LIFE Project Number

LIFE14 CCM/IT/000905

Mid-term Report

Covering the project activities from 01/09/2015 to 30/09/2017

Reporting Date

30/09/2017

LIFE PROJECT Acronym

LIFE FoResMit

Data Project

Project location:	Italy Toscana; Greece: Anatoliki Makedonia, Thraki
Project start date:	01/09/2015
Project end date:	31/08/2019
Total budget:	€ 1,480,568
EU contribution:	€ 879,264
(%) of eligible costs:	60

Data Beneficiary

Name Beneficiary:	Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria
Contact person:	Ms Alessandra Lagomarsino
Postal address:	Piazza M. D'Azeglio 30, 50121, Firenze, Italy
Telephone:	+39-0552491232
E-mail:	alessandra.lagomarsino@crea.gov.it
Project Website:	www.lifeFoResMit.com

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2. List of key-words and abbreviations

3. C = carbon
4. CEC = cation exchange capacity
5. CH_4 = methane
6. CO_2 = carbon dioxide
7. CRU = Climate Research Unit
8. FoResMit = Recovery of degraded coniferous Forests for environmental sustainability Restoration and climate change Mitigation
9. GHG = green-house gas
10. N = nitrogen
11. NGO = non-governmental organization
12. N_2O = nitrous oxide
13. PDSI = Palmer drought severity index
14. SPEI = Standardized Precipitation–Evapotranspiration Index

3. Executive Summary

This report summarizes the activities carried out in the frame of the project FoResMit (LIFE14 CCM/IT/000905) at mid-term period, from 01/09/2015 to 30/09/2017.
The FoResMit project aims at putting into practice clearly defined management options for degraded forests and at comparing the results of traditional management with options addressing the restoration and enhancement of carbon stock and mitigation potential of degraded forest ecosystems in Italy and Greece.
LIFE FoResMit aims to identify and adopt sustainable forest management strategies focused on climate change mitigation :
1. To enhance the net primary production of the site, thus increasing the sequestration capacity of C into above- and belowground living biomass.
2. To increase C accumulation in soil, thus increasing sequestration capacity in the long term, enlarging the pool of stable soil organic matter and its chemico-physical stability.
3. To avoid C losses from dead-wood degradation and to contain the global warming potential of greenhouse emissions derived from organic material decomposition;
4. To use the resulted biomass from conversion in co-generators to reduce electricity production from fossil fuels.
Thus, the proposal meets the objectives of the EU 20-20-20 targets, considering the main mitigation options within AFOLU (Agriculture, Forest and Other Land Use) sector.
Moreover, the proposal will produce a complete budget of GHG emissions, including non CO_2 GHG emissions, such as CH_4 and N_2O, according to the Decision N. 529/2013/EU.
Demonstrative Areas for forest management are set-up for raising public awareness on follow-up processes and results. Demonstrative Areas are available also for future monitoring and research. In this respect, the test areas provide a unique opportunity to follow, in the long-term, the development of forest structure and carbon related indicators.
The comparison in the same environmental conditions of three different silvicultural options is the optimal approach to the demonstration of the best practice management.
Forest degradation greatly affects social, cultural, and ecological functions. The definition needs to take into account the full range of biophysical and social conditions under which forests develop and the variety of ways they can be degraded. As widely used by forest scientists, forest degradation implies a long-term loss of productivity, which thereby lower the capacity to supply products and/or services, including C storage capacity in vegetation and

soil, changes in tree vigor and quality, species composition, soils, water, nutrients and the landscape.
In this context, the conversion of degraded forest pine plantations to facilitate the introduction of late successional native broadleaves species means to help restoring natural functioning processes (e.g. natural regeneration, or more generally, self-organization), increasing their stability, resilience and self-perpetuating capacity. As the interest for multiple benefit incoming from forests increases, the demand for management systems able to meet these expectations grows and it is more and more stimulated by policymakers. The lack of silvicultural interventions negatively affected stands suitability to natural processes as well as the secondary successions, that was one of the main goal of the planned plantations. The high density does not allow light availability at the soil level and the problems seems to be more effective in low fertility sites or where herbaceous species competition is significative. Besides the surface of some plantations is very large with absence of edge zones, where would be possible the tree species contact. That limits seeds dispersal of other species and negatively affects natural regeneration process from a biodiversity point of view.
At the mid-term period of the project, the following main technical objectives were achieved:

- Pedological and vegetation characterization of the two sites (actions A1 and A2) have been definitively completed.
- The implementation actions in Italy and Greece (actions C1 and C2) have been conducted as foreseen and thinning has been executed on 16.7 ha, on the whole.
- Monitoring actions are running as expected, following the protocols defined in the initial phase. The five carbon pools (above and below-ground biomass, litter soil and deadwood) (action D1) and the GHG emissions (action D2) are continuously monitored on 18 sub-plots for each site.
- Action D3 was anticipated in order to manage the carbon credits to offset the emissions of a cultural event in the municipality of Monte Morello forests.

In this Mid-Term Report the technical, administrative and organisational topics are described in Chapters 4 and 5, while the technical results and financial aspects related to mid-term period of the project are reported in Chapters 6, 7 and 8.

4. **Introduction**

Climate related problem/issue addressed

Forest degradation, resulting in a loss of biomass or in a reduced production, occurs through damage to residual trees and soil from poor logging practices, log poaching, fuelwood collection, overgrazing, and anthropogenic fire (FAO, 1993; Flint and Richards, 1994). Forest degradation, implying a decrease in canopy cover and regeneration , as well as forest fragmentation, will affect the annual increment of C sequestration, reducing the potential of these forests to act as a sink or transforming them into a source of GHGs. Carbon emissions from deforestation and forest degradation have been estimated to account for about 12-20% of global anthropogenic CO_2 emissions (IPCC, 2007). Although deforestation is the main source, forest degradation contribute to atmospheric GHG emissions through decomposition of remaining plant material and soil carbon. These larger emission are no more balanced by the C storage capacity in woody biomass and soil, due to unstable structural conditions of the degraded stands. Deforestation and forest degradation are important contributors to global GHG emissions, but if these processes are controlled, forests can significantly contribute to climate change mitigation. Therefore, the current forest degradation needs an innovative

management plan aimed to support and facilitate all the functionalities of a peri-urban forest, in a context of climate change mitigation.

Outline the hypothesis demonstrated by the project

The general objective of the proposal is to define the guidelines of good silvicultural practices for the restoration of peri-urban degraded coniferous forests in Italy and Greece with native broadleaved species, improving the ecological stability and climate change mitigation potential of these ecosystems. The project aims at testing and verifying in the field the effectiveness of management options for the conversion of degraded coniferous forests in meeting climate change mitigation objectives. The project will provide data on vegetation structure, biomass increment, C accumulation in all relevant pools of vegetation and soil, and CO2 and other greenhouse gas emissions, thus giving a complete picture of mitigation potential of management practices.

Description of the technical solution

To fulfil its objectives, the project will be arranged into the following actions:

- Preparatory actions will classify and characterize the two sites in Italy and Greece from a vegetation, climatic and pedological point of view. Target species/ecosystem types and test areas have been already identified. The preparatory action will be primarily used to validate the selection of the test areas, depending on vegetation and soil characterization. The methodological details of the Actions will be set out (e.g. sampling protocols) to ensure soundness to the aims of the project and comparability of results between the two sites.
- Implementation actions will be devoted to the application of silvicultural treatments for the forest restoration and productivity increase. Different treatments will be compared to demonstrate that innovative thinning has the best performance: 1) conventional thinning; 2) innovative selective thinning; 3) control plot without treatments. Harvested material will be converted into electrical/heat energy as substitute of fossil fuels.
- Monitoring actions will measure all C and N pools in above and belowground biomass, litter, dead wood and soil (IPCC 2003) and their temporal variations. Net primary productivity and C accumulation in soil after thinning treatments will be assessed. Greenhouse gas fluxes from soil and dead-wood material will be quantified. C sequestration potential and global warming potential in the short and medium-term will be estimated. Performance indicators will be monitored and measured.

Expected results and climate action related benefits

The main expected results of the project will be the following:

- Demonstration of the three mitigation options of i) reduction/prevention of emissions, ii) sequestration – enhancing uptake of C and iii) substitution of fossil fuels for energy production with biological products. Specific performance indicators will be quantified and reported. In detail the innovative thinning treatment will result in:
  - increased net primary production of forest ecosystem, due to the removal of non-growing or dead trees and the higher growth rates of remained vegetation. An increment of productivity up to 40 – 60 % can be expected;
  - an initial increase of greenhouse gas emissions is expected, followed by a stabilization towards a reduction after thinning treatment;
  - reduction of heterotrophic respiration of decomposable deadwood material, with a consequent reduction of CO_2 emissions in the range of 5-15 % per year is expected in the medium-long term;

- only minor changes in N_2O and CH_4 emissions are expected, although their accounting is very important due to possible high peaks of N_2O emissions in the short term that might alter the global warming potential;
- the decrease of standing biomass due to harvesting will be counterbalanced by the energy cogeneration of wood material as fossil fuels substitution option. We expect a neutral balance from living plants and a positive balance from dead trees, corresponding to 40 % of forest biomass;
- carbon credits deriving from the thinning intervention will be quantified;
- selective thinning and harvesting to reduce tree densities and remove deadwood material will reduce the probability and intensities of fires.

Expected long-term results

Provide "guidelines of good and sustainable silvicultural practices" for degraded coniferous forests restoration integrating greenhouse gases reduction objective in the framework of European mitigation targets. In detail, this result will include:

- updated knowledge about the effectiveness of new forest management practices in meeting climate change mitigation objectives;
- evaluation of management effects on health status of coniferous stands, ecological stability and restoration;
- demonstration of an innovative thinning treatment to adopt for the restoration of degraded coniferous forests, enhancing ecosystem stability, productivity and mitigation potential.

5. **Administrative part**

The FoResMit project proceeded smoothly and all actions were completed as foreseen. During all project phase, the FoResMit project has benefited from close collaboration between all beneficiaries and has maintained close contact through different media (e-mail, telephone, meetings, etc.).

The FoResMit management process needed daily work to maintain a permanent flow of action with the aim of achieving the objectives set. The specific management activities carried out were:

- Preparation of the Partnership Agreement
- Organisation of Coordination meetings
- Organisation of Monitoring meetings
- Organisation of different phone and web meetings between some beneficiaries in order to plan and monitor the project technical activities
- Continuous contact between all project beneficiaries for monitoring project activities
- Preparation of material for meetings and dissemination events.
- General actions and activities for the coordination of the project.
- Management of the financial aspects of the project.
- Monthly reports to the LIFE external team monitor on the evolution of the project.

The management of the project was carried out in compliance with what was established in the proposal approved by the European Commission, with all partners acting in compliance with the Grant and Partnership Agreements.

The project management structure is very simple, with only 4 beneficiaries, plus EC and LIFE external team. The following diagram provides information about the general management structure:

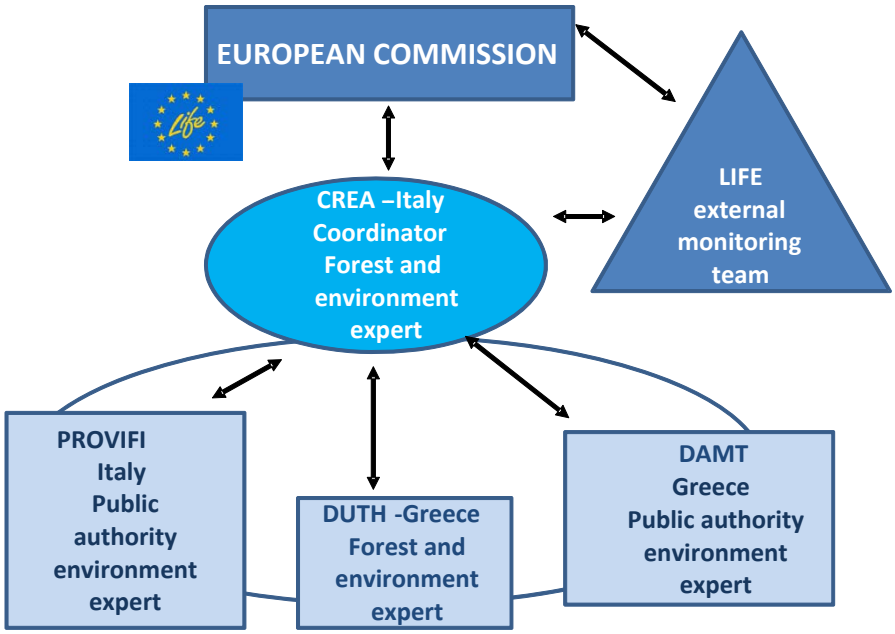

Figure 1. FoResMit management structure.

