Socio-economic impact of the LIFE project FoResMit

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FoResMit: recovery of degraded coniferous Forests for environmental sustainability
Restoration and climate change Mitigation

**Reference**
- LIFE14 CCM/IT/90 5
- Climate change Mitigation

**Duration**
- 4 years
- 01-SEP-2015 to 31-AUG-2019

**Budget**
- Total budget 1,465,443 €
- EU contribution 879,264 €

**Location**
- Tuscany (Italy)
- Greece (Thrace)

FoResMit partners:

- crea
- CITTÀ METROPOLITANA DI FIRENZE
- GENERAL DIRECTORATE OF FORESTS & RURAL AFFAIRS
- XANTHΗ FOREST DIRECTORATE
- HELLENIC REPUBLIC
Environmental problem: pine forest degradation

- Increased fire risk
- Susceptibility to adversities (insects/pathogens)
- Low productivity
- Absence of regeneration
- Reduced recreational attractiveness
- REDUCED POTENTIAL FOR C SEQUESTRATION

After reforestation the stands have been abandoned.
multidisciplinary approach
(soil – vegetation – atmosphere)
FoResMit impact

1. ENVIRONMENTAL
   - Increased C sequestration
   - Control of green-house gas production
   - Forest stability and regeneration

TRADE-OFF AND SYNERGY ANALYSES

2. ECONOMIC
   - Use of biomass for bioenergy production and fossil fuel substitution
   - Wood-chain analysis

3. SOCIAL
   - Periurban forest landscape attractiveness
   - Increase of recreational value
1. ENVIRONMENTAL

C POOLS

SOIL

Delta of measured organic C (g kg m\(^{-2}\))

i) before and after thinning intervention

ii) Percentage difference from Control

LITTER

DEADWOOD

Deadwood biomass removed with thinning *
deadwood C stock (g kg m\(^{-2}\)) before and after thinning intervention

C SEQUESTRATION

SOIL - LITTER

Delta of measured organic C (g kg m\(^{-2}\))

i) before and after thinning intervention

ii) Percentage difference from Control

BIOMASS & DEADWOOD

ABOVE- and BELOWGROUND BIOMASS

\[
C = [(I \cdot BEF \cdot WBD) + (I \cdot R \cdot WBD)] \cdot 0.5
\]

\(I\) = annual increment of volume (m\(^3\) ha\(^{-1}\) yr\(^{-1}\))

\(BEF\) = biomass expansion factor

\(WBD\) = wood basic density,

\(R\) = root-to-shoot ratio

0.5 (C content coefficient)

Fossil fuel substitution
1. ENVIRONMENTAL

CO₂, CH₄, N₂O FLUXES

C-CO₂ EQUIVALENTS (CO₂ + CH₄ + N₂O)

C SEQUESTRATION

CO₂ emitted from deadwood

C credits
2. ECONOMIC – C CREDITS

**Governance of the results** of the LIFE FoResMit Project in the carbon voluntary market. C credits will be used:
i) for the continuous maintenance of the improved forest practices and
ii) to reduce the CO$_2$ emissions produced by other sectors at regional level

First attempt: **Quantification of the CO$_2$ emission and environmental sustainability of a cultural event** (“Maggio in Centro” held in the municipality of the Project):

1. Direct measurements of:
   ✓ Waste (number of waste baskets and volume for each waste basket);
   ✓ Total number of visitors (count of visitors 10 minutes every hour).

2. **Administration of semi-structured questionnaires to the following actors:**
   ✓ Organizers of the “Maggio in Centro” event (Sesto Fiorentino municipality and “La Rocchetta” association were interviewed);
   ✓ Exhibitors (all 18 during the 3-day event were interviewed);
   ✓ Sample of visitors (61 visitors of the event were interviewed).
## 2. ECONOMIC – C CREDITS

