-related climate targets, Nature, 529, 477–483, doi:10.1038/nature16542
- Donat, M. G., A. L. Lowry, L. V. Alexander, P. A. O'Gorman, N. Maher (2016), More extreme precipitation in the world's dry and wet regions, Nature Climate Change, 6, 508–513, doi:10.1038/nclimate2941
- Avila, F. B., A. J. Pitman, M. G. Donat, L. V. Alexander, and G. Abramowitz (2012), Climate model simulated changes in temperature extremes due to land cover change, J. Geophys. Res., 117, D04108, doi:10.1029/2011JD016382
- Rezende, L. F. C., B. C. Arenque, S. T. Aidar, M. S. B. Moura, C. Von Randow, E. Tourigny, R. S. C. Menezes, and J. P. H. B. Ometto (2015) Evolution and challenges of dynamic global vegetation models for some aspects of plant physiology and elevated atmospheric CO2. International Journal of Biometeorology, 1-11. doi: 10.1007/s00484-015-1087-6
- Bernardello, R., I. Marinov, J. Palter, J. Sarmiento, E. Galbraith, and R. Slater (2014), Response of the ocean natural carbon storage to projected twenty-first-century climate change, J. Clim., 27, 2033–2053, doi:10.1175/JCLI-D-13-00343.1.

Relevant previous projects or activities, connected to the subject of this proposal:

- CCiCC (H2020-LC-CLA-821003)
  Climate-Carbon Interactions in the Coming Century.
- PRIMAVERA (H2020-SC5-01-2014-641727) https://www.primavera-h2020.eu/
  PRocess-based climate sIMulation: AdVances in high-resolution modelling and European climate Risk Assessment.
- EUCP (H2020-SC5-2016-2017-776613) https://www.eucp-project.eu/

European climate prediction system.

- SPFireSD (H2020-MSCA-IF-2016-748750) Seasonal Prediction of Fire danger using Statistical and Dynamical models.
- DeCUSO (MINECO-Retos-CGL2017-84493-R) Decadal predictions of Carbon Uptake in the Southern Ocean and impact of the biological carbon pump uncertainty.

Description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work:

BSC is a key element of and coordinates the Spanish Supercomputing Network, which is the main framework for granting competitive HPC time to Spanish research institutions. Furthermore, BSC is one of six hosting nodes in France, Germany, Italy and Spain that form the core of the Partnership for Advanced Computing in Europe (PRACE) network. PRACE provides competitive computing time on world-class supercomputers to researchers in the 25 European member countries.

BSC operates MareNostrum, the most powerful supercomputer in Spain since its inception In March 2004. The latest version, MareNostrum 4 (since July 2017) has a performance capacity of 13,7 Petaflop/s and is composed of two distinct parts. The general-purpose element, provided by Lenovo, has 48 racks with more than 3,400 nodes with next generation Intel Xeon processors and a central memory of 390 Terabytes. Its peak power is over 11 Petaflop/s, i.e. it is able to perform more than 11,000 trillion operations per second, ten times more than MareNostrum 3 despite costing only a 30% increase in energy consumption. The second element of MareNostrum 4 is formed of clusters of three different technologies that will be added and updated as they become available. These are technologies currently being developed in the USA and Japan to accelerate the arrival of the new generation of pre-exascale supercomputers. MareNostrum 4 will have a disk storage capacity exceeding 10 Petabytes and will be connected to the Big Data infrastructures of BSC, which have a total capacity of 24.6 Petabytes. BSC has also other cutting-edge computing infrastructure based on latest available technology like FPGA boards, small clusters based on ARM SoCs, GPUs, etc.

Participant No. 6: eLEAF B.V., Netherlands

Partner description: Established in 2000, eLEAF is a Dutch research focussed SME that provides satellite-based services to monitor biomass production and associated water use at different levels of detail. At the core of eLEAF's technology is the Energy Balance Model. eLEAF has developed and operationalised the ETLook algorithm that solves the energy balance at the earth surface using satellite derived inputs. The outputs generated by ETLook include time series of biomass production (related to NPP), crop water consumption, crop water stress, water productivity and so on. Assessments range from field scale up to continental monitoring and provide good insight in the temporal and spatial variability of vegetation growth and biomass production. eLEAF provides quantified data that is accurate and based on state-of-the-art satellite technology.

eLEAF staff comprise a versatile team of individuals of different nationalities, with MSc or PhD degrees in areas such as remote sensing and data informatics, agricultural production, biomass production monitoring, environmental sciences, agronomy, forestry, nature conservation, hydrology and water management. eLEAF's data scientists are well versed with the latest technologies and have in-depth knowledge of remote sensing covering multiple fields of expertise: surface energy balance modelling, vegetation characteristics and biomass production mapping, land cover classification and operational delivery of evapotranspiration parameters. eLEAF works with all kind of sensors, including VNIR, TIR and microwave (radar), and ranging in spatial resolution from > 10km to < 1m (RPAS). A strong emphasis lies in bringing technology a step further, from data to application. As a result eLEAF has a wide-ranging experience in translating satellite-based data into actionable applications to support governments, as well as public institutions and agribusinesses, in their decision-making processes.

Legal entity: SME

Role in the project:

eLEAF, with its expertise in using remote sensing to estimate biomass production and carbon uptake by vegetation at different scales and timeframes, will play its major role in WP3. In WP3 we will further develop our algorithms to monitor carbon uptake by vegetation and better understand the carbon fixing for various land use classes, to estimate the potential of LMTs as net carbon sinks, and to develop a method to monitor carbon fixation operationally. eLEAF will use Eddy Covariance data from local scientists (South Africa case study) to calibrate and validate the ETLook algorithm.Furthermore eLEAF leads the Burkina Faso case study that focusses on LMT activities supported by the World Bank that will include stakeholder engagement activities (WP2), qualitative assessments of LMT solutions (WP5) and regional engagement for global impact with the World Bank and others (WP6).

Involved personnel:
Karin Viergever, MSc, PhD (female) holds two MSc degrees (Geo-information Science from Wageningen University and Rural and Regional Resource Planning from the University of Aberdeen). She obtained a PhD from the University of Edinburgh on estimating savanna woodland biomass by using radar backscatter and interferometry. Karin is a remote sensing and geo-information specialist with 17 years of experience in projects focusing on the natural environment, land cover, forestry and agriculture. She has extensive experience collaborating in multinational multidisciplinary teams and has managed remote sensing-based mapping and data communication projects for a variety of commercial clients, government agencies and funding bodies.

Henk Pelgrum MSc, PhD (male). Henk is a data scientist with over 20 years of experience in the fields of visible/near-infrared and thermal infrared remote sensing. He obtained a PhD from Wageningen University in 1999 for his research on spatial aggregation of land surface characteristics - Impact of resolution of remote sensing data on land surface modelling. Henk was involved in developing the first operational surface energy balance model (SEBAL) and he is instrumental for the development and operationalisation of its successor ET-Look. He has participated in numerous projects mapping biomass production at different scale levels and in different countries. Henk works in eLEAF's Research unit, where he focuses on improving and developing eLEAF's algorithms.

Annemarie Klaasse MSc (female) is an experienced remote sensing specialist with 17 years of experience in the use of remote sensing data and algorithms for environmental applications, ranging from research studies and custom-made projects to operational services. She has a good understanding of the surface energy balance algorithms used to estimate biomass production and evapotranspiration from earth observation data. Internationally focused, Annemarie has been involved in projects worldwide on (agricultural) water management at scales ranging from single fields to river basins. She started her career in two EU projects on the mapping of forest fire severity and its impact on forest recovery using earth observation, and also was involved in the development of remote sensing products to improve the monitoring and assessment of wetlands.

Christos Sotiropoulos (MSc (male) is specialised in both optical and radar remote sensing. He has profound experience in analysing radar signal for the use of change detection applications, both for agricultural practices as well as forests. He has been involved in several forest mapping and monitoring projects where remote sensing was used to develop conservation plans, and has worked on satellite based deforestation detection.

Relevant publications to the call content:

- Burzykowska, A. Velasco, A. Klaasse, S. Huber, P. Geerders, R. Dost, A. Vrielink, E. Haas, R. de By and E. Aparacio (2018). How can Earth Observation support agricultural development in rural areas. In Nicklin, Sean and Ben Cornwell (compilers) A better world – Actions and commitments to the sustainable goals, goal 15: Life on Land. A Tudor Rose publication in partnership with UNCCD for the High-Level Political Forum (HLPF 2018) and beyond, pp. 18-23.
- Bastidas-Obando, E & Bastiaanssen, W.G.M. & Jarmain, Caren. (2017). Estimation of transpiration fluxes from rainfed and irrigated sugarcane in South Africa using a canopy resistance and crop coefficient model. Agricultural Water Management. 181. 94-107. 10.1016/j.agwat.2016.11.024.

- Singels, A, C. Jarmain, E. Bastidas-Obando, F.C. Olivier and A.L. Paraskevopoulos (2018). Monitoring water use efficiency of irrigated sugarcane production in Mpumalanga, South Africa, using SEBAL, Water SA Vol. 44 No. 4 October 2018, http://dx.doi.org/10.4314/wsa.v44i4.12
- Bastiaanssen, W.G.M. , M.J.M. Cheema, W.W. Immerzeel, I.J. Miltenburg and Henk Pelgrum (2012) Surface energy balance and actual evapotranspiration of the transboundary Indus Basin estimated from satellite measurements and the ETLook model, Water Resour. Res, 48, W11512, doi:10.1029/2011WR010482.
- Bastiaanssen, W.G.M. & Noordman, E.J.M. & Pelgrum, Henk & Davids, G & Thoreson, B.P. & Allen, Richard. (2005). SEBAL Model with Remotely Sensed Data to Improve Water-Resources Management under Actual Field Conditions. Journal of Irrigation and Drainage Engineering. 131. 85-93. 10.1061/(ASCE)0733-9437(2005)131:1(85).

Relevant previous projects or activities, connected to the subject of this proposal:

- The WaPOR programme, implemented by the FAO, assists countries in monitoring water productivity, identify water productivity gaps, and propose solutions to reduce these gaps, and contribute to a sustainable increase of agricultural production while taking into account ecosystems. eLEAF leads the FRAME consortium that provides the satellite based data to FAO's Water Productivity Portal. The datasets include decadal Net Primary Production (NPP in g/m2) and biomass production data (kg/ha) for the entire continent of Africa and the Middle East since 2009 to present. Data on biomass production is very relevant for the activities proposed under LANDMARC as it is closely related to the uptake of carbon in vegetation. Furthermore the activities under FRAME include detailed land cover (change) classifications and the monitoring of crop phenology. FAO WaPOR demonstrates the ability of eLEAF to operationally process and deliver data at continental scale: https://wapor.apps.fao.org/home/1
- Earth Observation for Sustainable Development (EO4SD) - Agriculture and Rural Development Cluster, ESA (2016-2019). eLEAF is consortium lead and EO service provider in this consortium that aims to increase the uptake of earth observation in the sustainable development community. Activities demonstrates how satellite derived information supports the assessment, planning and M&E of development efforts related to increasing agricultural productivity, improving irrigation performance and water management, and fostering land degradation neutrality: https://www.eo4idi.eu/
- FruitLook is an operational service that provides South African farmers with weekly updates on (biomass) growth and water consumption on their fields, using satellite remote sensing. The service has been running since 2011 with support of the department of agriculture. FruitLook demonstrates eLEAF's ability to monitor biomass production and other crop indicators at field level, providing accurate production numbers at a spatial resolution of 20m.

Description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work:

The core of eLEAF's technology is called Pixel Intelligence Mapping (PiMapping®). It generates detailed time series of among others biomass production, water consumption, stress and productivity. PiMapping® technology is used for field scale assessments up to continental monitoring. Elements of the eLEAF's PiMapping® technology used for Landmarc include:

- Download and pre-processing of Sentinel-2, Landsat, MSG, VIIRS and MODIS imagery for the study area
- Creation of ETLook inputs such as NDVI, albedo, land surface temperature and meteorological parameters
- Run the energy balance algorithm ETLook to estimate actual evapotranspiration and biomass production
- Statistical analysis of the ETLook results and aggregation of information to geographic units (parcel, LMT area, etc)
- Delivery of the results in different formats (GeoTIFF raster format, pictures, time series, csv tables)

Participant No. 7: BioRecro A.B., Sweden

Partner description:

Biorecro AB, is a Swedish SME founded in 2007, which is developing, deploying and commercialising the BECCS technology (Bio-Energy with Carbon Capture and Storage also known as Bio-CCS).

Biorecro has an extensive network of cooperation including the Swedish government administrations, such as the Ministry of Finance, Agency for Growth (Tillväxtverket) and Agency for Innovation (Vinnova), as well as international organisations such as the International Energy Agency (IEA), the IEA Greenhouse Gas R&D Programme (IEAGHG), the United Nations Industrial Development Organization (UNIDO) and the Global Carbon Capture and Storage Institute. Biorecro also has a history of interaction with academic researchers (Stanford University, Oxford University, Université d'Orléans, Edinburgh University, Chalmers, Stockholm School of Economics and KTH Royal Institute of Technology) as well as independent experts and NGOs (The Natural Step, WWF). Moreover, Biorecro is a project advisor to the first BECCS plant in operation globally (Midwest Geological Sequestration Consortium in Illinois, US). Proving its good record, Biorecro has been awarded the title Climate Solver by the World Wide Fund for Nature WWF, and is one of the finalists in the $25M Virgin Earth Challenge, founded by Richard Branson and Al Gore.

Biorecro has a long standing experience in supporting private corporates and local authorities in climate action, mainly through greenhouse gas emission compensation by of negative emissions achieved by BECCS. Indeed, carbon dioxide removal (CDR) is the most promising way of valorising CO_2 from the point of view of the global fight against climate change.

Legal entity: SME

Role in the project:
Biorecro will primarily be involved in the dissemination and communication activities in WP 8. We will also support the desktop study of BECCS in WP 7.

Involved personnel:
Henrik Karlsson, (male) was born in Mölndal, Sweden, on January 8th 1979, and lives in Stockholm, Sweden. He holds a M.Sc. in Industrial Engineering and Management from the Royal Institute of Technology KTH (Sweden). He has held guest lectures at Stanford University, Oxford University, the Swedish Royal Institute of Technology KTH, University of Orléans, Edinburgh University, Stockholm School of Economics and University of São Paulo, as well as been an invited speaker at the Policy Exchange, Westminster, UK, the Royal Academy of Engineering, UK and Chatham House, UK. He was the lead author of the first overview of BECCS deployment in the report 'Global Status of BECCS Projects 2010' presented at UNFCCC COP-16 by the Australian government initiative Global CCS Institute, and of the report 'BECCS som klimatåtgärd' to the Swedish Agency for Growth. His work on BECCS has been cited by the Swedish Government (Bill 2011/12:125 "Geologisk lagring av koldioxid") and the Intergovernmental Panel on Climate Change (IPCC) in their 5th Assessment Report (WG III, Chapter 7 Energy, released in april 2014). He has been a guest columnist and expert commentator in The Economist, Bloomberg New Energy Finance, SVT Vetenskapens Värld, SVT Rapport, TV4, Sveriges Radio, Svenska Dagbladet, Metro and BBC News.

Nicole Michaelis, (female). Born 1991 in Germany but moved to the US as a baby. Native in both German and English, she now lives in Stockholm, Sweden. She holds a M.Sc in Marketing from Stockholm University (Sweden). She now specializes in scientific copywriting, communication and content strategy lead, social media communication management, CRM management, ads analytics, A/B testing etc.

Johanna Ek Wahlqvist (female), Born in 1979, 24th of July in Gothenburg where she still lives and works. She holds a M.Sc in Chemical Engineering and Energy systems from Chalmers University of Technology, Gothenburg Sweden. After five years as Regulatory affairs manager in the pulp and paper industry (BIM Kemi AB) she now specializes in climate mitigation and biodiversity concerns in public management and functions as assistant manager for Biorecro.

Relevant publications to the call content:

- 'Carbon capture and storage, bio-energy with carbon capture and storage, and the escape from the fossil-fuel lock-in' (PJ Vergragt, N Markusson, H Karlsson Global Environmental Change 21 (2), 282-292) - H. Karlsson et al (2010). Global Status of BECCS Projects, Global CCS Institute and Biorecro AB, Stockholm, Sweden.
- H. Karlsson et al (2010). BECCS som klimatåtgärd En rapport om koldioxidlagring från biomassa i ett svensk - norskt perspektiv, Biorecro AB, Stockholm, Sweden.
- Deployment of BECCS in basic industry – a Swedish case study. J. Rootzén, J. Kjärstad, F. Johnsson, H.Karlsson (2018).
- Immediate deployment opportunities for negative emissions with BECCS: a Swedish case study. H.Karlsson et al. (2018)

Relevant previous projects or activities, connected to the subject of this proposal:

- The Midwest Geological Sequestration Consortium (MGSC) large-scale BECCS demonstration project in Decatur, Illinois, US, which started injection in 2011 and is ongoing. The project has now successfully scaled up to a capacity of 1 million tonnes per year. Biorecro has mainly been focused on the commercialization aspects including business models, sustainability analysis local and global stakeholders involvement as well as knowledge sharing. MGSC is funded by the American Department of Energy.
- World Wide Fund for Nature (WWF) sustainability assessment of BECCS. Biorecro was the initiator and lead in collaboration with the environmental NGO WWF on an assessment of the sustainability and capacity of CCS in combination with biomass on a global scale. This effort was part of the WWF climate solver programme.
- Policy development and Business cases for Carbon Capture and Storage (PAMOKO) is an ongoing Swedish National research project funded by the national innovation agency, Vinnova and lead by the Chalmers University of Technology. The project explores how new policy and business models could be designed to enable the implementation and commercialization of CCS technologies in Sweden and develop innovative regulations, incentives and compensation models. The project includes both producers and end consumers with key stakeholders in a reference panel. Biorecro is mainly in charge of the study of the BECCS aspects.
- Carbon Valorisation in energy efficient green fuels (CONVERGE) is an ongoing EU-funded Horizon 2020 research project. The project explores five new technologies for an innovative value chain to produce green biodiesel. The innovative configuration will reduce the total number of unit operations needed to achieve the conversion of secondary biomass and waste streams into green biodiesel, while simultaneously producing additional intermediate green refinery products. The CONVERGE project will demonstrate an innovative process based on 5 new unit operations in the technology value chain, taking these from the discovery stage (TRL3) to development stage (TRL5).

Participant No. 8: University of Kassel, Germany

Partner description:

The University of Kassel was founded in 1971 with currently more than 25.000 students, about 300 full professors and about 3.000 scientific, technical and administrative staff. With 10 faculties and an attached arts university, UNI KASSEL covers the entire higher education range, including engineering social and natural sciences with a budget of 289 Mio €/year including more than 60 Mio € research budget by third parties in 2018.

The CESR is an interdisciplinary research centre at the University of Kassel. The Center is unique in its concentration on environmental research from the systems perspective. It is well known for its work on global and regional environmental modelling, scenario development and assessment, and for its studies of society-environment interactions. Main goal of the Center's research program is to improve understanding about the functioning of environmental systems, the underlying causes of environmental problems, and how society interacts with the natural environment. Its research aims to develop strategies to support sustainability and

avert future problems, and enable society to adapt to unavoidable systems changes. CESR also focus on teaching and training of junior staff.

The GRID-Land research group from CESR is participating in this project. The group pursues basic and applied research on the spatial-temporal dynamics of land-use systems. Research goals are to gain a better scientific understanding of the functioning of land-use systems under global change conditions, to assess impacts of land-use change on environmental processes and to contribute to the development of sustainable land management strategies. A strong focus lies on the development of spatially explicit computer models to simulate land-use change and its environmental impacts on the regional and global scale (e.g. the LandSHIFT model). For assessing potential future development trajectories ("forecasting") the group is also active in the construction of scenarios that combine qualitative and quantitative elements by integrating storylines and computer simulation, using the Story and Simulation Approach (SAS). Recent research projects are concerned with tipping point cascades in social- environmental systems in the Amazon with an emphasis on land-climate interactions (PRODIGY) as well as the sustainable use of natural resources and protection biodiversity on the global level in the light of a developing bio-economy (BEPASO, SYMOBIO). The projects are funded by the German Federal Ministry of Education and Research (BMBF).

Legal entity: University

Role of UNI Kassel in the project:
The UNI Kassel profile matches several aspects of the LANDMARC work plan. It will lead WP7 that comprises the the global modelling efforts. The main focus is on the coupling of a global land-use model with an Earth system model as well as on scenario analysis. UNI Kassel will also be involved in the model-based analysis of LMT implementations on the national scale in WP5 and in the development of regional LMT portfolios in WP 6.

Involved personnel:
Prof. Rüdiger Schaldach (male) leads the research group 'Global and Regional Dynamics' (GRID-Land) at CESR. His research concentrates on questions of land-use change and its environmental impacts as well as on the development of sustainable land management strategies. He has a strong background in information science, system modelling and spatial data analysis. He is the main developer of the LandSHIFT model that integrates environmental and socio-economic model components to simulate spatial and temporal land-use dynamics. He has been involved in the EU projects COMBINE and SCENES as well as PI in numerous research projects funded by German federal ministries and agencies (e.g. BMBF and BMU), among others GLOWA-Jordan, CARBIOCIAL, MEILENSTEINE-2030, BEPASO, SYMOBIO and PRODIGY.

