



LIFE Project Number
<LIFE14 CCM/GR/ 000635>

Mid-term / Final Report
Covering the project activities from 16/07/2015¹ to 31/03/2017

Reporting Date²
<31/03/2017> b

LIFE PROJECT NAME or Acronym
<LIFE CLIMATREE>

Data Project

Project location:	
Project start date:	<16/07/2015>
Project end date:	<28/06/2019>
Total budget:	€ 1.931.447
EU contribution:	€ 1.158.868
(%) of eligible costs:	60%

Data Beneficiary

Name Beneficiary:	Institute of Urban Environment and Human Resources, Panteion University
Contact person:	Prof Kostas Bithas
Postal address:	Aristotelous, n° 29, 17671, Kallithea, Athens, Greece
Telephone:	0030 210 9247450
E-mail:	kbithas@eesd.gr, akolimenakis@gmail.com

¹ Project start date

² Include the reporting date as foreseen in part C2 of Annex II of the Grant Agreement

Project Website:

<http://www.lifeclimatree.eu/>

1. Table of contents

1.	Table of contents.....	<u>32</u>
2.	List of key-words and abbreviations.....	<u>43</u>
3.	Executive Summary.....	<u>54</u>
4.	Introduction.....	<u>87</u>
5.	Administrative part.....	<u>1140</u>
6.	Technical part.....	<u>1312</u>
6.2.	Main deviations, problems and corrective actions implemented.....	<u>2524</u>
6.3.	Evaluation of Project Implementation.....	<u>2726</u>
6.4.	Analysis of benefits.....	<u>3635</u>
7.	Project Specific Indicators.....	<u>4140</u>
8.	Comments on the financial report.....	<u>Error! Bookmark not defined.42</u>
8.1.	Summary of Costs Incurred.....	<u>Error! Bookmark not defined.45</u>
8.2.	Accounting system.....	<u>Error! Bookmark not defined.46</u>
8.3.	Partnership arrangements.....	<u>Error! Bookmark not defined.53</u>
8.4.	Certificate on the financial statement.....	<u>Error! Bookmark not defined.53</u>
8.5.	Summary of costs per action.....	<u>Error! Bookmark not defined.53</u>
9.	Envisaged progress until next report.....	<u>4356</u>

2. List of key-words and abbreviations

IPCC : Intergovernmental Panel on Climate Change

LULUCF: Land-Use, Land-Use Change and Forestry

DiCEM: The “Dipartimento delle Culture Europee e del Mediterraneo: Architettura, Ambiente, Patrimoni Culturali (DiCEM) of the University of Basilicata in Italy

AUA : The Agricultural University of Athens

UEHR : The Research Institute of Urban Environment & Human Resources

TN : TERRA NOVA Ltd

CSIC : The Spanish National Research Council

UOWM : The University of Western Macedonia

3. Executive Summary

LIFE CLIMATREE Project was officially launched on 16/7/2015 following the signature of the Grant Agreement on 10/07/2015. LIFE CLIMATREE's main objective is the development of a novel and sound approach for the calculation of tree crops' carbon sequestration, with case studies in Southern Europe.

The key outputs of the project are the following:

- A “novel methodology” for estimating CO₂ sequestration by Tree Crops
- Application of the “methodology ” in Greece, Spain and Italy. Estimates of current and future CO₂ balance for Tree Cultivations in Greece, Spain and Italy
- A “model” incorporating the novel methodology and permitting operational estimates for CO₂ sequestration by Tree Crops, under different scenarios
- A software application of the “model”
- Identification and projection of climatic conditions relevant to tree cultivations and to CO₂ sequestration
- Identification of best cultivation practices for maximizing CO₂ sequestration
- Evaluation of economic benefits arising from the CO₂ sequestration of tree crops
- Identification of ecosystem services related to tree cultivations

LIFE CLIMATREE attempts a novel methodology with high operational appeal as it is based on dataset readily available at the national or even local level. LIFE CLIMATREE takes into account but is not constrained, the IPCC-based LULUCF methods concerning CO₂ balance of tree cultivations. The core deliverables of LIFE CLIMATREE wish to contribute as a validation and supporting framework to the official, IPCC-based, accounting of the CO₂ which result in a $\pm 70\%$ uncertainty. In this respect the core findings of LIFE CLIMATREE could be a substantial input for a more informative agriculture and climate adaptation policies at the regional, national, and the European level.

The LIFE CLIMATREE Project's outcomes wish to influence the orientation of the Common Agricultural Policy towards the promotion of cultivation methods with high positive environmental and climatic effects.

Furthermore, LIFE CLIMATREE's results are expected to contribute to climatic policies at the European and National levels. DG CLIMA prepared a legislative proposal on the effort of Member States to reduce greenhouse gas emissions to meet the European Union's greenhouse gas emission reduction commitment in a 2030 perspective. Within this proposal the greenhouse gas emissions from agriculture and land use, land use change and forestry (LULUCF) were addressed. The methodology of LIFE CLIMATREE suggesting a robust CO₂ accounting system, will support the application of the LULUCF Framework. Similarly, the outcomes of the project will support the inclusion of removals or emissions from (LULUCF) in the Effort Sharing Decision of greenhouse gas emission reduction commitments up to 2020.

During the first months of the LIFE CLIMATREE project all necessary preparatory Actions (A.1, A.2, A.3) and their deliverables completed successfully. Action A.1 focused on the selection of critical parameters underlining the grouping of tree crops in representative categories, in respect to CO₂ sequestration. Action A.2 focused on the collection of most important variables concerning the soil C changes in relation to

cultivation methods and agricultural management options. Potential contributions to LULUCF methodology has been traced. Action A.3 provided a synthetic report analyzing the climatic, socioeconomic and environmental parameters related to the tree-crop cultivations in Greece, Italy, Spain and Cyprus. Key indicators and variables have been defined and estimated: Gross and Net Production Value, Producer Price, Employment and Imports and Exports quantities..The implications of Common Agricultural Policy (CAP) for tree crops in the recent years have been reviewed.

Actions C.1, C.2, C.3, and C.4 are in progress. Concerning Action C.1, a framework for accounting CO₂ balance is under development. The framework adopts principles and elements of a Life Cycle Assessment, with adjustments on the carbon cycle of tree crops cultivations. Experimentations and surveys are applied to representative cultivations. Specifically, a sampling methodology has been developed and applied by Agricultural University of Athens (AUA). Experiments and field surveys, are undertaken in orchards, through questionnaires, in order to quantify the total biomass growth of tree parts (Annual Shots, Leaves, fruit, woody canes and trunks, roots) under different conditions. This will allow to carry out a seasonal carbon balance. Action C.2 attempts identification and projection of the relevant, to tree cultivations, climatic conditions using the NASA GISS GCM ModelE. Action C.3 aims at developing a software application for accounting tree-crop carbon sequestration using the knowledge and information developed by C.1, C.2 and C.4 Actions. A calculating tool incorporating all relevant factors in a simple but scientific rigorous way will be developed. Extensive review of various models and calculating tools available in literature and in the web for quantifying GHG emissions/offsets from agricultural and forestry activities, has been attempted. Regarding Action C.4, working meetings (see Annex F.1.1) and communications took place among the beneficiaries of the LIFE CLIMATREE project in order to delineate the algorithm for the calculation of carbon input/output for current and future years.

A reference point for the progress of the project has been the organization of the LIFE CLIMATREE's Project Group meeting combined with the 2nd Monitoring Mission that took place in MATERA, Italy (8- 11 March 2017) in collaboration with the External Monitoring Team. This Project meeting focused on planning the future activities of the C1, C2, C3, C4 Actions and their contribution towards the objectives of the project. The final deliverables were discussed and emphasis was given to the interrelationships of C actions. "MATERA" meeting was supported by DiCem. For the preparation of a fruitful meeting in Matera two working meetings (among AUA, UEHR, TN) for the Coordination of C actions had already taken place in the premises of AUA at the 6th of February and 1st of March (see Annex F.1.1).

Regarding Actions E.1 and E.2 the official project's logo was prepared and the website of LIFE CLIMATREE was launched and is frequently updated (www.lifeclimatree.eu). In addition, the LIFE CLIMATREE twitter (www.twitter.com/lifeclimatree) and facebook (www.facebook.com/lifeclimatree/) accounts are updated with tweets and posts related to the project. The official kick off meeting took place at the 7th and 8th of October in the premises of the Agricultural University of Athens (see also Annex E.3 for the complete agenda and minutes). A standard process of communication was established between UEHR (Coordinating Beneficiary) and all LIFE CLIMATREE associated beneficiaries in order to secure the timely preparation of the main financial and managerial files (Timesheets Stamp) as well as regarding the financial reporting schedule. The QA/QC

manual was also implemented (Action F.2) and the 1st QA/QC report is currently presented in Annex F.2.1.

The Actions and deliverables are generally in line with LIFE CLIMATREE's official timetable and only minor deviations were noted in A Actions which did not affect the overall progress of the project. Therefore, the project work plan should be regarded as valid and still viable.

Regarding the networking strategy of CLIMATREE, it has two major dimensions:

- To benefit from knowledge and information developed in other projects, with specific emphasis of LIFE projects, with relevant objectives. LIFE CLIMATREE project has established a communication with several other projects. Collaborations exchanging methods, tools and information have been established (see Annex E.3).
- To explore the potentials of CLIMATREE outcomes by communicating them to relevant decision and policy makers and stakeholders. A communication has been established with EU Authorities, National Ministries (Environment and Agriculture), and other relevant experts and consultants. The development of the project's key actions (C&D sets of Actions) along with the consultation with the relevant National Ministries, are expected to lead to the communication and exploitation of LIFE CLIMATREE results in the updated "Greenhouse gas Monitoring Mechanism Regulation (MMR)". Towards this objective the project's scope, action plan and expected outputs were presented to a number of influential actors: DG CLIMA, National Ministries, National Accounting Authorities & LULUCF experts. The overall Dissemination and Networking Strategy as well as the detailed material of meetings and other dissemination strategy are clearly articulated in Annexes E.3 & F.3.