In particular, the FoResMit beneficiaries added values are:

- CREA, project coordinator, a public Italian organisation, expert in plant production, characterisation and analysis
- PROVIFI, an Italian plant nursery company in charge of plant trials in Italy
- DUTH, a public Greek organisation, expert in plant characterisation and analysis
- DAMT, a Greek Forest Service Directorate in charge of forest management and protection.

In particular the FoResMit beneficiaries defined the following three management structures:

- **Steering Committee:**
  - CREA: Alessandra Lagomarsino, Ugo Chiavetta e Alessandro Paletto
  - PROVIFI: Alessandro Varallo
  - DUTH: Kalliopi Radoglou
  - DAMT: Panagiotis Mouchtaridis
- **Technical Committee:**
  - CREA: Alessandra Lagomarsino e Isabella De Meo
  - PROVIFI: Luciana Gheri
  - DUTH: Elias Milios
  - DAMT: Maria Triadafillidou
- **Administrative Committee:**
  - CREA: Massimo Aglietti
  - PROVIFI: Simonetta Pappalardo
  - DUTH: Kyriaki Kitikidou
  - DAMT: Foteini Doukalianou

During all project phase, the 3 associated beneficiaries, PROVIFI, DUTH and DAMT participated in project management activities keeping in smooth contact with the project coordinator and the other beneficiaries. In this sense, they prepared and attended the project management meetings and collaborated with the project coordinator (CREA) in the preparation of this Mid-Term Report, as set out in the project proposal.

During this mid-term project period, monitoring tasks have been carried out for each action, in particular:

- CREA, as project coordinator, had continuous contacts with all project beneficiaries for monitoring project activities
- CREA, as coordinating beneficiary, prepared and sent a monthly indication of operative activities to be done to all the partners
- CREA, as coordinating beneficiary, every month sent a report to the monitor of LIFE's External Assistance Team on the progress of the project, which allowed him to follow-up of the FoResMit project.

Project beneficiaries have carried out different meetings in order to organize, coordinate, monitor and develop the project. The following coordination and monitoring meetings were organized:

- Progress and Coordination meetings:
  - Kick-off meeting, 8-9th October 2015, at the coordinator beneficiary CREA premises and demonstration site in Florence, Italy;
  - Progress meeting on 06-07th February 2017 at the demonstration site and at associated beneficiary PROVIFI premises in Florence, Italy
- Monitoring meetings with LIFE's External Assistance Team:
  - Monitoring meeting on 12-13th April 2016 at the demonstration site and coordinator beneficiary CREA premises in Florence, Italy: Mr. Angelino Carta.
  - Monitoring meeting during the progress meeting on 06-07th February 2017 at the demonstration site and at associated beneficiary PROVIFI premises in Florence, Italy: Mr. Angelino Carta.

In addition many phone and web meetings between some partners were organised in order to plan and monitor the project technical activities.

6. Technical part

6.1. Technical progress, per Action

Action A1 Climatic characterization and vegetation survey

Foreseen start date:	01/09/2015	Actual start date:01/09/2015
Foreseen end date:	31/12/2015	Actual end date:30/06/2016

Climatic characterization

All forecasted activities were carried out. Due to the lack of representative and long meteorological time-series data, we used datasets from the Climate Research Unit (CRU), University of East Anglia, UK, for mean temperature and total precipitation in the period 1901–2009, and for Palmer drought severity index (PDSI) in the period 1901–2002 (CRU self-calibrating PDSI), gridded on a 0.5 x 0.5 degree network. The chosen climate data, corresponding to the closest grid point to the two areas in which the sites are located, were taken from the website of the Royal Netherlands Meteorological Institute (http://climexp.knmi.nl/). The PDSI was calculated using air temperature, cumulated rainfall and field water-holding capacity to compute a standardized measure of soil moisture ranging from −6 to 6. We also calculated the Standardized Precipitation–Evapotranspiration Index (SPEI) at 1-month time-scale in the period 1901– 2009. The SPEI come from the CRU

datasets, with a spatial resolution of 0.5° (Vicente-Serrano et al., 2010; Beguería et al., 2010 - http://sac.csic.es/spei/).

Vegetation characterization

a) Delimitation of the intervention area and the monitoring plots.

b) Within every plots for all tree with diameter at breast height (DBH) > 3 cm the following attribute will be measured: species, DBH, total height, crown depth, crown projections, number of living whorls, minimum mensuration, crown vigour through the Terrestrial Laser Scanner. A subsample of trees stem cores was planned to be extracted in order to analyze the past growth rate. Anyway we decided to take them during the last phase of the project to be able to read on the same core the growing effect of the silvicultural intervention.

c) Forest type classification according the European Environmental Agency forest types nomenclature system.

d) Historical analysis of forest management.

e) Parameters of forest degradation: single tree mechanical stability, crown porosity, tree health issues (defoliation percentage, pest attack etc.) has been collected by the Terrestial Laser Scanner and are stored in digital format.

A complete report about the vegetation characterization of the intervention sites has been attached

Action A2 Pedological survey

Foreseen start date:	01/09/2015	Actual start date:01/09/2015
Foreseen end date:	31/03/2016	Actual end date:30/06/2016

The pedological survey allowed to validate the selection of test areas to reduce biases due to soil heterogeneity and, in particular, the absence of initial differences among treatments has been checked.

The results provided the following information:

- geological and pedological classification of the areas from existing thematic maps;
- soil profiles description in Xanthi forest plots and in monte Morello area;
- soil samples collection and physico-chemical characterization at 0-10 and 10-30 cm depth, including texture classification, fertility class and percentage of inorganic N forms;
- analyses of soil organic C and N pools at 0-10 and 10-30 cm depth.

The soils of Monte Morello present a loam or clay loam texture, with average values of sand and clay of 38 and 28 %, respectively. The soils were rich in carbonates and showed a moderately alkaline pH. Soil organic matter content of the site was typical of a Mediterranean forest site, with a clear vertical distribution of total N (TN) and total organic C (TOC), showing on average a double content of both parameters in the first 10 cm than in the 10-30 cm layer. No significant differences among the three group of plots assigned to the different treatments were observed.

The soils of xanthi present a sandy clay and sandy clay loamtexture, with average values of sand and clay of 60 and 20 %, respectively. The soils showed a moderately acidic pH. Soil organic matter content of the site was typical of a Mediterranean forest site, with a clear vertical distribution of total N (TN) and total organic C (TOC). No significant differences among the three group of plots assigned to the different treatments were observed.

Overall, 6 soil profiles were opened in the two sites, up to a depth to 120 cm, when possible.

The soils of Monte Morello presenta calcareous flysch (turbidites) substratum, constituted by alternating limestones, marly limestones ("alberese") marls, claystones and, subordinately, sandstones. The soil typologies were Calcaric Cambisols and Cambic Calcisols.
The geological formations of Xanthiregion consist mostly in metamorphic rocks, while sediments my occur but at lower altitudes. The rock formations at the location of the selected sites is Gneisses and Para-gneisses. The soils are Cambisosls and some sites may have Luvisols. Soil profiles suggest the occurrence of A-BW-C-R horizons, A-B-C-R or A-C-R
The soil structure is spheroidal in most of the cases particularly at the surface or near surface soil.

Action C1 Realization of thinning intervention in Italy

Foreseen start date:	01/01/2016	Actual start date:01/11/2015
Foreseen end date:	31/12/2016	Actual end date:31/12/2016

The implementation actions aimed at comparing the selective thinning, the traditional thinning (thinning from below) and no treatment (control). Trees have been selected in the different treatments according to the following silvicultural guidelines:

- Traditional thinning from below of medium-heavy intensity eliminated most of the dominated plants and included also some trees of the dominant layer. During the thinning about the half of the plants are cut in total (intensity >50 %).
- With selective thinning, the best trees of the stand have been selected according to vigour and stability, and their growth and development is actively promoted by removing competitors in the dominant layer, whereas plants in the dominated layer are harvested only in case of economic convenience. Standing dead trees and lying deadwood slightly decomposed are removed (1st and 2nd decay classes)

PROVIFI and CREA performed the following activities:

- a map of the applied silviculture treatment areas 1:10.000 was created
- all field measurements which were necessary for treatment implementation have been performed. The implementations were defined and the study completed until the previous Report.
- Tender for operations was assigned to be concluded in 90 days

Cutting activities have been performed between 03/08/2016 and 30/11/2016, according to the following schedule:

- August 3rd 2016 to October 31st 2016:
  - Survey and check of the work progress
  - Harvesting
  - Forest roads and paths preparation for yarding
  - Yarding operations
- October 31st 2016 to November 24th 2016:
  - Due to the weather conditions time extension was needed to complete the previous operations
- November 24th 2016 to November 30th 2016:
  - Woodchipping operations

In order to realize the previous activities a series of administrative work by PROVIFI was needed. Specifically, one month was needed to technically and legally validate the field

activities until the end of December 2016. Additionally, 20 working days were needed to check other administrative circumstances mandatory to authorize the payment by the PROVIFI as a public body.

Structural changes in forest stand are the direct consequence of the different silvicultural treatments. To asses thinning impact on structure we realised a series of circular and permanent sample plot across the demonstration site to be monitored before and after thinning. First surveys were conducted on the fall-winter season between September 2015 and march 2016. To quantify the thinning early effect on structure we checked removed trees by a second survey in December 2016-January 2017. Thus, we calculated all biometrical parameters and structure indices described in the Deliverable "Report on quantification of forest structural changes after silviculture application".
Summarizing the results we demonstrated that selective thinning has a stronger impact on basal area (resulting in a faster growth response) remaining inside legal prescription and removing a slight larger proportion of trees (in terms of density). These was due to the removal of larger trees directly competing with selected ones.
Furthermore, selective thinning had a better impact on the structure diversity. Both diameter and height variability were increased by the selective thinning application. A non meaningful impact was caused by the two thinning approach on spatial explicit indexes. That is probably due to the extremely simplified structure of origin (regular spatial distribution and planting scheme). All quantitative results and graphs are reported on the deliverable "Report on quantification of forest structural changes after silviculture application"

Action C2 Realization of thinning intervention in Greece

Foreseen start date:	01/01/2016	Actual start date:01/01/2016
Foreseen end date:	31/12/2016	Actual end date:31/12/2016

The implementation actions aimed at comparing the selective thinning, the traditional thinning and no treatment (control). Trees have been selected in the different treatments according to the following silvicultural guidelines:

- In the traditional silvicultural treatments mainly ~~the~~ dead, bad formed, damaged and intermediate - suppressed trees of the overstorey have been cut. Also, thinning of broadleaves was made aiming to a more or less uniform distribution of broadleaves in the understorey. In the selective (innovative) silvicultural treatments, intense cuttings of overstory pines for the release of broadleaved trees, and innovative thinning of the understory, took place. In the cuttings of the overstorey, ~~the~~ bad formed trees have primarily been removed, while the best formed trees have been retained. These cuttings have been more intense over dense areas with broadleaves. The innovative thinnings of the understorey resemble "positive selection" thinnings, where ~~the~~ competitors of the best broadleaved trees are removed.