Prof. Stefan Bringezu (male) is the Executive Director at CESR and professor for Sustainable Resource Management. He leads the Sustainable Resource Futures (SURF) group. He is biologist by training and holds a Ph.D. in ecosystems analysis. He worked on chemicals assessment, supply systems and environmental planning; lectured at several universities, initiated scientific networks, and pioneered on methods such as MFA (Material Flow Analysis) and derived indicators. He is member of the International Resource Panel (IRP) and various advisory boards. His main research subject is the multi-scale analysis of the socio-industrial metabolism and related land use, the indicators of sustainability and the implementation of the SDGs.

Dr. Benjamin Stuch (male) is a senior scientist at CESRs GRID research group. His research focuses on human-environmental interaction on global land surfaces including food security, land-use intensities, biodiversity, matter cycling and fluxes. He applies qualitative scenario development technologies and quantitative modelling approaches for scenario simulation and analysis based on the LandSHIFT and the LPJmL models. His research includes cross-scale (local to global) and cross-sector analysis of competing land/resource users. His research addresses sustainable development challenges (e.g. in achieving the SDGs) including trade-off and synergy analysis. He has contributed to scenario development and quantification processes in different international consortiums (e.g. FP7-CLIMSAVE project, CGIAR- CCAFS) and quantified land-use change scenarios for a set of policy workshops coordinated by UNEP-WCMC in East Africa, South-East Asia and South America.

Relevant publications to the call content:

- **Schaldach, R**., Alcamo, J., Koch J., Kölking, C., Lapola, D., Schüngel J., Priess, J. (2011). An integrated approach to modelling land-use change on continental and global scales. Environmental Modelling and Software 26, 1041-1051
- Alexander, P., Prestele, R., Verburg, P.H., … **Schaldach, R.** et al. (2017). Assessing uncertainties in land cover projections. Global Change Biology 23 (2), S. 767–781. DOI: 10.1111/gcb.13447.
- **Schaldach, R.**, Meurer, K.H.E., Jungkunst, H.F., Nendel, C., Lakes, T., Gollnow, F., Göpel, J., Boy, J., Guggenberger, G., Strey, R., Strey, S., Berger, T., Gerold, G., Schönenberg, R., Böhner, J., Schindewolf, M., Latynskij, E., Hampf, A., Parker, P.S. (2018). A model-based assessment of the environmental impact of land-use change across scales in Southern Amazonia. Regional Environmental Change 18(1), S. 161-173.
- van Soesbergen, A., Arnell, A.P., Sassen, M., **Stuch, B.**, **Schaldach, R.**, Göpel, J., Vervoort, J., Mason D'Croz, D., Islam, S., Palazzo, A. (2016). Exploring future agricultural development and biodiversity in Uganda, Rwanda and Burundi. A spatially explicit scenario-based assessment. Reg Environ Change 22 (2), S. 112. DOI: 10.1007/s10113-016-0983-6.
- Kok, K., Bärlund, I., Flörke, M., Holman, I., Gramberger, M., Sendzimir, J., **Stuch, B**., Zellmer, K. (2015). European participatory scenario development: strengthening the link between stories and models. Climatic Change 128 (3), S. 187–200. DOI: 10.1007/s10584-014-1143-y

Relevant previous projects or activities, connected to the subject of this proposal:
Members of the Uni Kassel team act(ed) as work package lead (WPL) and project coordinator within the following projects:
- BEPASO - Bio-economy Pathways and Societal Transformation Strategies. R. Schaldach (WPL), S. Bringezu (WPL). German Federal Ministry of Education and Research (BMBF). Funded for 450,000 Euro (total > 2 Mio. Euro), 2016-2019.
- Topic: Development of bio-economy scenarios for Germany; integrated modelling of global land-use change (focus on agriculture and forestry) and environmental impacts.
- CABIOCIAL - Carbon Sequestration, Biodiversity and Social Structures in Southern Amazonia: models and implementation of carbon-optimized land management strategies. R. Schaldach (WPL). BMBF. Funded for 320,000 Euro (total > 6 Mio. Euro), 2011-2016.
- Topic: Model-based analysis of land-use change and sustainable land management strategies in Southern Amazonia.
- PRODIGY - Process-based & Resilience-Oriented Management of Diversity Generates Sustainability. R. Schaldach (WPL). BMBF. Funded for 302,000 Euro, 2019 – 2022.
- Topic: Development and simulation of high resolution land-use scenarios for the western Amazon region (Bolivia, Peru, Brazil); feedbacks between land-use and climate change; exploration of potential tipping points of the regional social-environmental system.
- SYMOBIO - Systemic Monitoring and Modelling of the Bio-economy. BMBF. **S.** Bringezu (project coordination), R.Schaldach (WPL). Funded for 950,000 Euro (total > 3 Mio. Euro), 2017 - 2020.
- Topic: Conception and prototypic implementation of a sustainability monitoring system utilizing coupled simulation models; further development of global land and water footprint concepts.
- WANDEL – Water resources as important factors in the energy transition – conditions needed at the local and global level. R. Schaldach (co-coordination, WPL), S. Bringezu (WPL). BMBF. Funded for 440.000 Euro (total > 3 Mio. Euro), 2017 – 2020.
- Topic: Global land-use scenarios related to bio-energy development; further development of the water footprint concept.

Dissemination contacts:
- International Resource Panel (UN Environment). https://www.resourcepanel.org/
- Hessian Agency for Nature Conservation, Environment and Geology. https://www.hlnug.de/service/english.html
- Climate navigator web site (in German). Mission is to disseminate knowledge on climate science, mitigation options and regional climate adaptation initiatives to the general public. https://www.klimanavigator.eu/

Participant No. 9: Bioclear Earth, Netherlands

Partner description:
Bioclear earth is a Dutch Small Medium Enterprise (SME) innovation and consulting company established 30 years ago. Bioclear earth provides sustainable solutions based on natural, biological processes to its clients: governmental bodies and companies/industries. We are focussed on making the world cleaner, safer and more sustainable by using the power of nature. Using this power in an effective way is what drives our professionals and our solutions. We currently employ 32 highly skilled professionals including molecular and micro- biologists, soil experts, process engineers and environmental specialists. Bioclear earth is recognized as being a leading innovation and consulting company in the Netherlands and abroad in the field of in-situ and on-site soil and groundwater bioremediation, soil research and soil health. Bioclear earth has its own innovation and testing laboratory were we develop new and innovative techniques and high-end molecular screening analyses using RNA and DNA based q-PCR/v-PCR and Next Generation Sequencing (NGS) to provide insight in biological processes. Of our annual turnover approximately 20% is related to the development of new, innovative technologies. Over the past decades various innovations have been developed, introduced and applied by Bioclear earth in the field for its clients. Our molecular techniques can visualise the microbial soil community and allow us to investigate microbial processes, such as the bioremediation potential of soil.

Legal Entity: SME

Role of partner in the project:
Bioclear will mainly contribute to WP3 on earth observations work in the area of in-situ monitoring. Bioclear will lead and coordinate the activities on in-situ data collection and processing. In addition, Bioclear will coordinate the work on soil sampling to be done for all LANDMARC case studies and will perform soil biological analysis within their own lab facilities. Bioclear will also be a co-lead for the Dutch case study together with JIN and will furthermore will have a role in the calibration and validation of remote sensing data (based on in-situ data/observations), and will contribute to developing new earth observation business models.

Involved personnel:
Emiel Elferink (m)
"I want to contribute to a sustainable society by integrating relating issues and finding innovative multidisciplinary solutions."
Emiel Elferink is a Consultant biobased, sustainability and professor healthy soil and sustainable soil management at Van Hall Larenstein, University of applied sciences.
Since 2000 Emiel has been working on projects concerning sustainable soil, agriculture, food and biobased production. Following his graduation in Energy and Environmental science, he started working as PhD student at the University of Groningen. After obtaining his doctorate he worked for CLM research and advice. In 2014 he made the transfer to Bioclear earth. Emiel is known for his expert knowledge, his practical ingenuity and his talent to combine seemingly unrelated issues. Besides working for Bioclear earth, he is also professor sustainable soil management at Van Hall Larenstein, University of applied sciences.

Dr. E. (Elsemiek) Croese (BCE) (female) has a PhD in microbiology. She did her research in ecophysiology of microorganisms in electrolysis cells. Elsemiek is working at the department of Microbial Analysis of Bioclear, conducting molecular analysis in various working areas (soil and groundwater monitoring, biocorrosion, wastewater treatement plants, resource monitoring in circular economy). Elsemiek is senior researcher with background in molecular tools and responsible for implementation of these tools and further development within Bioclear.

Eline Keuning (female)

"My mission is to translate scientific knowledge into practical solutions that benefit a sustainable society."

Consultant biotechnology & innovation

After finishing a bachelor degree in Molecular Biology at the University of Groningen, Eline continued her studies at the faculty of chemistry. In 2017 she obtained a master's degree in Chemical Biology. During her internship at Bioclear earth she researched the application of bioaugmentation in fermentation processes. Furthermore, she conducted a feasibility study on the biological conversion of methane to methanol. Since she joined the team of Bioclear earth her main focus has been soil health and soil microbial communities.

Janneke Visser (female)

"Everything starts in the soil. I'm convinced that the solutions to climate problems are also based in the soil"

Specialist soil health and climate

Janneke studied biomedical sciences and obtained a master's degree in Medical and Pharmaceutical Drug Innovation (MPDI) at the University of Groningen. After finishing her master she worked at a pharmaceutical company and a company that produces microbiological reference material for the food and water industry. Although she found the lab work very interesting, she lacked the sustainability aspect in her work and therefore chose to switch careers. At our company she can further specialize on subjects that lie close to her heart as a farmer's daughter: soil health and climate. Janneke likes to really focus on a topic. It is her ambition to contribute to a more sustainable world by restoring and maintaining soil health with the help of science.

Publications:

- B. Geurkink, S.Doddema, H. De Vries, G.J.W. Euverink and E. Croese. Value of Next Generation Sequencing as monitoring tool for microbial corrosion: A practical case from bioprophyling to tailor made MMM analysis. NACE Corrosion 2016
- Levantesi C(1), Beimfohr C, Geurkink B, Rossetti S, Thelen K, Krooneman J, Snaidr
- J, van der Waarde J, Tandoi V**. Filamentous Alphaproteobacteria associated with bulking in industrial wastewater treatment plants**. Syst Appl Microbiol. 2004 Nov;27(6):716-27.
- Dar SA(1), Bijmans MF, Dinkla IJ, Geurkink B, Lens PN, Dopson M**. Population dynamics of a single-stage sulfidogenic bioreactor treating synthetic zinc-containing waste streams**. Microb Ecol. 2009 Oct;58(3):529-37. doi: 10.1007/s00248-009-9509-9.

Projects:

- **NORA- Marie Curie 2014-2016**

Acronym NORA (Nitrous Oxide Research Alliance training) (2014-2016)
Grant agreement no 316472
Call identifier FP7-PEOPLE-2012-ITN

The main scientific goal of this 2-year project was to map and understand how microbial communities in different types of WWTPs are involved in the N removal and what genetic potential they have to emit N_2O. Therefore, we used molecular analysis (e.g. qPCR and 'omics') to reveal the main abundant microorganisms and pathways related to the N cycle.

Wastewater treatment plants (WWTPs) produce lower N2O emissions when compared to agriculture, industry, fuel combustion and biomass burning (UNEP, 2013). Still, every well-planned city has at least one WWTP, which makes this system an important player on nitrogen (N) cycle.

- **Soil Health of Northern Dutch agricultural soils 2016-2020**

Bioclear earth is investigating the soil health in Dutch agricultural soils in the Northern part of the Netherlands. Here we developed several case studies to investigate the effect of land management on microbial populations and processes. We aim to link land management to the microbial processes in order to provide farmers with effective measures. This project is funded by the Provinces of Friesland, Groningen and Drenthe.

- **Resilient soil- POP3 2019-2022**

In this project Bioclear earth investigates the role of microbiology in soil in disease suppressive power of soils together with the Hilbrand Laboratorium (HLB). We are developing a database and a potential screening tool to test agricultural fields on their disease repressive qualities. The project involves several case studies with longterm monitoring (4 years). This project is funded by ELFPO.

- **Smart residues:** *Evaluating Compost and bio-based residues as methane mitigation strategy creating climate smart agricultural soils. "Putting microbes to work"* **2019-2023**

Bioclear earth is a contributing partner in this NWA research called Smart residues. Recent research by NIOO-KNAW has demonstrated that bio-based residues can turn soils into strong sinks of methane and even turn agricultural soils into net sinks of GHG. Smart residues aims at understanding the mechanisms of residue stimulated methane uptake and perform trials with a range of residues and mixtures to optimize this effect and to engineer residues and mode of application for optimal performance in agricultural practice. Microbial processes are monitored with molecular tools such as NGS and qPCR.

- **Towards a quick decision SUPPORT tool for SUstainable use of harvest RESidues (SURE SUPPORT) Be-Basic** 2014-2018

Bioclear earth is partner in this international public-private partnership project funded by BE-Basic. The general goal of the project is to deliver tools by which soils used for biomass production are managed in the most profitable and sustainable way. A general driver to achieve this goal is by optimal implementation of recycling of nutrients and OM in order to maintain soil ecosystem services. Below figure shows the work packages of the project. Complementary experiments with soils from The Netherlands, Brazil, Malaysia and Vietnam were carried out to study effects of crop residues in cropland soil. Effects of crop residues were investigated in relation to major ecosystem services a.o. prevention of GHG emission, production of pathogen and parasite-controlling volatile organic compounds, nutrient supply, soil microbial community composition and potential toxicological effects. In order to establish a 'normal operating range' for agricultural soil organic matter (OM) quality, effects of crop residue application are compared on different land use extensification gradients, where soil OM builds up naturally during land use transition from high input-output to low input-output arable fields.

- **Dynafilm- EU project 1998-2002**

Bioclear earth was the main coordinator of this EU project, which aimed to develop a molecular detection technique for the in-situ monitoring of bulking sludge bacteria in waste water treatment plants. This technique is called FISH, fluorescent in situ hybridization, and is the predecessor of current molecular techniques such as qPCR and DNA NGS. Our experience with these type of techniques and project date back to more than 20 years ago. The project resulted in the successful development of diagnostic tools for bacteria in bulking sludge.

Significant infrastructure and/or any major items of technical equipment, relevant to the proposed work:

Our in-home laboratory is fully equipped to perform molecular analysis such DNA and RNA sequencing (llumina), qPCR of selected genes/species or functional groups, such as methanotrophs. We have developed our own in-house software to perform DNA data analysis and we are continuously innovating our DNA/RNA analysis tools.

Our sample kits are easy to use and make it possible for a non-biologist to take the samples for analysis. The samples are conserved on site and can be shipped to our laboratory without the need of cooling.

Participant No. 10: Science Policy Research Unit (SPRU), University of Sussex (UOS), United Kingdom

Partner description: The University of Sussex (http://www.sussex.ac.uk) is a leading research-intensive university established in August 1961. Over 75% of research activity at Sussex is categorised as world leading or internationally excellent in terms of originality, significance and rigour. Sussex has an excellent international reputation and is ranked in the top 30 UK universities (The Guardian University Guide 2019 and The Complete University Guide 2019), and in the top 200 (161st) in the world (Times Higher Education World University Rankings 2019). In 2019 the QS World Rankings by Subject ranked six of Sussex's subject areas in the top 100 universities worldwide, including 1st in Development Studies.

The University has a dynamic and thriving research culture with strengths across the sciences, arts, social sciences and medicine with a focus on interdisciplinary research. It currently has over 17,000 students and 2,100 staff from all over the world including around 1,000 teaching and research staff, of which over 300 are research-only. It has had 3 Nobel Prize winners, 14 Fellows of the Royal Society, 12 Fellows of the British Academy and a winner of the prestigious Crafoord Prize on its faculty.

In the financial year 2017/2018 the total income was £297 million and the value of the University's total portfolio of external project research income was £36.8 million, ranging from commercial funders to charities and public sector organisations (including governmental departments).

The University of Sussex has experience in dealing with all European Research and Innovation programme matters. In FP7 it was awarded over 100 grants totalling over £33m. This included 18 European Research Council Investigator grants, 33 Marie Curie fellows and the coordination of numerous Collaborative Projects and Marie Curie Initial Training Networks. Sussex participates in three FET Flagships: the Human Brain Project, the Humane AI and the Quantum Flagship projects. In H2020 Sussex has been successful in securing 69 grants so far: 7 FET, 22 ERC, 17 Societal Challenges and 22 Marie Skłodowska-Curie projects (5 ITNs, 2 RISE projects, and 15 fellowships).

Science Policy Research Unit, SPRU, at the University of Sussex, is a world-leading department which combines research, consultancy and high-level policy advice with postgraduate teaching in science, technology, and innovation policy and management. Founded in 1966 by Christopher Freeman, SPRU was the first interdisciplinary research centre in the field of science and technology policy and management. Today, with over 70 faculty members, more than 70 doctoral students, over £7m of on-going Research Council projects, as well as hosting the leading journal in its field, *Research Policy*, SPRU remains at the forefront of new ideas, problem-orientated research, inspiring teaching, and creative, high impact engagement with decision makers across government, business and civil society. With a community of more than 200 MSc and doctoral students from all over the world, SPRU is also well known for its high quality, research-led teaching programmes. The multidisciplinary nature of SPRU means that students have access to an extensive range of expertise, whilst also contributing directly to SPRU research as part of their training and development. The Sussex Energy Group (SEG) at SPRU undertakes rigorous, inter-disciplinary research on energy and climate policy, focusing upon the challenge created by the transition to low carbon energy systems, and social sciences. SEG currently has 50 researchers and 25 doctoral students and is funded from an array of public and private sector sources, including the UK Research Councils, UK government departments and the European Commission. SEG is a partner in the UK Energy Research Centre.

Legal entity: University

Role in the project:
SPRU will lead a case study in Nepal and will support WP6 in the regional evaluation of LMTs in The Americas

Involved personnel:

Dr Rocio Alvarez Tinoco (female): is a Research Fellow in innovation at SPRU. She hold a degree in Biochemical Engineering (Instituto Politecnico Nacional, Mexico), MSc degrees in Food Science and Technology (Universidad Panamericana, Mexico), Management Science (University of London), and Science Technology and Innovation Policy Studies, STIPS; and PhD in STIPS at SPRU. Her research analyses the pathways for emissions reduction, the development of regional and institutional capabilities in agribusiness in developing countries, and responsible innovation for project management. She has focused on the interaction of different actors in complex systems which affected capabilities development to improve policy-making. Additionally Rocio has teaching experience in management and consulting experience with World Bank and United Nations developing the national plan for STI and providing strategic recommendations for institutionalisation of innovation, analysis of the competitiveness of main crops and food chains, and a wide experience in the understanding of industrial processes and their interdependencies.

Lokendra Karki (male): is a final year PhD researcher at SPRU. He holds a master degree in International Organic Agriculture (IOA) from the University of Kassel. His research focuses on smallholder farmers and adaptation to climate change and its subsequent impacts on farmers' livelihoods in Nepal. His research interest lies in climate change policy, innovations for adaptation/mitigation in agriculture and sustainable food systems.

He has more than ten years of experience on research and development projects in smallholders' livelihoods, technological diffusion and enterprise development in agriculture. During his work, he has developed programmes to support smallholder farmers liaised with various institutions and other regional, national and international stakeholders and institutions.