4. Introduction

Climate Related Problem

At the Paris climate conference (COP21), in December 2015, 195 countries adopted the first-ever universal legally binding global climate deal. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C. Towards this objective, **accurate monitoring and accounting of carbon stocks and fluxes** is a serious challenge, which will result in an improved assessment of climate change and evaluation of climate policies.

The European Union (EU), as a party to the United Nations Framework Convention on Climate Change (UNFCCC), must submit annually the greenhouse gas (GHG) inventories for emissions and removals within the area covered by its Member States (MS). The inventories must cover emissions and removals from the following sectors: Energy (fuel combustion and fugitive emissions from fuels - which also includes transport); Industrial Processes and Product Use; Agriculture, Land-Use, Land-Use Change and Forestry (LULUCF); and waste management. Since 1998, the Parties to the UNFCCC have agreed to use the Guidelines for National Greenhouse Gas Inventories provided by the Intergovernmental Panel on Climate Change (IPCC, 2006 and 2014) for estimating greenhouse gas emissions and removals.

The agricultural sector, which is a key sector in the EU, follows a consistent strategic framework since 1954, in the form of Common Agricultural Policy (CAP). In its latest reform of 2013 (reg. (EU) 1305/13) CAP recognized the significance of Agriculture as a key player in Climate Change policy. In order to encounter the targeted reduction of GHG emissions (i.e. 20% below the 1990 emissions by 2020), the EU issued the Decision 529/2013 (EC, 2013) aiming formally to include the activities of the LULUCF sector within the accounting GHG emissions for all member states (MS), modifying the criteria of accounting from area-based to activity-based. Reporting of LULUCF covers the following categories: forest land, cropland, grassland, wetland, settlements and other lands. According to IPCC, fruit tree orchards, which are managed agro-ecosystems, do not conform to the forest definition with the result that orchards are sometimes listed under categories (grasslands, croplands) so that carbon stored in orchard tree biomass is not accounted for, or is strongly underestimated. Similarly, variations in C pools (e.g. soil organic carbon and crop biomass) associated with land use change and with different management (e.g. sustainable, conventional) are often not accounted for in assessments of product life cycle greenhouse gas emissions due to limited information and inadequate accounting procedures.

Solution demonstrated by the project

According to the estimation categories established by the Decision 529/2013 (EC, 2013), Project LIFE CLIMATREE will support the estimations of emissions and removals resulting from the activities falling within the permanent tree crops which are accountable under cropland management categories. The project will provide a new CO₂ accounting framework in the agricultural sector contributing to the presently carbon removal estimates which include high uncertainty. S. Europe will be the field case for the development of CLIMATREE's methodology. Monitoring and accounting of carbon

stocks and fluxes as accurately as possible is an important problem and will result in a better assessment of climate change and its impacts. Towards this objective, LIFE CLIMATREE aims at contributing towards the development of a novel methodology, taking into account but not constrained by the LULUCF framework. Based on the relevant findings LIFE CLIMATREE will attempt to suggest tree-crop cultivation practices in S. Europe that contribute towards increased carbon sequestration and climate change adaptation measures.

Technical/ Methodological Solution

The methodology developed by LIFE CLIMATREE will be accommodated by a calculation tool for carbon dioxide (CO₂) sequestration by tree-crops. The tool will facilitate different plant species and different geographical, climatic and ecosystemic conditions. The tool will include key factors such as crops (species, yields, and rotations), climate conditions (temperature, rainfall, and evapotranspiration), different cultivation methods and their effects on the carbon budget.

Based on this tool a web-based user friendly application will be developed for the calculation of the CO₂ balance of permanent tree crops. Current and future CO₂ balance of tree-ecosystems in Greece, Italy and Spain, will be estimated and different cultivations methods will be tested providing climate change adaptation measures. The identification of best cultivation practices towards the increase of carbon sequestration will be concomitant of the abovementioned application. At the same time, the ecosystem services of tree crop cultivations will be defined and analyzed.

Expected Results

The correct and precise accounting of CO₂ sequestration capacity of crops combined with its socio-economic evaluation, will be of substantial contribution to the climatic and agricultural policies.

Agricultural activities and cultivation methods will be assigned with a relatively precise CO₂ value. This would permit the development of an incentive mechanism, reflecting the climatic parameters and inspire an "ecosystems payments" incentives framework. As a result, cultivation methods with substantial mitigation effect could be promoted.

Expected Longer Term Results

LIFE CLIMATREE's "longer term expected results" aim at providing a tool for more accurate accounting of carbon sink capacity and socioeconomic benefits of tree-crops. The aim of the tool is the improved and efficient monitoring and evaluation of effective climate change mitigation actions and measures.

Given the importance of sustainable development and the achievement of the objectives and targets of the Europe 2020 Strategy, the project aims to contribute towards the design and efficacy of European Union's environmental and climate policy and legislation, complementing LULUCF and providing a substantial contribution towards the Kyoto Convention targets.

Additionally, LIFE CLIMATREE project's aspiration is to play a pivotal part in the

promotion, integration and establishment of carbon sink objective into Agricultural Sector and its Stakeholders and Decision makers (Common Agricultural Policy, the relevant national public authorities and farmers' communities).

5. Administrative part

The Institute of Urban Environment and Human Resources (UEHR) is the Coordinating Beneficiary of the project and the project management-coordination is performed by Prof. Dr. Kostas Bithas.

UEHR is responsible for the effective management of the project, the operational internal communication, the effective administrative and technical control of the project and the successful implementation of the Actions by providing support and guidance to the Associated Beneficiaries.

Four (4) Management Committees (Scientific, Quality Assurance / Quality Control (QA/QC), Financial and Technical) were assigned for the successful and effective project management. Each Committee consists of one representative by each LIFE CLIMATREE beneficiary, while they are coordinated by the Project Manager.

The Scientific Committee monitors the implementation of the Actions, with scientific robustness and operational efficiency and transparency.

The Financial Committee monitors the financial progress of the project and performs the necessary contacts with partners' financial departments. Each partner maintains an updated accounting system, in accordance with law and existing regulations of each country.

The Technical Committee is responsible for all technical aspects of the project (definition of technical specifications for acquired equipment, market research, evaluation of technical offers etc.) and its demonstrative operation.

The QA/QC Committee sets the procedures for the monitoring and control of the various activities in order to ensure the best performance and the homogeneity of the methods and actions applied. A QA/QC system is developed in order to monitor the progress of the implementation of the project. The updated organigramme of LIFE CLIMATREE is provided in Annex F.1.4.

During LIFE CLIMATREE's official kick off meeting (7th-8th October, 2015) the official setup of all Committees took place delineating the role of each committee towards the successful implementation of the Project. The exact procedures for the sound operation of each Committee were agreed. The scientific Committee agreed on a methodology for the control of deliverables, through an internal "reviewing" process which contributed to the successful completion of LIFE CLIMATREE's first deliverables. The role of Financial Committee was concentrated on the delineation of the financial procedures, the LIFE CLIMATREE's timesheets, accompanied by other relevant financial documents, which were agreed to be sent to the LIFE CLIMATREE Project Coordinator (UEHR) every 3 months following the adoption of the new template. The Technical Committee emphasized on the sound adoption of the new guidelines of LIFE's "General Conditions" and conformation with the Internal Guidelines of each Participating Partner.

Since the beginning of the Project, a constant communication has been kept among the Coordinating Beneficiary and the Associated Beneficiaries through emails, telephone contacts, Skype meetings, working groups and regular team meetings. (A full list of all

the meeting and events that took place within the 1st reporting period can be found in the Annexes of Actions F.1.1 and E.3). This communication certifies the exchange of necessary managerial, administrative and financial documentation, the proper development of the project's progress and the production of the project's deliverables in line with the approved time schedule. All partners submit on a monthly basis their progress in line with the Actions which are under implementation. An aggregated report of all activities for each month is then submitted to the External Monitoring Team of the Project.

6. Technical part

6.1. Technical progress, per Action

Action A.1 Selection and analysis of tree-crop categories in S. Europe

Foreseen start date: 16/7/2015

Actual start date: 16/7/2015

Foreseen end date: 30/11/2015

Actual end date: 31/3/2016

The action has been successfully completed. In the context of present action, the following two major tasks were implemented:

1. Literature review on the Ecosystems Services Assessment, which resulted in the provision of a comprehensive framework for the relative assessment of the ecosystem services of Tree Crops, along with a provisional set of potential indicators for the enumeration of Ecosystem Services.
2. The development of a methodology for the categorization of Tree Crops according to their biological and cultivation characteristics. This methodology takes into account the widely available knowledge along with nation-wide statistics elaborated to the municipality level.

The date foreseen for Action A.1 completion was postponed until the end of March 2016, as a consequence of the delayed beginning of the project implementation by AUA (due to capital controls and the summer period vacation). In particular, the AUA team involvement in the project has started immediately after the signature of the agreement by its vice-rector (16/9/2016). This delay did not affect the implementation of the other activities of the project, since the data needed for the other actions was timely provided, while the correlated action C.1 has started without delay. The delay affected mainly the tree crops' significance on ecosystem function. This report was originally foreseen for 30/10/2015, and was finally produced in March 31st 2016.

All the action's objectives were fully achieved as indicated in the relevant deliverable A.1 entitled "*Technical report on Tree-Crop Categorization*" already submitted in the first progress report and attached herein as Annex A.1. In specific each of the two aforementioned tasks provided the following outcomes:

1. Literature review on the Ecosystems Services (ESS) Assessment: Present task's principal outcome is a novel methodology aiming to the simultaneous cross-assessment of Orchards ESS, complemented by a set of potential indicators for their enumeration.
2. The development of a methodology for the categorization of Tree Crops: Present task's principal outcome is the clustering of tree-crops in homologous categories enabling thus the inclusive and cumulative application of the previously developed methodology for the Orchards ESS assessment, but also providing solid and well defined clusters for the Action C.1 implementation. The main benefit of this task is the ability to draw conclusions on the sum of the Land Area covered by Orchards in all three Member States (MS).