<table>
<thead>
<tr>
<th>ENVIRONMENTAL IMPACTS</th>
<th>CO₂ ECONOMIC VALUES</th>
<th>ECONOMIC RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>83.27 t CO₂ eq.</td>
<td>EUA (Min) 474,50 €</td>
</tr>
<tr>
<td>Particulate matter</td>
<td>0.16 t PM₁₀ eq.</td>
<td>EUA (Max) 504,47 €</td>
</tr>
<tr>
<td>Photochemical oxidant formation</td>
<td>0.53 t NMVOC eq.</td>
<td>CER (Min) 33,30 €</td>
</tr>
<tr>
<td>Terrestrial acidification</td>
<td>0.44 t SO₂ eq.</td>
<td>CER (Max) 34,13 €</td>
</tr>
<tr>
<td>Freshwater eutrophication</td>
<td>0.01 t N eq.</td>
<td></td>
</tr>
</tbody>
</table>

**EUA = European Union Allowances**  
**CER = Certified Emission Reductions**

**Work in progress:**
How many ha of thinning should be realized in order to compensate emissions from such events?
Wood – energy chain analysis. Costs vs. profits considering all phases: felling, logging, chips production, transportation
### 2. ECONOMIC – BIOENERGY PRODUCTION

<table>
<thead>
<tr>
<th>PROFITS</th>
<th>Selective</th>
<th>Traditional</th>
<th>u. m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinning type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface (ha)</td>
<td>4.73</td>
<td>5.35</td>
<td>ha</td>
</tr>
<tr>
<td>Mean production</td>
<td>144.6</td>
<td>96.4</td>
<td>t/ha</td>
</tr>
<tr>
<td>Total production</td>
<td>684</td>
<td>516</td>
<td>t</td>
</tr>
<tr>
<td>Economic value</td>
<td>32,146</td>
<td>24,252</td>
<td>€</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COSTS</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FELLING and LOGGING</td>
<td>20,032</td>
<td>15,105</td>
<td>€</td>
</tr>
<tr>
<td></td>
<td>4,235</td>
<td>2,823</td>
<td>€/ha</td>
</tr>
<tr>
<td>CHIPS PRODUCTION</td>
<td>6,087</td>
<td>4,590</td>
<td>€</td>
</tr>
<tr>
<td></td>
<td>1,287</td>
<td>858</td>
<td>€/ha</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>6,665</td>
<td>5,026</td>
<td>€</td>
</tr>
<tr>
<td></td>
<td>1,409</td>
<td>939</td>
<td>€/ha</td>
</tr>
<tr>
<td>Works direction, marking, taxes and sale</td>
<td>3,764</td>
<td>2,839</td>
<td>€</td>
</tr>
<tr>
<td>Total costs</td>
<td>36,548</td>
<td>27,560</td>
<td>€</td>
</tr>
<tr>
<td></td>
<td>53.4</td>
<td></td>
<td>€/t</td>
</tr>
<tr>
<td>Total costs (without transportation)</td>
<td>29,882</td>
<td>22,534</td>
<td>€</td>
</tr>
<tr>
<td></td>
<td>6,318</td>
<td>4,212</td>
<td>€/ha</td>
</tr>
<tr>
<td>Chips costs</td>
<td>43.7</td>
<td></td>
<td>€/t</td>
</tr>
</tbody>
</table>

ECONOMICALLY SUSTAINABLE FOR A CHIPS PRICE HIGHER THAN 44 €/t AT LANDING
### 2. ECONOMIC – BIOENERGY PRODUCTION

<table>
<thead>
<tr>
<th></th>
<th>WOODCHIPS</th>
<th>u.m.</th>
<th>METHANE</th>
<th>u.m.</th>
<th>FUEL OIL</th>
<th>u.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CALORIFIC POWER</strong></td>
<td>2.81</td>
<td>MWh/t</td>
<td>10</td>
<td>kWh/mc</td>
<td>11.63</td>
<td>MWh/t</td>
</tr>
<tr>
<td><strong>PLANT EFFICIENCY</strong></td>
<td>0.79</td>
<td></td>
<td>0.85</td>
<td></td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td><strong>THERMAL ENERGY PRODUCED</strong></td>
<td>1,809</td>
<td>MWh</td>
<td>1,809</td>
<td>MWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ELECTRIC ENERGY PRODUCED</strong></td>
<td>487.2</td>
<td>MWh</td>
<td></td>
<td></td>
<td>487.2</td>
<td>MWh</td>
</tr>
<tr>
<td><strong>AMOUNT</strong></td>
<td>1,200</td>
<td>t</td>
<td>212,890</td>
<td>mc</td>
<td>167.5</td>
<td>t</td>
</tr>
<tr>
<td><strong>TONS OIL EQUIVALENT (TOE)</strong></td>
<td>0</td>
<td>TOE</td>
<td>174</td>
<td>TOE</td>
<td>164</td>
<td>TOE</td>
</tr>
<tr>
<td><strong>CO₂ EMISSIONS (Kg CO₂)</strong></td>
<td>0</td>
<td>t</td>
<td>504.6</td>
<td>t</td>
<td>475.7</td>
<td>t</td>
</tr>
</tbody>
</table>