Relevant publications to the call content:

- Alvarez-Tinoco, R., Stua, M., and Mackerron, G. (2019) *United Kingdom: Pathways towards a low-carbon* electricity systems – nuclear expansion versus nuclear phase-out (Chapter 5). Routledge studies in energy transitions. Available: https://www.taylorfrancis.com/books/e/9780429858772.
- Lieu, J., Spyridaki, N., Alvarez-Tinoco, R., van der Gaast, W., Tuerk, A. and van Vliet, O. (2018) *Evaluating Consistency in Environmental Policy Mixes through Policy, Stakeholder, and Contextual Interactions*. *Sustainability*, 10, 1896. doi:10.3390/su10061896
- Nikas, A., Doukas, H., Lieu, J., Alvarez-Tinoco, R., Charisopoulos, V. and van der Gaast, Wytze (2017) Managing stakeholder knowledge for the evaluation of innovation systems in the face of climate change. Journal of Knowledge Management, 21 (5). pp. 1013-1034. ISSN 1367-3270.
- Tinoco, Rocio Alvarez, Sato, C.E.Y. and Hasan, R (2016) *Responsible project management: beyond the triple constraints.* Journal of Modern Project Management, 4 (1). pp. 81-93. ISSN 2317-3963.
- Alvarez Tinoco, Rocío (2011) Evolution of capabilities in agribusiness: the case of the Mexican dairy sector. Doctoral thesis (DPhil), University of Sussex.
- http://sro.sussex.ac.uk/id/eprint/6344/1/Alvarez_Tinoco%2C_Guadalupe_del_Roc%C3%ADo.pdf
- Karki, L, Schleenbecker, R. and Hamm, U. (2011) *Factors influencing a conversion to organic farming in Nepalese tea farms.* Journal of Agriculture and Rural Development in the Tropics and Subtropics, 112 (2). pp. 113-123. ISSN 1612-9830

Relevant previous projects or activities, connected to the subject of this proposal:

- TRANSrisk. Transition Pathways and Risks Analysis for Climate Change Policies, EU Horizon 2020 Programme (Sept 2015-August 2018). TRANSrisk created a framework in which risks and uncertainties are integral to the assessment of how climate change mitigation and adaptation affects the overall economic, social and environmental well-being of society in the EU, emerging countries, and at the broader global level. It assessed the interlinkages between climate change mitigation and adaptation pathways and uncertainty, as well as generated mitigation and adaptation scenarios. These scenarios will help our understanding of the challenges, the interrelations between actors and/or sectors, as well as the feasible options for low-carbon pathways. The project provided policymakers estimates of the costs and risks associated with climate change as well as of the costs, benefits and other effects of actions that may limit, stop or reverse the magnitude and/or rate of long-term climate change. In addition, it offered ways to devise policies that are robust against uncertainty, engaging multiple stakeholders, and acknowledging that there is no single 'optimal' pathway to mitigate or adapt to climate change (http://transrisk-project.eu/).

- Resilience and Vulnerability in the making at the urban Nexus of food, water, energy and the environment ResNexus (2015-2019) It investigates resilience and vulnerability at the urban nexus of food, water, energy and the environment. The project investigates how vulnerabilities within urban communities are constructed by through trade-offs and aggravations at the food, water and environment nexus, in three mid-sized highly-dynamic cities in East Africa (Kampala), Brazil (Guarulhos) and Europe (Sofia) (http://www.sussex.ac.uk/spru/research/projects/resnexus).
- Innovation Pathways, Strategies and Policies for the Low Carbon Transition in Europe (INNOPATHS, 2015-2020). This research project works with a range of stakeholders from government, academic and civil society, to generate new, state-of-the-art low-carbon pathways for the European Union. Applying insights from existing research on transitions to sustainability, INNOPATHS aims to identify the major cross-sectoral challenges faced by the decarbonisation transition, and put forward innovative solutions to overcoming them. Working closely with its partners and stakeholders, INNOPATHS is 'co-designing' a set of new, low-carbon pathways that will be assessed from all perspectives, including their implications

for economic growth, industrial competitiveness, employment, social issues (e.g. affordability), and environment and resources (e.g. land, materials, water) (http://www.sussex.ac.uk/spru/research/projects/innopaths).

- SPRU community collaborates with the STEPS Centre (Social, Technological and Environmental Pathways to Sustainability, which is part of Institute of Development Studies, IDS) in the areas of grass roots for innovation for sustainable development, the transformation of complex sociotechnical systems and transitions to sustainability, and policy analysis for sustainability and other research organisations. Some relevant collaborative projects are:

- Constructing pathways to sustainability: learning across disciplines, sectors, regions and cultures (2015, UNESCO). The Pathways Network built on strong international collaborations and an established joint track record to produce both evidence and practice for a step-change in application of social science to real-world sustainability challenges. It contributed to construction of transformative pathways to sustainability across three themes: sustainable urban water and waste; low carbon energy transitions for the poor; and sustainable agricultural and food systems for healthy livelihoods. The network proposal built on seed-funded 'co-design' workshops involving multiple stakeholders across 5 continents. Through cross-learning between and across paired network hubs in low, middle and high income settings it examined and compared the processes of constructing transformative pathways to sustainability in diverse historical, political and cultural contexts.

- Social, Technological and Environmental Pathways to Sustainability Centre, STEPS (2006, 2012 and 2017, IDS). The project has contributed: a) To expand and enrich the IDS' pathways approach, developing new theory to explain complex, dynamic social-technological-ecological systems aiming specific sustainability and social justice goals; b) To develop a new set of cross-disciplinary methodologies for negotiating complexity and addressing contemporary sustainability challenges; c) To collaborate with international partners in developing a global movement for action around science, technology, environment and development addressing international processes (i.e. Rio plus 20 Earth Summit to MDG assessments); d) To create evidence linked to targeted conceptual and practical impacts around interfaces of environment, development and technology, generated through field-based projects in Africa, Asia and Latin America; e) To create a set of new perspectives, insights and forms of policy dialogue that bring informed challenge and facilitate the building of pathways to sustainability within and across the domains of food and agriculture, health and disease, water and sanitation, and energy and climate; and f) To expand and raise the IDS' profile as a national and international hub for interdisciplinary social science around the interfaces of environment, development, science and technology, with worldwide networks.

- Accelerating and Rescaling Transitions to Sustainability, ARTS (2016 EU-DRIFT). ARTS contributed to new strategies aiming to achieve European policy ambitions like Europe 2020 and the Roadmap 2050 from a transitions perspective addressing the persistence of existing incumbent regimes: dominant cultures, structures and practices that have developed historically and dominate current systems of provision. ARTS advanced the understanding of the conditions and mechanisms, and develop strategies and instruments for accelerating transitions to sustainable low-carbon societies. ARTS had a lasting impact on policy, business and civil society at regional, national and European levels by creating social learning environments within transition regions as well as by using various and innovative ways of disseminating lessons and insights from the transition regions.

Participant No. 11: Cambridge Econometrics Ltd., United Kingdom

Partner description:

Cambridge Econometrics (CE) is an SME that was originally spun out from the University of Cambridge more than 30 years ago, with offices in Cambridge, Brussels and Budapest. The company specialises in the application of economic modelling and data analysis techniques for

forecasting and for policy analysis. We have particular expertise in the application of whole-economy macro-sectoral models, notably our global E3ME model.

The work of the company covers a range of key policy issues (labour markets, energy and climate, innovation, infrastructure and macro/sectoral policy) at local and national level around the world. Our clients represent a wide range of public and private sector institutions. Through our macroeconomic modelling, CE has provided key inputs to European Impact Assessments of the recent Clean Energy Package, and previous ETS reforms and Energy Efficiency and Taxation Directives. We have also provided inputs to several Trade Sustainability Assessments. At global level we have provided inputs to G20 analysis for both the UK and German governments, the latter in a joint collaboration with IRENA and the IEA.

Legal entity: SME

Role in the project:
CE will contribute primarily to WP6 and WP7. CE's profile matches the key aspects of these LANDMARC work plans. Previous CE work includes assessments of upscaling policy solutions to EU and global level, comparable to WP6 requirements. CE has substantial expertise in providing insights into potential socio-economic impacts of environmental and climate policy, particularly through scenario modelling. This work has included the development of modelling frameworks involving CE's E3ME model; notably, E3ME has been used alongside climate modelling to assess climate scenarios (Holden et al., 2018). CE will also contribute to WP8, the communication, dissemination and exploitation of the results. The company has extensive experience working within large transdisciplinary teams for such research projects, including H2020 consortia.

Involved personnel:
Hector Pollitt, Director and Head of Modelling (male). Hector is a post-Keynesian economist who leads the modelling team at CE and has worked with the E3ME model for over 16 years. He has overseen development of E3ME from a macro-econometric model of 15 European countries to a global tool that disaggregates 59 countries and integrates bottom-up technology representation across several sectors.

Hector helped to develop the labour market forecasting methods that are applied by CEDEFOP and has overseen inputs to EU Impact Assessments of the Work-Life Balance Directive and various energy-related policy packages. He also led on the modelling for CE's Brexit report for the mayor of London and the recent EIGE report on the economics of gender discrimination in the EU. He was responsible for CE's inputs to the MONROE, Transrisk and Sim4Nexus H2020 research projects that assess improving modelling of R&D, managing risks in environmental transitions, and assessing energy-water-food interactions.

Aside from applications of the E3ME model, Hector provides modelling training to external organisations (e.g. the UN). He is highly familiar with the differences between modelling approaches (e.g. CGE, macro-econometric, DSGE) and the key underlying assumptions in each approach.

He is also a fellow of the C-EENRG centre at the University of Cambridge and his recent academic work has focused on the role of finance in energy-climate models, and a quantification of the risk of stranded assets from a low-carbon transition.

Unnada Chewpreecha, Principal Economic Modeller (female). Unnada has over 10 years of experience in the development and application of CE's E3ME model as well as custom made country-specific E3 models for Thailand, India, Brazil, Kosovo and the US.

Her expertise is in the application and development of E3ME and other E3 models to provide macroeconomic analysis of the climate, energy and resource efficiency policies. Her involvements as modelling expert include contribution to impact assessments of revisions to the EU's EPBD and Energy Services Directive and Energy Taxation Directive (DG Energy) and the EU's 2030 Climate targets (DG Climate Action). Her other recent E3-modelling contributions cover a variety of topics including energy and resource efficiency, carbon and energy taxation, regulatory standards, emission trading schemes, environmental tax reform, renewable targets, feeds-in-tariffs, renewable subsidies, the circular economy, the collaborative economy, environmental and distribution impacts of free trade agreements, NDC's, 2c and 1.5c degree targets, carbon leakage and border tax adjustments.

Beyond her technical contributions, Unnada has extensive project management experience. She also regularly runs E3ME and general macroeconomic modelling training courses in the UK and abroad.

Alistair Smith, Senior Economist (male). Alistair is a senior economist within the modelling team at Cambridge Econometrics. At Cambridge Econometrics, he is primarily responsible for data processing, scenario development and analysis, and macroeconomic modelling. Recent projects that Alistair has worked on include: a study modelling economic impacts of renewable energy expansion and decarbonisation pathways (IRENA); macroeconomic modelling for the 2018 New Climate Economy Report (WRI); and the H2020 research project TRANSrisk (DG Research).

Relevant publications to the call content:

- Eise Spijker, Annela Anger-Kraavi, Hector Pollitt & Dirk-Jan van der Ven (forthcoming): Evaluating integrated impacts of low-emission transitions in the livestock sector. Environmental Innovation and Societal Transitions, Elsevier.
- Hector Pollitt, Karsten Neuhoff and Xinru Lin (2019) 'The impact of implementing a consumption charge on carbon-intensive materials in Europe', Climate Policy, in press.
- Mercure, J-F, MA Paim, P Bocquillon, S Lindner, P Salas, P Martinelli, II Berchin, JBSO de Andrade Guerra, C Derani, CL de Albuquerque Junior, JMP Ribeiro, F Knobloch, H. Pollitt, NR Edwards, PB Holden, A Foley, S Schaphoff, RA Faraco and JE Vinuales (2019) 'System complexity and policy integration challenges: The Brazilian Energy-Water-Food Nexus', Renewable and Sustainable Energy Reviews, in press.
- Lehmann, Paul, Jos Sijm, Erik Gawel, Sebastian Strunz, Unnada Chewpreecha, Jean-Francois Mercure and Hector Pollitt (2018) 'Addressing multiple externalities from electricity generation: a case for EU renewable energy policy beyond 2020?', Environmental Economics and Policy Studies, Volume 21, Issue 2, pp 255–283.
- Mercure, Jean-Francois, Aileen Lam, Sophie Billington and Hector Pollitt (2018) 'Integrated assessment modelling as a positive science: private passenger road transport policies to meet a climate target well below 2°C', Climatic Change, November 2018, Volume 151, Issue 2, pages 109–129.
- Knobloch, Florian, Hector Pollitt, Unnada Chewpreecha, Vassilis Daioglou and Jean-Francois Mercure (2018) 'Simulating the deep decarbonisation of residential heating for limiting global warming to 1.5°C', Energy Efficiency, Volume 12, Issue 2, pp 521–550.
- Holden, Phil B, Neil R Edwards, Andy Ridgwell, Richard D Wilkinson, Klaus Fraedrich, Frank Lunkeit, Hector Pollitt, Jean-Francois Mercure, Pablo Salas, Aileen Lam, Florian Knobloch, Unnada Chewpreecha and Jorge E Viñuales (2018) 'Climate–carbon cycle uncertainties and the Paris Agreement', Nature Climate Change, Volume 8, pp 609-613.
- Mercure, Jean-Francois, Jorge E Viñuales, Neil R Edwards, Phil B Holden, Unnada Chewpreecha, Pablo Salas, Ida Sognnaes, Aileen Lam & Florian Knobloch (2018) 'Macroeconomic impact of stranded fossil fuel assets', Nature Climate Change, Volume 8, pp 588–593 (2018).
- Foley, Aideen M, Philip B Holden, Neil R Edwards, Jean-Francois Mercure, Pablo Salas, Hector Pollitt and Unnada Chewpreecha (2016) 'Climate model emulation in an integrated assessment framework: a case study for mitigation policies in the electricity sector', Earth System Dynamics, Volume 7, Issue 1, pp 119-132.
- Mercure, Jean-Francois, Hector Pollitt, Unnada Chewpreecha, Pablos Salas, Aideen M Foley, Philip B Holden, Neil R Edwards (2014) 'The dynamics of technology diffusion and the impacts of climate policy instruments in the decarbonisation of the global electricity sector', Energy Policy, Volume 73, pp 686–700.

Relevant previous projects or activities, connected to the subject of this proposal:

- **Brazil Energy-Water-Food Nexus (2016-2020)**: This ambitious project, completed for ERSC, explored how the energy-water-food nexus could affect future development in Brazil. Brazil is seen as a key country in nexus analysis because it provides food to many other parts of the world and suffers constraints in both water supplies and available land (without inducing deforestation). As part of the project, the

FTT:Agriculture land use model was developed and linked to E3ME through a series of new equations for food consumption. The expanded model allows for a much better assessment of policies related to biofuels and food prices.

- **MONROE (2017-2019)**: Monroe was a Horizon 2020 project that focused on how the economic impacts of R&D and innovation can be assessed in a macroeconomic modelling framework. Three models from complementary backgrounds (CGE, DSGE and macro-econometric) were developed and applied during the project. CE contributed modelling through its E3ME macro-econometric model, which was further developed during the project.
- **Sim4NEXUS (2016-2019)**: Sim4Nexus was a large Horizon 2020 project that involved partners from all across Europe. It focused on both bio-physical and socio-economic components of the energy-water-food nexus. CE contributed modelling to a set of case studies using the E3ME macro-econometric model, linked to the FTT models of energy consumption. The final outputs in the project were used to build a new simulation tool that could be used for educational purposes.
- **TRANSrisk (2015-2018)**: Transitions Pathways and Risk Analysis for Climate Change Mitigation and Adaption Strategies. EU Horizon 2020 project with the objective to explore low emission transition pathways and analyse risks related to these. TRANSrisk brought together in one research team quantitative researchers (i.c. modellers) and qualitative researchers with the goal to organise, for a set of case studies in Europe and beyond, iterative processes, whereby stakeholder preferences and concerns were communicated as research questions with modellers. After that, the modelled outcomes were communicated with stakeholders to help them obtain a clearer picture of risks and socio-economic impacts of scaled up climate change mitigation measures. This helped stakeholders assess what would be acceptable climate policies, given their own preferences. Within TRANSrisk, CE's main role was assessing socio-economic, energy, and environmental impacts within individual country-case studies, through applications of E3ME.
- **New Climate Economy Report (2017-2018)**: Cambridge Econometrics (CE) contributed to the New Climate Economy (NCE, http://newclimateeconomy.report) 2018 Report ('Major Opportunities for Growth and Climate Action') published by the Global Commission on the Economy and Climate, a major international initiative to examine how countries can achieve economic growth while dealing with the risks posed by climate change. The CE team modelled the climate, economic and social impacts of scenarios with the aim of illustrating examples of policies that can simultaneously promote economic growth and reduce the risks of climate change. Policies are assessed using CE's macroeconomic modelling approach (E3ME) that will identify both potential emission reductions and impacts on the wider economy.
- **Macroeconomic impacts of energy and climate policies (2015-2017)**: This major project, led by Cambridge Econometrics and including E3Modelling and Trinomics as partners was completed for DG Energy, European Commission. The project extended the capability of two global energy-economy-environment models to give a fuller assessment of the impact of policies designed to promote energy efficiency and a transition to a low carbon economy. The improved capability relates to the treatment of (1) policy-induced technological innovation in energy production and use, and (2) the role played by money and finance in the availability of funding for investment. The two models have been chosen to represent two very different traditions in economics, so as to test the extent to which differences in assumptions about behaviour in the economy affect the assessment of the potential impact of policies: post-Keynesian macroeconometric modelling (the E3ME model) and Computable General Equilibrium modelling (GEM-E3). The enhanced models will be applied to assess the impact of potential policies in the energy-environment field and the impact of changes in the global economic and policy environment on economic, energy and environmental emissions outcomes in the European economies.

Description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work:

The E3ME macro-econometric model is the largest tool of its kind in the world. E3ME was originally developed through the European Framework Programme and has since been enhanced to become one of the key tools available for Impact Assessment in the EU. Its core post-Keynesian economic framework has been expanded to include bottom-up models of technology diffusion in the energy sector and is currently being

linked to an innovative new model of land allocation. We will apply E3ME, alongside the suite of partners' models, to assess the socio-economic and environmental effects of LBNET and climate policies.

Participant No. 12: The Stockholm Environment Institute (SEI), Sweden

Partner description: The Stockholm Environment Institute (SEI) is an international independent research institute that has been working at the cutting edge of environment and development policy research for over thirty years. SEI's mission is to support decision-making and induce change towards sustainable development around the world by providing integrative knowledge that bridges science and policy. The SEI was named for the first United Nations Conference on the human environment held in 1972 that came to be known as the Stockholm Conference. The SEI has been ranked as the number one or number two environmental think tank in the world during the past six years by the University of Pennsylvania's Think Tanks and Civil Society Program.

The SEI has its headquarters in Stockholm, with offices or centres across five continents, making it unique among environment and development research institutes. The centres are located in York, Oxford, Tallinn, Boston, Nairobi, Bangkok and Bogota. The latter three centres are regional in design, each having established extensive networks and partnerships across their respective regions (Africa, Asia, Latin America). The global and regional convening power of SEI makes it a perfect work package leader for WP6 – *Regional Engagement for Global Impact*. With more than 300 researchers, program managers and support staff, the SEI employs a wide variety of interdisciplinary research approaches aimed at policy impact across all levels—local, national, regional and global.

Legal entity: Foundation (Stiftelse)

Role of SEI in the project:
SEI's role in the project is Work Package Lead of WP6, leader of several case studies and contributor to tasks in WP2, WP4, WP5, WP7 and WP8. Staff would be drawn from the Nairobi, Bangkok, Stockholm/HQ and Bogota offices, all of which are part of the SEI Foundation that is registered in Sweden.

Involved personnel:

Dr Francis X. Johnson (male) is a Senior Research Fellow at SEI Stockholm/HQ. Francis has over 25 years of experience in economic and environmental analysis of bioenergy strategies, land use, climate mitigation, and energy efficiency. He has served as an advisor or expert for international initiatives run by UNIDO, FAO, European Commission, and the Environment Committee of the European Parliament. He was co-PI for the Horizon2020 TRANSrisk project. He served as a lead author for the recent IPCC special report on Climate Change and Land.

Dr Olle Olsson (male) is a Research Fellow at SEI Stockholm with extensive experience in the forestry and bioenergy sectors in the Nordic countries, including analysis of the climate adaptation implications of expanded bioenergy trade. He is a task leader for IEA Bioenergy and is leading a study on Bioenergy with Carbon Capture and Storage (BECCS) as well as a new SEI initiative on Gridless Transitions. He has investigated the mechanisms of price formation and international market integration for biomass-based fuels such as wood chips and wood pellets.

Stefan Bößner (male) is an SEI Associate based in France. He has worked for leading think tanks and research institutes on low carbon transitions, international climate governance and clean technology innovation in France, the UK and Lebanon. He has significantly contributed to past Horizon2020 projects such as CARISMA and TRANSrisk and has extensive professional and personal experiences in the South-East Asian region, notably Indonesia and Thailand.

May Thazin Aung (female) is a Research Associate with SEI Asia. May has been researching environmental issues related to food, water and energy in the South East Asian region and has extensive experience with

participatory stakeholder approaches for environment and development projects in several countries in the region.

Ivonne Lobos Alva (female) is a Research Fellow in SEI's Latin America centre in Bogota and leads work on sustainable land management. She has long experience with participatory processes and has implemented over 50 multi-stakeholder dialogues. She has engaged significantly in global platforms such as the FAO Global Soil Partnership and the UN Convention to Combat Desertification (UNCCD), including work on Land Degradation Neutrality and global indicators for sustainable land and soil use. She supported the U.N. process to negotiate the 2030 Agenda and establish the SDGs.

Mbeo Ogeya (male) is a Research Fellow at SEI's Africa centre in Nairobi. Mbeo has over 10 years research experience in renewable energy technologies and systems modelling, with extensive skills in LEAP Energy Systems Modelling, Engineering Design, Bioenergy, Land use and Energy Efficiency. He has worked as an energy consultant, mentor and national policy advisor.
Ekaterina Bessonova (female) is Communications Officer focusing on agriculture and land use in relation to climate change and sustainable development goals. Ekaterina leads the digital communications of the Swedish International Agriculture Network Initiative (SIANI) and the SEI Initiatives on Governing Bioeconomy Pathways. She has collaborated closely with the Global Landscapes Forum and other major international platforms related to land use.