Action A.2 Adjustment of the “Land use, land-use change and forestry (LULUCF) Methodology” to the environmental problem targeted

Foreseen start date: 1/10/2015
Foreseen end date: 31/3/2016

Actual start date: 1/10/2015
Actual end date: 30/4/2016

Action A.2 aimed at systematically reviewing the accounting methodologies and identify those parameters and aspects that may be facilitated by LIFE CLIMATREE in order to reduce uncertainty and to improve accounting.

Action A.2 analyzed the current methodology for monitoring and accounting of GHG emissions for the Agriculture Forestry Land Use (AFOLU) sector focusing the tree crops. Particularly, current legislation (EC Decision 529/2013) and technical Guidelines for National Greenhouse Gas Inventories issued at 2006 and 2014 by the Intergovernmental Panel on Climate Change has been reviewed. The Action A.2 summarizes current methodology for monitoring and accounting of GHG emissions for the Agriculture Forestry Land Use (AFOLU) sector with a focus on tree crops which are included in Cropland category. Key documents were reviewed and possible improvements/adjustments of current methodology were identified.

Action A.2 shed light on the potential of tree crops categories to serve as carbon sink and provided examples on methodology to gather quantitative information on carbon storage in tree crop categories. Particularly, the Net Ecosystem Carbon Balance (NECB) methodology was adopted to account for both the natural capacity of tree crops to sequester carbon and the impact of the farmers’ management actions.

The deliverable titled “Adjustment of the LULUCF methodology for a better accounting of mitigation cultural practices of agro-ecosystem” foreseen in this Action has been timely prepared and is annexed to the current Report (Annex A.2).

Within Action A.2, a supporting study on the carbon budget in a peach orchard has been prepared and published in the international journal Agricultural Ecosystem Environment (2017, 238: 104-113, DOI: 10.1016/j.agee.2016.05.031). This publication is annexed to the present Report as single PDF file (Annex F.3.2) and will contribute to improve quantitative information on carbon stored in various stocks.

Action A.2 has been completed accordingly to the Project schedule.

There were no problems during the development of the Action A2. Results on methodology on carbon balance are supportive to the following Actions:

- Action C.3 - Interface development of software application
- Action C.4 - Carbon input/output calculation for current and future years
- Action C.5 - Suggestions and evaluation of climate change mitigation policies and measures.

Action A.3 Analysis of climatic, environmental and socioeconomic parameters of tree-crop categories in S. Europe

Foreseen start date: 1/10/2015

Actual start date: 1/10/2015

Foreseen end date: 31/3/2016

Actual end date: 31/5/2016

Action A.3 started on time (October 2015) and has been successfully completed. The Deliverable of Action A.3: Analysis of Climatic, Environmental and Socioeconomic Parameters of tree-crop categories in S. Europe was completed according to the timetable and is attached to the current report (Annex A.3)

The main climatic parameters related to tree crops are temperature, precipitation and humidity and analyzed for the three countries using observation data from monitoring stations. Environmental parameters which are mainly related to the cultivation practices are: Plantation density, Soil tillage, Irrigation requirements, Fertilization use, Herbicides use, Pesticides use. The main socio-economic parameters influencing tree crops in S. Europe are production, employment and trade. The role of Common Agricultural Policy (CAP), as a socioeconomic parameter affecting the development of permanent tree crops in South Europe was also examined. Although the action started on time and it was planned to be completed in March 2016, the extension of Action A.1 suggested a two months extension of Action A.3 in order to incorporate A.1 inputs in environmental parameters affecting tree crop cultivations. The action was completed and the delays have been caught up, without affecting other actions. Since the action was successfully completed, and the deliverable has been completed, there is no continuation through the next reporting period.

All action's objectives (i.e., analysis of the climatic, environmental and socioeconomic conditions that influence and relate to tree crop cultivations in S. Europe) were achieved.

Action C.1 Life Cycle Assessment of carbon cycle in tree-crop categories

Foreseen start date: 1/4/2016

Actual start date: 1/4/2016

Foreseen end date: 29/9/2017

Actual (or anticipated) end date: 29/9/2017

The action started on April 1, 2016. So far, a significant progress has been achieved according to the action's schedule. In specific, the following major tasks have been materialized in full compliance with the initial planning:

1. **Variables affecting carbon sequestration:** A complete list of these variables has been defined. Those Variables include:
 - a. **Plant Variables:**
 - i. Crop Annual Plant Biomass
 - ii. Gross Annual Production of TC
 - iii. Fruit dry weight per Kg
 - iv. Percentage of the respective metabolite (cellulose, protein, fat) in fruit's dry weight, including:
 1. Carbon Content Coefficient of Cellulose
 2. Carbon Content Coefficient of Protein
 3. Carbon Content Coefficient of Fats
 - b. **Cultivation Variables:**
 - i. Years of TC Productive Life
 - ii. Area of TC

- iii. Plantation Density
 - iv. Soil Cultivation Measures (Frequency, Intensity, Machinery employed)
 - v. Irrigation Measures (Frequency, Intensity, Machinery employed)
 - vi. Fertilization Measures (Frequency, Intensity, Machinery employed, kind of fertilizer)
 - vii. Crop Protection Measures (Frequency, Intensity, Machinery employed, kind of Agrochemical Applied)
 - viii. Other Cultivation Measures (Frequency, Intensity, Machinery employed, Method of application)
2. Literature-review: Though this task is considered completed, the relevant report is not attached to the draft deliverable, because a continuous effort is screening monthly the related literature in order to incorporate recent advances, and provide crucial scientific advances as inputs for the rest of the implementation Actions.
 3. Assessment of Millennium Ecosystems Services: This task had already being completed upon the completion of action A.1 deliverable. An updated approach with distinct focus on the Regulating services of Tree Cultivations (TC) has been drafted but is not attached in the draft deliverable. This report will be further refined upon the completion of the Carbon balance accounting, thus even considered complete is appearing as a pending task in the milestone's table.

Besides the already completed tasks, there is significant progress in all other action's major tasks. In these are included the following:

1. Methodology for the calculation of Carbon Storage by tree-crops: The basic functions of the methodology have been developed. They were first presented in the project's annual meeting in Matera, Italy, and is fully incorporated in the accompanying the present report.
2. Sampling documentation of carbon captured by selected tree-crops: The sampling presents significant maturity. Underground sampling will commence by the end of 2017 vegetative season. All primary data along with the sampling methodology will be presented in the forthcoming deliverable.
3. Survey documentation of carbon emissions in the selected tree-crops: This task also presents significant progress. The survey methodology has been developed and two thematic questionnaires have been produced.
4. Impacts of tree-crops in Soil Organic Matter: A survey of literature on the LCA issue has been carried out considering also the preliminary evaluation of primary and secondary data required. A manuscript dealing with LCA has been submitted to an international journal. DiCEM scheduled the activities related to LCA analysis for the tree crops category selected.

In the course of action implementation three major problems were encountered:

1. Plant nursery emissions: This figure has been incorporated in all LCA approaches found in the literature review. The problem of incorporating this figure in LIFE CLIMATREE's approach lies on the fact that the emissions of the related nurseries are allocated in a different area and correspond to a different than tree-crop cultivation Land Use. To resolve this inconsistency we decided not to include this figure in our

approach.

2. Plantation establishment: This period is characterized by a drastic annual change in both fruit yield and plantation's biomass, while also requires differentiated cultivation measures. The total period for plantation establishment is also quite differentiated between various tree-crop escalating from 3 to 8 years. Our problem regarding this period is the inconsistencies in relation with the tree-crops productive life accounting parameters, which cannot be treated within the same linear approach applied through the plantations productive life span. To resolve this issue an algorithm was developed in order to exclude this figure from the annual accounting. In specific, for a given tree-crop with X hectares in year 1, and Y hectares in year 1 - 5 (= average maturing period) the accounting protocol is applied for the absolute difference of hectares Z ($Z=|X-Y|$). The issue of the establishment period Carbon balance will be further elaborated in the course of C.3 Action because its non-linear nature dictates the application of a modeling approach.
3. Plantation end-of-life management: This issue had not been considered by previous studies but consists of major importance for LIFE CLIMATREE's objectives, since it regards the consideration of tree biomass as permanent carbon storage. To resolve this issue a dedicated section in the best available practices Annex of the present action's deliverable is foreseen in order to maintain the fundamental consideration of plantation biomass as permanent carbon storage.

Beside these significant problems, also minor were encountered, dealing mostly with data acquisition:

1. Root sampling: This issue related to the accounting of root annual growth, both auxiliary and radial. To resolve this issue we weighted young trees during the 2016-17 dormancy period, planted them and we scheduled one more measurement at the end of the 2017 vegetative period in order to acquire distinct measurements. This adjustment prolonged for almost three months the field work period and is expected to cause an action prolongation of two to three months, as indicated in the following milestone's table.
2. Production means and machinery carbon footprint: This issue is of great importance since the relative figures influence in the tree-crops Carbon balance but as the nursery figure is not located in the tree-crop's land use. Moreover since these emissions have already been considered as emissions of the relative production sector there is a significant possibility to jeopardize the relevant results through double accounting of these emissions. Therefore we concluded to the decision to omit the relevant emissions from the proposed methodology.
3. Survey sample size: This issue regards the credibility of the performed survey. After careful review of similar cases in the literature it was decided to apply as minimum threshold the 50 completed questionnaires for each tree-crop, which is a number acceptable as credible in numerous previous cases.