Eighteen circular subplots, with a radius of 13 m and an area of 0.0531 ha were placed in the study area (six subplots were traditional thinning was applied, six subplots were innovative thinning was applied and six control subplots).
Measurements and thinnings were done in autumn 2016.
The following variables were measured:

- diameter at breast height (*d*) of each tree, with caliper, in cm, with one decimal place of accuracy

- total height (h) and bole height (h_b) of the trees with $h \geq 1.3$ cm, with Haglöf Vertex laser hypsometer, in m, with one decimal place of accuracy
- form height (fh) of the trees with $d \geq 15$ cm, with Bitterlich's Spiegel relaskop (first measurement with the relaskop at breast height)
- social rank and health (visual assessment).

In traditional thinning, basal area was decreased by 20.68%, while in innovative thinning basal area was decreased by 39.19% (reference: control plots).

In traditional thinning, conifers volume was decreased by 18.82%, while in innovative thinning conifers volume was decreased by 28.10% (reference: control plots).

In traditional thinning, broadleaves volume was decreased by 7.61%, while in innovative thinning broadleaves volume was decreased by 33.43% (reference: control plots).

Action D1 Monitoring and quantification of C pools in vegetation and soil

Foreseen start date:	01/01/2016	Actual start date:01/10/2015
Foreseen end date:	30/06/2019	Actual end date:

Aboveground biomass

After thinning application a second survey was conduct to check removed and released trees. This operation allowed to assess the real aboveground biomass removed during thinning. The biomass estimation was conducted using the same approach but slightly different methods between the Greek and the Italian sites. This was due to the different availability of estimation tools for the two countries and for the different species present in the sites. The complete methodology has been described in the deliverable "Assessment of early influence of silviculture application on carbon pools"

Monte Morello

Results showed that despite the baseline in terms of biomass is lower for the innovative thinning, there is a non meaningful difference between the thinning approaches and the control.

Xanthi forest

In traditional thinning, conifers biomass was decreased by 18.82%, while with selective thinning conifers volume was decreased by 28.10% (reference: control plots).
In traditional thinning, broadleaves biomass was decreased by 5.52%, while with selective thinning broadleaves volume was decreased by 39.69% (reference: control plots).

Indicators of progress:
9 plots measured for each site, with two replicates for each plot, for a total of 36 monitoring plots of 531 m^2 for each site. All 18 plots were measured applying the survey protocol the first time between September 2015 and May 2016.

Belowground biomass

After thinning application a second survey was conducted to check removed and released trees. This operation allowed to assess the real aboveground biomass removed during thinning. Starting from aboveground biomass we derived per each tree the estimated belowground biomass.

The biomass estimation was conducted using the same approach but slightly different methods between the Greek and the Italian sites. This was due to the different availability of estimation tools for the two countries and for the different species present in the sites. The complete methodology has been described in the deliverable "Assessment of early influence of silviculture application on carbon pools"
In the Italian sites results showed that despite the baseline in terms of biomass is lower for the innovative thinning, there is a non meaningful difference between the thinning approaches and the control.
A further investigation on root biomass was performed in Xanthi forest. Soil samples from each treatment were extracted using a metallic cylinder of 6-8 cm and 60 cm height, at a depth of 50 cm. The soil samples were placed in plastic bags and stored at -18 ° C until analyzed. The samples are washed mechanically or manually and sorted from further organic materials (e.g. leaves, branches) using filters of various diameters. Roots from soil samples are sorted by classes of diameter <2, [2,4] and >4 mm, they are dried at 75° C for 48 hours and weighed.

Indicators of progress:
All 18 plots were measured applying the survey protocol the first time between September 2015 and May 2016.

Litter
36 baskets for litterfall collection have been installed in each site, 4 times more than planned, to have more replicates and reliable estimates. With respect to planning, litterfall has been collected at the end of each season, starting after the end of thinning operations, in order to have a certain amount of material to be processed. In addition to planning, litter has been separated into coniferous and broadleaves and further into leaves, reproductive structures, twigs and branches < 4cm, bark. In addition, carbon and nitrogen content have been measured in each litter component.
Forest floor has been collected once a year, as planned, in both sites (November 2015 and January 2017). In Italy the second sampling was delayed to January to wait until the end of thinning operations. Forest floor has been separated into the three components (undecomposed - L, fragmented - F, humified - H), as planned. In addition, carbon and nitrogen content of each component have been measured.
The two sites showed different initial conditions: in monte Morello most biomass of forest floor was concentrated in F layer, in Xanthi in L layer. After thinning, a larger amount of forest floor was present in treated plots, with respect to control, in both sites. In monte Morello the amount was larger in the three components (110 % in L, 58 % in F and 40 % in H with traditional thinning, 33%, 25 %and 22 % with selective thinning).
In Xanthi forest after six months of thinning a significant change has been observed in both sites. In traditional thinning a high increase has been observed in deciduous reproductive structures (+0.446 gr), whereas in innovative thinning a decrease has been observed in all fractions, with the lowest litterfal observed at another fraction, pine needles (-55.77%).

In addition to what planned, hydrolytic enzymes activities linked to C, N, S and P cycling have been measured on forest floor samples collected in January 2017. Results indicated an increase of enzyme activity during litter decomposition, linear from fraction L to H. This increase was correlated with the decrease of carbon content and the correspondence decrease of C/N ratio.

Indicators of progress:
9 plots measured for each site, with four replicates for each plot, for a total of 72 monitoring points for each site at each sampling event. Litter components results in 1152 samples. Forest floor components resulted in 864 samples.
Laboratory analyses were always performed on three further replicates, for a total of 3456 samples for litter and 2592 for forest floor.

Forest floor

The three components of forest floor showed well distinguished characteristics, with a decrease of C content along the litter decompositions level. A correspondent increase of N % determined a decrease of C/N ratio. C is lost first during decomposition process and the concentration of N increase consequently. This pattern occurred independent of treatments and remained stable along time.
Thinning induced a significant increase of forest floor, much evident for L fraction in bioth sites.
In monte Morello, 1.51 and 0.83 kg of forest floor biomass m^{-2} were added by traditional and selective treatments, respectively. C pools followed the same trend of forest floor biomass, with an increase due to silvicultural treatments, stronger in L fraction with traditional and in F fraction with selective one. Overall, thinning added 0.55 and 0.26 kg C m^{-2} to forest floor with traditional and selective treatments, respectively.

Deadwood

The data of deadwood were collected in 18 sample plots both in Monte Morello study area and in Xanthi study area (36 sample plots in total). All deadwood pieces lying on the soil (logs), standing dead trees (snags) and stumps were measured in sample plots of 531 m^2 (Fixed-area sampling or FAS method). With special regard to the lying deadwood (logs) the data were collected also using the Line intersect sampling (LIS) method. In addition to planning was decided to compare the results and the applicability of the two methods (FAS and LIS) in the field measurements.
The results indicated that Monte Morello study area is characterized by a high quantity of deadwood (75.1 m^3 ha^{-1}), concentrated in the lying deadwood component with an average volume of 59.9 m^3 ha^{-1} (estimated with FAS method). Considering the other two deadwood components the volume is: 13.9 m^3 ha^{-1} for standing dead trees and 1.25 m^3 ha^{-1} for stumps. Conversely, the total amount of deadwood volume in the Xanthi study area is 9.21 m^3 ha^{-1} divided among components as follows: 3.11 m^3 ha^{-1} of lying deadwood (estimated with FAS method), 1.63 m^3 ha^{-1} of standing dead trees and 4.48 m^3 ha^{-1} of stumps.
Considering the distribution of deadwood volume by decay classes, the results indicated that in Monte Morello the lying deadwood volume is concentrated in the third decay class (54% of total volume) followed by second and fourth decay class (respectively with 25% and 14% of total volume). The standing dead trees volume is equally distributed among the first three decay classes (respectively with 32%, 35% and 32% of total volume of this component). The volume of stumps is concentrated in third and fourth classes of decay (respectively 56% and 32%). In the Xanthi study area, the volume of lying deadwood presents the higher percentage in the first decay class (29%), while the other four classes include the remaining 52% of the total volume. Standing dead trees volume is concentrated in the second decay class (71% of the total volume), while the fourth and fifth classes of decay are not represented in this study area. Concerning stumps, the volume is concentrated in the fifth decay class (43% of total volume of this component) followed by first and third decay class (respectively with 20% and 18%).

With regard to the distribution of deadwood by species, the results show that in Monte Morello 75.5% of total deadwood is represented by Calabrian pine followed by Arizona cypress (22.3%), while broadleaved species represent only 2% of total deadwood. The distribution of deadwood by species and component is the following: 83% of lying deadwood is Calabrian pine and 16% Arizona cypress; 51% of standing dead trees are Calabrian pine and 42% Arizona cypress; 77% of stumps belong to Calabrian pine. In the Xanthi study area, the results show that all three components are mostly represented by Calabrian pine. In particular, 98% of the volume of lying deadwood, 94% of the volume of standing dead trees and 98% of the volume of stumps.
In addition to planning, comparison between methods of estimation was realized. Results show that the mean volume of lying deadwood in Monte Morello estimated using the FAS method is 59.91 m^3 ha^{-1}, while using the LIS method is 64.9 m^3 ha^{-1}. In Xanthi, the mean volume of lying deadwood is 3.11 m^3 ha^{-1} using FAS method and 5.49 m^3 ha^{-1} using the LIS method. The non-parametric Wilcoxon signed-rank test shows that these differences are not statistically significant considering all 36 plots (V=224, p-value=0.088, α=0.01). Also analyzing the data by study area, the differences are statistically not significant both for the 18 plots of the Xanthi peri-urban forest (V=56, p-value=0.212, α=0.01) and for the 18 plots of Monte Morello peri-urban forest (V=60, p-value=0.284, α=0.01). Therefore, we can assert that the LIS method can be used alternatively to the traditional FAS method.

Indicators of progress:
9 plots measured for each site, with two replicates for each plot, for a total of 36 monitoring plots of 531 m^2 for each site.
A total of 170 deadwood samples have been collected, at least 10 replicates for each decomposition class, for each deadwood component. 100 %samples have been analyzed for carbon and nitrogen content.

Soil
Two soil sampling have been performed in each site in the two years, before and after the thinning operations. Soil has been sampled at 0-10 and 10-30 cm depth, reflecting A horizon. 30 cm was the maximum depth chosen as reference for the two sites, since all plots reach it, whereas deeper profiles are not always available. Overall, two replicates for each plot for each site were sampled, with a total of 144 soil samples.
Soil sampling occurred always in correspondence of forest floor sampling, in order to consider interactions. Carbon and nitrogen content was measured in all samples.
Soil of monte Morello showed a general increase in the second sampling, independent of treatments, at both depths. Silvicultural operations caused slight differences, not significant. The trend at 10-30 cm depth was a decrease of TOC with traditional and an increase with selective thinning.
The pattern of C/N ratio of soil organic matter showed a general increase in the second sampling, more relevant in thinned plots. In the 0-10 cm layer an increase was observed due to traditional and selective thinning.
In addition to planning, humus profiles have been sampled and characterized before and after thinning in the nine plots of monte Morello. 3 main humus classes have been identified in the plots and linked to C and N pools, CO_2 and CH_4 emissions. Further, hydrolytic enzymes activities linked to C, N, S and P cycling have been measured on soil samples collected in January 2017. Generally enzyme activities followed the trend of TOC, with a decrease in the deeper layer. On average soil enzymes were significantly reduced in thinned plots, without differences between the two management options.

In Xanthi forest thinning induced a significant increase of TOC stock, particularly at 0-10 cm depth. The increase of C/N ratio is confirmed.

Indicators of progress:
9 plots measured for each site, with two replicates for each plot, at 2 depths for a total of 72 monitoring plots. 2 sampling were performed in each site, with a total of 144 samples and 432 analyses carried out and elaborated.

Action D2: Monitoring and quantification of GHG emissions and Global Warming Potential

Foreseen start date:	01/01/2016	Actual start date:01/01/2016
Foreseen end date:	30/06/2019	Actual end date:

Monitoring of GHG emissions has started according to planning and to the common protocol defined at the beginning of the project and reported in the first progress report. 18 big collars for CO_2, CH_4 and N_2O collection were installed in monte Morello and Xanthi sites (two replicates for each plot). 36 additional small collars for CO_2 emission measurement with portable instruments have been installed at the monte Morello site.
Gas collection has been performed monthly or bi-monthly from February 2016 until June 2017. Samples from Xanthi are sent monthly at CREA premises for gas chromatographic analysis.