Relevant publications to the call content:

- Bößner, Stefan, Tahia Devisscher, Timothy Suljada, Cynthia J. Ismail, Auditya Sari, and Novelita W. Mondamina. 2019. "Barriers and Opportunities to Bioenergy Transitions: An Integrated, Multi-Level Perspective Analysis of Biogas Uptake in Bali." *Biomass and Bioenergy* 122 (March): 457–65. https://doi.org/10.1016/j.biombioe.2019.01.002.
- Johnson, Francis X. 2017. "Biofuels, Bioenergy and the Bioeconomy in North and South." *Industrial Biotechnology* 13 (6): 289–91. https://doi.org/10.1089/ind.2017.29106.fxj.
- Olsson, Olle, and Bengt Hillring. 2014. "The Wood Fuel Market in Denmark – Price Development, Market Efficiency and Internationalization." *Energy* 78 (December): 141–48. https://doi.org/10.1016/j.energy.2014.09.065.
- Hurlbert, M., Krishnaswamy, J., Davin, E., Johnson, F.X., Mena, C.F., Morton, J., Myeong, S., Viner, D., Warner, K., Wreford, A., Zakieldeen, S., Zommers, Z. (2019). Climate Change and Land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. https://www.ipcc.ch/srccl-report-download-page/.
- van de Ven, D. J., Sampedro, J., Johnson, F. X., Bailis, R., Forouli, A., Nikas, A., ... & Doukas, H. (2019). Integrated policy assessment and optimisation over multiple sustainable development goals in Eastern Africa. Environmental Research Letters (accepted, in press). https://doi.org/10.1088/1748-9326/ab375d.
- Johnson, O., Ogeya, M., Wanjiru, H., Johnson, F.X. (2019). Kenya: Risks and uncertainties around low-carbon energy pathways, In: (Hanger-Kopp, S., Lieu, J., Nikas, A., Eds), Narratives of Low-Carbon Transitions. London: Routledge.

Relevant previous projects or activities, connected to the subject of this proposal:
Members of the SEI team act(ed) as overall project coordinator of the following projects:

- Low emission Development Pathways: https://www.sei.org/projects-and-tools/projects/initiative-low-emission-development-pathways/
- Fossil Fuels and Climate Change: https://www.sei.org/projects-and-tools/projects/fossil-fuels-and-climate-change/
- Governing Bioeconomy Pathways: https://www.sei.org/projects-and-tools/projects/sei-initiative-bioeconomy/
- Gender and Social Equality Programme: https://www.sei.org/projects-and-tools/projects/gender-social-equality/
- Description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work:

- With its nine centres around the world, distributed on five continents (Europe, Asia, Latin America, North America and Africa), SEI is uniquely positioned to serve as a convenor for regional stakeholder engagement.

Participant No. 13: PT Sustainability and Resilience (su-re.co), Indonesia

Partner description:

Established in 2015, su-re.co (Sustainability and Resilience) is a young environmental think-do-be-tank, based in Bali, Indonesia. Our vision is to ensure that sustainability and resilience issues are consistent and synergized from policy to local activities and that both are supported by science (https://su-re.co/). Moreover, our mission is to engage both policy and local actors on climate change adaptation/mitigation strategies and clean energy implementation as a "think-tank" and "do-tank," and to learn and show evidence by ourselves as a "be-tank." As such, su-re.co's focus is to synergise Climate Smart Agriculture and affordable renewable energy with circular businesses.

Su-re.co was involved in the EU Horizon2020 GREENWIN project and collaborated with EU Horizon2020 TRANSrisk in 2015-2018. The Indonesia case study in these projects illustrated the tangible implications of low carbon pathways for small-scale farmers in Bali in collaboration with Udayana University and Stockholm Environment Institute (SEI). The Indonesia case study was selected as the only representative case during the 17th ASEAN Ministerial Meeting on Science and Technology held in 2017 in Nay Pyi Taw, Myanmar. Moreover, the research findings were used as reference for Indonesia's Mid-Term National Plan (2020-2024) formulated by BAPPENAS (Indonesian Ministry of National Development Planning). The CEO of su-re.co, Dr. Takeshi Takama, has 15+ years of experience working on climate vulnerability assessment and has worked with several international agencies, such as UNDP, UNIDO, ADB and JICA. The experience highlighted above shows how su-re.co's capacity is fit for this project. In addition, su-re.co has established a good network of key stakeholders, including local and national government, local NGOs, and small-holder farmers to support the journey of Indonesia's case study.

Legal entity: SME

Role in the project: Su-re.co's profile matches several aspects of the LANDMARC work plan. Su-re.co will be involved in WP2, WP4, and WP7. Su-re.co is responsible for managing, organizing, and coordinating local meetings or stakeholder engagement events within Indonesia on WP2. Also, collecting and providing complementary data at the local and regional level if necessary. WP4 involvement relates to conducting a qualitative climate vulnerability assessment in targeted locations of Indonesia case study. Within WP7, su-re.co's task is to create (inter)national LMT learning and dissemination, including international publications and science-policy workshop with Indonesian policy makers at the local and national level.

Involved personnel:

Dr. Takeshi Takama (male). Takeshi leads this young think-do-be tank which aims to truly achieve a better environment and society. He makes strategic plans and decisions to make sure that projects run smoothly and effectively to support people in developing countries and solve environmental problems based on scientific analysis. He has been working as an international expert on climate change, environment and energy for nearly two decades for ADB, IRENA, JICA, GIZ, and UN agencies. Before Takeshi started su-re.co, he worked for Japan International Cooperate Agency (JICA) to run the largest climate change and technical cooperation project in Indonesia as Sub-chief Manager. Takeshi still holds his associate position at Stockholm Environment Institute (SEI) as a research fellow, which he began after obtaining his PhD. He is a visiting professor of Udayana University to support international collaboration of the University. Takeshi earned a full scholarship from University of Oxford to pursue an MSc and a PhD with transdisciplinary focus on environmental management including energy and rural development.

Cynthia Juwita Ismail (female). Ms. Ismail has been working in the area of climate change as a researcher since 2012. Cynthia is involved in a number of collaborative projects with international agencies, e.g., EU (i.e., GREENWIN), UNIDO, UNDP and ADB. With a main focus on climate change adaptation and

mitigation, she was involved in the design of clean energy at the household level, collecting complementary data at the local level and organising international workshops under GREENWIN, a collaboration with the TRANSrisk project. Related to climate vulnerability assessment, she was involved in UNDP-GCF Feasibility Study, contributing to vulnerability assessment on estate crops in NTT Province – Indonesia and demonstrated transformative adaptation for the respective region. Cynthia had a BSc in Chemistry (ITB, Indonesia) and MSc in Management and Engineering of Environment and Energy under Erasmus program in Kungliga Tekniska Hogskolan, Sweden (2013-2015).

Relevant publications to the call content:

- Bößner, S., Devisscher, T., Suljada, T., Ismail, C. J., Sari, A., & Mondamina, N. W. (2019). Barriers and opportunities to bioenergy transitions: An integrated, multi-level perspective analysis of biogas uptake in Bali. *Biomass and Bioenergy*, *122*, 457–465. https://doi.org/10.1016/j.biombioe.2019.01.002
- Ismail, C. J., Takama, T., Budiman, I., & Knight, M. (2019). Comparative Study on Agriculture and Forestry Climate Change Adaptation Projects in Mongolia, the Philippines, and Timor Leste. In P. Castro, A. M. Azul, W. Leal Filho, & U. M. Azeiteiro (Eds.), *Climate Change-Resilient Agriculture and Agroforestry* (pp. 413–430). https://doi.org/10.1007/978-3-319-75004-0_24
- Takama, T., Aldrian, E., Kusumaningtyas, S. D. A., & Sulistya, W. (2016). Identified vulnerability contexts for a paddy production assessment with climate change in Bali, Indonesia. *Climate and Development*, *9*(2), 110–123.
- Silaen, M., Yuwono, Y., Taylor, R., Devisscher, T., Thamrin, S., Ismail, C., & Takama, T. (2019). Risks and uncertainties of biogas for electricity and cooking. In *Narratives of Low-Carbon Transition*. London and New York: Routledge.
- van Vliet, O., & Takama, T. (2018). *Policy dialogues in integrated assessment modelling (IAM) to strengthen climate change mitigation and adaptation* [1.5°C Insight Brief]. Retrieved from Climate Strategies website: https://climatestrategies.org/wp-content/uploads/2018/10/P2933_CS_Vliet_Takama_PRINT.pdf

Relevant previous projects or activities, connected to the subject of this proposal:

- **TRANSrisk (2015-2018)** is a completed EU-funded research project aimed at comprehending the risks and uncertainties within the low carbon transition pathways and how they were assessed to contribute according to the local- and national policy context. Su-re.co supported this project through assistance at the local and national data collection, stakeholder engagement at the local/sub-national level (e.g., farmers, agricultural agencies and extension workers, local energy agencies, local authorities, NGOs, universities, and private sectors) and at the national level (policymakers/ministerial officers, state-owned energy company, national energy agency) to deliver research findings on bioenergy into policymaking considerations. We also produced a dissemination of this project through an interactive short video.

- **GREEN-WIN (2015-2018)** is another completed EU-funded research project aimed at achieving win-win solutions for green growth strategies. Su-re.co took a significant role in conducting action-based research on the role of biogas—that is produced by the processing of agricultural waste—in farmers' livelihood, mainly on farming activities and business. We identified how the participatory business model could help the local community gain access to the market and improve their farming activities. This project was disseminated in UNESCAP's best SDG practices.

- **Feasibility study for UNDP Indonesia (2016-2017)** is a climate change adaptation project for GCF proposal in East Nusa Tenggara Timur (Indonesia), for which we conducted a climate change vulnerability assessment on six agricultural commodities. Here, we integrated qualitative and quantitative data through research, extensive field work, and climate data modelling to come up with more robust incremental, systemic, and transformative adaptation recommendations.

- **INSISTS (2016-2017)**, which stands for Indonesia-Swedish Initiative for Sustainable Energy Solution, provided su-re.co with the opportunity to conduct a vulnerability assessment of bioenergy feedstock availability (bioethanol from sugarcane in East Java and bioethanol/biogas from rice husk in Bali) and identify multiple barriers of bioenergy development in Indonesia. Here, we came up with quantitative analysis on how climate change would impact the productivity of mentioned crops in the future as well as a list of obstacles that hindered the implementation of bioenergy adoption.

- **JICA (2014-2016)** initiated the work for a vulnerability assessment in Bali in partnership with the Indonesian Meteorology, Climatology, and Geophysics Agency. Here, we conducted a multimethod assessment such as research, statistical analysis, stakeholder and policy assessment, and interviews with local paddy farmers based on the national policy system to identify issues with climate change. As an output, we produced a 6-step framework to understand context-based vulnerability, potential risks, and their variables.

Description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work:
We intend to conduct a vulnerability assessment using the climate change sensitivity matrix that we have developed. This tool will be used to measure the sensitivity of different variables of agricultural and forestry activities (e.g., water resource, infrastructure, soil nutrition, etc.) against the climate hazards or stressors (e.g., floods, heavy rain, drought, landslides). This tool requires workshops that will involve multiple stakeholders in case study areas. It has been used in the JICA project/publication (see the above) and in UNIDO LCCR project to assess the industrial vulnerability in four countries in Africa.

For (inter)national LMT learning and dissemination, we possess two tools, namely policy dialogue and dissemination through videomaking. Both have been useful to convey learning tools to policymakers and the public, especially in the TRANSrisk project. The policy dialogue was conducted as a platform for knowledge exchange between the researchers and policymakers and could become a powerful tool for policymaking considerations. This tool facilitates the researchers to present their findings and gain policymakers' perspective within the national policy context. Furthermore, disseminations through video could help attract a wider audience to comprehend best practices for LMT application upscaling.

Participant No. 14: Royal Netherlands Meteorological Institute (KNMI), Netherlands

Description of the participant
The Royal Netherlands Meteorological Institute (KNMI) was established in 1854. Primary tasks of KNMI are weather forecasting and monitoring of weather, climate, air quality and seismic activity. KNMI is also the national research and information centre for meteorology, climate, air quality, and seismology for The Netherlands. KNMI has a long record of activities doing research and providing services to many different sectors (e.g. water, agriculture, health, transport, energy), both on the national as well as the European scale. KNMI provides users, ranging from policy makers at European, national or regional levels to the scientific community, with tailored science-based assessments through Climate Services activities, as well as detailed state-of-the-art datasets based on satellite and in-situ observations.

Koninklijk Nederlands Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu

Research at KNMI aims at observing and understanding weather, climate, and atmospheric composition in order to improve forecasts and projections. KNMI has contributed (coordinating) lead authors to the IPCC-WGI-AR5 report and KNMI is responsible for development and dissemination of the national climate change scenarios for adaptation. KNMI hosts the WMO regional climate center node on data for Europe (ECA&D); is responsible for the atmospheric composition satellite instruments OMI and TROPOMI; participates in ESA-CCI and in JPI-Climate; and maintains the Climate Explorer web portal: climexp.knmi.nl.

For OMI (Ozone Monitoring Instrument) on NASA's EOS-Aura platform, and TROPOMI on the EU Sentinel-5P mission, KNMI has the scientific lead. The OMI and TROPOMI missions observe atmospheric composition and surface parameters on a daily basis at global scale. KNMI leads the measurements of nitrogen dioxide air pollution, the ozone layer, clouds and surface effects, including albedo and solar-induced fluorescence by vegetation. KNMI makes strong contributions to the interpretation of CH_4 satellite measurements. In the EU FP7 QA4ECV project, coordinated by KNMI, traceable quality assurance methods for ECVs are developed,

including a generic and trustable system for quality assurance (QA) of satellite retrievals, data products, and in situ retrievals that can be applied to many ECVs as a prototype of a sustainable service.

KNMI is involved in many recent EU projects, with topics that reach from process studies and model development to the analysis of (in-situ and RS) observation, production of consistent climate data records and user-oriented applications (e.g. ERACLIM2, UERRA, QA4ECV, CLIPC, EUCLEIA, and GAIA-CLIM). A significant part of the contribution of KNMI to the Copernicus Climate Change Service and its precursor projects is through the European Climate Assessment and Dataset (ECA&D, http://www.ecad.eu). The significant international role of KNMI is also expressed through its involvement in many services benefiting climate policy, and via personal and project-wise collaborations with WMO, EUMETSAT, EUMETNET, and ECMWF.

Legal entity: Research Institute

Role of partner in the project:
KNMI's profile, and in particular its expertise with remote sensing of air pollution, greenhouse gases, and surface parameters (albedo, fluorescence), align very well with the LANDMARC work plan. KNMI will be involved in WPs 3, 4, and 7. The involvement in WP3 focuses on the application of innovative satellite measurements from the TROPOMI sensor to monitor the consequences of LMTs in terms of changes in air quality, surface characteristics, and carbon fluxes. In WP4, KNMI contributes to (a) the evaluation of climate model simulations of LMT effects with satellite remote sensing data, and (b) planning, reviewing, and revising LMT climate simulations by the Barcelona Supercomputing Centre. The last task fits excellently with KNMI's expertise in developing and operating the EC-Earth climate model. Last but not least, KNMI will make contributions to WP7 on communication, dissemination and exploitation of the results, tapping the large network of KNMI within The Netherlands and abroad.

Involved Personnel
Dr. Folkert Boersma (male) is research scientist at KNMI. He has a long-standing experience in the development, validation and application of satellite measurements to obtain a better understanding of processes relevant to air quality and climate change in the atmosphere and at the interface between land and atmosphere. He has a track record with more than 90 peer-reviewed publications. At KNMI, Boersma is the PI for the OMI NO2 algorithm, the GOME-2(A) Solar-induced Fluorescence algorithm, and co-PI for the TROPOMI NO2 algorithm. He received a prestigious personal grant in 2010 to investigate the 'Attribution of the sources of tropospheric ozone from space' from the Dutch science foundation (NWO Vidi grant), and was the scientific coordinator for the 2014-2018 FP7 project QA4ECV (www.qa4ecv.eu). Boersma also holds a position as associate professor at Wageningen University, where he teaches courses on air quality and atmospheric composition at the bachelor and master level.

Dr. Henk Eskes (male) is senior scientist at KNMI. He is an expert on atmospheric chemistry modelling, chemical data assimilation and satellite observations of trace gases in the atmosphere. Henk Eskes is strongly involved in the Copernicus Atmosphere Monitoring Service (CAMS), implemented by ECMWF. He is currently the coordinator of the CAMS validation contract (CAMS-84), leading a consortium of 14 partners. Furthermore, he is involved in the CAMS regional ensemble air quality analyses and forecasting, where KNMI is responsible for the daily forecasts with the Dutch LOTOS-EUROS model. Henk Eskes is also product lead for the NO_2 product of TROPOMI on the Sentinel-5P satellite, coordinating the development of the satellite retrievals. He has participated in the development and production of a new satellite NO_2 retrieval product for OMI as results of the European QA4ECV project (Boersma, 2019). He is also involved in future satellite mission concepts, and the preparation for Sentinels 4 and 5.

Relevant publications

- Zeng, Y., Su, Z., Barmpadimos, I., Perrels, A., Poli, P., **Boersma, K.F.,** Frey, A., Ma, X., de Bruin, K., Goosen, H., John, V.O., Roebeling, R., Schulz, J., and Timmermans, W.: Towards a Traceable Climate Service: Assessment of Quality and Usability of Essential Climate Variables, Remote Sens., 11(10), 1186, https://doi.org/10.3390/rs111011862019, 2019.

- **Boersma, K. F.**, Eskes, H. J., Richter, A., De Smedt, I., Lorente, A., Beirle, S., van Geffen, J. H. G. M., Zara, M., Peters, E., Van Roozendael, M., Wagner, T., Maasakkers, J. D., van der A, R. J., Nightingale, J., De Rudder, A., Irie, H., Pinardi, G., Lambert, J.-C., and Compernolle, S.: Improving algorithms and uncertainty estimates for satellite NO_2 retrievals: Results from the Quality Assurance for Essential Climate Variables (QA4ECV) project, Atmos. Meas. Tech., 11, 6651-6678, https://doi.org/10.5194/amt-11-6651-2018, 2018.
- Koren, G., van Schaik, E., Arau, A. C.**, Boersma, K. F.**, Gartner, A., Killaars, L., Kooreman, M. L., Kruijt, B., van der Laan-Luijkx, I. T., von Randow, C., Smith, N. E., and Peters, W.: Widespread reduction in sun-induced fluorescence from the Amazon during the 2015/2016 El Nino, Phil. Trans. R. Soc. B 373: 20170408, http://dx.doi.org/10.1098/rstb.2017.0408, 2018.
- Stavrakou, T., Müller, J.-F., Bauwens, M., De Smedt, I., Lerot, C., Van Roozendael, M., Coheur, P.-F., Clerbaux, C., **Boersma, K. F.**, van der A., R. J., and Song, Y.: Substantial underestimation of post-harvest burning emissions in the North China Plain revealed by multi-species space observations, Sci. Rep., 6(32307), doi:10.1038/srep32307, 2016.
- Verstraeten, W. W., Neu, J., Williams, J. E., Bowman, K. W., Worden, J. R., and **Boersma, K. F.**: Rapid increases in tropospheric ozone production and export from China, Nature Geoscience, 8, 690–695, doi:10.1038/ngeo2493, 2015.

Relevant projects or activities

- **QA4ECV** (2014-2018): the QA4ECV project (www.qa4ecv.eu), funded by the EU Seventh Framework Programme, demonstrated how reliable and traceable quality information can be provided for satellite and ground-based measurements of climate and air quality parameters. The project developed and applied a Quality Assurance Framework on new and improved multi-decadal data records on Essential Climate Variables. These included the Land ECVs Albedo, Leaf Area Index (LAI), and Fraction of Absorbed Photosynthetically Active Radiation (FAPAR), and the Atmosphere ECV precursors nitrogen dioxide (NO_2), formaldehyde (HCHO), and carbon monoxide (CO). Many of the lessons learned for the Atmosphere retrievals have been transferred to the ongoing TROPOMI mission.
- **UERRA**-EU-FP7 project (2014-2017): Ensemble of regional reanalysis. UERRA is a European FP7 reanalysis project of meteorological observations. It includes recovery of historical (last century) data, estimating uncertainties in the reanalyses and user friendly data services. It aims to prepare for and contribute to a future Copernicus climate change service.
- **TROPOMI** (since 2013): KNMI is deeply involved in the TROPOMI project (www.tropomi.eu). TROPOMI is a satellite sensor, built and designed in The Netherlands, that is the Dutch contribution to ESA's Copernicus programme. KNMI is the P.I. institute for many of the main TROPOMI products, including NO_2 and albedo, and is using TROPOMI methane (CH_4) data to study carbon fluxes.
- Coupled Model Intercomparison Project Phase 6 (**CMIP6).** An important goal of CMIP is to make the multi-model output publicly available in a standardized format. KNMI contributes to CMIP6 with the global climate model EC-Earth. In particular, KNMI chairs the High-Resolution MIP (HighResMIP), and coordinates EC-Earth's contributions to the Aerosols and Chemistry MIP (AerChemMIP).
- **AC SAF**. KNMI is involved in the EUMETSAT Satellite Application Facility on Atmospheric Composition Monitoring. Within this SAF, KNMI generated offline products such as global albedo and Solar-induced Fluorescence from (GOME-2 and TROPOMI) satellite data. Data are available via http://www.temis.nl/.