Action C.2. Projections of future climatic conditions for tree crop categories in S. Europe

Foreseen start date: 1/9/2016
Foreseen end date: 31/12/2017

Actual start date: 1/9/2016
Anticipated end date: 31/12/2017

Action C2 started on time (September 2016) and it is being implemented without problems or delays. The milestones of the Action have been reached and the simulations are being continued as foreseen. The method used and the preliminary results are presented in detail in Annex C.2 and are summarized below.

The NASA Goddard Institute for Space Studies (GISS) ModelE Global Climate Model (GCM) is used to simulate global climate. Before initiating the climate simulations for Action C2, the model was extensively evaluated for the correct installation using a benchmark suite provided by NASA that concerns both software testing and case testing. The software testing was done in order to verify that the compilers installed on the workstation and the model configurations provide a bit-for-bit reproducibility. The case testing was done to confirm code robustness and reasonableness through the run of specific simulations (12 in total). Evaluation was done by comparing the outputs of the code for all simulations carried out with existing plots of the selected simulations. After verifying ModelE's correct installation, simulations were carried out for the period from 1880 to 2060. Preliminary results under the RPC8.5 suggest a temperature increase between 1.0 and 2.0 °C for the largest part of Europe between current (1981-2010) and future (2031–2060) periods while a reduction in precipitation rates up to 0.2 mm/day is simulated over west and south Europe.

In order to obtain climatic information in a very fine scale (i.e., 9 km x 9 km) the Weather Research and Forecasting (WRF) mesoscale meteorological model was employed to dynamically downscale NASA GISS GCM outputs in S. Europe. The latest version of WRF mesoscale meteorological model has been set up along with the graphical software for visualization of the outputs. The WRF model installation has been tested using the "WRF Testing Framework" utility. Preliminary results suggest an increase of about 1.5 °C for the mean temperature over S. Europe annually, for the selected current and future periods (i.e., 2008-2012 and 2048-2052). The most intense temperature increase is expected at the Iberian Peninsula and the North of Italy. Precipitation change presents a mixed trend with high spatial variability. Central Mediterranean is the only region where a significant increase is simulated, annually.

The progress of the action is following the initial time schedule without any problems. The first milestone of the Action C.2: Completion of Global Climate Model simulations for current years as well as the second milestone: Completion of Meteorological Model simulations for current years in S. Europe, have been accomplished as scheduled (i.e., 30/6/2016 and 31/1/2017, respectively). The simulations are continued as scheduled, as well, and the next milestone (i.e., Completion of Meteorological Model simulations for current years in S. Europe) is estimated to be achieved on time (i.e., 30/09/2017).

Action C.3 Interface development of a software application for accounting tree-crop carbon sequestration

Foreseen start date: 01/01/2017	Actual start date:	01/06/2016
Foreseen end date: 31/06/2018	Actual (or anticipated) end date:	31/06/2018

The Action C.3 started earlier than 01/01/2017. During the reported period the following steps were undertaken:

- a literature survey on Greenhouse Gases (GHG) Emissions and Removals related to Cropland Ecosystems. (Annex I)
- a study of the various models and methodologies available in literature.(Annex II)
- a search of the web, excel, or any other software-based calculation tools for quantifying GHG emissions/offsets from agricultural and forestry activities. (Annex III).

This introductory work was necessary in order to investigate the capabilities, characteristics and data requirements of the various available models, tools and methodologies.

Based on the literature review as well as on the knowledge provided by Actions A.1, A.2, C.1, C.2 and C.4 a web based tool is under design.

The web based application will incorporate two distinct sources/sinks of CO₂. The first will be based on the tree-crop ecosystem while the second will try to capture the energy consumption associated with the various management practices.

Carbon stock changes for a tree-crop ecosystem will be estimated for the following carbon pools, as indicated in IPCC guidelines for the AFOLU Sector:

- 1) biomass (above-ground biomass and below-ground biomass)
- 2) dead organic matter (deadwood and litter)
- 3) soils and
- 4) harvested wood products.

The estimation for the 1st, 2nd and 4th pool will be implemented following the methodology proposed by Action C.1.

For the 3rd pool, a specific model for the prediction of changes in soil organic carbon stock on agricultural land available in literature will be selected. The application of RothC model is a possible choice, because of its simplicity and the availability of the data (at regional and national level in Greece-Italy-Spain) to run the model.

Secondly, the energy consumption of the different management practices leading to emissions, will be estimated from the dataset facilitated by Action C.1.

As a consequence, the user interface will include a number of tabs with details on:

- General information i.e. label , year, climate zone (with simple map)
- Biomass i.e. crop type, weight of product, area etc.
- Energy consumption on farm in order to apply fertilizers, pesticides, pruning, tillage, irrigation

In the biomass and energy tabs the user will be able to examine alternative scenarios

concerning land use, crop cultivations as well as different management practices. The CO₂ balance will be calculated and presented appropriately (total number, sub-calculations, graphical display). The inputs alongside the estimates could be exported to a pdf or printed. The tool will be connected to a database of common agricultural management practices and available statistics (relevant to crop types and local climate conditions, fed in by previous actions).

At this stage, from action C.4 the description of the calculation process is expected which will be based on results of Actions A.1, A.2, A.3, C.1 and C.2. This will cover biomass - dead organic matter - harvested wood products pools leaving us to treat the soil pool. To this end, data input from actions C.2 (climatological variables), C.1 (litter) are expected in order to apply RothC (or a similar model for the prediction of changes in soil organic carbon stock on agricultural land) to treat soil. The next steps include the beginning of the implementation of the web tool which will last the rest of the remaining time for this action. No delay in this action is foreseen.

Action C.4 Carbon input / output calculation for current and future years

Foreseen start date: 1/11/2016
Foreseen end date: 30/06/2018

Actual start date: 1/11/2016
Anticipated end date: 30/06/2018

Action C.4 started in November 2016 and until the end of March 2017 (Reporting date) is progressing according to the scheduled timetable, without any problems or delays.

In the context of the specific action a significant number of working meetings and communications between the project beneficiaries took place aiming at a thorough brainstorming towards the specification of the required characteristics that the CO₂ sequestration calculation algorithm should have. The final discussions between beneficiaries about the algorithm and its variables took place in Matera, during the project meeting.

In this meeting the following have been finally defined regarding the development process of the algorithm:

1. The type of available data that will be used from the pool of delivered results of Actions A.1, A.2, A.3, C.1 and C.2
2. Algorithm's design principle. More specifically, the algorithm will calculate the capacity of the tree to accumulate/ store carbon from atmosphere CO₂ minus the CO₂ quantity which is emitted by the agricultural practices which are used for its cultivation.
3. Algorithm's boundary, which is the tree itself. This means that the base of the calculations will be the tree as a single unit regarding its biological cycle as well as the various practices which are applied for its cultivation, maintenance, protection and harvesting. The result of these calculations will then be extrapolated based on production/ cultivation data (surface of cultivated land, density of trees per hectare).
4. Algorithm's key criteria. These consist of three categories:
 - ✓ trees species (olive, apple, orange, peach, almond)

- ✓ climatic zones (northern, middle, southern)
 - ✓ types of cultivation (extensive, intensive)
5. Algorithm's specific parameters. These consist of seven categories, the components of each one differentiate depending on the above mentioned key criteria:
- ✓ changes of trees biomass (trunk, leaves, roots, fruits)
 - ✓ soil (CO₂ balance regarding biological activities)
 - ✓ discarded material (fallen leaves)
 - ✓ cultivation practices (e.g. tillage)
 - ✓ maintenance practices (trimming, application of fertilizers, irrigation)
 - ✓ protection practices (application of pesticides)
 - ✓ harvesting practices (manual or mechanical harvesting, in the field transportation)
6. Algorithm's purpose of use. Algorithm will provide the set of detailed equations, which are required for the development and operation of the CO₂ sequestration calculation platform (action C.3), so as this platform to be suitable and reliable to be used for:
- ✓ policy decision making purposes at central authority level
 - ✓ CO₂ sequestration calculation at farm level.

The process for designing and developing the CO₂ sequestration calculation algorithm based on the above mentioned specifications is under progress. More specifically the structure of the algorithm is under construction as well as the determination of the values of the various coefficients that will be used of each individual criteria and parameter is in process.

Action E.1 Creation of project's logo

Foreseen start date: 16/07/2015	Actual start date: 01/09/2015
Foreseen end date: 30/09/2015	Actual end date: 16/10/2015

No major problems have been encountered for this Action. The design of the official LIFE CLIMATREE logo has been successfully completed (Annex E.1) and is being used in all project's deliverables, reports and dissemination material.

Action E.2 Development, launching and maintenance of project's website

Foreseen start date: 16/07/2015	Actual start date: 01/10/2015
Foreseen end date: 28/06/2019	Anticipated end date: 28/06/2019

The design of the website and the development of its content started in October 2015. The LIFE CLIMATREE website offers information about the project and its actions, the beneficiaries and the activities during the implementation of the project. In addition, it contains useful links and links to the official Facebook page and Twitter account of the project. The website is being maintained and will continue to be maintained and updated until the end of the project.

Until 31.3.2017, 1,160 visitors of LIFE CLIMATREE website have been recorded.

Approximately 5,111 page views were reached with an average of 4.41 page views/visitor.

The website features the budget, EC contribution and an explicit acknowledgement to the support of the LIFE financial instrument of EU.

LIFE CLIMATREES' website was designed, developed and launched at the following web address: www.lifeclimatree.eu. The website is maintained by TN with the contribution of all beneficiaries.