Fig. 1. Gas collection at monte Morello (left) and Xanthi forests (middle) and IRGA for CO_2 measurements (right).

Dr.Fotini Doukalianou, PhD student of DUTH, has been visiting CREA institute with a Short Term Scientific Mission funded by COST Action FP1305 to organize data elaboration in Italy and Greece following the same protocol.
In monte Morello, an increase of CO_2 emissions have been found during thinning operations (43 % increase with traditional thinning and 49% with selective thinning), mainly due to soil disturbance by heavy machinery and residual dispersion. After thinning, the increase of CO_2 continued in the first 6 months both in traditional and selective thinning but which much lower intensity (7 % with traditional thinning and 2% with selective thinning). Thus selective thinning had a lower impact (-5 %) than traditional one after 6 months from thinning.
In Xanthi forest, a decrease of CO_2 emissions during thinning operations was observed in traditional thinning (-31.78%) whereas an increase of 6,82% has been observed in selective thinning. It should be considered that the period of GHG measurements during thinning operations was very short (only one month). Moreover, in Xanthi thinning operations have been performed without heavy machinery. However, after thinning a slightly increase of CO2 has been observed in the first 6 months in traditional thinning (9,59%) whereas in selective thinning has not been observed a significant change. Thus selective thinning had a lower impact (-9,40%) than traditional one after 6 months from thinning.

Both sites are CH_4 sinks, independent of management. Selective thinning was able to even increase CH_4 uptake after thinning (+ 52 %). Differently, traditional thinning reduced the sink capacity for CH_4 of about 30 %. In Xanthi foresta similar pattern was observed: both sites are CH_4 sinks also, independent of management. However, traditional thinning reduced the sink capacity for CH_4 of 40,55 % during thinning, whereas an increase 16,68% of CH_4 uptake was observed after thinning. Selective thinning was able to increase CH_4 uptake during and after thinning with a small increase during thinning and high increase after thinning (+ 9,29 and + 87,38%, respectively).
N_2O was more variable, with seasonal peaksin monte Morello. During silvicultural operations an increase of emissions was observed with selective thinning (+17 %) and after thinning a reduction of emissions was observedwith traditional thinning(- 41 %).
InXanthi forestafter thinning a reduction of emissions were observed in traditional thinning (-32.89%) whereas an increase of them has been observed in innovative thinning (+23%). However a strong differentiation of emissions have been observed among treatments during thinning.

See par. 6.4 and deliverable D2 for detailed results.

Two additional experiments are running at the monte Morello site aiming to assess the contribution of litter and deadwood to GHG emissions. For litter contribution, IRGA instrument was used to measure CO_2 emissions, highlighting a contribution of forest floor of 24 %, independent of management.
Deadwood contribution was assessed in field and in laboratory. In field, 18 mesocosms have been installed and GHG emissions are monitored once a month. 5 decomposition classes have been considered, with a CO_2 contribution ranging between 51 and 22 % from less to more decomposed classes. An uptake of N_2O and CH_4 was observed. Overall, additional 792 samples have been collected and analysed by gas chromatography.
The removal of deadwood with thinning intervention, stronger with selective thinning, will therefore reduce ecosystem GHG emissions. This calculation will be implemented after the final sampling of deadwood foreseen in 2018.

Fig. 2. Litter (left) and deadwood (middle and right) contribution monitoring systems.

With respect to planning, we respected timing and analyses. For security reasons field work was always carried out by at least two persons, requiring an extra work than planned at the beginning. We solved the problem with the help of training and theses students, also teaching them about sampling procedures.
The shipping of samples from Greece to Italy for analyses occur each months without problems.

Indicators of progress for both sites:
Until June 2017, 19 sampling events has been performed in each site, with a total of 2736 vials collected and analysed by gas chromatography. 100% of emissions have been calculated between September 2016 and June 2017 for both sites.

Action D3 Governance of the project results in the carbon voluntary market

Foreseen start date:	01/01/2018	Actual start date:	01/01/2016
Foreseen end date:	30/06/2019	Actual end date:	

In order to manage the C credits generated by the project it was decided to use these credits to offset the emissions of a cultural event in the municipality of Monte Morello forests (Sesto Fiorentino municipality). A crucial part of project management is to interact with the stakeholders in order to make them contribute what the project needs and to avoid or limit possible conflicts arising from project activities. In the Action D3 key stakeholders identification of the Monte Morello study area forest were identified in order to involve them in the future activities of the governance of the project.
In the first step of the stakeholders analysis were recognized and listed all the stakeholders belonging to organized groups who affect and/or are affected by the decisions and actions of the project. All stakeholders were identified during two brainstorming sessions. A brainstorming session was evaluated as the best tool for project's researchers and participants to lay expectations, objectives and needs related project on a table and to develop a preliminary list of all possible stakeholders. During the brainstorming sessions participants considered the following aspects to identify all possible stakeholders: (1) potential stakeholders in different geographic or administrative areas within one organization; (2) potential stakeholders belonging to organizations of civil society having direct interest in the project. Subsequently, the previously identified stakeholders were classified in five groups of interest. At the end of brainstorming sessions, 32 stakeholders have been identified (Table 1) and shared in five groups of interest, basing on their field of activity (public administrations, environmental Non-Governmental Organizations-NGOs, forest-wood chain actors, actors of tourism sector, Universities and research institutes). In particular, 10 public administrations, 5 environmental NGOs, 4 forest-wood chain actors, 10 actors of tourism sector, and 3 universities and research institutes were identified.

Table 1. List of all possible stakeholders of the FoResMit project.

Name of stakeholders	Field of activity	Group
La Racchetta	Protection of forest fires	Environmental NGO
Città Metropolitana di Firenze	Management of municipality forests	Public administration
Pro Loco Sesto Fiorentino	Local development and tourism promotion	Tourism sector
Poseidon	Management of urban forests, parks and gardens	Forest-wood chain actor
Agri-ambiente Mugello	Management of urban forests, parks and gardens	Forest-wood chain actor
CAI Sesto Fiorentino	Tourism development, trekking and hiking	Tourism sector
"Cammina che ti passa" association	Trekking and hiking	Tourism sector
Club Ausonia ASD	Trekking and hiking	Tourism sector
Gruppo Mico-Ecologico Sestese	Activities in mushrooms and environment	Environmental NGO
Sport Club Gualdo	Trekking and hiking	Tourism sector
Rifugio Gualdo	Catering activities	Tourism sector
Consigli restaurant	Bar, restaurant	Tourism sector
Briganti di Monte Morello MTB	Biking	Tourism sector
Morello's brothers MTB	Biking	Tourism sector
Comandi Regione Toscana CC Forestali	Forest monitoring	Public administration
Gruppo Carabinieri Forestali Firenze	Forest monitoring	Public administration

Comando stazione Carabinieri Forestali Sesto Fiorentino	Forest monitoring	Public administration
Tuscany Region	Forest policy and legislation	Public administration
Consorzio di Bonifica Toscana Centrale	Reclamation and environmental protection	Public administration
Consorzio di Bonifica 3 Medio Valdarno	Reclamation and environmental protection	Public administration
Calenzano Heating District Plant (HDP)	Energy production by forest biomass	Forest-wood chain actor
Legambiente Sesto Fiorentino	Environmental protection	Environmental NGO
WWF Tuscany	Environmental protection	Environmental NGO
Caravan serraglio	Bar, restaurant	Tourism sector
Sesto Fiorentino municipality	Management of environment and forests	Public administration
Office for forests fires protection Tuscany Region	Protection against forests fires	Public administration
Unione dei Comuni Valdarno e Valdisieve	Land management	Public administration
Massoni P.E.M. SRL	Forest enterprises	Forest-wood chain actor
Circolo Arci I Risorti	Environmental and cultural activities	Environmental NGO
Tuscia University	Research and education	Universities and research institutes
Florence University	Research and education	Universities and research institutes
Mediterranea of Reggio Calabria University	Research and education	Universities and research institutes

Finally, a contact list of all identified stakeholders was developed with the stakeholders' names, field of activity, group of interest, postal addresses, email address and phone numbers. These stakeholders will be involved in the governance of the FoResMit results and, specifically, in the identification of a local cultural event which emissions will be compensated by the C credits generated by the Project.

Action E.1 Project website

Foreseen start date:	01/09/2015	Actual start date: 01/09/2015
Foreseen end date:	31/12/2015	Actual end date: 31/12/2015

During October 2015 the web site www.lifeFoResMit.com and the project Facebook page were published and they are network-accessible in English, Italian and Greek language. The site is periodically updated and it contains, in its public or reserved areas, all the documents produced during the project's activities, in particular:

- Visit counter;
- Link to LIFE+,
- Link to each beneficiary website;
- Results update;
- News update;
- Coming up;
- Reserved area;
- Link with the Facebook page for event booking/registration.

The technical deliverables and informative materials will be uploaded on the website.
CREA was the responsible of the creation of the FoResMit web site and the project Facebook page. The project web site and Facebook page created are clearly and visibly marked with Life logo. In August 2017 the website visitors are 217,907 and the Facebook friends are 202.

The results of the activities carried out in Action E.1 were defined in the dedicated deliverable (Deliverable Action E1: Project website), which was already sent as annex of the Progress Report on 31 May 2016.

Action E.2 LIFE+ information boards

Foreseen start date:	01/09/2015	Actual start date: 01/09/2015
Foreseen end date:	31/12/2015	Actual end date:31/12/2017

During the first period of the FoResMit project CREA created the structure of the project Notice Board and produced 8 FoResMit Notice Boards, which were sent to all partners and displayed in visible spots and accessible places to the public on the partners' premises.
In addition CREA and DAMT produced 4 specific FoResMit Notice boards which they put in the project demonstration sites.
The results of the activities carried out in Action E.2 were defined in the two dedicated deliverables (Deliverable Action E2: Project notice boards in beneficiary premises, Deliverable Action E2: Project notice boards in demonstration areas), which were already sent as annexes of the Progress Report on 31 May 2016.

Action E.4 Diffusion material preparation

Foreseen start date:	01/09/2015	Actual start date: 01/09/2015
Foreseen end date:	31/08/2019	Actual end date:31/08/2019

During this period, all partners prepared various dissemination materials to be used in fairs, conferences, newsletters, etc, in particular:

- Logo definition and design performed. A FoResMit logo was created for the project, to be shown on all dissemination documents of the project;
- 6,000 FoResMit brochures in English and Italian
- 3 rolls-up
- 50 posters
- 600 usb flashes, 200 keyrings, 200 block-notes, 400 pens, 400 pencils, 20 t-shirts and 20 huts as FoResMit gadget.