1 t of fuel oil = 0.98 TOE; 1000 mc methane = 0.82 TOE
2.9 kgCO₂ emitted per kg oil (Hellrigl B.. 2001)
Currently, the annual visitors of Monte Morello periurban forest (status quo scenario) are 18,475 visitors yr\(^{-1}\).

**Impact on:**

Aesthetic value, recreational facilities, social benefits

↓
Economic implication

Semi-structured questionnaire to 261 visitors of Monte Morello forest formed by 15 questions (2 open-ended and 13 closed-ended questions) divided in 4 thematic sections.

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<table>
<thead>
<tr>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Personal information</td>
</tr>
<tr>
<td>2. Recreational use of forest</td>
</tr>
<tr>
<td>3. Benefits provided by urban forest landscape</td>
</tr>
<tr>
<td>4. Preferences and perceptions towards the urban forest landscape</td>
</tr>
</tbody>
</table>
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Thank you for the collaboration.

**ANNEX 1**

**QUESTIONNAIRE**

The questionnaire has been realized in the framework of the LIFE project FoResMit (LIFE14 CCM/IT/000905) “Recovery of degraded coniferous forests for environmental sustainability Restoration and climate change Mitigation”. The project aims at testing and verifying the effectiveness of management options for the restoration of degraded coniferous forests in meeting climate change mitigation objectives. The present research is aimed at investigating the touristic value of the black pine peri-urban forest of Monte Morello, located in Italy (Tuscany Region) near the metropolitan area of Florence.
1. The preferred forest from the aesthetic point of view is a **mixed forest** (69.7% of total respondents) with a **random distribution of trees** in the space and a **differentiated horizontal and vertical stand structure** (54.7%).

2. 48% think that the **recreational facilities** improve the attractiveness of the area (mean 3.17 in a 5-point Likert scale). The most appreciated facilities are waste baskets and picnicking areas. The urban forest landscape after the traditional thinning is considered most suitable for sports activities, while others for contemplative activities.

3. The most important benefit provided by Monte Morello urban forest is the **tourism-recreation** followed by the improvement of **air quality** and the **biodiversity conservation**.
3. SOCIAL

**Economic implication**
After the traditional thinning an increase of visitors by 7.8% is assumed (19,916 visitors), while after the selective thinning an increase of visitors by 29.4% is assumed (23,908 visitors).

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional thinning</td>
<td>19,916 visitors</td>
</tr>
<tr>
<td>Selective thinning</td>
<td>23,908 visitors</td>
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</tbody>
</table>

The estimated - with Travel Cost Method - consumer surplus is **10.04 € per visit**.
The current economic importance of recreational benefits is 179.2 € ha\(^{-1}\) yr\(^{-1}\) (*status quo* scenario), while in future years the economic importance of recreational benefits 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.
COMMUNICATION & DISSEMINATION

- General public
- Public administrations
- Environmental NGOs
- Forest-wood chain actors
- Actors of tourism sector
- Universities and research institutes

WEBSITE
WWW.lifeforesm.it.com

NETWORKING

INFORMATIVE BOARDS

DIFFUSION MATERIAL

PRESS RELEASE MANUAL

WORKSHOPS, SEMINARS, CONFERENCES
FoResMit replicability

In degraded pine forests of Mediterranean environment

In forest stands characterized by trees with goods characteristics

To accelerate species successional in mature forests

To improve timber quality in young even-aged stands

In forest stands with heliophilous species