Action E.3 Dissemination of project's progress and results

Foreseen start date: 16/07/2015

Actual start date: 16/07/2015

Foreseen end date: 28/06/2019

Anticipated end date: 28/06/2019

Dissemination strategy (Annex F.3.1) identifies two groups of potential stakeholders: a) decision and policy makers at the European and National levels in relation to climate and agricultural policies, b) Farmers and stakeholders from the sectors of agriculture and crop cultivations. Until this reporting period the dissemination policy focused on the establishment of an effective contact with policy relevant stakeholders. A communication channel has been established with EU Authorities, National Ministries (Environment and Agriculture), and other relevant experts and consultants. Among else, important meetings have been organized with DG CLIMA, Ministries in the 3 countries, LULUCF experts mainly in Greece and Italy, in order to communicate the target of the project and to incorporate the current European legislation objectives into the project context (main conclusions from these meetings can be found in Annex F.3.1). As a direct result of these meetings, LIFE CLIMATREE established a tune for mining important data for the successful implementation of its actions. The development of the project's key actions (C& D sets of Actions), are expected to lead to the dissemination of LIFE CLIMATREE results in a farmer-agricultural oriented level. Therefore, the 2nd set of the dissemination strategy will be targeted to the second group of stakeholders: Farmers and agricultural unions, as the project's outcomes will be communicated to them when available.

The production of a 1st set of Informative leaflets and Posters has been implemented on time and can be found in Annex E.3.1 In addition, the project's 1st Newsletter was launched on December 2016 and can also be found in Annex E.3.2.

No significant problems have been encountered for this Action.

Action E.4. Development of project's notice boards

Foreseen start date; 1st Set: 30/06/2016; 2nd Set: 28/04/2017

Actual start date; 1st Set: 30/06/2016; 2nd Set: 28/10/2017

Foreseen end date; 1st Set: 30/06/2016; 2nd Set: 28/04/2017

Actual end date; 1st Set: 30/06/2016; 2nd Set: 28/10/2017

The design and installation of the 1st set of Notice Boards took place in the 12th month (see Annex E.4).

The 2nd set is expected to take place by the 10th of 2017 and this small delay is taking place in order to incorporate some basic results from the implementation of C Actions.

No other major problems are expected during the implementation of Action E.4.

Action F.1 Project management by UEHR

Foreseen start date: 16/07/2015

Actual start date: 16/07/2015

Foreseen end date: 28/06/2019

Anticipated end date: 28/06/2019

The Kick off meeting of the Project took place on the 7th and 8th of October 2015 following the signature of the Partnership Agreements in September 2015. Apart from the short delay in the installment of the 1st prefinancing caused by the Greek banks dysfunction of the 2015 summer, no serious problems have emerged so far concerning the project management of LIFE CLIMATREE. The compilation of the Mid Term report covers the period indicated in the initial project's timetable, while the compilation of the next Progress report is also expected to take place by the end of 2018 (12/18).

The Project Management team established a constant communication with all the participating Beneficiaries through emails, telephone contacts, skype meetings, working groups and regular team meetings in order to certify the successful implementation of necessary managerial, administrative and financial documentation, the proper development of the project's progress and the production of the project's deliverables in line with the approved time schedule. As a result, all partners submit on a monthly basis their progress in line with the Actions which are under implementation. An aggregate report of all LIFE CLIMATREE's works for each month is then submitted to the LIFE External Monitor. Furthermore up to date two monitoring missions (project's visits) have taken place (Athens 02/16, Matera 03/17). All Beneficiaries submit to the coordinating beneficiary their financial progress and documentation every 3 months.

A full list of all the meetings and events that took place within this reporting period is presented in the Annexes of Actions F.1 and E.3.

For the time being the coordinator does not foresee any essential delays in the project's continuation. Marginal re-allocations of workplans are duly described in each Action's description or in section 6.2 of the current report. Rescheduling serves operational needs of the prospect and promotes productivity.

Action F.2 Monitoring of project progress

Foreseen start date: 16/07/2015

Actual start date: 16/07/2015

Foreseen end date: 28/06/2019

Anticipated end date: 28/06/2019

A Quality Assurance/Quality Control System was developed in order to monitor the progress of the implementation of the LIFE CLIMATREE project. A QA/QC Committee was established at the kick off meeting, the QA/QC manual was formulated by the Committee (Annex F.2). The Committee consists of one representative of each project beneficiary. Its role is to assist the task of project monitoring by completing and evaluating the corresponding report.

The QA/QC Manual was prepared on time (September 2015) and can be found as an Annex F.2.

The 1st QA/QC Report was finalized on 31/3/2017 upon the completion of the 2nd monitoring visit, covering the activities of the project until 31/1/2017 and can be found as an Annex F.2.1. In this same report a table listing the deliverables and milestones foreseen for the reporting period, indicating the actual date of completion/accomplishment and the date foreseen in the revised period.

The 2nd QA/QC report is expected to be completed by 12/2017.

We have not encountered any remarkable problems for this specific Action.

Action F.3 Networking activities with other relevant EU projects

Foreseen start date: 16/07/2015

Actual start date: 16/07/2015

Foreseen end date: 28/06/2019

Actual (or anticipated) end date: 28/06/2019

Since the initiation of the Project, LIFE CLIMATREE's team has applied a structured networking strategy with other relevant projects and key stakeholders. This strategy is presented along with the dissemination strategy in Annex F.3.1. The objective is to maximize the Operational Application of the project in the EU level by exchanging information and outcomes with other relevant projects and key actors. Main networking activities so far include the establishment of contacts with the following LIFE Projects: LIFE Olive Clima, LIFE Organiko, LIFE ECOCITRIC, LIFE IPNOA, ADAPT2CLIMA etc. An important networking action is the establishment of operational contact with the European Agroforestry Federation (<http://www.agroforestry.eu>) who were also invited and actively participated in the MATERA meeting (8-11/3/17). In addition, LIFE CLIMATREE participated in LIFE IPNOA's (LIFE11 ENV/IT/000302) final workshop in Pisa, Italy. UEHR and CSIC also participated in the closing workshop of LIFE ECOCITRIC Project (LIFE13 ENV/ES/000889) in Spain. UEHR organized of two working meetings in Rome (7th of March) with: LIFE OLIVE4CLIMATE, LULUCF Italy (Ispra Ambiente Institute) and LIFE MEDINET. All networking activities will be exploited in the next period to increase the potentials of LIFE CLIMATRE while at the same time contribute to the targets of the associated prospects and activities.

No remarkable problems have been encountered for this specific Action so far.

Action F.6 Indicator Tables of Project's Progress

Foreseen start date: 31/03/2017
Foreseen end date: 28/06/2019

Actual start date: 31/03/2017
Actual (or anticipated) end date: 28/06/2019

Estimates concerning CO₂ balance of tree crops will be the outcome of LIFE CLIMATREE project. These estimates could contribute to the national GHG inventories where tree crops are included in the category of croplands. CLIMATREE estimates could be used as a verification variable which could have further effect:

- To reduce the inherent uncertainty of GHG inventory
- To support the incorporation of climate objectives within agricultural and land use policies
- To identify the ecosystemic contribution of tree cultivations.

An updated indicators table is annexed (Annex F.6) and also addressed at Chapter 7 of the present report. The indicators are monitored on an annual basis.

6.2. Main deviations, problems and corrective actions implemented

AUA-general: The AUA team leader involvement (Prof. S. Haroutounian) in various project activities was more vigorous as compared to those described in approved project, because at the time of project compilation/submission (summer 2014) he had been assigned with parallel duties as president of Hellenic Agricultural Research Organization “DEMETER” (4/2013 to 2/2015). When project began, he had fully resume his AUA duties and consequently he also undertook these responsibilities as AUA team leader and project participant. This involvement in several project activities implementation-management did not affect the total amount allocated for the AUA personnel, since the corresponding involvement of other AUA team members was decreased. The only modification –as compared to the approved project– concern the total working hours per action which were adjusted accordingly (slightly decreased).

A problem encountered during this action implementation, concerned the extension of its end-date to March 2016, as a consequence of the two months’ delay to start the project by AUA team due to late reception of EU financial contribution and the signature of the partner agreement contract (September 2015 instead of July 2015). It must be noted that this time-schedule modification had the approval of project manager and was not affected the proper and timely implementation of the other project activities. Another necessary modification –in respect the approved project- concerns the upgrade of the qualifications of the foreseen external expert (Agrarian) hired by AUA to contribute in Actions A and C implementation. The large volume and the high-level quality deliverables assigned to AUA in the terms of these actions, forced its team leader to reconsider the external expert’s qualifications (Agrarian) by upgrading the BSc level foreseen in the approved

proposal to PhD level. This modification-upgrade was considered as necessary by the AUA team leader after hiring –in the terms of A1 Action- two BSc Agrarians on a two weeks trial basis in the early stages of the A1 Action (September 2015). Both scientists failed to fulfill properly their assignments, forcing the AUA team leader to ask the written approval of the project management to hire a PhD Agrarian. The latter was proved very efficient contributing decisively to the proper implementations of AUA assignments. It must be noted that this modification of personnel qualifications did not affect the total amount allocated for the relevant personnel, since the PhD Agrarian received the same total amount of money allocated for the external personnel for performing the relevant project activities.

Action C.1: “Life Cycle Assessment of carbon cycle in tree-crop categories”

No problems were encountered in the context of C1 Action timely and proper implementation. For the reasons mentioned before the hired Agrarian external expert (by AUA team) is a PhD holder.

Even though no problems occurred this action was decided to continue employ the A.1 action’s upgrade of the additional personnel level for reasons of continuation and coherency through project implementation. Though this small alteration had already created repercussions in the permanent personnel assignment that was not obvious through action A.1, mostly as a result of the short period and intense employment in it. In present action though it was made quite obvious that the upgrade of the additional personnel to post-doc, created necessities for the increase of the employment in the project of senior academics. The reasons behind this requirement rested on the provision of appropriate supervision and guidance, roles otherwise attributed to junior academics.

Action E.3: “Dissemination of project’s progress and results”

This action implementation provisioned an overseas travel for the LIFE CLIMATREE representation in the IUCN’s World Conservation Congress 2016 in Hawaii, USA. This activity was not implemented, because and after consultation with project management it was concluded that there were no significant data to present, due to the premature phase of project’s implementation. Therefore, when a relevant venue will be set for IUCN’s World Conservation Congress 2020, a request will be presented for the relocation of the relevant amount in order to attend that conference and present the project progress-outcome.