Participant No. 15: Oeko-Institut e.V., Germany

Partner description:

Oeko-Institut is a leading independent European research and consultancy institute working for a sustainable future. Founded in 1977, the Institute develops principles and strategies for realising the vision of sustainable development globally, nationally and locally. Oeko-Institut employs more than 165 staff, including 115 researchers at three locations in Germany – Freiburg, Darmstadt and Berlin. It is

a non-profit association. Based on value-oriented research, the Institute provides consultancy for decision makers in politics, industry and civil society. The Institute's key clients are ministries and national agencies, industrial enterprises and the European Union. In addition, the Institute is commissioned by non-governmental organisations and environmental associations. Oeko-Institut collaborates with research institutions and is active in national and international networks such as in Ecornet (Ecological Research Network). In the consortium it thus takes the important role of bridging between scientific requirements evolving from climate policy and scientific knowledge transfer into policy options.

Oeko-Institut has recently successfully completed research in the field of renewable energy and land use, assessment of bioenergy potentials and sustainability criteria for biomass production with direct relevance to the key questions regarding this project proposal. This includes the "Study on impacts on resource efficiency of future EU demand for bioenergy" (ReceBio) commissioned by DG Environment and the "Independent Monitoring: Building trust and consensus around GHG data for increased accountability of mitigation in the land use sector" commissioned by DG CLIMA. Moreover, Oeko-Institut has recently worked on accounting rules for forests and land use, the impact of including the land use sector in the 2030 energy and climate package, requirements for accounting evolving from the Paris Agreement, and the role of independent Monitoring Reporting and Verification (MRV) opportunities for the land-use sector. Oeko-Institut is further developing and applying a forestry and an agriculture model that can be used to simulate forest management options in Germany and for assessing impacts of agricultural biomass production and use.

Legal entity: SME

Role in the project:
Within LANDMARC Oeko-Institut will be involved regarding the following aspects. Oeko-Institut will lead and carry out a case study on exploring potentials and opportunities for implementing LMTs through forest management in Germany. This work includes stakeholder involvement, modeling of forest management options, risk and sustainability assessment of the case study and its dissemination. Moreover, Oeko-Institut will coordinate Task 2.4 that will provide guidance on how adequate and transparent reporting and accounting of LMT solutions will have to be designed in order to effectively capture mitigation contributions, ensure permanence of mitigation effects and avoid double counting. Oeko-Institut will also contribute to Task 6.2 Development of LMT scaling narratives and specification of global scenario.

Involved personnel:
Hannes Böttcher (male) is Senior Researcher at Oeko-Institut in Berlin and coordinating the team "Biogenic resources and land use". He holds an MSc degree in forest sciences and ecology from the University of Gottingen (Germany). In 2008 he received his PhD degree from the University of Freiburg. Previously Hannes Böttcher worked at the Max Planck Institute for Biogeochemistry in Jena (Germany) on forest carbon modelling. From 2007 to 2013 he coordinated research related to GHG emissions from land use at the International Institute for Applied Systems Analysis (IIASA, Austria). Dr. Böttcher worked on and published research for more than 10 years on biomass potentials and sustainability criteria for the use of biomass, modelling of forest management options and their implications for the carbon balance, global monitoring of forests and activities for mitigating emissions from deforestation and forest degradation, as well as accounting rules in the land use, land use change and forestry sector (LULUCF) in international climate policy. He has been a lead author of the IPCC Report "2013 Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol" and works on consultancy projects for NGOs, the European Commission and the German Government on climate policy around the land use sector.

Klaus Hennenberg (male) works as a Senior Researcher in the Energy and Climate Division of the Oeko-Institut since 2007. Formerly, from 2005 to 2007 he worked as project manager for biogas projects (Turkey, China). His PhD study was embedded in the BIOTA-project (Biodiversity Transect Analysis in Africa) and dealt with vegetation ecology and forest edge effects (2001-2004). In parallel, he finished a part-time program of studies on energy and environment at the University of Kassel. Key issues of his expertise are biodiversity and ecological research as well as material-flow and life-cycle analysis and project development. Currently, his work focuses on the sustainability of biomass production for energy and materials (topics: biodiversity, soil, water, land use change and related indirect effects) as well as modelling LULUCF, land use (agriculture and forestry) and housing stock. He is a member of the German DIN-Committee NA 172-00-10 AA

“Sustainability Criteria for Biomass” working on international sustainability standards for bioenergy and biomaterials (CEN, ISO).

Judith Reise (female) has been working at the Eberswalde University for Sustainable Development (HNEE) since 2015 as a research assistant in the field of forests and environment. From September 2019 she will join Oeko-Institut as a Senior Researcher supporting the team “Biogenic resources and land use”. Judith Reise studied Biodiversity and Ecology (B.Sc.) at the University of Göttingen until 2009, specialising in evolutionary biology, nature conservation and vegetation ecology. In 2012 she completed her master's degree in Global Change Ecology at the University of Bayreuth and specialized in ecological modelling for the impact analysis of climate and land use changes on biodiversity. At HNEE she worked in the work package "Biodiversity and Nature Conservation" (AP 6) of the joint project "Sustainability Assessment of Alternative Forest Treatment and Wood Use Scenarios with Special Consideration of Climate and Biodiversity Conservation (WEHAM Scenarios, 2015-2017)". Her work focused on assessing the impact of different forest management measures on forest biodiversity in Germany and determining forest biodiversity indicators as part of a comprehensive sustainability assessment. Judith Reise's current research focuses include the analysis of National Forest Inventory data with regard to its potential for monitoring forest biodiversity, sustainability criteria for the use of biomass, and regional climate mitigation and adaptation concepts.

Relevant publications to the call content:

- Böttcher, H.; Hennenberg, K.; Winger, C. (2018): Forest vision Germany – Description of methods, assumptions and results. https://www.oeko.de/fileadmin/oekodoc/Forest-Vision-Methods-and-Results.pdf
- Böttcher, H.; Herrmann, L.; Herold, M.; Romijn, E.; Román-Cuesta, R.; Avitabile, V.; de Sy, V.; Martius, C.; Gaveau, D.; Fritz, S.; Schepaschenko, D.; Dunwoody, A. (2017): Independent monitoring: Building trust and consensus around GHG data for increased accountability of mitigation in the land use sector. Available at https://www.oeko.de/publikationen/p-details/independent-monitoring-building-trust-and-consensus-around-ghg-data-for-increased-accountability-of/
- Frank, S.; Böttcher, H.; Gusti, M.; Havlík, P.; Klaassen, G.; Kindermann, G.; Obersteiner, M. (2016). Dynamics of the land use, land use change, and forestry sink in the European Union: The impacts of energy and climate targets for 2030. Climatic Change. doi:10.1007/s10584-016-1729-7.
- Böttcher, H.; Graichen, J. (2016): Going beyond 40% - options to ensure LULUCF maintains the high environmental integrity of the EU climate and energy package. Öko-Institut e.V. Berlin. Available at http://www.oeko.de/oekodoc/2541/2016-068-en.pdf
- Smith, P.; Haberl, H.; Popp, A.; Erb, K.-H.; Lauk, C.; Harper, R.; Tubiello, F.; De Siqueira Pinto, Alexandre; Jafari, M.; Sohi, S.; Masera, O.; Böttcher, H.; Berndes, G.; Bustamante, M.; Ahammad, H.; Clark, H.; Dong, H.; Elsiddig, E.; Mbow, C.; Ravindranath, N.; Rice, C.; Robledo Abad, C.; Romanovskaya, A.; Sperling, F.; Herrero, M.; House, J. & Rose, S. (2013). How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals? Global change biology, 19(8), pp. 2285–2302. doi:10.1111/gcb.12160.
- Böttcher, H., Freibauer, A., Scholz, Y., Gitz, V., Ciais, P., Mund, M., Wutzler, T., Schulze, E-D. (2012) Setting priorities for land management to mitigate climate change. Carbon Balance and Management, 7:5.
- Böttcher, H. and M. Lindner (2010). Managing Forest Plantations for Carbon Sequestration Today and in the Future. In: J. Bauhus, P. v. d. Meer and M. Kanninen, Ecosystem Goods and Services from Plantation Forests, Earthscan: 240.

Relevant previous projects or activities, connected to the subject of this proposal:

- **Strengthening independent monitoring of GHG emissions from land activities for publishing, comparing and reconciling estimates**, DG CLIMA, 2014 –2017, The objective of the study was a proof of concept for publicly available, comprehensive, global, spatial information systems on land cover, land emissions, land use and associated trends. A number of case studies were developed to demonstrate how publicly available, comprehensive, global, spatial information systems on land cover, land emissions, land use and associated trends can support the implementation of land-based mitigation activities. The case studies were oriented towards different stakeholder groups and different data approaches to demonstrate what is needed to enable, catalyze and fasten progress towards more reliable, accurate, precise, time-

consistent and globally comparable information on land-emissions. See www.transparent-monitoring.org for more information.

- **Forest Vision Germany - Plan B for German forests**, Greenpeace Germany, 2015-2018, The project aimed at modelling and discussing alternative forest management scenarios and their implications for key environmental and economic indicators such as biodiversity, carbon storage and total GHG emissions, wood production, wood quality and use at the landscape level. The scope went beyond the forest area and included the entire forestry sector and a discussion of trade implications. For the project the forestry and agriculture model FABio, that has been developed at Oeko-Institut was developed further. See www.waldvision.de for more information.
- **Low-Carbon Europe: Development of ambitious climate protection scenarios, taking into account security of energy supply, sustainability and competitiveness**, German Environmental Agency, 2016-2019, The aim of the project was to develop a "Low-carbon Europe 2050" model including all sectors. The focus was on quantitative and qualitative analysis of options for a low-emission scenario for Europe. The analysis included the exploration of decarbonisation and mitigation strategies in the land use sector. The constructed scenario showed that a GHG-neutral EU is feasible even without the use of CCS and limited amounts of bioenergy. Due to unavoidable GHG emissions from agriculture, industrial processes and waste procurement, however, a lower activity of the agricultural sector and an increased GHG sink from the LULUCF sector is necessary.

Description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work:

FABio - Forestry model: The Forestry and Agriculture Biomass Model (FABio) is being developed at Oeko-Institut since 2015. FABio forestry is a simulation model programmed in the software AnyLogic. It projects individual tree growth (distance-independent), mortality and harvest under different management systems. The model is based on data of the German National Forest Inventories 2002 and 2012. It includes modules for the calculation of carbon stored in living and dead biomass, harvested wood products, litter and soil.

Participant No. 16: CIAT, Colombia

Partner description:

The International Center for Tropical Agriculture (CIAT) is part of the Consultative Group International Agricultural Research (CGIAR) conducting cutting-edge research across the developing world with more than 1000 staff members and 35 country offices. CIAT develops technological, socio-institutional and market-driven innovations to enhance crop improvement and management, sustainable use of natural resources, and improve policy- and decision-making. Its underlying mission is to support agriculture sectors in developing countries achieve poverty reduction, food and nutrition security, and livelihood resilience to emerging climate- and environment-related risks.

For more than ten years, CIAT has been leading the research program on Climate Change, Agriculture and Food Security (CCAFS), which is a strategic partnership that arises from the collaboration between the CGIAR and the Earth System Science Partnership (ESSP). The initiative brings together strategic research in agricultural science, research for development, climate science and the terrestrial system, in order to identify and address the most important interactions and synergies between climate change, agriculture and food security. This cooperation seeks to integrate the knowledge and needs of farmers, policy makers, donors and other stakeholders into the tools and approaches developed. As a collective effort coordinated by CIAT, CCAFS will facilitate actions through various CGIAR centers and other research programs. More information about CCAFS in the following link: https://ccafs.cgiar.org/about-us#.XQo-BlVKiUk

Legal entity:

CIAT is a non-for-profit international research organization, with Headquarters in Colombia and regional offices in LAC, Asia and Africa. We work in 53 countries in the tropics.

Role of partner in the project:
Leader of Vietnam Coffee case study, contributor to Indonesia cocoa case study and to the regional engagement actions and within key world regions with CIAT presence (Latin America, Africa and Asia). CIAT will also contribute to the development of regional upscaling scenarios for LMT solutions and will also will provide the LANDMARC consortium access to its global network.

Involved personnel:
Peter Laderach (PhD) (male): Peter is the Climate Change Theme Leader at the International Center for Tropical Agriculture (CIAT) and the Contact point of the global program on Climate Change, Agriculture and Food Security (CCAFS). Peter is based in Rome, Italy as a joint Senior Climate Expert for CIAT, CCAFS, IFAD and WFP. Peter led the expansion of the Climate Change theme at CIAT to Central America, Africa and Asia, with extensive work experience in more than 20 countries. More than 15 years of experience of research in developing countries to support the goals of alleviating poverty, adapting to and mitigating climate change, and protecting the environment. Peter's passion is designing and conducting research that leads to visible impact. His work has supported private sector, NGO's, governments and multinational agencies in taking evidence-based decisions and deliver impact on the ground. Peter is also a globally recognized coffee and cocoa expert. Peter holds an Msc in Geography and a PhD in Tropical Agriculture (suma cum laude), he has published over 50 peer-reviewed articles.

Nam Nguyen (male): Nam is a researcher in the Climate-Resilient Agriculture team at the International Center for Tropical Agriculture (CIAT). His research interests is on sustainable and clean development within the South East Asia region and especially Vietnam. In the past, Nam has maintained a wide portfolio of work, including: conducting research with CIAT on the adoption of climate-smart cassava cropping practices from farmers in Quang Binh, Central Vietnam; with Environmental Resources Management (ERM), reviewing environmental impact assessments and the adherence to Vietnamese environmental, labor, health and safety regulations of major oil, gas, solar, hydropower projects in Vietnam; assessing and comparing carbon sequestration levels between shade-grown coffee and monoculture coffee plantations in Costa Rica; working as a data analyst for his university in the United States to collect and analyse transportation and commuting data, to estimate the university's carbon footprint levels; and finally, examining the capacities and resources, as well as the existing gaps, for communities in Panchkhal Valley, Nepal to adapt and mitigate the impacts of climate change. Currently, Nam is collaborating with CIAT scientists and engaging with national partners to study the vulnerability of communities in Vietnam to climate shocks and stressors.

Relevant publications to the call content:

- Baca M, **Läderach P**, Haggar J, Schroth G, Ovalle O (2014) An Integrated Framework for Assessing Vulnerability to Climate Change and Developing Adaptation Strategies for Coffee Growing Families in Mesoamerica. PLoS ONE 9(2): e88463. doi:10.1371/journal.pone.0088463
- Bunn C, **Läderach P**, Ovalle Rivera O, Kirschke D (2014) A bitter cup: climate change profile of global production of Arabica and Robusta coffee. Climatic Change (2015) 129:89–101 DOI 10.1007/s10584-014-1306-x
- Craparo A.C.W, Van Asten P.J.A, **Läderach P**, Jassogne L.T.P, Grab S.W (2015) Coffea arabica yields decline in Tanzania due to climate change: Global implications. Agricultural and Forest Meteorology 207/ 1–10: DOI:10.1016/j.agrformet.2015.03.005
- **Läderach, P** ; Ramirez–Villegas, Julian; Navarro-Racines, Carlos; Zelaya, Carlos; Martinez–Valle, Armando; Jarvis, Andy. 2016. Climate change adaptation of coffee production in space and time. Climate Change. Springer Link, 1-16 p. http://dx.doi.org/10.1007/s10584-016-1788-9
- **Läderach P**, Martinez-Valle A, Schroth G, Castro N (2013) Predicting the future climatic suitability for cocoa farming of the world's leading producer countries, Ghana and Côte d'Ivoire. Climatic Change DOI 10.1007/s10584-013-0774-8
- **Läderach P**, Oberthür T, Cook S, Estrada Iza M, Pohlan JA, Fisher M, Rosales Lechuga R (2011) Systematic agronomic farm management for improved coffee quality. Field Crops Research 120 (2011) 321–329: Doi:10.1016/j.fcr.2010.10.006

- Ovalle-Rivera O, **Läderach P**, Bunn C, Obersteiner M, Schroth G (2015) Projected Shifts in Coffea arabica Suitability among Major Global Producing Regions Due to Climate Change. PLoS ONE 10(4): e0124155. DOI:10.1371/journal.pone.0124155
- Rahn E, **Läderach P**, Baca M, Cressy C, Schroth G, Malin D, van Rikxoort H, Shriver J (2014) Climate change adaptation, mitigation and livelihood benefits in coffee production: where are the synergies? Mitig Adapt Strateg Glob Change (2014) 19:1119–1137: DOI 10.1007/s11027-013-9467-x
- Schroth G, Jeusset A, da Silva Gomes A, Tavares Florence C, Pinto Coelho NA, Faria D, **Läderach P** (2014) Climate friendliness of cocoa agroforests is compatible with productivity increase. Mitig Adapt Strateg Glob Change: DOI 10.1007/s11027-014-9570-7
- Schroth G**, Läderach P**, Martinez-Valle, AI, Bunn, C, Jassogne, L (2016) Vulnerability to climate change of cocoa in West Africa: Patterns and opportunities and limits to adaptation. Science of Total Environment 556, 231-241: http://dx.doi.org/10.1016/j.scitotenv.2016.03.024
- Schroth G**, Läderach P**, Martinez-Valle, AI, Bunn, L (2016) From site-level to regional adaptation planning for tropical commodities: cocoa in West Africa. Mitig Adapt Strateg Glob Change: http://link.springer.com/article/10.1007/s11027-016-9707-y
- Schroth G, **Läderach P**, Blackburn Cuero DS, Neilson J, Bunn C (2014) Winner or loser of climate change? A modeling study of current and future climatic suitability of Arabica coffee in Indonesia. Regional Environmental Change. DOI 10.1007/s10113-014-0713
- van Rikxoort H, Schroth G, **Läderach P**, Rodríguez-Sánchez B (2014) Carbon footprints and carbon stocks reveal climate-friendly coffee production. Agronomy for Sustainable Development. 34 (4) 887-897: DOI 10.1007/s13593-014-0223-8
- Vermeulen S, Challinor AJ, Thornton PK, Campbell BM, Eriyagama N, Vervoort JM, Kinyangi J, Jarvis A, **Läderach P**, Ramirez-Villegas J, Nicklin KJ, Hawkins E, and Daniel R. Smith (2013) Addressing uncertainty in adaptation planning for agriculture. PNAS: Doi/10.1073/pnas.1219441110

Relevant previous projects or activities, connected to the subject of this proposal:
- Reducing Indonesian cacao's environmental footprint while securing supply in the face of progressive climate change. Tiffany, T. (Principal Investigator). *Mondelez International*. Funded for 400,000 USD. (1/13/2017 – 9/30/2018).
- Hands and minds connected to boost eco-efficiency on smallholder livestock-crop systems: Participatory approaches towards eco-efficient livestock-crop systems for smallholder farmers in Laos, Cambodia and Vietnam. Sabine, D. (Principal Investigator). *German Agency for International Cooperation*. Funded for 946,940 USD. (5/1/2015 – 12/31/2018).
- Improved business through seasonal forecasting. Tiffany, T. (Principal Investigator). *Nordic Climate Fund*. Funded for 284,695 USD. (9/3/2018 – 3/3/2021).
- Applying seasonal climate forecasting and innovative insurance solutions to climate risk management in the agriculture sector in South-East Asia (De-RISK). Pablo, I. (Principal Investigator). *World Meteorological Organization.* Funded for 3,210,603 USD. (8/16/2018 – 12/31/2022).
- Development and implementation of Terra-I for near real time monitoring of Vietnamese forests - Piloting in Di Linh district, Lam Dong province (Terra-I). Louis, R. (Principal Investigator). *United Nations Development Program.* Funded for 41,591 USD. (8/25/2017 - 3/31/2019).
- Measuring the Pulse of Vietnam. Peter, L. *World Food Programme.* Funded for 90,000 USD. *(5/1/2019 – 10/31/2019).*

Participant No. 17 – COBRA Collective (COBRA), United Kingdom

Partner description:

The COBRA Collective CIC (www.cobracollective.org) is a UK-based social enterprise with a clear vision: to see a world where marginalised communities are empowered to control their own destiny. Our mission is to empower communities to achieve positive change through capacity building, strengthening resilience, and developing long-term partnerships and collaborations. We currently have a membership of 16 researchers and practitioners of UK, Belgian, Italian, French, Guyanese, Brazilian and Venezuelan nationalities, with diverse

gender, ethnic and career profiles, who share the same commitment towards social justice, participation and environmental preservation.