The results of the activities carried out in Action E.4 were defined in the dedicated deliverable report, which is annexed to this Mid-Term Report:

- Deliverable related to Action E4: Diffusion material at Project Mid-term

Action E.5 Press and media release

Foreseen start date:	01/09/2015	Actual start date: 01/09/2015
Foreseen end date:	31/08/2019	Actual end date:31/08/2019

During this period, CREA produced the following 6 articles:

- Corriere Fiorentino 5 febbraio 2016. *Monte Morello cambierà colore*.
- Georgofili info 24 febbraio 2016. *Perchè recuperare le pinete degradate– il progetto LIFE-FoResMit.*

- SISS (Società Italiana della Scienza del Suolo). 40° congresso Nazionale Roma 1-3 dicembre 2015. Extended abstract. *Recovery of degraded coniferous Forests for environmental sustainability Restoration and climate change Mitigation: the LIFE FoResMit project.*
- 2 articles on Greek newspapers on thinning interventions
- Article on Sherwood n. 228: "Il progetto LIFE FoResMit Recupero di foreste degradate di conifere per il ripristino della sostenibilità ambientale e la mitigazione dei cambiamenti climatici"

All the above articles are also in the project website.
The results of the activities carried out in Action E.5 were defined in the dedicated deliverable report, which is annexed to this Mid-Term Report:

- Deliverable related to Action E4: Diffusion material at Project Mid-term

Action E.6 Networking

Foreseen start date:	01/09/2015	Actual start date: 01/09/2015
Foreseen end date:	31/08/2019	Actual end date:31/08/2019

During this period, all the beneficiaries were responsible of the following networking activities stimulating an international exchange of ideas among consortia that have been working in the past or present on similar topics:

- SelPiBioLife (LIFE13 BIO/IT/282)
- HESOFF LIFE (LIFE11 ENV/PL/459)
- LIFE CarbOnFarm (LIFE12 ENV/IT/719)
- LIFE Future For Coppices (LIFE14 ENV/IT/514)
- LIFE Clima Tree (LIFE14 ENV/GR/635)
- LIFE VITISOM (LIFE15 ENV/IT/392)

The project managers collated information, experience and feedback in order to stimulate an exchange of ideas for improving project activities.
The results of the activities carried out in Action E.6 were defined in the dedicated deliverable report, which is annexed to this Mid-Term Report:

- Deliverable related to Action E6: Report on networking at Project Mid-term

In the Deliverable we define a specific table with:

- Day of the networking
- How (phone, meeting, etc.)
- Which projects
- Who (name of the participants)
- Topics discussed and conclusions

Action E.8 Demonstration workshop, seminars, conferences and other events

Foreseen start date:	01/09/2015	Actual start date: 01/09/2015
Foreseen end date:	31/08/2019	Actual end date:31/08/2019

During this period the following workshops were organized and defined:

- International Day of Forests is held annually on 21 March as a means of focusing attention on the importance of the forests ecosystemms. A joint event took place on Monday, 21 March 2016 at the central square of Xanthi town. A presentation of the project

LIFEFoResMit (LIFE14 CCM/IT/000905) took place, informing the citizens for the project objectives.

- DAMT in cooperation with DUTH organized a FoResMit workshop on 6th of April 2016 with the title ”The role of peri-urban forests at the climate change limitation” (83 participants)
- Day conference on 11th of April 2016 at DUTH organized by the Xanthi Directorate Second Education Level: *“The peri-urban forest: green lung - sustainability ecosystem– climate change mitigation factor”*.
- One day environmental action organized by DAMT in collaboration with the elementary school of Thermes in the mountain area of Xanthi Region on 15th of December 2016.
- PROVIFI in cooperation with CREA organized a FoResMit workshop on 15th of May 2017 in Florence (27 participants).
- Public event pre – cut at Monte Morello, June 22, 2016
- Prato event, Circolo “I risorti”. 20 January 2017
- DAMT organized a two day event on March 21 and 22 in 2017 to celebrate the International Day of Forests (IDF). In the peri-urban forest of Xanthi DAMT, in collaboration with the 9th elementary school of Xanthi and environmental group of 2nd high school of Xanthi City, organized an environmental action including plantation of conifers and showing the students the benefits of the forests and especially informing them about the Life ForesMit program, its activities and objectives

The results of the activities carried out in Action E.10 were defined in the dedicated deliverable report, which is annexed to this Mid-Term Report:

- Deliverable related to Action E10: Report on participation in fairs and other events at Project Mid-term

Action E.9 Dissemination to Institutions and policy makers

Foreseen start date:	01/09/2015	Actual start date: 01/09/2015
Foreseen end date:	31/08/2019	Actual end date:31/08/2019

During this period the following preliminary contacts were organized and defined:

- Two meetings with Tuscany Region team in February and April 2016 to discuss on the project objectives
- During the COST event in Rome, 17-19 November 2015, CREA had many contacts with NGOs interested in soil-plant relationships and the role of belowground biodiversity in promoting ecosystem resilience and stability
- General Secretary of Decentralized Administration Macedonia & Thrace briefing about the program in Thessaloniki
- Meeting with the Sesto Fiorentino Municipality on 2 March 2016 (Enio Bruschi, Responsabile servizio cultura. Biblioteca Ernesto Ragionieri.
- On 27th of April 2016 the General Secretary of Decentralized Administration of Macedonia & Thrace Dr. Nikitas Fragkiskakis was informed by DAMT team members for the project actions that have already completed and for the future actions.
- Meeting with the responsible for cultural services of Sesto Fiorentino municipality on May 2016
- The Deputy Minister of the Environment & Energy Mr. John Tsironis visited the Decentralized Administration of Macedonia-Thrace on Monday the 13th of June 2016.
- Visit of local authorities (città Metropolitana, Regione Toscana, Corpo Forestale dello Stato) at the monte Morello site on June 22.

- The Deputy Minister of the Environment & Energy Mr. Sokratis Famelos during his visit in Thessaloniki attended business meeting in the Decentralized Administration of Macedonia-Thrace on Thursday the 3th of January 2017.
- During The Old Town Festival of Xanthi in September 2016, the city authorities were informed about the program and the city mayor expressed his interest about the actions and the activities of the project.
- 18 May 2017: Conference and interview at the event "LIFE & Foreste" on 18 May 2017.

The results of the activities carried out in Action E.9 were defined in the dedicated deliverable report, which is annexed to this Mid-Term Report:

- Deliverable related to Action E9: Report on the results of the lobbying activity at Project Mid-term

In the Deliverable we define a table with:

- Name of the policy maker contacted
- Where
- Topics discussed and conclusions

Action E.10 International fairs and other events

Foreseen start date:	01/09/2015	Actual start date: 01/09/2015
Foreseen end date:	31/08/2019	Actual end date:31/08/2019

The FoResMit beneficiaries have disseminated the project activities objectives and preliminary results participating at the following fairs:

- Expo of KONOTINI at the pavilion of DUTH 20-22 November 2015
- COST Action FP1305 BioLink: Linking belowground biodiversity and ecosystem function in European forests. 3rd Annual Meeting. Rome, 17-19 November 2015. *Recovery of degraded coniferous Forests for environmental sustainability Restoration and climate change Mitigation*
- SISS (Società Italiana della Scienza del Suolo). 40° National Congress Roma 1-3 dicembre 2015. *Recupero delle pinete degradate per il ripristino della sostenibilità ambientale e la mitigazione dei cambiamenti climatici – il progetto LIFE FoResMit.*
- At Sunday, April 24 started the Easter children's football tournament FC Skoda Xanthi AO 2016, which takes place in a sports center Pigadia Xanthi. One of the teams that participated in tournament is Hephaestus Tziolas from Thessaloniki. Our workgroup gave the children's team t-shirts with the logo of the ForesMit program for their games, usb flashes with the program logo and informed them, their couches and parents about the program.
- Workshop on Mediterranean forest management and Natura 2000. Parc naturel regional du Luberon, Monday 9 – Wednesday 11 May 2016.
- Old Town Festival of Xanthi on 03/09/2016
- Presentation at the congress "Natural resources green technology and sustainable development", Zagabria, 5-7 October 2016 on "Quantifying volume of coarse woody debris in forests: comparison between two sampling methods", by Graziani et al.
- Presentation at the night of researchers BRIGHT 2016 on 30/9/2016, Botanical Garden, Firenze.
- In 25 October 2016 DAMT Directorate participated in a one day environmental action that was organized by our service in collaboration with the elementary school of Gorgona in the mountain area of Xanthi Region. At that event two DAMT members

informed the students and teachers about the services and the benefits of the forests and especially about the Life ForesMit program and its activities and objectives.

- In 11 April 2016 DAMT participated in a one day conference that was organized by the Xanthi Directorate Second Education Level with two FORESMIT presentations. After the end two DAMT members joined the students in a 30 minutes walk in the peri-urban forest and informed them for the ForesMit program activities.
- Forest Academy Symposium, September 29, 2016 Foresmit was presented at the Forest Academy Symposium along with other three Life projects Selpibiolife , FutureForCoppiceS Carbon Farm with which have been activated networking.
- Festa del Grano – Sesto Fiorentino (Fi), June 28, 2016 - July 8, 2016
- PRE-XIII meeting. Protection and Restoration of the Environment XIII. Mykonos Island July 3, 2016 – July 8, 2016. *Measuring green-house gases emission from soil in different ecosystems: a methodological description.*
- Workshop on Mediterranean forest management and Natura 2000. Parc naturel regional du Luberon, Monday 9 – Wednesday 11 May 2016
- Fiera di Primavera 20-22 May 2016, Sesto Fiorentino.
- Participation at the congress: SUSTAINABLE RESTORATION OF MEDITERRANEAN FORESTS. Analysis and perspective within the context of bio-based economy development under global changes. PALERMO 19-21 APRIL, 2017.
- 19 May 2017: Meeting at the event "LIFE & Foreste" on 19 May 2017, including dissemination to students.
- In 23 May 2017 Xanthi Forest Directorate participated in a one day environmental action that was organized by our service in collaboration with the elementary school of Exinos in the mountain area of Xanthi Region
- International Conference "Landscape Futures", Copenhagen 19th-22th June 2017: "Visitors' preferences for urban forest landscapes: the case study of Monte Morello forest in Italy"

The results of the activities carried out in Action E.10 were defined in the dedicated deliverable report, which is annexed to this Mid-Term Report:

- Deliverable related to Action E10: Report on participation in fairs and other events at Project Mid-term

Action E.11 Digital supports for international diffusion

Foreseen start date:	01/09/2015	Actual start date: 01/09/2015
Foreseen end date:	31/08/2019	Actual end date:31/08/2019

During this period, CREA prepared a preliminary project video to be used in project events.

6.2 Main deviations, problems and corrective actions implemented

The FoResMit project started in the expected time and is running following the planning, with the following exception:

- The acronym of the legal name of the Coordinating beneficiary has changed by CRA (Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria) to CREA (Consiglio per la Ricerca in Agricoltura e l'analisi dell'economia agraria) mantaining the same name, activities and characteristics.
- As already informed by the project coordinator and taken note by the EASME (as defined in the email of 20/07/2016 by Joelle Noirfalisse EASME), we confirm that the form FC in the Grant Agreement of the FoResMit project presents a calculation error on the budget allocation to the partners, in particular in the amount of EU contribution requested. The changes concern the distribution of the budget among partners only, not the total contribution. Total cost of the project and total EU contribution remain the same in the correct form and do not change. The correct budget allocation has been already reported in the partnership agreement. The consortium has modified the budget allocations amongst partners set out in Annex III (Form FC), without this adjustment being considered an amendment of the Agreement within the meaning of Art. II.12.

Beneficiary	Total cost	Beneficiary contribution	Amount of EU contribution as for Grant Agreement with calculation error	Correct amount of EU contribution as for Partnership Agreement
CREA	€ 632,661	€ 251,715	€ 368,946	€ 380,946
DAMT	€ 247,907	€ 102,763	€ 154,144	€ 145,144
DUTH	€ 456,336	€ 189,360	€ 269,976	€ 266,976
PROVIFI	€ 143,664	€ 57,466	€ 86,198	€ 86,198
TOTAL	€ 1,480,568	€ 601,304	€ 879,264	€ 879,264

- Action A1 was extended to June 2016, due to technical reason including the use of Terrestrial Laser Scanner for the vegetation survey, which required an extra time for the set up and calibration and further application in Xanthi site. The deliverable has been completed (in attachment).
- Action A2 was extended to the second quarter of 2016 (June). The extension was required for practical reason regarding only the opening of soil profiles within plots, in order to allow the excavator entering in the plots of monte Morello forest without provoke extra disturbance to the forest floor and soil. In Xanthi forest soil profiles have been dug manually. The soil total C , total N, and the cation exchange capacity (CEC) analyses of Xanthi site are still running due to delay of equipment supply (expected to be measured by the end of June). Anyway, deliverables for Action A2 has been provided for both sites (in attachment).
- Action C1 was anticipated to the end of 2015 in order to allow administrative procedures to be carried out in time by PROVIFI following the Italian legislation. A short delay (within one month) can take place due to 35 days of standstill required by the legislative decree 50/2016. Anyway, the expected end date of implementation is July 2016, as foreseen. The first deliverables related to action C1 have been anticipated and are already available (in attachment).
- Action C2 is running in the scheduled time. DAMT made a public tender for the special forest management study and signed procurement. The main aim of the action is to design

and to develop a pattern and dynamic website and phone application, for viewing and getting information for the data of the management study of the forest. DAMT made a contract and the deadline for the work is the end of May. The first deliverables related to action C2 have been anticipated and are already available (in attachment).