UOWM has planned to participate at the annual American Geophysical Union conference (AGU 2017) as described in ACTION E.3: Dissemination of project’s progress and results. However, due the renovation of the Moscone Center’s at San Francisco, the city where for nearly 50 years the AGU Fall Meeting has been held, Washington, D.C. has been selected for the 2018 Fall Meeting. As Washington, D.C. is located in the East coast travel expenses to participate in AGU 2018 conference will be lower compared to AGU 2017. Therefore, in order to reduce the related cost, it is planned to participate at the AGU 2018 conference instead of AGU 2017 conference.

6.3.Evaluation of Project Implementation

Action	Foreseen in the revised proposal	Achieved	Evaluation
<p>Action A.1.</p> <p>Selection and analysis of tree-crop categories in S. Europe</p>	<p>Objectives:</p> <p>To identify the prominent tree-crops of S. Europe with regard to their characteristics defining their carbon sink potentials as well as their GHG emissions.</p> <p>Expected results:</p> <p>The formation of clusters of individual tree-crops with regard to their biological, cultivation, and climatic zone characteristics.</p>	<p>1.A comprehensive framework for the assessment of Tree Crops Ecosystem Services (ES), complemented by a set of potential indicators for the enumeration of ES</p> <p>2. A methodology for the clustering of Tree Crops, that concluded to 4 major clusters</p>	<p>Though this action exhibited a significant prolongation, fully met its objectives within the prescribed budget limitations.</p> <p>Moreover this prolongation presented crucial benefits enabling the partially overlap with C.1 Action, thus ensuring coherency between the herein results and the prerequisites for LIFE CLIMATREE's objective materialization.</p>
<p>Action A.2.</p> <p>Adjustment of the "Land use, land-use change and forestry (LULUCF) Methodology" to the environmental problem targeted</p>	<p>Objectives:</p> <p>To offer improved estimates of CO₂ balance in permanent tree crops taking into account the high inherent uncertainty of current LULUCF accounting system</p> <p>To determine CO₂ balance in permanent tree crops is a gap for accounting emissions and removals in the current LULUCF framework.</p> <p>Expected results:</p> <p>More accurate estimation of CO₂ balance in tree-ecosystems.</p>	<p>- Identification of potential contributions to the LULUCF methodology</p> <p>-Important processes defining the CO₂ balance have been traced. Soil functioning is one of the key processes which is almost "ignored" in LULUCF based accounts. We made a first attempt to study in Italy the CO₂ carbon balance.</p> <p>-Carbon balance based on the Net Ecosystem Carbon Balance which includes CO₂ soil emissions and carbon inputs to ecosystem. The relevant findings published as LIFE CLIMATREE outcome (https://doi.org/10.1016/j.a)</p>	<p>The Action A.2 started on time (October 2015) and it is being implemented without problems or delays. The main objectives (deliverable and milestone) of the Action have been reached.</p>

		gee.2016.05.031)	
<p>Action A.3.</p> <p>Analysis of climatic, environmental and socioeconomic parameters of tree-crop categories in S. Europe</p>	<p>Objectives:</p> <p>To examine the current status of tree crop categories in S. Europe assessing the parameters interconnected with them</p> <p>Expected results:</p> <p>Detailed description for the environmental, climatic and socioeconomic parameters influencing the selected tree crop categories in S. Europe. The findings define the "current state conditions".</p>	<p>-Collection of environmental/ climatic and socioeconomic data for Greece, Italy and Spain</p> <p>-Database with the parameters influencing tree crop in these countries</p> <p>-Report on the climatic, environmental and socioeconomic parameters relevant to tree crops</p>	<p>The Action was successfully initiated following the selection of the main tree crop categories defined in Action A.1. The extension of Action A.1 suggested a two month extension of Action A.3 in order to incorporate A.1 inputs in environmental parameters affecting tree crop cultivations. The final report of Action A.3 was completed on May 2015 with, a minor, 2 month delay..</p>
<p>Action C.1.</p> <p>Life Cycle Assessment of carbon cycle in tree-crop categories</p>	<p>Objectives:</p> <p>Action C.1 is one of the core actions of CLIMATREE and aims at the development of a novel methodology for the estimation of CO₂ balance of tree cultivations. The methodology will be based on data and information readily available at the national level in order to have a direct operational appeal. The methodology takes into account, but it is not constrained, the IPCC methods for CO₂ accounting</p> <p>Expected results:</p> <p>An operational methodology for estimating CO₂ balance will be delineated. The methodology will reflect not only the relevant biological process but the manmade inputs such as cultivation methods</p>	<p>So far has been produced:</p> <p>-A complete list of the variables affecting carbon sequestration, their definition and the methodology to assess their effects</p> <p>-A literature review report on those variables</p> <p>-An experimental calculation of those variables numeric value</p> <p>-A report on the significance of each variable against the MESA most important functions</p>	<p>The Action C1 started on time (April 2016) and it is being implemented without problems or delays. The milestones of the Action till now have been reached and the simulations are continued as scheduled.</p>

	<p>and technical factors. As a result the methodology attempts a kind of Life Cycle assessment for tree-crops taking into account the framework of the CO₂ estimations and paying particular attention to avoid double counting of CO₂ emissions and removals. Based on the methodology the Best Available Practices will be defined.</p>		
<p>Action C.2. Projections of future climatic conditions for tree crop categories in S. Europe</p>	<p>Objectives: This Action aims to determine future climatic conditions and the related uncertainties in S. Europe based on the Representative Concentration Pathways RCPs</p> <p>Expected results: i) Database containing all the climatic parameters relevant to trees cultivations (e.g., temperature, precipitation, humidity, solar intensity) for Europe for the period 2000 – 2060. ii) Database containing monthly average changes in the meteorological parameters affecting trees cultivations (e.g., temperature, precipitation) in S. Europe between current (i.e., 2008 – 2012) and future years (i.e., 2048-2052).</p>	<p>-Completion of Global Climate Model simulations for current years. -Completion of Meteorological Model simulations for current years in S. Europe.</p>	<p>The Action C2 started on time (September 2016) and it is being implemented without problems or delays. The milestones of the Action till now have been reached and the simulations are continued as scheduled.</p>

<p>Action C.3.</p> <p>Interface development of a software application for accounting tree-crop carbon sequestration</p>	<p>Objectives:</p> <p>The design of a web-based application for accounting tree crop carbon sequestration for the Mediterranean region under different geographical, climatic and ecosystemic conditions.</p> <p>Expected results:</p> <p>- A model reflecting the properties of CLIMATREE-based methodology for estimating CO₂ sequestration</p> <p>A software application of the model</p>	<p>- A survey of literature on Greenhouse Gases (GHG) Emissions and removals related to Cropland Ecosystems</p> <p>-A survey on the available models and methodologies concerning CO₂ estimations, including those following the IPCC standards</p> <p>-A search of the web, excel, or any other software-based calculation tools for quantifying GHG emissions/offsets from agricultural and forestry activities</p> <p>-Preparation of an initial design of the software application</p>	<p>The action started six months earlier and it is being implemented without substantial problems.</p>
<p>Action C.4.</p> <p>Carbon input / output calculation for current and future years</p>	<p>Objective:</p> <p>The development of an algorithm which will calculate efficiently the CO₂ sequestration capacity of selected tree crops</p> <p>Expected results:</p> <p>A CO₂ sequestration calculation algorithm</p>	<p>In the context of the specific action a significant number of working meetings and communications between the project beneficiaries took place aiming at a thorough brainstorming towards the specification of the required characteristics that the CO₂ sequestration calculation algorithm should have. The final discussions between beneficiaries about the algorithm and its variables took place in Matera, during the project meeting and the parameters affecting the development process of the algorithm were decided.</p>	<p>Action C.4 started on time and it is implemented without problems</p>

<p>Action D.1.</p> <p>Evaluation of the effectiveness of the proposed policies and measures</p>	<p>Objectives:</p> <p>Assess the effectiveness of the proposed best practices (Action C5) to contribute towards climate change mitigations targets.</p> <p>Expected results:</p> <p>i) Reduction of Greenhouse Gas emissions</p> <p>ii) Increase in agricultural land used as carbon sink area.</p>	<p>Action D.1 will start on October 2017</p>	<p>Action D.1 will start on October 2017</p>
<p>Action E.1.</p> <p>Creation of project's logo</p>	<p>Objectives:</p> <p>Production of the Project's logo</p>	<p>The project's logo was successfully produced</p>	<p>No problems have been encountered for this Action.</p>
<p>Action E.2.</p> <p>Development, launching and maintenance of project's website</p>	<p>Objectives:</p> <p>Development, launching and maintenance of project's website</p> <p>Expected results:</p> <ul style="list-style-type: none"> - At least 50 visitors/month - At least 500 likes at the project's facebook page - At least 100 followers on Twitter 	<p>The design of the website and the development of its content started in October 2015.</p> <p>Up to-date the LIFE CLIMATREE website has approximately ~65 visitors/month.</p> <p>The project's facebook page has received 119 likes and the project's twitter account has 68 followers</p>	<p>Action E.2 is implemented without problems. More effort will be given in the next period in the increase of facebook likes and twitter followers.</p>

<p>Action E.3. Dissemination of project's progress and results</p>	<p>Objective of this Action is the communication of the knowledge that will be extracted from the implementation of the project's Actions to the relevant stakeholders, the farmers and their associations, the scientific community and the public in general, aiming at:</p> <ul style="list-style-type: none"> - Assisting & Informing stakeholders to understand the linkage between climate change and the problem related to carbon sequestration - Demonstrating to farmers and associations their key role towards climate change mitigation policies. - Enhancing public awareness on climate change impacts. 	<ul style="list-style-type: none"> • Creation of Informative Leaflets: 7/16 • Creation of Informative Posters: 7/16 • Project's results are disseminated to: <ul style="list-style-type: none"> -the relevant stakeholders, -the farmers and their associations, -the scientific community and -the public in general •Establishment of communication with farmers and associations: 11/15 	<p>Communication will be further enhanced along with the progress of the Project's core Actions (C&D)</p>
<p>Action E.4. Development of project's notice boards</p>	<p>Production of Project's Noticeboards</p>	<p>1st Set of Project's Noticeboards have been already produced.</p>	<p>No problems have been faced so far</p>