The Cobra Collective was founded in 2016 by four participants - Drs Mistry, Berardi, Simpson and de Ville as Co-Directors – from the FP7 project 'Local solutions for future challenges: Community Owned Best practice for sustainable Resource Adaptive management in the Guiana Shield, South America' (COBRA). This project aimed to evidence how local community owned solutions in South America can contribute to maximising ecological sustainability and social justice.

The Cobra Collective is unique in three ways: firstly, we take an interdisciplinary and systemic lens on global challenges. Through our membership, we bring together several decades of environmental, social and technological experience in tackling the root causes of inequality and environmental degradation, including the loss of local knowledge, poor social cohesion, and the lack of participation and representation in decision-making processes. Secondly, we are solutions focused. Using the idea of 'positive deviance', we foster long-term engagements to identify, promote and strengthen those solutions that are already present within marginalised communities. This enables self-belief, confidence and resilience towards self-determination. Thirdly, we use accessible technologies to build capacity and agency in marginalised communities. We specialise in using participatory video, photography and community blogging, which allow marginalised groups to develop and control their own narratives in the context of institutional inequality. We also build capacity for local groups to use ecological techniques and low-cost drones for monitoring their territories in light of environmental threats, and deploy community wireless networks to facilitate information sharing within remote locations.

Legal entity: Community Interest Company

Role of partner in the project:
COBRA collective will take the role of case study leader in Venezuela, Colombia and Brazil focused on Indigenous ways of fire management as LMT to prevent catastrophic wildfires and preserve large carbon sinks in the amazon forests. In addition, COBRA will co-lead the regional case study for the Americas as proposed in WP6.

Involved personnel:
Prof. Dr. Bibiana Bilbao (female). Bibiana Bilbao is an active member of Cobra Collective CIC, UK, and Professor at the Environmental Studies Department, Universidad Simón Bolívar, Venezuela. Bibiana, a field and experimental ecologist, has more than 25 years of teaching and researching experience in tropical ecology, fire ecology, biogeochemical cycles and vegetation change. Bibiana's expertise also includes coordination, leading national and international interdisciplinary action-research projects facilitating the integration of scientific, technical and local Indigenous knowledge for the design of environmental sustainable management plans. She has also promoted legitimate policies of fire management, fostering Indigenous livelihood and cultural heritage as well as biodiversity conservation in natural areas of Venezuela, Guyana and Brazil. Europe Award 2010 Innovation for Sustainable Development for the coordination of the interdisciplinary project: "Risk factors in habitat reduction in the Canaima National Park: Vulnerability and Tools for Sustainable Development". National Award 2013 for Best Scientific Work, Technology and Innovation. Area: Natural Sciences. Ministry of Science, Technology and Innovation. She co-leads the Participatory and Intercultural Fire Management Network in South America and member of Advisory Board of the international Leverhulme Centre for Wildfires, Environment and Society, UK.

Prof. Dr. Jayalaxshmi Mistry (female). Jay Mistry is Co-Director of the Cobra Collective CIC specialising in environmental management and governance in the tropics. She is also Professor of Environmental Geography at Royal Holloway University of London, and Associate Director of the Leverhulme Centre for Wildfires, Environment and Society, UK. She has a BSc in Biology (KCL) and a PhD in Geography (SOAS). A transdisciplinary scholar, she has published widely on fire management across both the natural (e.g. Journal of Biogeography, Biotropica) and social (e.g. Human Ecology, Ambio) sciences and now co-leads the Participatory and Intercultural Fire Management Network in South America. She has significant and sustained success in obtaining research grants and has been Principal Investigator of, amongst others, prestigious EU Seventh Framework programme, US-based National Geographic, and UK Darwin Initiative (DEFRA) and

Foreign and Commonwealth Office grants. These have all involved leading and supporting multidisciplinary, multinational research teams; for example, the EU-funded project involved ten partners across Europe and South America, of various disciplines and institutional structures and a budget of 1.9 million Euros. Together with a post-doctoral researcher, a project administrator and a PhD student, Jay managed all research and associated activities undertaken by partners and staff, which comprised a team of 30 people. She was awarded the Busk Medal in 2015 by the Royal Geographical Society in recognition of her contributions over the last 25 years to conservation policy in the Global South.

Dr. Rosalba Gómez (female). Rosalba Gómez is a biologist (Universidad Central de Venezuela), with a PhD in Plant Systematics Studies from The University of Reading, UK. She is currently working as a Professor in the Universidad Nacional Experimental Francisco de Miranda UNEFM, in charge of Botany undergraduate courses as well as Foresight Studies postgraduate courses, and coordinating the recently created Instituto de Investigaciones y Postgrado en Ciencias del Agro y del Mar (Research and Postgraduate Institute in Agronomical and Marine Sciences. She has fourteen years of experience in management in academic as well as in public office positions. She has been in charge of university inter-institutional cooperation and planning offices. From 2006-2011, she directed several projects aimed to improve the environmental and technological sustainability of traditional productive processes of farmers´ communities in Falcón state, through the creation of academic and institutional collaborative networks. Since January 2017, she has been actively involved in the research team coordinated by Prof Bibiana Bilbao, assisting the intercultural workshops developed as part of the projects funded by British Academy of Science and British Embassy in Caracas.

Ingrid Jasmine Lanz (female). Ingrid Jasmine Lanz is Pemón Arekuna Indigenous from the community of Kavanayen in the south of Bolivar State, Venezuela. She is fluent in Spanish as well as the native Indigenous Pemón language. She has been working as a community researcher for more than 8 years in research projects coordinated by the Simón Bolívar University for the benefit of Indigenous communities in the conservation of their traditional knowledge and practices. As part of these activities, she is contributing to the rescue of Indigenous knowledge through the development of a book for the community that collects the testimonies of Pemón Indigenous grandparents regarding Indigenous ancestral practices including fire.

Relevant publications to the call content:

- **Bilbao**, B., **Mistry**, J., Millán, A. and Berardi, A. 2019. Sharing Multiple Perspectives on Burning: Towards a Participatory and Intercultural Fire Management Policy in Venezuela, Brazil, and Guyana. Fire, 2, 39. https://doi.org/10.3390/fire2030039
- **Mistry**, J., Schmidt, I. Eloy, L. and **Bilbao**, B.A. 2018. New perspectives in fire management in South American savannas: The importance of intercultural governance. Ambio https://doi.org/10.1007/s13280-018-1054-7
- Eloy, L., **Bilbao**, B.A., **Mistry**, J. and Schmidt, I. 2018. From fire suppression to fire management: advances and resistances to changes in fire policy in the savannas of Brazil and Venezuela. The Geographical Journal. DOI: 10.1111/geoj.12245
- **Mistry**, J., **Bilbao**, B.A. and Berardi, A. 2016. Community owned solutions for fire management in tropical ecosystems: case studies from Indigenous communities of South America. Philosophical Transactions of the Royal Society B, 371: 20150174
- Russell-Smith, J., Monagle, M. C., Jacobsohn, M., Beatty, R. L., **Bilbao**, B.A., Vessuri, H., Sánchez, I., y Millán, A. 2013. Can savanna burning projects deliver measurable greenhouse emissions reductions and sustainable livelihood opportunities for indigenous and local communities, in fire-prone settings? Climatic Change, 121: 1-15. DOI 10.1007/s10584-013-0910-5
- **Bilbao**, B.A, Leal, A., and Méndez, C. 2010. Indigenous use of fire and forest loss in Canaima Nacional Park, Venezuela. Assessment of and tools for alternative strategies of fire management in Pemón indigenous lands. Human Ecology, 38:663-673. doi. 10.1007/s10745-010-9344-0.

Relevant previous projects or activities, connected to the subject of this proposal:

Profs. Bilbao and Mistry of the CC team, involved in this proposal, act(ed) as overall project coordinators of the following projects:

- "Evaluation of vulnerability actions and adaptation to climate change in RIOCC countries". RIOCCADAPT Project. Ibero-American Network of Climate Change Offices (RIOCC), ARAUCLIMA

Program, Transfer, Exchange and Knowledge Management Plan for the Development of Spanish Cooperation in Latin America and the Caribbean —INTERCOONECTA, Spanish Agency for International Development Cooperation (AECID). (Lead Coordinator-Author, Project Fire Section). 2017-2019

- "Design of action plans on climate change: Integrating the perspectives from the local Indigenous with the academy and institutions in the Canaima National Park", British Embassy in Venezuela. 2016-2017
- "Building the case for integrating indigenous and academic knowledge into a participatory and sustainable fire management policy". British Academy of Science. 2016-2018
- "Ecological basis and traditional knowledge Pemón del fuego: local solutions to global problems of change. Apök (Fire in Pemón Language) Project". Strategic. Project FONACIT - 2011000376), Ministry of Popular Power of Science, Technology and Intermediate Industries. 2013-2018
- Risk factors in habitat reduction in Canaima National Park: vulnerability and tools for sustainable development. Group Project: FONACIT G-2005000514 - Ministry of Science, Technology and Intermediate Industries. 2007 - 2013

Description of any significant infrastructure and/or any major items of technical equipment, relevant to the proposed work:

The COBRA Collective has state-of-the-art audio-visual equipment to support the research programme, as well as accompanying manuals and materials in English, Spanish and Portuguese.

Participant No. 18: Innolab Space (ILS), Canada

Partner Description:

Innolab Space (ILS) is a Non-profit organization (NGO) incorporated in Alberta, Canada in 2016 aiming to bridge the gap between traditionally academic spheres and spheres championing social and environmental causes. Innolab Space seeks to merge difference spheres of expertise to find innovative solutions to age-old problems. We tackle a wide variety of projects, but always at the core of what we do, is our interdisciplinary approach and vision for a sustainable and better transition to the future.

ILS has as main objectives: (i) To provide a platform to promote social, technological and policy innovations for a transition towards more sustainable future, (ii) To support evidence based decision making at the policy and business level through the development of robust methods, strategies, and frameworks, (iii) To promote stakeholder engagement through providing neutral platforms that support collaboration and co-development for sustainable approaches and solutions, and (iv) To provide a safe experimental space for entrepreneurs, researchers, professionals, interns, new graduates from all social, cultural, religious and education backgrounds to encourage learning and innovation.

Legal entity: Non-profit organization

Role of partner in the project:

ILS' role in the project is to lead case study work in Canada, Colombia and Venezuela exploring socio-economic factors impacting green transitions. ILS will specifically evaluate field data aligned with the WP objectives in the countries of action, contribute to expand knowledge in different regions under different contexts, and further support transdisciplinary research methods across other case studies when needed.

Involved personnel:

Dr. Luis Virla (male) is a Postdoctoral Associate in the University of Calgary and Co-Director of ILS. Luis earned his PhD in Chemical Engineering from the University of Calgary (2018). His research focus was the development of catalytic technologies for CO2 capture and utilization. He also holds a BSc (2008) and an MSc (2013) in Chemical Engineering from the University of Zulia in Venezuela. Luis is currently working as a postdoctoral fellow with Industrial Climate Solutions, Inc. and the University of Calgary in a joint project dedicated to the development of a novel Gas-Liquid contacting technology for CO2 capture and chemical

synthesis. Before his PhD, Luis worked for six years as a Project Leader for Investigacion Desarrollo C.A. (INDESCA), dedicated to R&D in chemical processes and optimization for the petrochemical industry. In addition, Luis held a two-year appointment (2016-2018) as a Research Fellow of the Science Policy Research Unit (SPRU) of the University of Sussex as part of the TRANSrisk project (EU Horizon 2020). In this role, Luis lead a case study looking at risks and uncertainties within low-carbon transition pathways for the Canadian energy sector. Luis is also the co-founder of InnoLab Space, a NGO dedicated to promote policy innovation and sustainable development with communities as starting point.

Relevant publications to the call content:

- P. Erickson, R. Boychuk, S.J. Davis, G. Goldman, N. Healy, K. Mulvey, G. Piggot, K. Siegel, G. Supran, Kelly Trout, and L.D. Virla. *Addressing fossil fuel extraction under a Green New Deal.* Science (2019). (Submitted)
- L.D. Virla, D. van de Ven, J. Sampedro, O. van Vliet, A. Smith, H. Pollit, and J. Lieu. *Local perspectives on risks in the lower-carbon transition of the Alberta Oil Sands.* Environmental Innovation and Societal Transitions (EIST). (2019). (Submitted)
- L.D. Virla, C. Fitzpatrick, and J. Lieu. *Finding common ground: The need for plural voices in lower-carbon futures of the Alberta oil sands, Canada*, in "Hanger-Kopp, S., Lieu, J., Nikas, A. (Eds.), "Narratives of Low-Carbon Transitions: Understanding Risks and Uncertainties". Routledge, Abingdon, 2019
- J. Lieu, L.D. Virla, R. Abel, and C. Fitzpatrick. '*Consensus Building in Engagement Processes' for reducing risks in developing sustainable pathways: Indigenous interests as core elements of engagement*, in "Understanding risks and uncertainties in energy and climate policy: Multidisciplinary methods and tools towards a low carbon society". TRANSrisk Special Edition. Springer Book. Editors: H. Doukas, Al. Flamos, J. Lieu, 2018

Relevant previous projects or activities, connected to the subject of this proposal:

- TRANSrisk (2015-2018): 'Transitions Pathways and Risk Analysis for Climate Change Mitigation and Adaption Strategies'. The project has the objective to explore low emission transition pathways and analyse risks related to these. Funded by EU Horizon 2020. Grant Agreement No: 642260. www.transrisk-project.eu.

4.2. Third parties involved in the project (including use of third-party resources)

Participant No. 1: ETH Zurich, Switzerland

No third parties involved

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
If yes, please describe and justify the tasks to be subcontracted We would like a sub-contractor to support training case study leads with ALCES, the land use models. The sub-contractor will also provide customer service after the training in case partners have follow up questions. We would also like the partner to apply ALCES more in-depth with its full features in 1-2 LMT case studies. We also want to have sub-contracting agreement with a network multiplier such as WOCAT to ensure that we can benefit from existing regional networks, benefit from the use of existing tools and methods, and aid in the further development of others, as well as have a place to put our research outputs that outlives the projects.	
Does the participant envisage that part of its work is performed by linked third parties[1]	N
If yes, please describe the third party, the link of the participant to the third party, and describe and justify the foreseen tasks to be performed by the third party	

[1] A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
If yes, please describe the third party and their contributions	
Does the participant envisage that part of the work is performed by International Partners[2] (Article 14a of the General Model Grant Agreement)?	N
If yes, please describe the International Partner(s) and their contributions	

Participant No. 2: JIN Climate and Sustainability (JIN), Netherlands

No third parties involved

Participant No. 3: AMBIENTA Ingeniería y Servicios Agrarios y Forestales S.L.U. (AMBIENTA), Spain

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
If yes, please describe and justify the tasks to be subcontracted	
Does the participant envisage that part of its work is performed by linked third parties	Y
If yes, please describe the third party, the link of the participant to the third party, and describe and justify the foreseen tasks to be performed by the third party AMBIENTA is planning to subcontract Mr. Luis Guada, technical manager of INNOFOR, as a technical consultant. Mr. Guada is MSc Forestry Engineer, with more than 16 years of experience. He will work in the related tasks in the in-situ measurements of WP3, as well as support for the development of technological tools for forestry, agroforestry and agriculture monitoring. His experience in forestry and environmental engineering, with three years at INNOFOR as an external consultant for companies and institutions, focused on the application of innovative solutions to land and forestry management, is very much appreciated for LANDMARC in situ monitoring and measurements. Mr. Guada has extensive experience in: o R & D forestry projects. o Sustainable forest management. o Certification of sustainable management. o Environmental works and restorations. o Harvesting of wood and biomass. o Optimization of operations and processes in forest and agrarian management. o Innovative project consulting. o Application of new technologies to forestry and precision agriculture. o Methodological & software development for forestry and precision agriculture. INNOFOR - Ingeniería e Innovación Forestal S.L. (Ingeniería e innovación forestal S.L. CIF: ES- B65042302, Pintora María Blanchard, nº 2 14011 Córdoba, Spain - www.innofor.es) is a start-up company that started its activity in 2013, and in 2016 it became a commercial company, SME, in Spain. The activity of the company focuses on the field of project consultancy, and on the application of innovation to forestry and agrarian management. For this, it has international technological partners with proven experience in the areas of interest of its clients. INNOFOR is the representative and exclusive distributor in Spain of the FIELD-MAP technology for in situ data collection in the field, developed by the Czech Republic company IFER Monitoring and Mapping Solutions, being an official Partner of IFER-MMS in Spain.	

[2] 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

INNOFOR is also an official Partner and representative in Spain of the company ARBONAUT, manufacturers and developers of ArboLiDAR software and other GIS applications on the web. The ArboLiDAR software and the developed Web GIS applications have been used in large projects of sustainability and climate change in more than 30 countries. ---- LABAN - LABORATORIO DE ANÁLISIS DE AGUA, S.L. Poli. Ind. El Carrascal, nave 56, 06140 Talavera la Real (Badajoz). CIF: B-06207104 www.laboratoriodeanalisis.es LABAN has a qualified professional team formed by biologists, agricultural technicians, chemical engineers and food technicians. It has the latest equipment guaranteeing maximum reliability in their tests. Performs the analysis of more than 50,000 annual samples. AMBIENTA is planning to subcontract LABAN for complete analysis of textured soils and C.I.C. of the different case studies. That includes pH, Conductivity, Phosphorus, Calcium, Magnesium, Potassium, Total Organic Matter, Copper, Iron, Manganese, Zinc, Boron, Total Nitrogen, C / N Ratio, Sodium, Texture, Sand, Clay, Slime, C. Cationic, Oxidized Organic Carbon.	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
If yes, please describe the third party and their contributions	
Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
If yes, please describe the International Partner(s) and their contributions	

Participant No. 4: Agroinsider (AI), Portugal

No third parties involved

Participant No. 5: Barcelona Supercomputing Center, Spain

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
If yes, please describe and justify the tasks to be subcontracted	
Does the participant envisage that part of its work is performed by linked third parties	N
If yes, please describe the third party, the link of the participant to the third party, and describe and justify the foreseen tasks to be performed by the third party	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	Y
BSC applies a Third Party modality with the Institut Català de Recerca i Estudis Avançats (ICREA), where the third party makes its resources available to the beneficiary under Article 12 of the Grant Agreement - Use of in-kind contributions provided by third parties free of charge. According to this situation, ICREA will not carry out any part of the work and just lends resources to the beneficiary. These resources are directly used by the beneficiary, the work is performed in its premises and there is no reimbursement by the beneficiary to the third party. The third party makes available resources (dedicated time of **Prof. Francisco J. Doblas-Reyes**, who is employed by **ICREA**) to the beneficiary, which does not reimburse the cost to the third party, but which charges the costs of the third party as an eligible cost of the project. Its costs will be declared by the beneficiary in its Financial Reporting (Form C) but will be recorded in the accounts of the third party. ICREA resources will be available for the whole duration of the project especially for the activities in the Work Packages 4 and 6 with approximate allocation of 10 PMs.	
Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N

If yes, please describe the International Partner(s) and their contributions

Participant No. 6: eLEAF B.V., Netherlands

No third parties involved

Participant No. 7: BioRecro A.B., Sweden

No third parties involved

Participant No. 8: University of Kassel, Germany

No third parties involved

Participant No. 9: Bioclear Earth, Netherlands

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
A subset of the physical and chemical soil parameters will be subcontracted as well as a GHG flux analysis at one of the pilot sites. The analysis always meets the NEN-EN ISO standards. Interpretation of the analysis results is performed in-house at Bioclear earth.	
Does the participant envisage that part of its work is performed by linked third parties	Y
The molecular analyses are performed by the sister company Microbial analysis, part of the Bioclear group. The data analyses is performed by Bioclear earth.	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
If yes, please describe the third party and their contributions	
Does the participant envisage that part of the work is performed by International Partners (Article 14a of the General Model Grant Agreement)?	N
If yes, please describe the International Partner(s) and their contributions	

Participant No. 10: Science Policy Research Unit (SPRU), University of Sussex (UOS), United Kingdom

No third parties involved

Participant No. 11: Cambridge Econometrics Ltd., United Kingdom

No third parties involved

Participant No. 12: The Stockholm Environment Institute (SEI), Sweden

No third parties involved

Participant No. 13: PT Sustainability and Resilience (su-re.co), Indonesia

No third parties involved

Participant No. 14: Royal Netherlands Meteorological Institute (KNMI), Netherlands

No third parties involved

Participant No. 15: Oeko-Institut e.V., Germany

No third parties involved

Participant No. 16: CIAT, Colombia

No third parties involved

Participant No. 17: COBRA Collective (COBRA), United Kingdom

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
If yes, please describe and justify the tasks to be subcontracted	
Does the participant envisage that part of its work is performed by linked third parties[3]	Y
If yes, please describe the third party, the link of the participant to the third party, and describe and justify the foreseen tasks to be performed by the third party *COBRA will subcontract local experts in remote sensing to validate the in-situ data measured by community researchers with satellite information. will collaborate with three academic institutions in the region with expert teams in remote sensing, which will also have access to local data provided by COBRA. These institutions are:* • Universidad del Zulia, Venezuela • Universidad Militar de Nueva Granada, Colombia These institutions will be performing specific remote sensing tasks to validate and complement all the in-situ work done by COBRA in collaboration with the local communities. Due to exchange rate challenges and high overhead charged by the institutions, COBRA will subcontract expert groups on each institution.	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
If yes, please describe the third party and their contributions	
Does the participant envisage that part of the work is performed by International Partners[4] (Article 14a of the General Model Grant Agreement)?	N
If yes, please describe the International Partner(s) and their contributions	

Participant No. 18: Innolab Space (ILS), Canada

No third parties involved

[3] A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

[4] 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

Section 5: Ethics and Security

5.1 Ethics

An ethics self-assessment was performed with the help of the H2020 Ethics self-assessment guidance document.[5] Potential ethical issues were identified for the following two categories:

- Personal data
- Non-EU countries

5.1.1 Personal data

a. Procedures to identify/recruit research participants

LANDMARC will execute a number of tasks for mapping, identification and recruitment of stakeholders to engage within the LANDMARC research activities e.g. providing local data, information, opinions and ideas. This will be done both within the case study countries as well as five world regions. These stakeholders include policymakers, experts, representative academics, NGOs and regional experts. The methodologies applied will contain the recruitment methods, criteria to ensure adequate inclusion/representation of stakeholders and diverse stakeholder groups, criteria for avoiding research bias (e.g. gender dimension), and the criteria to select specific sectors to carry out the following research methods:

1. **In-depth interviews with stakeholders:** Throughout the project stakeholders will be contacted personally by e-mail and/or phone. A list of stakeholders' will be drawn, first from institutional contacts and then from further recommendations given from previously consulted stakeholders.

