



The FOREST4EU Factsheet Collection brings together the key findings, best practices, and innovative tools developed within the project. Each factsheet offers a clear, concise, and accessible summary of a specific topic, ranging from novel wood-based products and climate resilience strategies to advanced monitoring technologies.

FACTSHEETS

BOOKLET COLLECTION

ITHub3

Sustainable forest
management and
ecosystem services



FOREST4EU partner: UNIFI

OG: CO2S.Fo.Ma

OG's country: Italy

Type of Innovation: Process

Training for Forest Operators in Intervention Techniques to Enhance Carbon Credit Generation

Introduction

A project aimed at generating ecosystem credits requires approval from a verification body. Among all the criteria necessary for project approval, additionality is perhaps the key factor: it must be demonstrated that without the implementation of the project and specific management measures, no environmental benefit would be achieved. Therefore, in the context of ecosystem credit generation, it is necessary to develop additionality projects through silvicultural interventions that increase carbon storage and improve biodiversity within the canopy. These silvicultural interventions, as opposed to conventional forestry practices, require specific training for the operators working in the forest.

Within the framework of OG CO2S.Fo.Ma, which has the goal of enhancing carbon credits, it was considered important to provide specific training for forestry operators in silvicultural choices and forest interventions aimed at generating additionality. The training included activities such as selective harvesting, thinning, conversion to high forest, and the selection of trees to promote biodiversity aspects. The training was conducted directly in the forest through a practical course. The training allowed for practical activities to explain how to carry out additionality projects and to educate operators who typically work in the forest only on conventional silvicultural interventions. This has enabled the operators to become self-sufficient in implementing specific additionality interventions in the designated OG CO2S.Fo.Ma project area, as well as to make them self-sufficient for future additionality projects in other areas.

Lessons learned

The course was useful for pursuing qualitative growth in the work of forestry workers with a view to sustainable forest management and the improvement of ecosystem services and the carbon stock. The practical course was considered useful by the operators because it was conducted directly in the forest. Furthermore, it allowed for the expansion of the operators' skills.

For further information contact

Marco Perrino, Project Coordinator, Italy, email: marco.perrino@dream-italia.net

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.co2marche.it/>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGROALIMENTARI, AMBIENTALI E FORESTALI	 CO₂ S.Fo. Marche	 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu	Website 
--	--	---	--	--



FOREST4EU partner: UNIFI

OG: CO2S.Fo.Ma

OG's country: Italy

Type of Innovation: Process

Group Certification for Sustainable Forest Management: Promoting Shared Forest Management and Ecosystem Services Enhancement

Introduction

In Italy one of the main obstacles to forestry management is fragmentation and small forest area of private properties. For overcoming this problem, the project CO2 Marche promoted a Group Certification between different forest owners.

The Group Certification is specifically designed for small and collective forest properties, is the result of great teamwork related to the ability to unite public and private forces, overcoming territorial fragmentation for a common goal in order to simplify and share the organisational aspects of Sustainable Forest Management Certification and to reduce its costs. It is an alternative approach to individual certification, allowing certification of several forest owners as a group. It requires a Lead Partner representing the group, with responsibility for ensuring that the forest management practices of individual owners within the certified area comply with PEFC requirements.

In the context of the project, the 'Bosco di Marca' was created, a forest consortium of 9208,25 ha that achieved the goal to obtain the PEFC Sustainable Forest Management Group Certification. Forest Group Certification is a good opportunity for forest owners to manage forests and the ecosystem services produced, by increasing carbon storage, prevent forest fires, hydrogeological instability, soil erosion, protect forests and biodiversity, contribute to good water and air quality, mitigate temperatures and climate change, enhance the landscape and offer better tourism and recreational services. Moreover, in the context of the project, a particular attention was put in promoting the exchange of sustainability credits and create employment and wealth in the mountain areas of the Marche Region, with a special focus on the 2019 earthquake crater area.

The certification highlights the effort put to enhance ecosystem services: it demonstrates concretely how forests and woodlands can be not only an environmental but also an economic resource, and how everything is interconnected. Forest owners and managers will then be able to calculate the forest's carbon storage capacity and offer credits to be sold to organisations or companies wishing to neutralise their emissions. In this way, forest communities will be able to survive and not abandon the inland areas of the country.

Lessons learned

This group certification model allowed the achievement of the largest group certification in central Italy with 9,208.25 ha. This certification is proof of the possibility of overcoming territorial fragmentation for a common objective by uniting public and private forces. In these areas, obtaining and maintaining GFS certification will guarantee not only the application of a continuous monitoring system but also the implementation of a continuous improvement programme.

For further information contact

Marco Perrino, Project Coordinator, Italy, email: marco.perrino@dream-italia.net

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.co2marche.it/>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI	 CO₂ S.Fo. Marche	 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	--	---	--



Enhancing Additionality Assessment of Carbon Credit of Various Interventions by Utilizing Site-Specific Historical Data in Compliance with IPCC International Standards

Introduction

In carbon credit additionality projects, it is essential to use precise quantification methods to avoid incorrect estimations. In this context, within the framework of the OG CO2S.Fo.Ma, an international methodology based on the IPCC standards has been chosen as reference for the quantification of carbon credits. However, to arrive at a more accurate estimation of carbon credits, the international ICPP methodology has been linked with a site-specific methodology developed within the OG CO2S.Fo.Ma. The site-specific methodology takes into account site-specific data for each of the additionality measures proposed concerning the Business As Usual (BAU) scenario (e.g., converting coppice/stand, extending the harvesting rotation, and wildfire prevention). Indeed, the OG CO2S.Fo.Ma covered 9,000 hectares of forests managed in the past for which historical dendrometric data were already available. These historical data pertained to forest parcels managed in the past with practices similar to those proposed in the additionality measures. This enabled the adjustment of the IPCC models to the actual biomass and CO₂ increases recorded in the project areas. This approach allowed for more accurate carbon estimates and the calculation of additionality based on real growth data. From a credit quantification perspective, this approach is, therefore, more rigorous compared to the usual methods applied in other certification standards. In this context, the OG CO2S.Fo.Ma has also contributed to develop the national certification standard of PEFC for carbon credits that can be requested just if the forest are managed under the sustainable forest management PEFC national standard. Moreover, at the moment in Italy there is a National Carbon Credit Register.