<p>Action F.1. Project Management</p>	<p>Objectives:</p> <ul style="list-style-type: none"> •The scientific management of the various Actions •The financial management concerning project's expenditures •The monitoring and control of the various activities within the different Actions •The design and organization of the activities required for the dissemination of the project results 	<ul style="list-style-type: none"> •Kick Off Meeting: 10/15 •Compilation of Inception Report: 7/16 •Compilation of Mid-term Report: 5/17 	<p>No problems have been faced so far.</p> <p>The Project Management is monitored by the 3 Management Committees of the Project:</p> <ul style="list-style-type: none"> •The Scientific Committee: decides the details for the implementation of each project's Action •The Financial Committee: monitors the economic figures of project's implementation •The Dissemination Committee: designs and organizes all the activities required for the successful dissemination and diffusion of project's results
<p>Action F.2. Monitoring of Project Progress</p>	<p>Objectives:</p> <ul style="list-style-type: none"> •Quality Assurance / Quality Control (QA/QC) system will be developed in order to monitor the progress of the implementation of the LIFE CLIMATREE project •QA/QC Committee: will monitor the performance of the project's implementation 	<ul style="list-style-type: none"> •QA/QC Manual: 30/09/2015 •QA/QC 1st Report: 31/3/2017 	<p>So far the Monitoring of the project is successfully achieved through:</p> <ul style="list-style-type: none"> •The management part: <ul style="list-style-type: none"> - project milestones - deliverables completion - consistency with the project timetable - performed expenditures and consistency with the proposed cost breakdown

			<ul style="list-style-type: none"> •The technical part: <ul style="list-style-type: none"> - will examine the performance of the project's implementation according to its targets
<p>Action F.3.</p> <p>Networking activities with other relevant EU projects</p>	<p>Objectives:</p> <ul style="list-style-type: none"> •Find projects relevant to LIFE CLIMATREE's objectives, aims and actions •Establish communication with the beneficiaries of the most relevant projects •Exchange information about the scientific approach, the targets and the deliverables of each one of these projects 	<p>Established networking activities so far:</p> <ul style="list-style-type: none"> •DG CLIMA •National LULUCF Accounting Authorities •Greek Ministry of the Environment & Min. of Agriculture •Spanish Ministry of the Environment •European Agroforestry Federation •Hellenic Agricultural Organization "DIMITRA" •ASSOFRUIT-ITALIA •AGREENMENT srl ALSIA-Regione Basilicata • Participation of LIFE CLIMATREE in LIFE IPNOA's (LIFE11 ENV/IT/000302) final workshop in Pisa, Italy Participation of UEHR and CSIC in the closing workshop of LIFE ECOCITRIC Project (LIFE13 ENV/ES/000889) in Spain •Establishment of Networking with the European Agroforestry Federation (http://www.agroforestry.eu) •Organization of 2 working meetings in Rome (7th of March) with: <ul style="list-style-type: none"> -LIFE 	<p>The networking activities will be preserved and enhanced throughout the whole project's duration</p>

		OLIVE4CLIMATE -LULUCF Italy (JRC & Ispra Ambiente) -LIFE MEDINET	
Action F.6. Project management and monitoring of the project progress	Objectives: To monitor the project results or expected results (i.e. carbon emissions reductions achieved or achievable by adopting the proposed best practices, etc.). This Action will contribute to evaluating the impact of the LIFE project in view of the overall objectives of the LIFE Programme, in line with the Regulation and the Multiannual Work Programme for 2014-2017.	A revised table of indicators is attached with the current report (Annex F.6)	A more precise version of the indicators will be produced upon the completion of Action C.4.

- Indicate the effectiveness of the dissemination activities and comment on any major drawbacks.

Please find a detailed analysis of the dissemination and networking strategy in Annex F.3.1.

- Policy impact

Contribution to the EU CLIMA policies

The project contributes to the legislation actions that support European Climate Policies. The implementation of the relevant LULUCF framework and the inclusion of the agricultural sector on the framework of the Decision 529/2013 (EC, 2013), which targeted reduction of GHG emissions (i.e. 20% below the 1990 emissions by 2020), will be enhanced through the implementation of the project's key actions.

The methodology which is in progress through LIFE CLIMATREE's action plan is:

- a) contributing towards a better accounting of the emissions and removals resulting from cropland management and especially permanent tree-crops;
- b) facilitating the monitoring and accounting of carbon stock and fluxes for land resource managers
- c) informing decision makers towards the formulation of agricultural strategies.

Moreover, the identification of the socioeconomic benefits of the best tree-crop practices are expected to contribute towards a better understanding of economic and social benefits of climate change mitigation actions and the proposition of new policies at national and EU level.

LIFE CLIMATREE project supports the implementation of the EU's climate policy and prepares the EU for climate actions challenges in the coming decades, contributing to climate change mitigation priority area through Greenhouse gas accounting of land use.

Gaps or barriers in terms of policy at the national and EU levels

LIFE CLIMATREE will support the more accurate monitoring and accounting of carbon balance in the tree cultivations being a sector bothered with several obstacles resulting in an uncertainty up to ~70%. LIFE CLIMATREE estimates could be used as a policy input as well as a validation framework to the official, IPCC-based CO₂ accounting.

6.4. Analysis of benefits

1. Environmental benefits

a. Direct / quantitative environmental benefits:

The mitigation potentials of the agricultural sector are substantial and yet not fully exploited on a global scale. For example the Australian National Outlook report (<https://www.csiro.au/nationaloutlook/>), concerning the prospect of green growth of Australian economy, highlights that trees present high potentials for absorbing CO₂ once they are properly managed. Tree cultivations could substantially support mitigation actions especially in S. Europe where a relatively high percentage of land use is allocated to tree cultivations.

However, missing knowledge and high uncertainty of relevant accounts inhibit the prospects of mitigation. The existing Tier 1 CO₂ accounting methods result in high uncertainty in the case of tree cultivations because of the very general data on the removal factors (e.g., tree above and below biomass). In addition, different cultivation management practices result in different level of CO₂ balance. In this context LIFE CLIMATREE attempts to develop a methodology for a more accurate estimation of CO₂ absorption of different crops under different management practices. New factors and processes (e.g., soil management) not included in the current accounts will be studied and their impacts assessed. Cultivation methods and other manmade influences will be considered. The potentials of this methodology are extending from influencing climate and agricultural policies to performing a validation test of the official accounts.

The following Table 1 shows the amount of carbon accumulated in above- and below-ground standing biomass (t C ha⁻¹) measured by the LIFE CLIMATREE team providing quantitative new information for a peach orchard.

Table 1 - Carbon accumulated in above- and below-ground standing biomass (t C ha⁻¹) during the 14-year lifetime of the orchard. Data for the 15-year old orchard are the mean of that collected at the sustainable and conventional plots, the 1-year-old data (redrawn from Montanaro et al., 2017 *Agr Ecosyst Environ* 238:104-113)

	1-year-old	15-year-old	Lifetime removal
Above-ground	0.02	17.21	17.19
Below-ground	0.01	8.15	8.14
Total	0.03	25.36	25.33

LIFE CLIMATREE team has analyzed in details the ecosystem services flowing from orchards focusing the key role of the soil carbon stock (Montanaro et al., 2017 *Scientia Horticulturae*, 217:92-101).

Agricultural policies and certain dimensions of the Common Agricultural Policy will be assigned with a relatively precise climatic outcome - CO₂ value-. This would permit the development of an incentive mechanism reflecting the climatic and environmental impacts as those described by the term of the "ecosystems payments" incentives. As a result, cultivation methods with substantial mitigation effect will be promoted.

Climate policies will be enhanced with more precise accounting methods and the potentials for mitigation from still underestimated sources, such as tree cultivations could be promoted. This will promote the effective application of LULUCF as a climate policy option.

b. Qualitative environmental benefits

Beyond the direct clima-relevant environmental benefits LIFE CLIMATREE wishes to result in additional environmental benefits concerning biodiversity of soil resources and water resources management. The pioneering work of one of the beneficiaries Prof. C. Xiloyannis, the leader of the team of DiCem, has identified the environmental benefits of certain management methods in tree cultivations. The holistic environmental benefits of cultivation methods will be identified and incorporated in the policy proposals of LIFE CLIMATREE. As a result the ecosystem services of tree cultivations will be defined, ranked and systematically related to the major objective of the prospect, the CO₂ balance of tree crops.

Project's results to date have demonstrated however that climatic conditions have to be considered when accounting for the tree CO₂ absorption capacity and water management and indeed tree plant water status plays a determinant role in the agro-ecosystem CO₂ exchange. In citrus trees it was demonstrated that the citrus orchard acted as a sink for CO₂, fixing 3,855 kg CO₂/ha/year, with a water use efficiency of 5.1±1.9 g CO₂/kg, respectively. Similar type of data is currently under collection for peach orchards under arid conditions and a rainfall regime of only 250 mm/year. So far, it has been shown that the use of practices such as cover crops should be adapted considering the rainfall regime of the selected climatic zones. Under semi-arid conditions, the use of cover crops should be managed in a way that can also provide for direct ecosystem services related to the water cycle.

2. Economic benefits.

Action A.3 has identified and evaluated the socioeconomic aspects of tree cultivations. The baseline for evaluating the benefits of any relevant future evolution has been established. Employment, Gross and Net production, added value, imports and exports, prices trends, are among the crucial variables addressed.