- Action D1 was anticipated to September 2015 in order to have extra time to monitor deadwood biomass and C pool and complete the initial sampling before thinning intervention. An improvement of biomass stock of forest trees quantification has been applied, which consisted in the application of Terrestrial Laser Scanner and the virtual measurement of stem density, basal area and quadratic mean. The application of this instrument required a period for setting up and application in Italian and Greek sites. The methodological protocols has been set up by CREA and agreed afterwards with DUTH, thus application of protocols in the Xatnhi forest started few months after monte Morello forest, but within the expected initial date.
- Action D2 started in the scheduled time in monte Morello forest. The methodological protocol has been set up by CREA and afterwards it was transferred to DUTH, thus application of protocol for GHG measurement in the Xatnhi forest started few months after monte Morello forest.
- Action D3 was anticipated to January 2016 to include a cultural event in the municipality of Monte Morello forests (Sesto Fiorentino municipality) in collaboration with local administrators to quantify the C emissions and other environmental impacts of the "*Fiera di Primavera*".

6.3 Evaluation of Project Implementation

The project coordination actions needed daily work to maintain a permanent flow of action with the aim of achieving the objectives set. The actions carried out were:

- Preparation of the Partnership Agreement
- 2 Coordination meetings
- 2 Monitoring meetings
- Organisation of different phone and web meetings between some partners in order to plan and monitor the project technical activities
- Continuous contact between all project partners for monitoring project activities
- General actions and activities for the coordination of the project.
- Management of the financial aspects of the project.
- Monthly reports to the LIFE external team monitor on the evolution of the project.
- CREA, as project coordinator, prepared and sent a monthly indication of operative activities to be done to all the partners
- CREA, as project coordinator, prepared and sent a monthly summary of the project activities carried out to monitoring representant and to all the partners

The following table compares through quantitative and qualitative information the results achieved at the end of the FoResMit project against the objectives of the proposal:

Action	**Foreseen in the revised proposal**	**Achieved at project mid-term**	**Evaluation**
A.1. Climatic characterization and vegetation survey	1. Climatic trends and frequencies analysis of the main climatic variables	1. Mean temperature and total precipitation in the period 1901–2009. Palmer drought severity index (PDSI) in the period	In line

	2. Complete quantification of the vegetation initial consistence	1901–2002. Standardized Precipitation Evapotranspiration Index (SPEI) at 1-month time-scale in the period 1901–2009. 2. Parameters measured: species, DBH, total height, crown depth, crown projections, number of living whorls, crown vigour	
A.2. Pedological survey	Geological classification Soil type classification Pool of organic C actually stored in the soil.	– geological and pedological classification of the areas from existing thematic maps; – soil and humus profiles description; – soil physico-chemical characterization and analyses of soil organic C and N pools at 0-10 and 10-30 cm	More than expected
C.1. Realization of thinning intervention in Italy	Thinning implementation in monte Morello forest	traditional thinning carried out on 5.35 ha selective thinning carried out on 4.73 ha	In line
C.2. Realization of thinning intervention in Greece	Thinning implementation in Xanthi forest	traditional thinning carried out on 3.2 ha selective thinning carried out on 3.2 ha	In line
D.1. Monitoring and quantification of C pools in vegetation and soil	- C stock for above- and below-ground biomass. - Amount of litter and forest floor - Carbon stock in deadwood; - Soil organic C content - Harvested biomass.	- Reduction of C stock in biomass, stronger with selective thinning - litter input and forest floor increased with thinning - soil organic carbon increased - deadwood was reduced with selective thinning. - harvested biomass chipped and transformed in energy	In line

D.2. Monitoring and quantification of GHG emissions and Global Warming Potential	-Daily, seasonal and annual rates of CO_2, N_2O and CH_4 fluxes - Global warming potential	- daily and cumulative fluxes have been calculated during thinning and the 6 months after thinning - global warming potential have been calculated and N_2O and CH_4 fluxes expressed as CO_2 equivalents.	In line
D.3. Governance of the project results in the carbon voluntary market	- Processes of awareness and training of the stakeholders involved in the project; - Quantification and governance of the carbon credit number in the voluntary market.	- Recognized and listed all the stakeholders belonging to organized groups who affect and/or are affected by the decisions and actions of the project - 32 stakeholders have been identified and shared in five groups of interest (public administrations, environmental Non-Governmental Organizations-NGOs, forest-wood chain actors, actors of tourism sector, Universities and research institutes)	More than expected
D.4. Monitoring of technical-socio-economic assessment of the LIFE FoResMit project	- Proof of technical-social and economic viability of FORESMIT treatment. - Elaboration and analysis of data in terms of socio-economic impact on the local economy and population	Not yet started	-
E.1. Project website	Project web site and Facebook page	Project web site (217,907 visits) and Facebook page (202 friends) continuously updating	In line
E.2. LIFE+ information boards	18 FoResMit notice boards	8 notice boards displayed in beneficiary public places and 4 in demonstration sites	In line
E.3. Layman's report	FoResMit Layman's report	Not yet started	-
E.4 Diffusion material preparation	➢ Logo definition ➢ 24 posters ➢ 12,000	➢ Logo defined ➢ 6,000 leaflets/brochures/factsheets ➢ 50 posters	In line

	brochures/leaflets ➢ 2,400 various items ➢ 6 roll-up	➢ 3 rolls-up ➢ 600 usb flashes, 200 keyrings, 200 block-notes, 400 pens, 400 pencils, 20 t-shirts and 20 huts as FoResMit gadget	
E.5. Press and media releases	30 publications on different media	6 articles	More effort needed
E.6. Networking	Clusters with 7 projects	Clusters with 6 projects	More than expected
E.7. LIFE FoResMit manual	FoResMit manual	Not yet started	-
E.8. Demostartion workshops, seminars, conferences and other events	4 FoResMit workshops	➢ DAMT and DUTH organized 1 Greek workshop on 6th of April 2016 ➢ DUTH organized a day conference on 11th of April 2017 ➢ DAMT organized a day conference with schools on 11th of April 2017 ➢ DAMT during the annual International Day of Forests organized a one day event on 21st of March 2016 and two days event on 21st-22nd of March 2017 ➢ PROVIFI and CREA organized 1 Italian workshop on 15th of May 2017 ➢ CREA organized two public events on 22th of June 2016 and on 20th of January 2017	In line
E.9. Dissemination to Institutions and policy makers	Successful communications to EU and national Institutions and policy makes	Preliminary contacts with 10 policy makes	In line
E.10. International fairs and other events	participation at minimum 6 events between international	Participation at 19 events and fairs	More than expected

	conferences and fairs		
E.11. Digital supports for international diffusion	1 Project video	Production of preliminary video	In line
E.12. After-LIFE Communication Plan	FoResMit After-LIFE Communication Plan	Not yet started	-
F.1. Project management	Management of project activities	Continuous contact between all project partners and project meetings	Great beneficiaries collaboration
F.2 Project monitoring	Monitoring of project activities	monthly indication of operative activities and monthly summary of the project activities	Great help from monitoring team
F.3 Audit	Audit Report	Not yet started	-

It is clearly evident from the above table that the work carried out during the mid-term period of the FoResMit project is perfectly in line with was expected in the FoResMit proposal.

6.4 Analysis of benefits

1. Environmental benefits
   a. Direct / quantitative environmental benefits:

1.1 GHG EMISSIONS:

Performance indicators for monte Morello:
During thinning a short term increase of CO_2 was observed: 40% increase with traditional thinning and 49% with selective thinning. This increase reduced to 15 % during the 6 months after thinning intervention, without differences between the two management options.
N_2O showed a reduction of 18% with traditional thinning and of 6 % with selective thinning. During the following 6 months the reduction was of 36 % with traditional thinning and remained of 5 % with selective thinning.
The site is a sink for CH_4 independent of treatments. The CH_4 uptake was reduced during and after traditional thinning (-29 % on average) and increased during and after selective thinning (+ 11 and + 46 % respectively).

Performance indicators for Xanthi:
During thinning a short term decrease of CO_2 emissions was observed in traditional thinning (-31.78%) whereas an increase of 6,82% has been observed with selective thinning. However, after thinning a slightly increase of CO_2 has been observed in the first 6 months with traditional thinning (9,59%) whereas in selective thinning no significant changes have been observed (-0.7%).
N_2O showed a strong differentiation during thinning. It has been observed a strong decrease of N_20 with traditional (-499%) and a strong increase with selective thinning (375%). After thinning a reduction of emissions were observed with traditional thinning (-32.89%) whereas an increase with innovative thinning (23%).

The site is a sink for CH_4 independent of treatments. Traditional treatment reduced the sink capacity for CH_4 of 40,55 % during thinning, whereas a16,78% increase of CH_4 uptake was observed after thinning. Selective thinning increased CH_4 uptake in both periods (+ 9,29 and + 87,38% during and after thinning,respectively).

1.2 GLOBAL WARMING POTENTIAL

Overall, in monte Morello approx. 6400 kg CO_2eq ha^{-1}have been emitted more than control. In the six months after thinning the increase was reduced to 2116 and 713kg CO_2eq $ha^{-1}$with traditional and selective thinning, respectively. Thus, selective thinning saved 1403 kg CO_2eq ha^{-1} with respect to traditional one.
In Xanthi forest during thinning period 383kg CO_2eq ha^{-1}have been saved in traditional thinning and 109kgCO_2eq ha^{-1}have been emitted with selective thinningmore than control, thus 269 kg CO_2eq ha^{-1}have been saved overall with respect to control. After 6 months period of thinning 396 kg CO_2eq ha^{-1} emitted in traditional thinning more than control whereas it has been observed a significant save with selective thinning. (-1152 kg CO_2eq ha^{-1}).Thus, selective thinning saved 1548 kg CO_2eq ha^{-1} with respect to traditional one.

1.3 SOIL CARBON

Soil C showed a very strong increase between November 2015 and January 2017, independent of treatments, also due to seasonal variation. Overall, soil gained 5.6, 3.6 and 3.9 Mg ha^{-1} in Control, traditional and selective plots.
The next sampling foreseen in Autumn 2017 will give a more reliable measure of soil C stock variations.

2. Economic benefits

Wood production was estimated considering the local market prices (year 2016) and wood volumes harvested during the silvicultural treatments. In accordance with the characteristics of black pine trees in Monte Morello forest, 100% of the harvested volume - both living trees, standing dead trees and lying deadwood of 1st and 2nd decay classes - is intended for bioenergy production (woodchips), while 0% is for timber production intended for sawmills.
Bioenergy production in Monte Morello peri-urban forest was calculated through the field measurement of the volume of wood (m^3 ha^{-1}) harvested with the traditional thinning and the volume of wood (m^3 ha^{-1}) harvested with the selective thinning. Woodchips production (q ha^{-1}) was then calculated taking in consideration black pine wood basic density. Woodchips was finally transformed in energy at the Calenzano heating power plant, located in a municipality closed to the study area.
The economic value of bioenergy production was evaluated through the direct calculation of profit from the annual income derived from the sale of woodchips (€ ha^{-1} yr^{-1}) considering the local price of woodchips and a rotation period of 15 years:

$$R = \frac{Vt_0}{\frac{(1+i)\cdot\left[1-(1+i)^{-t}\right]}{i}}$$

Where: R is the annual income derived from the sale of woodchips at the time t0 (€ ha^{-1} yr^{-1}), Vt0 is the total current value derived from the sale of woodchips (€ ha^{-1}), i is the average inflation rate in Italy for the period 2002-2016 (1.7%), t is the rotation period (15 years).
In forest parcels managed with traditional thinning 141.7 m^3 ha^{-1} of living trees volume and 9.5 m^3 ha^{-1} of deadwood (1^{st} and 2^{th} decay classes) was removed with the silvicultural operations.