2. **Surveys:** Survey software (e.g. SurveyMonkey, Google Forms) will be used to contact a wider stakeholder group. The stakeholder list will include:
    - Government departments;
    - Private and public sector industries, associations, and distributors;
    - Electric utilities and regulators;
    - Private sector low emission technology users and/or suppliers;
    - Organisations involved in manufacture, import and sale of technologies;
    - Community Associations (representing households and communities etc.);
    - Environmental and social NGOs and academics;
    - Technical support providers;
    - Labour unions, consumer groups and media;
    - Country divisions of international companies;
    - International organisation/donors;
    - Key market/business stakeholders and associations;
    - Financial experts; and
    - Other relevant NGOs and academics (outside of the environmental and social scope).

    These stakeholders will be drawn from the existing contacts of each partner institutions and affiliated organisations, as well as public domain sources (i.e. the internet).

3. **Workshops**: Participants will include stakeholders in the regions (see point 2 for their possible affiliation).

Once the methodology for stakeholder identification and recruitment (this also relates to the recruitment and selection of Advisory Board members) is established among all partners and confirmed by the consortium, it will be communicated to the EC by month 2 as part of D1.1: Ethics conformance statement, prior to start of the stakeholder engagement activities.

b. Informed consent procedures

The consent procedures for in-depth interviews, surveys and workshops will follow the standard practices/protocols within the research organisations in each country, where a case study or regional engagement actions will be carried out. Each interviewee will be contacted via e-mail or phone, to outline the

[5] https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/ethics/h2020_hi_ethics-self-assess_en.pdf

research intentions and provide details on how the interview information will be used. In general, individual names and organisations will not be identified in the reports. If for any reason, individuals are quoted, we will first verify the accuracy of quotes that are being used with the interviewee.

Those participating in the survey and/or workshop will be provided an Information Sheet, including a consent form, on the project. Participants will be given a minimum of 24 hours to respond to the sheet prior to participating in the research. If the stakeholders' consent to the terms indicated in the Information Sheet, they can proceed to fill in the survey and/or participate in the workshops.

An example Information Sheet and consent form will be communicated to EC by month 2 (as part of D1.1: Ethics requirements) prior to start of activities.

c. Data Protection

All participant institutions will comply with the EU directive 95/46/EC on data protection and with any updates on standards or requirements it might receive during the lifetime of the project.

The ethical standards and guidelines of Horizon 2020 will be rigorously applied, regardless of the country in which the research is carried out.

d. Data Protection – personal data

All stakeholders who will partake in the project will respond within their professional capacity, and only professional opinions will be collected. Personal data collected will include the name of participants, contact details, and the organisations they are affiliated to, and will be kept confidential unless otherwise agreed upon by the interviewee / participant.

The data, including interview recordings, notes, survey responses and comments from stakeholder workshops, will be stored in accordance with **EU data protection requirements** and we will ensure that no identifiable data will be stored longer than required. After the completion of the project, the data will be destroyed, unless agreed otherwise and in line with data protection regulations.

Participants in the interview, surveys and workshops will also be asked if they can be contacted again over the duration of the LANDMARC project.

Data collection, management and protection will be organised in a **data management plan**. It supports the data management life cycle for all data that will be collected, processed or generated by the project. The document will outline how generated data will be handled during the project, and after it is completed (M6).

5.1.2 Non-EU countries

Self-assessment result:
Q: In case non-EU countries are involved, do the research related activities undertaken in these countries raise potential ethics issues?

A: No. It would relate to small soil samples being taken and imported to the EU for scientific research purposes, which are generally exempt from import duties and do not require specific import licenses. The overall weight of a soil sample taken (incl. parcel packaging materials) will range between 0-2kg.

Q: Is it planned to use local resources.

A: No. Does not include any samples of human or animal materials as well as soil samples with historical value or endangered fauna or flora. Will include micro-organisms (in soil), but these samples will be chemically preserved.

Q: Is it planned to import any material from non-EU countries into the EU?
A: Yes.

These soil samples will be used for soil chemical/physical analysis as well as soil biological analysis in EU-based lab facilities (the Netherlands and/or Spain). The samples will be taken from specific plots/sites including forests and grass/agricultural lands in order to determine e.g.:

- Organic matter, quality of SOM and organic carbon
- Nutrients (N, P, K S etc); pH; clay, sand, silt%;
- CEC.

A sample kit (developed and compiled within the Netherlands) will be sent out to the sampling sites. These kits also include a ***'Protocol for sampling and preservation of solid samples'***, including safety sheets regarding the low quantities of chemical substances (e.g. 10 ml of ethanol) that are used for preserving the soil samples. The chemical preservation ensures that no living micro-organisms are imported to the EU.

The non-EU source countries of these soil samples include:

- Indonesia,
- Vietnam,
- Nepal,
- Burkina Faso,
- Kenya,
- South Africa,
- Colombia,
- Venezuela,
- Canada,

LANDMARC partner Bioclear Earth B.V. will coordinate this effort. Bioclear Earth B.V. has extensive experience and expertise with carrying soil analysis (including importing soil samples into the EU) research for scientific purposes.

5.2 Security[6]

Please indicate if your project will involve:

- activities or results raising security issues: NO
- 'EU-classified information' as background or results: NO

[6] See article 37 of the Model Grant Agreement. For more information on the classification of Information, please refer to the Horizon 2020 guidance: https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/secur/h2020-hi-guide-classif_en.pdf.

METEOROLOGICAL, CLIMATOLOGICAL, AND GEOPHYSICAL AGENCY
RESEARCH AND DEVELOPMENT CENTER
Jl. Angkasa I No. 2, Kemayoran, Jakarta 10720, Phone : (021) 4246321 Ext. 1900 Fax. : (021) 65866238
P.O Box 3540 Jakarta, Website : http://www.bmkg.go.id

August 16, 2019

To: JIN – Climate & Sustainability
Ubbo Emmiussingel 19
9711 BB Groningen
The Netherlands
Tel: +31(0)50 762 0930

Letter of Intent to collaborate with proposed H2020 project - LANDMARC
LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate within the LANDMARC H2020 project (proposal) that JIN Climate & Sustainability (the Netherlands) is submitting on behalf of the LANDMARC consortium in the framework of the Horizon 2020 programme.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance the work on the development and implementation of land-based mitigation activities, as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

- Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2),
- Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3)
- Taking part in performing a climate vulnerability assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4)
- Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP5)

Yours sincerely,

Dr. Ardhasena Sopaheluwakan
Deputy Director of Climate and Air Quality Research
Agency for Meteorology Climatology and Geophysics (BMKG)

Ministry of National Development Planning/
National Development Planning Agency (BAPPENAS)
Republic of Indonesia

JALAN TAMAN SUROPATI NOMOR 2 JAKARTA 10310
TELEPON (021) 3912422, 3905650; FAKSIMILE (021) 3912422
www.bappenas.go.id

Indonesia, August 16, 2019

To: JIN – Climate & Sustainability
Ubbo Emmiussingel 19
9711 BB Groningen
The Netherlands
Tel: +31(0)50 762 0930

Letter of Intent to collaborate with proposed H2020 project - LANDMARC

LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project (proposal) that JIN Climate & Sustainability (the Netherlands) is submitting on behalf of the LANDMARC consortium in the framework of the Horizon 2020 programme.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation activities, as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2),	y/n
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3)	y/n
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3)	y/n
Taking part in performing a climate vulnerability assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4)	y/n
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the region, with the help of both land-use and economic models (WP5)	y/n
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated risks, co-benefits and trade-offs of LMT actions in the region, with the help of both land-use and economic models (WP5)	y/n
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP5)	
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2)	y/n

Supporting the establishment and taking an active role in an international LMT learning network (WP7), which will be established within LANDMARC	y/n

Yours sincerely,

Andianto Haryoko,
Deputy Director for Energy Non Electricity

LOIC BRAUNE
Senior Ntural Resource Specialist
Sustainable Development, Africa, Environment and Natural resources management

August 25, 2019

To: JIN – Climate & Sustainability
Ubbo Emmiussingel 19
9711 BB Groningen
The Netherlands
Tel: +31(0)50 762 0930

Letter of Intent to collaborate with proposed H2020 project - LANDMARC

(LAND use based MitigAtion for Resilient Climate pathways)

Dear Sir, Madam,

With this letter we express our intent to collaborate with the LANDMARC H2020 project (proposal) that JIN Climate & Sustainability (the Netherlands) is submitting on behalf of the LANDMARC consortium in the framework of the Horizon 2020 programme.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation activities, as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2),	N
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3)	Y
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3)	Y
Taking part in performing a climate vulnerability assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4)	Y
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-	N

offs of LMT actions in the region, with the help of both land-use and economic models (WP5)	
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated risks, co-benefits and trade-offs of LMT actions in the region, with the help of both land-use and economic models (WP5)	N
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals(WP5)	Y
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.)(WP2)	N
Supporting the establishment and taking an active role in an international LMT learning network (WP7), which will be established within LANDMARC	N

Sincerely,

Loic Braune
Senior Natural Resource Specialist

Annex 1: Description of LMT project or initiative

Burkina Faso has launched multiple actions to design and test in pilot sites a REDD+ strategy. Considering the specificity of the ecoregion (Soudanian savannahs), REDD+ in Burkina Faso includes not only mitigation activities in the forested areas but also in the agriculture fields and pasture land and should be understood as an integrated policy to reduce the Greenhouse gas (GHG) emissions from land use (agriculture, pastoralism), land uses changes (desertification, agriculture expansion) and forestry (deforestation related to fuelwood).

In particular, Burkina Faso has launched in 2018 and 2019 pilot actions in 32 communes (about 120 different sites) with an integrated approach that aims to reduce the GHG emissions. Those activities are almost entire based on land-use based mitigation technologies (LMT) as they combine actual investments in agricultural/pastoralist practices and governance improvement at local level (combining Geographic data and sociology).

The support from LANDMARC wold help Burkina Faso to better assess the result of those investments through earth observation and those results will help Burkina Faso refine its REDD+ strategy to reduce the GHG emissions through land use and land governance activities.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural
and Agricultural Sciences
Department of Plant and Soil Sciences

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Ubbo Emmiussingel 19
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26 August 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project (proposal) that JIN Climate & Sustainability (the Netherlands) is submitting on behalf of the LANDMARC consortium in the framework of the Horizon 2020 programme.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation activities, as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2),	y
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3)	y
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3)	n
Taking part in performing a climate vulnerability assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4)	n
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the region, with the help of both land-use and economic models (WP5)	n
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated risks, co-benefits and trade-offs of LMT actions in the region, with the help of both land-use and economic models (WP5)	n
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals(WP5)	n
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.)(WP2)	n
Supporting the establishment and taking an active role in an international LMT learning network (WP7), which will be established within LANDMARC	n

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www.up.ac.za

Fakulteit Natuur- en Landbouwetenskappe
Lefapha la Disaense tša Tlhago le Temo

Yours sincerely

Nicolette Taylor
Senior Lecturer

•

Annex 1: Description of LMT project or initiative

We are willing to share Eddy Covariance data from agricultural systems, more specifically fruit tree orchards in South Africa for the purpose of increasing our understanding of the role orchards can play in carbon sequestration. Our research is focussed on water use of orchards and we therefore view our role more towards the provision of data sets.

EIP AGRI OPERATIONAL GROUP ECOPRADERAS (SPAIN)

EIP AGRI GRUPO OPERATIVO ECOPRADERAS

TRANSFERENCIA DE CONOCIMIENTO E INNOVACIÓN PARA LA MEJORA EN EL MANEJO Y LA PRODUCTIVIDAD SOSTENIBLE DE LAS PRADERAS DE REGADÍO Y OTROS PASTOS EN EXTREMADURA.

To: JIN – Climate & Sustainability
Ubbo Emmiussingel 19
9711 BB Groningen
The Netherlands
Tel: +31(0)50 762 0930

August, 20th 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC

LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs), as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	yes
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	yes
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	yes
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	yes
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	yes
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	yes
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	yes
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in an regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	yes

Yours sincerely
María del Cármen Martínez
EIP AGRI Operational Group Ecopraderas – Coordinator

EIP AGRI OPERATIONAL GROUP ECOPRADERAS (SPAIN)

EIP AGRI GRUPO OPERATIVO ECOPRADERAS

TRANSFERENCIA DE CONOCIMIENTO E INNOVACIÓN PARA LA MEJORA EN EL MANEJO Y LA PRODUCTIVIDAD SOSTENIBLE DE LAS PRADERAS DE REGADÍO Y OTROS PASTOS EN EXTREMADURA.

Annex 1: Description of LMT project or initiative

EIP AGRI Ecopraderas Operational Group aims to focus its actions on working with a group of Spanish grasslands farmers who want to apply innovative measures, which contribute to a reduction in production costs, greater productivity and yield of crops and their products, climate change adaptation, as well as a lower incidence on the natural environment and river ecosystems.

This is achieved through the transfer of knowledge and innovation, dissemination among the producers of the area of the results obtained, which serves as the basis for a change and improvement of the production model more efficient and competitive, and more respectful with the natural resources of the environment.

The results will be disclosed to the rest of the community. The main object of the group will be the irrigated meadows, but a second beneficiary of the work in red of the same will be the past affected in the extreme pastures.

The general objectives are intended to be achieved through the development of five more concrete lines of work:

- Better knowledge of the existing resources and the different agronomic and environmental variables that influence the prairies through monitoring and the use of new technologies to obtain data that improve the decision-making processes of the farmers.
- Improvement of the efficiency in the management of the prairies, by means of technological transfer to the owners of the prairies, in fields such as paschal mixtures, fertilization, water use, soil conservation, tillage, etc.
- Improvement of innovation in the processes of sustainable production of grasslands. A new innovative agronomic engineering service will be developed that combines the most sustainable traditional management techniques with engineering and the use of new technologies.
- Adaptation to climate change as an end in the decision-making process, and involvement of farmers who must know the role played by the natural environment and in the watershed.
- Transfer, dissemination, co-design activities among the members of the operating group, among others, through work networks, websites, fairs and the works and trials on pilot farms, which are proposed to be developed in the innovation project.

EIP AGRI OPERATIONAL GROUP CEREAL AGUA

Transfer and innovation for water and agronomic sustainability of cereal basins.

EIP AGRI GRUPO OPERATIVO CEREAL AGUA

Grupo Operativo de transferencia e innovación para la sostenibilidad hídrica y agronómica de las cuencas de cereal.

To: JIN – Climate & Sustainability
Ubbo Emmiussingel 19
9711 BB Groningen
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August, 27th 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs), as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	yes
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	yes
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	yes
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	yes
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	yes
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	yes
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	yes
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in an regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	yes

Yours sincerely
Álvaro Santiago Julián
EIP AGRI Operational Group Cereal Agua – Coordinator

EIP AGRI OPERATIONAL GROUP CEREAL AGUA

Transfer and innovation for water and agronomic sustainability of cereal basins.

EIP AGRI GRUPO OPERATIVO CEREAL AGUA

Grupo Operativo de transferencia e innovación para la sostenibilidad hídrica y agronómica de las cuencas de cereal.

Annex 1: Description of LMT project or initiative

EIP AGRI Cereal Agua Operational Group.

Under a watershed management approach, transfer and innovation actions are planned in monitoring and models for greater sustainability in Spain, in three cereal areas of Andalusia, Extremadura and Castilla y León, with socio-economic challenges linked to water, soil, landscape, employment and markets. Alternatives for healthier crops than cereal will also be studied. Cereal Agua Operational Group develops the focus idea of basin-scale management, in three pilot basins, for cereal crops with major agronomic, environmental, hydrological, economic, market, political and social challenges.

Objectives.

- Good management of cereal cultivation, good practices, innovation and dissemination to farmers, to achieve greater production, higher quality and profitability, reducing costs and contributing to the better use of water and integration of the ecosystems.
- More profitable cereal cultivation, improving land use management through transfer of science and technology to farmers, connecting them to thematic networks in Spain and EU for climate change adaptation and mitigation.
- More sustainable cereal cultivation, with innovation in production processes, transferring knowledge related to water, ecosystems, landscape, climate and economy to farmers.
- Encourage the integration of young people and women in cereal agriculture, under a perspective of environmental, social, economic, technological and new market oriented integration.

Actions.

- Market studies for new innovative engineering, monitoring and cereal management services.
- Promoting the integration of young people and women in rural areas and cereal crops.
- Study of alternatives to cereal cultivation by searching for other healthier crops.
- Outreach with farmers in cereal basins.
- Dissemination and communication of agriculture and climate good practices.
- Integration into European thematic networks with experiences of innovative and sustainable agriculture.

UNITED NATIONS NATIONS UNIES

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC
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escap-edd-edps@un.org • www.unescap.org

To: JIN – Climate & Sustainability
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26/08/2019

Letter of intent to collaborate with proposed H2020 project - LANDMARC
LAND use-based MitigAtion for Resilient Climate pathways

With this letter I express my intent to collaborate with the LANDMARC H2020 project.

My own primary interest to collaborate with LANDMARC during project implementation is to further promote quality research finding and good practices related to the development and implementation of Land-based mitigation technologies (LMTs) through our SDG Help Desk < https://sdghelpdesk.unescap.org/>. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	y/n
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	y/n
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	y/n
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	y/n
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	yes
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	yes
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	yes
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in a regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	yes

Yours sincerely,

Aneta Slaveikova Nikolova
Environment Affairs Officer
Environment and Development Division

ESCOLA DE CIÊNCIAS E TECNOLOGIA
DEPARTAMENTO DE ENGENHARIA RURAL

To: JIN – Climate & Sustainability
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The Netherlands
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28/08/2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC

LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs), as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	y
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	y
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	n
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	n
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	n
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	y
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	n
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in an regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	n

Yours sincerely

Adélia Sousa
Head of the Agriculture Department

Annex 1: Description of LMT project or initiative

We are willing to share our Stakeholders network specially the ones dealing with forest management due to the fact that our main research focus is associated with remote sensing and forest management.

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26 August 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC LAND use based MitigAtion for Resilient Climate pathways

I am very pleased to collaborate on the proposed LANDMARC H2020 project.

IITA primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of integrated soil fertility management (ISFM) as a potential land-based mitigation technology. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	yes
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	yes
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	no
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	no
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	no
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	no
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	no
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in an regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	no

Yours sincerely

Dr. Bernard Vanlauwe
Director of Research for Development, Central Africa
IITA

www.iita.org

stockholm exergi

To: Stockholm Environment Institute
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27 August 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC
(LAND use based MitigAtion for Resilient Climate pathways)

Stockholm Exergi provides district heating and cooling to the city of Stockholm and provides solutions for a sustainable urban system, with a goal to become 100 percent renewable by 2022. This supports Stockholm's climate strategy and its aim to be a fossil-fuel-free city by 2040. Stockholm Exergi is supporting innovative pilot projects in several areas that contribute to negative emissions through land-based mitigation technologies (LMT). These projects include Biochar and Bioenergy with Carbon Capture and Storage (BECCS). The pilot projects are also an important part of our collaboration with researchers in Sweden and across the Nordic region and elsewhere across the European Union.