The exploitation of the mitigation potentials of tree cultivations could promote policies that increase tree cultivations and modify them towards maximizing CO₂ absorption. These policies may incorporate incentives for farmers as an ecosystem payment instrument. The results of this kind policies will be positive for jobs, income and added value of agricultural sector while enhance the resilience of society through food production.

Furthermore, the findings of the project will be reflected in land use scenarios concerning rural areas and incorporating environmental and economic dimensions.

3. Social benefits

Human, economic and natural systems are interdependent and strongly coupled. The improvement in the link between agriculture sector, the environment and the economy will result in positive outcomes for society as well. In this context, LIFE CLIMATREE adopts the principle “think globally act locally” and increases the contribution of local society to global welfare with local welfare be also promoted in terms of awareness, integration and employment.

4. Replicability, transferability, cooperation:

The development of the Project's overall networking and dissemination strategy is to ensure the information and involvement of key actors in four levels: a) Global level, b) EU level (EC, Directorate General for Agricultural and Rural Development, Directorate General for Climate Action), c) Member States level (Ministries of Agriculture and Environment), d) Regional level (Regional/ provincial authorities, prefectures).

LIFE CLIMATREE project has been officially presented to delegates of the Climate Change Units and LULUCF experts of the 3 countries in order to synchronize LIFE CLIMATREE with the National Strategic Priorities for the Reduction of Greenhouse gas emissions, particularly in relevance with the update of the Land Use, land-use change and forestry (LULUCF) framework.

Furthermore, the alignment of LIFE CLIMATREE with the “Greenhouse gas Monitoring Mechanism Regulation (MMR)” and other forthcoming policy proposals issued from the Directorate-General for Climate Action is of key importance for the preparation of national reformations proposals designed for future use by the National Authorities of Greece, Italy and Spain.

Integral part to LIFE CLIMATREE’s dissemination process is an ongoing contact with Farmers, Agricultural Unions and Organizations that could be potentially benefited by the

project. The potential for expanding the findings of the project to other countries such as China as relevant contacts have been stabilized and interactions have been articulated. This expansion may increase the global mitigation potentials. LIFE CLIMATREE was invited and presented in the meeting of "China's New Silk Road Strategy: Pathway to Green Growth for European and Chinese Strategy" in Paris (17/3/16).

5. Best Practice lessons:

CSIC is demonstrating that under the semi-arid conditions of eastern Spain, in order to increase the orchards CO₂ capacity, soil water management is the critical factor to consider. Actions to increase the ability of the soil to retain water and to reduce the competition during the dry part of the season should be promoted. This includes the use of winter cycling cover crops that are only active during the winter time of the season when they can provide for ecosystem services related to soil conservation and soil water retention capacity.

Furthermore DICEM performs research on the potentials of organic cultivation to increase CO₂ absorption capacity as well as the positive effect biodiversity and soil.

6. Innovation and demonstration value:

The practices are currently demonstrated in commercial orchards where the growers are directly involved in the experimentation carried out because they provide support to maintain the tree cropping systems. Stakeholders then are directly involved in the innovation since they are really part of the experimental team.

7. Policy implications:

DG Clima is preparing legislative proposals on LULUCF emission reductions and the outcomes of the project are expected to contribute towards this direction by providing a relatively precise accounting method for the CO₂ impacts of the tree cultivations. Towards this objective LIFE CLIMATREE's coordinator has contacted European and National Authorities related to the LULUCF application. Once the outcomes of Actions C.1, C.2 and C.3 will be available, they will be immediately communicated to DG CLIMA, and the European Legislation Bodies. That is a major reason why communication with DG CLIMA was established from the first months of the project.

On the other hand, decision makers in the agricultural policies at the European level have not been contacted yet. Relevant actions should take place once actions C1, C2, C3 give the first concrete results.

The development of the Project's overall networking and dissemination strategy is to ensure the information and involvement of key actors in four levels: a) Global level, b) EU level (EC, Directorate General for Agricultural and Rural Development, Directorate General for Climate Action), c) Member States level (Ministries of Agriculture and Environment), d) Regional level (Regional/ provincial authorities, prefectures).

Among else, LIFE CLIMATREE project has been officially presented to delegates of the

Climate Change Units and LULUCF experts of the 3 countries in order to synchronize LIFE CLIMATREE with the National Strategic Priorities for the Reduction of Greenhouse gas emissions, particularly in relevance with the update of the Land Use, land-use change and forestry (LULUCF) framework.

Furthermore, the alignment of LIFE CLIMATREE with the “Greenhouse gas Monitoring Mechanism Regulation (MMR)” and other forthcoming policy proposals issued from the Directorate-General for Climate Action is of key importance for the preparation of national reformations proposals designed for future use by the National Authorities of Greece, Italy and Spain. Specifically, in Spain a link has been established with the “Oficina Española del Cambio Climático” and the methodology used for accounting CO₂ pools has been shared. The established contact will be used in the further activities to be established by CSIC.

Lastly, integral part to LIFE CLIMATREE’s dissemination, is an ongoing contact with Farmers, Agricultural Unions and Organizations that could be potentially benefited by the project.

7. Project Specific Indicators

The Project Specific Indicators depict the current and potential mitigation effects of tree cultivations. Certain side effects should also be reflected with prevalent certain ecosystem services arising from tree cultivations. The project's major indicators are connected with Action C.4 where carbon input / output calculations for current and future years under different climate and land management scenarios will be performed. Concomitantly, the measurement of specific indicators will be feasible to be implemented after the completion of Action C.4 (expected by 06/2018).

Concerning the table of indicators, two Excel files are included in the present report in Annex F.6. The first file concerns the attached indicators table of the Approved Proposal and the 2nd file is the updated validated table of indicators of the life.idom web database.

Two sets of indicators are used for the monitoring of LIFE CLIMATREE performance. The first set concerns those indicators that reflect the influence of the project during its implementation period. The second set concerns the ultimate impacts of the project which can only be evaluated around the end of the project.

The first set includes: Website, Publications, Presentations at conferences, Other tools for reaching/raising awareness of the general public, Networking, Jobs, Running cost/operating costs during the project and expected in case of continuation/replication/transfer after the project period. These indicators will be estimated and updated on an annual basis, at the end of the project and at 3 to 5 years after the end according to available data.

The second set concerns the ultimate impacts of the project:

Climate Change Mitigation

The CO₂ absorption of tree crops will be estimated for Greece, Italy, Spain. This is the key indicator, which will be assessed under several plausible "conditions", scenarios. CO₂ estimates will reflect both the current and future climatic conditions in the pilot areas. Furthermore, different land use scenarios will be considered reflecting policy options concerning rural areas (reclamation of abandoned agricultural land etc.). Most important, the impacts of relevant agricultural policies should be reflected. The impacts of different management practices will be assessed and presented through the indicators.

As the atmospheric CO₂ is absorbed by trees through the photosynthesis and stored as carbon into woody structures (above and belowground biomass), estimation of the change of biomass produced at existing orchards after the change of management (toward more sustainable land use) or at new tree crop plantations (land use change) would be a good indicator of the CO₂ sequestered.

In addition, the biomass of cover crops grown under changed management practices would be a good indicator.

Soil carbon sequestration

According to IPCC, soil is among the main carbon pools that can be monitored in the agricultural sector in order to determine the impact of management practices on GHG emissions/removals. Several models predict the variation of SOC stock according to carbon inputs to soil (due to the management options adopted) and some environmental parameters including weather variables.

Therefore, it is proposed to use the estimation of the variation of SOC stock as induced by the land use as indicator for potential sequestration of carbon. The initial value of SOC content will be determined through standard soil analysis methodology.

Water resource efficiency 4.3 Resource efficiency soil

Increasing the carbon content of soil could improve also certain related ecosystem services. For example the soil water holding capacity and in turn the ability (service) of soil to store water. That soil ecosystem service is pivotal also for the socio-economic dimension of rainfed crops and their ability to sustain tree physiological activity which is in favor of CO₂ sequestration. In soil with higher water holding capacity the irrigation requirements could be reduced increasing water use efficiency.

Correlative information between SOC and soil water holding capacity exist.

Therefore, it is proposed to use the estimation of changes of soil water holding capacity as indicator of the effectiveness of the increased soil carbon content which is expected under the sustainable practices boosted by LIFE CLIMATREE. Information from standard methodology for the determination of soil water retention curve will be combined with those on root zone depth to estimate soil water holding capacity.

8. Envisaged progress until next report

Until the submission of the next progress report, which is expected in December 2018, the majority of tasks related to the implementation of C Actions are expected to have been completed.

These mainly include:

Action C.1: A guide including the Best Available Practices for Tree Crops Carbon Sequestration is expected to have been completed.

Action C2: (Projections of future climatic conditions for tree crop categories in S. Europe) is expected to be completed as schedule (i.e., end of 2017) and the related deliverable (Future climatic and meteorological conditions affecting tree crops in S. Europe) to be on time prepared (i.e., January 2018). As such till the next reporting period we expect that this action will be fully completed.

Action C.3: The development of the a web based interface based on the best available model according to bibliography and the available data is expected to be in operation.

Action C.4: A report on the CO₂ Balance calculations in tree-ecosystems for current and future climatic conditions in Greece, Italy and Spain is expected to have been finalized.

Action C.5: The outputs of Actions C.1, C.3 and C.4 will feed the analysis of C.5. C.5 will trace the outcomes of different cultivation measures and other relevant practices in relation to the CO₂ balance. A report on policy suggestions for climate change mitigation practices is expected to be implemented in parallel with the development of an Economic module based on the progress in other C Actions

At the same time, the three key monitoring Actions, D.1, Evaluation of the effectiveness of the proposed policies and measures, D.2. Assessment of the Socioeconomic Impact of the project's outputs, D.3. Assessment of the impact of the proposed methodology in supporting the ecosystem function restoration, are expected to commence by the end of 2017 in order to monitor the impacts of the C Actions.

Lastly, the 2nd QA/QC report and the development of a new version of Notice Boards, based on some core results of the C Actions are expected until the next reporting period.