Conversely, in the forest parcels managed with selective thinning was removed 200.7 m^3 ha^{-1} of living trees volume and 18.2 m^3 ha^{-1} of deadwood (1st and 2th decay classes) (Table 1).
As above-mentioned, all the volume removed during the silvicultural operations is intended for bioenergy production. The results show that the selective thinning provides a slightly higher quantity of woodchips for bioenergy production respect to the traditional thinning: respectively 1374.3 q ha^{-1} and 1989.9 q ha^{-1}.
From the economic point of view, the total economic benefits as bioenergy production provided by traditional thinning is 2061.4 € ha^{-1} and by selective thinning is 2984.8 € ha^{-1}, while the annual economic benefits are 154.2 € ha^{-1} yr^{-1} and 223.3 € ha^{-1} yr^{-1}.
Consequently, the results show that the economic value of wood production in the selective thinning scenario is higher that the economic value of this ES in the traditional thinning scenario. This difference is mainly due to the percentage of living trees volume harvested in the two thinning: 34% of growing stock volume in the selective thinning and 24% of growing stock volume in the traditional thinning, according to the different silvicultural criteria adopted in selective thinning. In addition, the selective thinning tends to maximize deadwood as biomass for energy use - 24.4% of total deadwood volume is removed for bioenergy production - while the traditional thinning (which removes only standing dead trees) uses for energy only 12.7% of total deadwood volume.

Table 1. Wood production in the Monte Morello peri-urban forest.

	Selective thinning	**Traditional thinning**
Removed living tree volume	200.7 m^3 ha^{-1}	141.7 m^3 ha^{-1}
Removed deadwood volume	18.2 m^3 ha^{-1}	9.5 m^3 ha^{-1}
Woodchips	1989.9 q ha^{-1}	1374.3 q ha^{-1}
Rotation period (*t*)	15 yr	15 yr
Inflation rate (*r*)	1.7%	1.7%
Total current value woodchips - (Vt_0)	2984.8 € ha^{-1}	2061.4 € ha^{-1}
Annual income (*R*)	223.3 € ha^{-1} yr^{-1}	154.2 € ha^{-1} yr^{-1}

3. Social benefits

Recreational benefits provided by Monte Morello peri-urban forest were assessed through the administration of a semi-structured questionnaire to a sample of visitors. The aim of the questionnaire is to analyze visitors' preferences for the two forest management options (selective thinning and traditional thinning) and to investigate the costs for the trip to the Monte Morello peri-urban forest.
The questionnaire was face-to-face administered to 201 visitors (75% of 269 visitors contacted) of the Monte Morello forest in the period from April to July 2016 (four months). The visitors were selected in a systematic way, selecting one out of two visitors who arrived in three previously identified sampling points (two rest areas and one parking). The number of visitors counted in the sampling points during the survey days - both weekend and working days - was used to estimate the theoretical total number of visitors of the Monte Morello peri-urban forest per year (18,475 visitors per year).
The recreational value was indirectly calculated using the Travel Cost Method (TCM) and considering individual total cost expenditures for the trip to the Monte Morello forest.
Concerning recreational benefits provided by Monte Morello peri-urban forest, the results of pairwise comparison highlighted that the visitors prefer the forest scenario after selective thinning (priority score of 0.5034) to the scenario after traditional thinning (priority score of

0.2873). In addition, results show that visitors prefer managed peri-urban forests (selective thinning scenario or traditional thinning scenario), while unmanaged peri-urban forests (*status quo* scenario) are evaluated negatively from the aesthetic point of view by the sample of respondents.
The visitors' preferences for the different images were used in order to estimate the change in the number of visitors in the selective and traditional thinning scenario. Currently, the annual visitors of Monte Morello peri-urban forest (*status quo* scenario) are estimated in 18,475 visitors yr^{-1}. Therefore, after the traditional thinning is assumed an increase of visitors by 7.8% (19,916 visitors), while after the selective thinning is assumed an increase of visitors by 29.4% (23,908 visitors).
The estimated Consumer Surplus is 10.04 € per visit. Consequently, the total social surplus in terms of recreational benefits in the Monte Morello peri-urban forest is equal to 179.2 € ha^{-1} yr^{-1} (*status quo* scenario), while in future years the social surplus could increase to 193.2 € ha^{-1} yr^{-1} in the case of traditional thinning scenario and to 231.9 € ha^{-1} yr^{-1} in the case of selective thinning scenario.

4. Replicability, transferability, cooperation

First results have been shared with other LIFE+ projects, with the aim to 1) transfer the silvicultural approach, 2) exchange observations in different ecosystems, 3) plan for future cooperation. In particular the participation at the event LIFE & Forests 2017 allowed the networking with 10 LIFE projects working on forest management (see action E6 for details). Demonstration workshops organised in situ at monte Morello and Xanthi forests reached the general public and experts (see action E8 and E9).
A strict cooperation is assuring an efficient information exchange with SelPiBio LIFE+ project ("Innovative Silvicultural Treatments to enhance soil Biodiversity in artificial black Pine stands" - LIFE13 BIO/IT/000282), LIFE AForClimate ("Adaptation of Forest management to Climate variability: an ecological approach" - LIFE15 CCA/IT/000089) and LIFE FutureForCoppiceS ("Gestione sostenibile dei boschi cedui nel sud europa: indicazioni per il futuro dall'eredità di prove sperimentali" - LIFE14 ENV/IT/000514).

Thinning of an adjacent area in monte Morello forest has been implemented during 2017.

5. Best Practice lessons:
   Although the effect of thinning will be more evident in the longer term and at this stage is not possible to directly measure the results in terms of tree growth and sustainability in the long term, first results indicate the effectiveness of selective thinning in terms of economical and social values. Environmental benefits has been affected by disturbance during thinning in the short term. The comparison of the two sites demonstrated clearly that 1) the duration of thinning operation and 2) the type of machinery used were two important variables affecting the short term response of forest ecosystem to thinning. This will be considered when developing guidelines for degraded forests management.

6. Innovation and demonstration value:
   The use of selective thinning to manage degraded pine forests is an innovation *per se*, both in Italy and Greece. Moreover, $_{N2}O$ and C_{H4} fluxes measurements are adding data and information of processes that were lacking for Mediterranean ecosystems.

Demonstration to students, forest service, administrators and experts is giving a good response, reaching the objectives of 1) increase awareness of forest degradation issues, 2) provide solutions to the problem and 3) improve knowledge to ecological processes and interactions.
Also, the project is focusing on deadwood management, providing data on its dual role as C sink and C source. Innovative approaches to measure GHG emissions from deadwood in field and in laboratory are running (see Action D2 for details).

7. Policy implications:
The project is contributing to the following policies:

- 6th Community Environment Action Programme concerning Climate change mitigation (decision no 529/2013/eu and regulation (EU) No 1293/2013 of the European Parliament): the project at this stage is contributing with an account that accurately reflect all emissions and removals in degraded pine forests. After the thinning implementation the project is providing data on the short and medium term effects that will be used for guidelines for GHG emissions removals through sustainable forest management.
- EU 2020 strategy for biodiversity: the project is implementing a strategy for deadwood management with positive implication for biodiversity, considering the trade-off with other ecosystem services, such as the identification of a threshold for deadwood biomass inside the forest.
- bioeconomy policies (COM(2011)112 final): the use of wood biomass as energy source investigated the effectiveness of sustainable resource production compared to fossil fuels.
- Regional/local policies: the collaboration with regional authorities and municipalities is improving awareness of the climate problem targeted and providing solutions through sustainable forest management.
- Rural development program 2014-2020 of Tuscany enhance the sustainable management of forest resources aimed at balancing different ecosystem services.

7. **Project Specific Indicators**

Project specific indicators foreseen in the proposal are confirmed at the mid-term period of the project. As annex of this Mid-term report we have included an updated table of the Project Specific Indicators with the values reported consistent with the environmental, economic and social benefits reported in the preceding section.

8. **Comments on the financial report**

The budget is being spent within the foreseen limits and there is no discrepancy with regard to initial estimations.
The following main budget movement for some beneficiaries are defined:

- CREA
  - Personnel: CREA has a deviation in personnel costs: due to a change in National Italian Law related to work contracts, a contract foreseen in the proposal (specific project collaboration contract CoCoCo, now prohibited) was changed in the new allowed contract (Timing determined contract) needed for the project personnel involved with specific expertise on analytical laboratories techniques for physico-chemical characterization of soil, use and maintenance of laboratory instruments, gas-chromatograph for GHG emissions determination with static chambers and and

elemental analyzer for C and N quantification. This contract type change caused an higher daily rate cost, related to higher predefined national contractual costs, for this specific project personnel.

- DAMT
  - Budget small changes: DAMT, due to an internal reorganization of the project activities and related costs, needs to implement some small cost movements in some cost categories, as defined in the following table maintaining the DAMT total amount, objectives and activities defined in the project:

DAMT BUDGET AS FOR PROJECT				DAMT BUDGET AS FOR NEW CHANGE			
Cost category	Cost Action	Cost description	Cost amount	Cost category	Cost Action	Cost description	Cost amount
External services	C 2	GIS analysis	€ 8,000	External services	C 2	GIS analysis	€ 0
	C 2	thinning intervention	€ 40,000		C 2	thinning intervention	€ 38,000
	E 4	project videos	€ 11,000		E 4	project videos	€ 0
	E 5	Drafting and sending of press releases	€ 5,000		E 5	Drafting and sending of press releases	€ 3,000
	E 7	preparation of project Manual	€ 7,000		E 7	preparation of project Manual	€ 2,000
	E 5	organisation of workshop	€ 10,000		E 5	organisation of workshop	€ 20,000
	E 9	Contacts and Organisation of public institutions and entity meetings	€ 7,000		E 9	Contacts and Organisation of public institutions and entity meetings	€ 7,000
	E 10	Search, organisation, predisposition, organisation and selection of fair participation and other events	€ 6,000		E 10	Search, organisation, predisposition, organisation and selection of fair participation and other events	€ 6,000
	E 11	project videos	€ 6,000		E 11	project videos	€ 0
					C 2	Special forest management study for CO2 reduction purposes	€ 10,000

					C 2	ARC GIS license for the Xanthi Forest Directorate	€ 8,000
					E 8	Gadget production	€ 6,000
TOTAL			€ 100,000	TOTAL			€ 100,000
Consumable	D 2	scientific supply	€ 10,000	Consumable	D 2	scientific supply	€ 4,000
TOTAL			€ 10,000	TOTAL			€ 4,000
EQUIPMENT				EQUIPMENT		pc, gps, distance-meter, relascope, thick-meters	€ 6,000
TOTAL			€ 0,00	TOTAL			€ 6,000
PROJECT TOTAL FOR EXTERNAL SERVICES, CONSUMABLE AND EQUIPMENT			€ 110,000	PROJECT TOTAL FOR EXTERNAL SERVICES, CONSUMABLE AND EQUIPMENT			€ 110,000

In particular, the need of the equipment is due to collect, monitor and manage the project field data of the area of peri-urban forest of Xanthi.