With this letter we express our intent to collaborate with the LANDMARC H2020 project. The collaboration can potentially include, depending on shared mutual interests with—and the capacity of—the partners in LANDMARC:

- contributing to stakeholder engagement efforts and complementary data gathering;
- analysis or discussion on alternative business models for LMT actions in Sweden and the EU;
- collaborating or advising on climate risk assessment for LMT actions;
- reviewing or advising on socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions, including especially Biochar and BECCS;
- Taking an active role in exploiting research results for policy making processes and to align and address Sustainable development goals;
- Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling, especially in understanding how Biochar and BECCS can be deployed, replicated and upscaled across the EU.

Where appropriate, staff from Stockholm Exergi can contribute actively to research tasks, especially in relation to the techno-economic specification of Biochar and BECCS options across different scenarios and assumptions, including as feasible guidance available from the results of our pilot projects. We envision solutions for Biochar and BECCS as well as other LMTs as part of a portfolio that needs to be analysed and tested with respect to effectiveness and resilience.

Stockholm Exergi can nominate an expert representative for the external advisory board of LANDMARC in order to ensure the regional and global relevance of LANDMARC and added value and legacy after project completion.

Yours sincerely

Erik Dahlén
Research & Development Manager
Stockholm Exergi

MZUZU UNIVERSITY
DEPARTMENT OF GEOSCIENCES

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Date: 26 August, 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs), as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	Y
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5, 6&7).	Y
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	Y

Additionally, Mzuzu University through the faculty of Environmental Sciences, Directorate of Research, Department of Forestry and Department of Geosciences, seeing the problems emanating from climate variability and change has embarked on a number of activities to mitigate the problems. These project activities can have links to LANDMARC directly or indirection include:

- Tree planting for induce afforestation, forest management and protection to trigger regeneration of indigenous forest.

- Waste management to abate water and environmental pollution and also incentivizing sanitation and sustainable sanitation technologies
- Water resources development and management to sustain water use
- Disaster preparedness and management to ensure habitat protection

These activities have been done through research, training, outreach and entrepreneurship, policy direction, publication and workshops have been used to disseminate information to both government and the public.

It is for these reasons that we seek partnership with the LANDMARC H2020 Project so that we learn more and scale up our activities and also contribute to the global effort in building resilient climate pathways.

Yours sincerely

James Kushe

Senior Lecturer in Geography and Water Resources Management

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C JIN Climate & Sustainability
Ubbo Emmiussingel 19
9711 BB Groningen
The Netherlands

Datum : 29 augustus 2019
Ons kenmerk : 129-19/HvdW/GA/MA

Letter of Intent to collaborate with proposed H2020 project - LANDMARC
LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs). The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	Y
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	Y
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	Y
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	Y
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	Y
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	Y
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	Y
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in an regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	Y

Yours sincerely

Mr. Hans van der Werf
Director Frisian Environmental Federation

Government of Nepal
Ministry of Agriculture and Livestock Development

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4211932
4211665
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4211915
4211940
Fax : 4211935

Singhadurbar, Kathmandu,
Nepal

Ref: 17

20.08.2019

To whom it may concern

I am writing to express support for the LANDMARCproject, coordinated by JIN Climate & Sustainability (the Netherlands) that will be submitted under the Horizon 2020 topic *Negative emissions and land-based mitigation assessment.*

We, at the Ministry of Agriculture and Livestock Development (MoALD), are pleased to know about the LANDMARC Project. The proposed research project will improve the knowledge base for evaluating land-based mitigation technologies that will help policy decisions in promoting these technologies. We would be keen to support research projects on land based mitigation technologies through active participation in the project workshops and engaging in policy dialogues. We hope to receive policy recommendations on the prioritization of mitigation/adaptation technologies in agriculture the research may generate to inform our strategy in reducing emissions from agriculture.

I view that LANDMARC can achieve its goals and leave a strong impact given the strength and experience of the team, the enthusiasm they share, and the integration of earth observation, modelling and stakeholder-oriented approach chosen to carry out this action research.

With hopes that the LANDMARC proposal will be successful, and looking forward to cooperating in future steps.

Yours sincerely,

.....

Maniratna Aryal, PhD

Senior Agri Economist

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29 August 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC
LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project (proposal) that JIN Climate & Sustainability (the Netherlands) is submitting on behalf of the LANDMARC consortium in the framework of the Horizon 2020 programme.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation activities, as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2),	Y
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3)	Y
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3)	y/n
Taking part in performing a climate vulnerability assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4)	y/n
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the region, with the help of both land-use and economic models (WP5)	y/n
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated risks, co-benefits and trade-offs of LMT actions in the region, with the help of both land-use and economic models (WP5)	y/n
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals(WP5)	
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.)(WP2)	y/n
Supporting the establishment and taking an active role in an international LMT learning network (WP7), which will be established within LANDMARC	Y

Yours sincerely
Dr. Sebinasi Dzikiti

Senior Researcher, Water Resources, Smart Places Cluster, Council for Scientific and Industrial Research, South Africa

Annex 1: Description of LMT project or initiative

The proposed study requires in situ data to improve the biomass production model and also to expand it to include carbon uptake by vegetation. The Hydrosciences Research Group at the Council for Scientific and Industrial Research (CSIR) in South Africa has substantial data that may be useful for calibrating and validating this model for South African ecosystems. The data, mainly the CO2/H2O fluxes were collected using the open eddy covariance systems and additional information also includes site microclimates, leaf area index (m2 of leaf area per m2 of ground area), soil moisture dynamics, yield etc. The ecosystems include agricultural lands, mainly fruit tree orchards (apples, citrus, nectarines, peaches, plums etc.), indigenous tea crops, mostly rooibos, commercial and indigenous forests and forests of self-established invasive alien plants. The CSIR also has strong links with stakeholders with vested interests in land based global change mitigation mostly in the agricultural sector e.g. the deciduous fruit industry (represented by Hortgro Science), and the citrus industry (represented by Citrus Research International). These industries are seeking technological solutions for their sustainability in light of the adverse climate change projections for South Africa as they are heavily reliant on irrigation. The rain-fed indigenous tea sector (via the Rooibos Council of South Africa) also has a need for tools and information to mitigate against global change in key production areas especially in the Western Cape Province. The Natural Resources Management (NRM) program within the Department of Environmental Affairs in South Africa has a keen interest in monitoring the spread and impacts of invasive alien plants. They would be interested in the Land based mitigation strategies to reduce the adverse impacts on the country's natural resources mainly the scarce water resources, grazing land, biodiversity etc.

UNIVERSITÄT
BERN

CDE
CENTRE FOR DEVELOPMENT
AND ENVIRONMENT

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29 August 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC

LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intention to collaborate with the LANDMARC H2020 project.

WOCAT[1] is a global network on Sustainable Land Management (SLM) that promotes the documentation, sharing and use of knowledge to support adaptation, innovation and decision-making in SLM. The following possible collaboration opportunities between LANDMARC and WOCAT have been identified:

- The data and information collected on the land-based negative emission solutions (LMTs) within the LANDMARC case studies will be fed into the Global SLM database. This database contains over 1500 SLM practices from all over the world, and it the primary recommended database by UNCCD for reporting on best SLM practices. The LANDMARC project will provide this input (via the SLM Technology questionnaire) to the SLM database, to ensure that key data and results on LMTs will be preserved and further disseminated after project completion.
- LANDMARC earth observation results on the net GHG impacts of the different LMT solutions will be shared with WOCAT in their efforts to extend the thematical coverage of their SLM database to also include GHG impacts. These LANDMARC results will feed into the existing collaboration that WOCAT has with the Carbon Benefits Project (CBP). Within this collaboration, WOCAT and CBP are linking resp. the SLM database with the carbon benefits project tools and so that SLM projects can perform a GHG impact assessment. Targeted earth observation data and results for the LANDMARC case studies can help to develop and implement Tier 3 methods.
- The LANDMARC project will also explore both qualitatively and quantitively (new climate change scenarios with CMIP6) the climate change risk and sensitivity of different land-based negative emission solutions for the different case studies regions (WP4). This work within LANDMARC can benefit from the existing Climate Change Adaptation Module provided by WOCAT.
- Also (elements of) WOCATs SLM mainstreaming Tool, which provides a decision support framework for mainstreaming and scaling up of SLM practices can be applied within the LANDMARC assessment work with stakeholders (in WP2,5 and 6).
- WOCAT will provide (online) trainings to LANDMARC partners to enable the usage of the abovementioned tools, modules and questionnaires.

[1] World Overview of Conservation Approaches and Technologies

- WOCAT can nominate an expert representative for the external advisory board of LANDMARC in order ensure the regional and global relevance of LANDMARC and the projects' added value and legacy after project completion.

Yours sincerely

Hanspeter Liniger, PhD
Director of WOCAT

RM-099-2019
August 2019

To: JIN – Climate & Sustainability
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Letter of Intent to collaborate with proposed H2020 project - LANDMARC LAND use based MitigAtion for Resilient Climate pathways

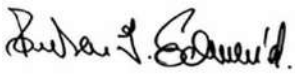
With this letter, we express our intent to collaborate with the LANDMARC H2020 project.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs), as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	y
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	y
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	y
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	y
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	y
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	y

Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	y
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in an regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	y

Sincerely,



Ruben Echeverria
Director General
International Center for Tropical Agriculture - CIAT

Annex 1: Description of LMT project or initiative

Vietnam is the largest coffee (Robusta coffee) producing country in the world. Its farmers count on the highest yields per hectare globally and at the same time the highest emissions per unit produce. Increased climate variability, specifically the ENSO phenomena is threatening coffee production, specifically because soils are depleted and production depends heavily on chemical inputs and irrigation. The Vietnamese government and coffee sector are seeking for more sustainable and low emission coffee production. To that end, promising solutions including moving towards agroforestry systems, which will help farmers adapt to progressive climate change but also sequester carbon and halt encroachment of forests. This in combination with pyrolysis technologies that have the potential to convert the sector to negative emissions are the key LMT that we will analyse.

SPCS
Sociedade Portuguesa da Ciência do Solo

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30/08/2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC

LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project [1].

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs), as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	Y
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	N
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	N
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	N
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	N
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	Y
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	N
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in an regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	N

Yours sincerely,

Carlos Alexandre
(President of the SPCS)

[1] However, the Portuguese Society of Soil Science (SPCS) cannot assume any kind of expense commitments that may result from the collaboration of its members with the LANDMARC project.

Annex 1: Description of LMT project or initiative

As a Soil Science National Society we are willing to share our Stakeholders network specially the ones dealing with soil management due to the fact that our main research focus is associated with soil conservation and soil management.

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JIN - Climate & Sustainability
Ubbo Emmiussingel 19
9711 BB GRONINGEN

Date	28 August 2019
Our reference	881931
Contact	Gert-Jan van Duinen
Subject	Letter of Intent to collaborate LANDMARC H2020 project

Dear Mr/Mrs,

Letter of Intent to collaborate with proposed H2020 project - LANDMARC

LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs), as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

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Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	Yes
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	Yes
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	Yes
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	No
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	Yes
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	Yes

Waterschap
Aa en Maas

Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in an regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	Yes

Yours sincerely,
on behalf of the daily board

B. Schlooz, MA.
manager of department Property & Project Management,

Annex 1: Description of LMT project

Rewetting Peat Soils in the Netherlands:
Staatsbosbeheer, Water board Aa & Maas and Province North-Brabant have a pilot site in the Deurnsche Peel. There is a plot planted with cattail (*Typha latifolia*) and a plot with willow (*Salix*). The water table in the cattail plot could not be raised to the surface or above (which would be optimal for cattail) and both plots suffered from the exceptionally dry summer of 2018. This had a high impact on the survival and growth of the plants, especially the cattail, that were still in the phase of establishment. New plants and additional measures have been taken in 2019 to make this pilot more successful. An important lesson that is learned in this project is that in the well-drained higher sandy soil landscape it appears to be difficult to find plots that can be sufficiently rewetted to establish a paludiculture.
Water board Aa & Maas selected two additional pilot sites. One site focusses on the growth and use of *Miscanthus* biomass as part of biological growing media for oyster mushrooms (*Pleurotus ostreatus*) in Erp. An additional pilot site is prepared in Aarle-Rixtel/Helmond. This site is situated next to the Schevelingse Loop and is currently a wet grassland. Here several small ditches will be closed to better retain water in the site and thereafter cattail and probably reed (*Phragmites australis*) will be planted.
Water board De Dommel has selected several pilot sites for wet crops. Here cattail or other plants have been planted recently, or will be planted in the coming months. One potential site has now been selected near Hulsel, located in a stream valley that will be reconstructed. Another site is situated at the border of the Natura 2000 reserve Kampina. In addition, a local farmer with wet grassland expressed interest to participate in the project.

Chelsey**Greene** B.Sc. MES
Sustainability | Land-based Climate Change Mitigation | Ecological Reclamation

To: JIN – Climate & Sustainability
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August 28, 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC

LAND use based MitigAtion for Resilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs), as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

Enabling effective stakeholder engagement, providing access to our stakeholder networks and complementary data gathering (WP2).	y/n
Enhancing earth observation practices for LMT actions, by enabling / supporting in retrieving relevant local (e.g. in-situ and satellite data) data and information (WP3).	y/n
Exploring the possibility of generating alternative/external funding for LMT actions within our country via the (voluntary) carbon or offset markets (WP3).	y/n
Taking part in performing a climate risk assessment for local LMT actions, that make use of the latest or updated future climate scenarios for the region (WP4).	y/n
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).	y/n
Taking an active role in exploiting research results particularly for policy making processes and to align and address Sustainable development goals (WP6).	y/n
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).	y/n
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in a regional LMT learning network (WP6 & 7), which will be established within LANDMARC.	y/n

Yours sincerely,
Chelsey M. Greene

Independent Environmental Consultant

Annex 1: Description of LMT project or initiative

- **Title:** Willow plantation on abandoned mine-sites for bio-energy generation: Reclaiming coal-towns through renewable negative-emissions technologies
- **Objectives/Tasks:**
  - Identify local priorities for BIOSALIX project (use of biosolids as fertilizer and carbon sequestration method) – What is the potential for environmental and socio-economic benefit? How welcome it is?
  - Estimate biomass and soil carbon offset capacity and contribution to NDC
  - Develop remote sensing methods and land-use model for potential areas for implementation
  - Study possible technical, social, economic and political opportunities to meet NDC and SDGs
  - Co-develop strategies with local communities to extrapolate the BIOSALIX model
  - Evaluate risks (climatic, social, political, economic, etc) and scalability for potential solutions
  - Retrofit local communities with further knowledge on climate change impacts and economic diversification
  - Incorporate desk research in other regions where similar challenges have been identified
- **Region/Sector:** Alberta, BECCS
- **Local connections:** SME – SYLVIS, Government and Community (building on BIOSALIX model and Alberta Rural Organic Waste Recycling Network (AROWRN))
- **Methods:** satellite imaging, in-situ verification, radar, stakeholder/rightholder engagement, land-use modelling (ALCES)
- **Expected Impact:** co-development of strategies for community sustainability transitions, technology advance on BECCS, policy evaluation of these solutions, determine impact of this strategy in global goals

UNIVERSIDAD SIMÓN BOLÍVAR
VICERRECTORADO ACADÉMICO
DIVISIÓN

2019-007

To: JIN – Climate & Sustainability
Ubbo Emmiussingel 19
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The Netherlands
Tel: +31(0)50 762 0930

Caracas, Venezuela. 09/02/2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC LAND use based **M**itigAtion for **R**esilient Climate pathways

With this letter we express our intent to collaborate with the LANDMARC H2020 project.

Our own primary interest to collaborate with LANDMARC during project implementation is to further advance our work on the development and implementation of our Land-based mitigation technologies (LMTs), as described in Annex 1. The intended collaboration focusses on the following elements of the LANDMARC work plan, including:

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Taking part in performing a climate risk assessment for local LMT actions that make use of the latest or updated future climate scenarios for the region (WP4).
Taking an active role in performing an integrated socio-economic and environmental assessment of the anticipated, risks, co-benefits and trade-offs of LMT actions in the country and/or region, with the help of both land-use and economic models (WP5,6&7).
Taking an active role in implementing research results particularly for policy making processes and to align and address Sustainable development goals (WP6).
Taking an active role in and supporting the creation of a domestic LMT learning network that actively exploits and disseminates insights and results from the LANDMARC project within the relevant LMT networks (e.g. water boards, provinces, etc.) (WP2).
Supporting the co-development / co-creation of robust LMT upscaling scenarios for regional and global land-use, climate and economic modelling; and taking an active role in a regional LMT learning network (WP6 & 7), which will be established within LANDMARC.

Yours sincerely,

Dr. Héctor Herrera
Dean of Biological Sciences
div-biologia@usb.ve

Annex 1: Description of LMT project or initiative

Activity 1: Assess LMT (Land-use based mitigation technologies: LMTs), potential at the local level

This activity ensures proper engagement of LANDMARC with the local stakeholders working on LMT implementation and supports the execution of activities 2-5.

Activity 2: Improving earth system observations

This activity takes the case studies and their stakeholders as a starting point and uses satellite and in-situ based earth observation instruments to monitor the impact of LMTs as net sinks at the local level. The information collected will improve our understanding of earth system dynamics, provide key information on the distribution and dynamics of GHGs, and quantitatively assess LMT impacts.

Activity 3: Assessment of climate vulnerability/risk and potential effectiveness

This activity will explore and analyse output from IPCC-class climate models to identify common projected patterns of climate risk and vulnerability for LMT activities. This will be supported by a more qualitative and participatory process that enables local case study stakeholders to perform better climate risk assessment and management for their LMT solutions.

Activity 4: Human system impact assessment of LMT solutions and SDGs (Sustainable Development Goals: SDGs)

Activity 5: Upscaling of LMTs solutions to the global level

Based on insights from activities 1-4, global scenarios for the large-scale LMT implementation will be constructed and assessed regarding their mitigation and sequestration potential and effects on land use change. For this we will implement a model system that soft-couples a global land use model, an economic model and an earth system model. This model system will run a set of scenario simulations to provide new insights into LMTs' potential while considering future climate and socio-economic development constraints.

Departamento de Estudios Ambientales
Universidad Simón Bolívar

29th August 2019

To: JIN – Climate & Sustainability
Ubbo Emmiussingel 19
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I am currently Professor at the Environmental Studies Department, Universidad Simón Bolívar (USB), Caracas, Venezuela, and active member of COBRA Collective (CIC), United Kingdom (UK). My professional career at USB, Caracas, Venezuela, started in 1995. During this time, I was involved on teaching, researching and capacity building activities related with ecological and human dimensions of tropical ecosystem management topics. In 2015, after 20 years of full time work at Universidad Simón Bolívar, I retired from teaching obligations and moved to the United Kingdom, in order to devote myself to research as well as family projects. Since then, I have kept my academic liaison with USB through different projects and also developed new research initiatives, which include the successful partnership with COBRA Collective (CIC) in UK. During this time, we have coordinated together 4 research projects, including the organization of 10 intercultural events (with the participation of Indigenous communities, academics and governmental Institutions), 10 participatory films and the publication of 11 scientific papers and reports, related to different aspects of capacity building in Indigenous communities and fire intercultural management and policy making in Venezuela, Guyana and Brazil, with funds provided by the British Embassy in Venezuela and the British Academy of Science, which were successfully administrated and implemented through the collaboration of COBRA Collective (CIC).

At the present time, the local administration of international funds allocated to research projects in Venezuela is very challenging due to the hyperinflation process that affects the country since several years ago. Prices in the local currency (Bs, bolívar) rise every day reaching up to 20-35% of increase per month (https://www.finanzasdigital.com/2019/07/an-inflacion-de-junio-2019-se-ubico-en-248-anual-445-482/,https://www.finanzasdigital.com/2019/08/an-inflacion-de-julio-2019-se-ubico-en-338-anual-264-873/). Although the official exchange rate varies daily in relation to foreign currencies including euros (bcv.org.ve, **20,407.04 Bs = 1 EUR,** August 29, 2019)**,** the prices of goods and services are fixed accordingly to parallel exchange market indicators which are usually more devaluated (https://elpropio.net/monitordolarve/ **24,182.48 Bs = 1 EUR**, August 29, 2019). So, funds transferred to Venezuela will convert to local currency losing their exchange value almost immediately.

Furthermore, under current foreign and Venezuelan governmental political and economic restrictions exists numerous obstacles to transfer foreign funds to Venezuelan governmental Institutions and Universities. Additionally, according to USB current policies, research projects administered through the University Foundation (FUNINDES) are charged with a 40% overhead fee, which is much higher than the rate allowed by the funding European organization to which this proposal will be submitted.

Taking into account the conditions of the current scenarios in Venezuela, and the successfully outcomes obtained through the collaboration of COBRA Collective, in order to guarantee the success of the project, we consider that COBRA Collective is the most convenient choice for administering the funds in this case.

Bibiana Bilbao. Ph.D. - Prof.

Departamento de Estudios Ambientales
Universidad Simón Bolívar - Apartado 89000 – Caracas, Venezuela

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Waterschap De Dommel

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Boxtel, September 2nd 2019

Letter of Intent to collaborate with proposed H2020 project - LANDMARC

LAND use based MitigAtion for Resilient Climate pathways

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Yours sincerely

Annelies Balkema
Senior advisor policy and innovation Waterschap de Dommel

Annex 1: Description of LMT project

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