- DUTH
  - Personnel: the personnel daily rate of Kalliopi Radoglou is slightly higher than foreseen in the project due to a wrong initial estimation of salary slips and hourly working rates defined by the University for the category of full professors, due to the specific period of Greek economic crisis and National salary reorganisation. The activities of Kalliopi Radoglou is extremely important for the project objectives achievement due to her many years of experience and deep knowledge of project topics.
  - Other costs: DUTH substained the unforeseen costs of catering for workshop, needed for a better organisation of the event

8.1 Summary of Costs Incurred

PROJECT COSTS INCURRED				
	Cost category	Budget according to the grant agreement in €*	Costs incurred within the reporting period in €	%**
1.	Personnel	930,960	578,109.37	62.09
2.	Travel and subsistence	77,990	28,397.57	36.41
3.	External assistance	229,000	85,124.83	37.17
4.	Durables goods: total non-depreciated cost			

	- Infrastructure sub-tot.			
	- Equipment sub-tot.	30,250	17,293.34	57.16
	- Prototype sub-tot.			
5.	Consumables	74,600	6,472.00	8.67
6.	Other costs	41,900	13,387.47	31.95
7.	Overheads	95,868	51,030.76	53.23
	TOTAL	**1,480,568**	**780,041.57**	53.23

8.2 Accounting system

Each beneficiary has a specific payment responsible

- CREA: Alessandra Lagomarsino selects the project cost formally approved by department director or CREA council
- PROVIFI: Alessandro Varallo selects the project cost formally approved by PO responsible
- DUTH: Kalliopi Radoglou selects the project cost formally approved by department director
- DAMT: Panagiotis Mouchtaridis selects and decides in accordance with DAMT Legal Responsible.

All beneficiaries have defined the following internal specific code (*codice commessa*) which identify the project and all costs and income related to the project:

- CREA:C82I15000150005 – 1.08.08.19.00 – 3.00.04.00
- PROVIFI: CAP. E 232
- DUHT: 81627
- DAMT: 53.90.20.061

For CREA, PROVIFI, DAMT and DUTH VAT is a cost. All the four beneficiaries have activated all the procedure to the relative National authorities to have the certification of the VAT as a cost: they are waiting for the official documents which will annexes to the project next Report.

All beneficiaries respects the procedure of the best value for money for selecting all the project costs. All the beneficiaries approved only the costs:

- directly linked to, and necessary for, carrying out the FoResMit project;
- reasonable, justified and comply with the principles of sound financial management, in particular in terms of economy and efficiency;
- compliant with applicable tax and social legislation; and
- actually incurred during the lifetime of the project, as defined in the grant agreement, and which could be identifiable and verifiable

All the beneficiaries completed in the electronic way all the project financial documents before printing them for the original signatures.

All the beneficiaries charged to the project only invoices contain a clear reference to the FoResMit project.

8.3 Partnership arrangements

CREA, as coordinating beneficiary, carried out that all the appropriate FoResMit payments were made to the other beneficiaries without unjustified delay in accordance with the agreements concluded with the associated beneficiaries in the Partnership Agreement.

All the beneficiaries entered directly the information in the financial tables of the FoResMit project.

8.4 Certificate on the financial statement

The selected auditor is Dr Marco Battistelli, Piazza Pietro Mascagni 55, 50127 Firenze, Accountant and Statutory Auditor - N° 1650 in the Firenze Register, date 06-07-2004.

8.5 Summary of costs per action

The following table presents the allocation of the incurred project costs per Action from the start of the project 01/09/2015 until the mid-term period of the project 31/09/2017.

Action no.	1. Personnel	2. Travel and subsistence	3. External assistance	4.b Equipment	6. Consumables	7. Other costs	TOTAL
Action A.1 Climatic characterization and vegetation survey	123,521.36	3,012.10			1,993.81	440,73	128,968.00
Action A.2 Pedological survey	117,812.56	1,012.00		4,612.80	1,232.98		124,670.34
Action C.1 Realization of thinning intervention in Italy	63,075.58		40,671.60		486.16		104,233.34
Actithe on C.2 Realization of thinning intervention in Greece	148,560.32	3,020.10	24,983.93				176,564.35
Action D.1. Monitoring and quantification of C pools in vegetation and soil	53,312.07	4,010.01		7,999.54	2,759.44		68,081.06
Action D.2. Monitoring and quantification of GHG emissions and Global Warming Potential	45,312.45	3,101.02		4,681.00			53,094.47
Action D.3. Governance of the project results in the carbon voluntary market							0
Action D.4. Monitoring of technical-socio-economic assessment of the LIFE FoResMit project							0
Action E.1. Project website			5,000.00				5,000.00
Action E.2. LIFE+ information boards			3,000.00				3,000.00
Action E.3. Layman's report							0
Action E.4. Diffusion material preparation						12,540.23	12,540.23

Action E.5. Press and media releases							0
Action E.6. Networking	3,150.42						3,150.42
Action E.7. LIFE FoResMit manual							0
Action E.8. Demonstration workshop, seminars, conferences and other events			11,469.3			406,51	11,875.81
Action E.9. Dissemination to Institutions and policy makers	7,321.63						7,321.63
Action E.10. International fairs and other events		5,130.12					5,130.12
Action E.11. Digital supports for international diffusion							0
Action E.12. After-LIFE Communication Plan							0
Action F.1. Project management	13,011.75	9,112.22					22,123.97
Action F.2. Monitoring	3,061.23						3,061.23
Action F.3. Audit							0
Over-heads							**51,030.76**
TOTAL	**578,109.37**	**28,397.57**	**85,124.83**	**17,293.34**	**6,472.00**	**13,387.47**	**780,041.57**

9. Envisaged progress until next report

Number/name of action	2015		2016				2017				2018				2019		
	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III
Action A.1 Climatic characterization and vegetation survey																	
	/	/	/	/													
Action A.2 Pedological survey																	
	/	/	/	/													
Action C.1 Realization of thinning intervention in Italy																	
		/	/	/	/	/											
Action C.2 Realization of thinning intervention in Greece																	
			/	/	/	/											

Action D.1. Monitoring and quantification of C pools in vegetation and soil																		
		/	/	/	/	/	/	/	/									
										X	X	X	X					
Action D.2. E Monitoring and quantification of GHG emissions and Global Warming Potential																		
			/	/	/	/	/	/	/									
										X	X	X	X					
Action D.3. Governance of the project results in the carbon voluntary market																		
											X	X	X					
Action D.4. Monitoring of technical-socio-economic assessment of the LIFE FoResMit project																		
Action E.1. Project website																		
	/	/																
Action E.2. LIFE+ information boards																		
	/	/																
Action E.3. Layman's report																		
Action E.4. Diffusion material preparation																		
	/	/	/	/	/	/	/	/	/									
										X	X	X	X					
Action E.5. Press and media releases																		
	/	/	/	/	/	/	/	/	/									
Action E.6. Networking																		
	/	/	/	/	/	/	/	/	/									
										X	X	X	X					
Action E.7. LIFE FoResMit manual																		
Action E.8. Demonstration workshop, seminars, conferences and other events																		
	/	/	/	/	/	/	/	/	/									
										X	X	X	X					
Action E.9. Dissemination to Institutions and policy makers																		
	/	/	/	/	/	/	/	/	/									
										X	X	X	X					
Action E.10. International fairs and other events																		
	/	/	/	/	/	/	/	/	/									
										X	X	X	X					
Action E.11. Digital supports for international diffusion																		
	/	/	/	/	/	/	/	/	/									
										X	X	X	X					
Action E.12. After-LIFE Communication Plan																		

Action F.1. Project management	/	/	/	/	/	/	/	/	/									
										X	X	X	X					
Action F.2. Monitoring	/	/	/	/	/	/	/	/	/									
										X	X	X	X					
Action F.3. Audit																		

Key ■ Task foreseen in the proposal / Actual task duration X Next actions to Progress Report 30/09/2018

In particular the following activities of the following Actions will be carried out during the next months until the next project Progress Report foreseen for the 30st of September 2018.

Action D.1. Monitoring and quantification of C pools in vegetation and soil
Monitoring will continue following the same protocols for the different pools. Litter sampling will be carried out seasonally, soil sampling, deadwood and vegetation survey annually.

Action D.2. Monitoring and quantification of GHG emissions and Global Warming Potential
Monitoring will continue following the protocol. Monthly or be-monthly measurements of GHG emissions will be carried out and elaboration of cumulative emissions and global warming potential will follow. Soil temperature and moisture measurements will be monitored as related parameters.

Action D.3. Governance of the project results in the carbon voluntary market
Stakeholders will be involved in the governance of the FoResMit results and, specifically, in the identification of a local cultural event which emissions will be
compensated by the C credits generated by the Project.

Action E.2 LIFE+ information boards
CREA and PROVIFI are preparing 4 new notice boards for the Italian demonstration site

Action E.4 Diffusion material preparation
All the FoResMit beneficiaries will produce more FoResMit dissemination material in relation with the organisation and participation at project events and activities.

Action E.5 Press and media releases
All the FoResMit beneficiaries will produce more articles in relation with the progress of the project activities.

Action E.6 Networking
All the FoResMit beneficiaries will be responsible for the organisation of networking activities in relation with the progress of the project activities.

Action E.8 Demonstration workshop, seminars, conferences and other events
The following workshops have been already planned:

- PROVIFI has already planned a project policy maker and Institutions workshop in Italy on September 2018

- CREA final scientific workshop in CREA premises at the project end in September 2019
- DAMT and DUTH will also organize 1 Greek workshop at the project end in September 2019

Action E.9 Dissemination to Institutions and policy makers
All the FoResMit beneficiaries will be responsible for organizing contact and meeting with Institutions and policy makers in order to disseminate and sensitize them on new normative issues based on FoResMit activities and results.

Action E.10 International fairs and other events
All the FoResMit beneficiaries will be responsible for the participation at events and fairs related to the progress of the project activities.

Action E.11 Digital supports for international diffusion
CREA will define the final structure and the text of the project video and will produce the final project video to be distributed during the final project workshops in Italy and Greece.

Action F.1 Project management
CREA, with the support of all the beneficiaries, will continue the daily work of project management in order to maintain a permanent flow of actions with the aim of achieving the objectives set. In particular:
- Organisation of Coordination meetings;
- Organisation of different meetings between some partners in order to plan and monitor the project technical activities;
- Management of the financial aspects of the project;
- Monthly reports to the LIFE external team monitor on the evolution of the project.

Action F.2 Monitoring
CREA, with the support of all the beneficiaries, will continue to monitor the execution of project activities, to verify the status of actions compared to the expected timing of the project. In particular:
- CREA, as project coordinator, will have continuous contacts with all project beneficiaries for monitoring project activities;
- CREA, as project coordinator, will continue to prepare and send a monthly indication of operative activities to be done to all the beneficiaries;
- CREA, as project coordinator, will continue to prepare and send a monthly summary of the project activities carried out to monitoring representatives and to all the beneficiaries.

10. Annexes

10.1 Deliverables

In attachment the following Deliverables foreseen in this project period:

- Deliverable related to Action C1: Report on quantification of forest structural changes after silviculture application
- Deliverable related to Action C2: Report on quantification of forest structural changes after silviculture application
- Deliverable related to Action D2: Assessment of early influence of silviculture application on GHG fluxes
- Deliverable related to Action D1: Assessment of early influence of silviculture application on carbon pools
- Deliverable related to Action F2: Monitoring Report at Mid-Term Period
- Deliverable related to Action E4: Diffusion material at Project Mid-term
- Deliverable related to Action E12: First commitment of the main targeted stakeholders to uptake the solutions proposed by the project
- Deliverable related to Action D3: List of local, regional and national stakeholders who will be involved in the governance of carbon credits
- Deliverable related to Action E6: Report on networking at Project Mid-term
- Deliverable related to Action E10: Report on participation in fairs and other events at Project Mid-term
- Deliverable related to Action E9: Report on the results of the lobbying activity at Project Mid-term

10.2 Annex Dissemination activities

- The Deliverables related to Actions E4, E6 and E10, annexed to this Mid-term Report, shows evidences of all the dissemination activities carried out with details and photos of all the materials and events.
- A project brochure in English
- FoResMit project gadgets

10.3 Partnership agreement

The FoResMit Partnership agreement with original signatures was annexed to the previous Progress Report sent on 31 May 2016.

10.4 Answers to EC recommendations

A specific document with the answers to EC recommendations received as evaluation of the monitoring visit is annexed to this Mid-Term Report.

10.5 Administrative annexes

In attachment the following Administrative annexes:

- "Standard Payment Request and Beneficiary's Certificate" - duly signed original
- "Consolidated Cost Statement for the Project" - signed original
- "Financial Statement of the Individual Beneficiary" completed for each project beneficiary, signed, originals.