Lessons learned

In the context of carbon credits, it is necessary to have quantification methodologies for the carbon credits generated by additionality measures that are as rigorous and transparent as possible to avoid speculation. In this context, the OG CO₂S.Fo.Ma worked to develop a methodology that aligns with the IPCC standards but is also informed by site-specific data. This was made possible because the forests had been managed in the past, and historical dendrometric data allowed for the quantification of the increases resulting from silvicultural interventions. The project highlighted that it is indeed active forest management that generates additionality and, consequently, carbon credits.

Furthermore, these evidence-based methodologies using real data ensure that the generated credits can be certified, particularly under the new PEFC standard in Italy, which is based on stringent methodologies compared to other standards.

For further information contact

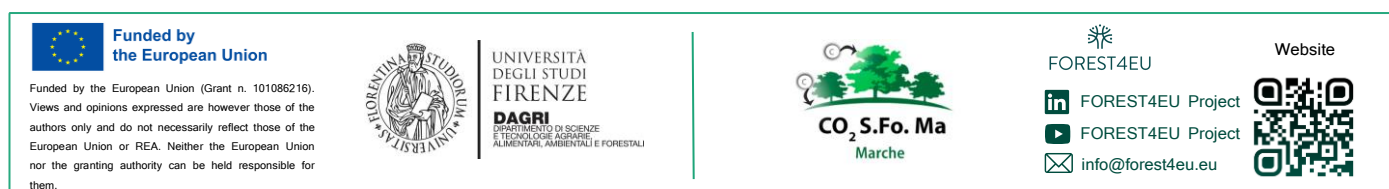
Marco Perrino, Project Coordinator, Italy, email: marco.perrino@dream-italia.net

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.co2marche.it/>



Efficient Sampling Methodology for Calculating Soil Carbon Credits

Introduction

Soil Carbon Credits are additional carbon credits that enhance ecosystem services, such as C stocking and improving rural economy, and SFM applicability. Soil Carbon Credits are additional carbon credits that enhance ecosystem services, such as C stocking and improving rural economy, and SFM applicability. Data from 5 different C pools of forests were estimated for the quantification of total organic C in 3 forest sites: Above and below ground biomass (AGB; BGB), litter, dead wood and soil. AGB C was estimated in sample plots on an INFC model, BGB C was calculated using specific root-to-shoot ratios (RSR), dead wood by field analysis (measurements of the diameter of dead wood >2.5 cm and the classification based on decomposition classes on a transect) followed by the application of a function to calculate the C stored; litter C stock through the ratio of organic C mass to surface area and SOC by collection of composite samples taken at 3 different depths (0-5 cm, 5-15 cm, 15-30 cm) and rock% and Bulk Density (BD) calculation, followed by SOC estimation through elemental analyzer.

Thanks to this analysis it was possible to calculate the total C content of the forest ecosystems and compare the C storage capacity of conventionally managed forest plots (unmanaged or coppiced) and plots under SFM (transitional forest).

Lessons learned

SFM supports C storage in the various forest compartments, (soil, biomass and necromass) increases the provision of ecosystem services, forest productivity, and contributes to climate change mitigation while providing support to the local rural economy

For further information contact

Marco Perrino, Project Coordinator, Italy, email: marco.perrino@dream-italia.net

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.co2marche.it/>





Assesing the efficiency of different prenvetion methods of pine pitch canker, and the creation of a manual with the good practices to follow in plant nurseries

Introduction

Pine pitch canker is a disease caused by the fungi *Fusarium circinatum*, which is a quarantine disease, that can lead to serious problems in the production of plants by the nurseries and a shortage in the availability of seeds. The fungi can be dispersed by wind, water and insects, however the most common way is by transporting/using seeds and plants that are infected but don't show signs and symptoms of the disease yet. This project had as its objectives the creation of standard procedures to disinfect the seeds, plant containers and the water used to irrigate. To achieve this goal various technics were tested in different pine specimens (*Pinus pinaster*, *Pinus pinea*, *Pinus radiata*, *Pinus sylvestris*), and their results were reported in a manual that summarizes the results of the different experiments and has the description of the techniques used with the most success. The success of the technique was measured by different factors, first of all was if the fungi was present after the treatment, then the germination rate, and for last, the size of the plants created. The methods that had a high success in the lab experiments were put to the test in the field, in this case the plant nurseries, to check their feasibility in the "real world".

The seeds are one of the most important ways of dispersion of the fungi inside a plant nursery, therefore the disinfection of seeds is a way to avoid and minimize the infection of plants by the disease. The treatments that will be described should be applied before the hydration of the seeds and after the treatments they are ready to be seeded. From the different approaches used the most successful ones were:

Heating water until 60°C and submerging the seeds for 15 minutes maintaining the water temperature;
Submerging the seed for 30 minutes in a solution of 20% H₂O₂ (Hydrogen peroxide);
Submerging the seeds for 5 minutes in a solution of 60% C₂H₆O (Ethanol) or 70% in the case of *P. pinea*;
Submerging the seeds for 5 minutes in a solution containing 1,9g of Captana (Captana 800 WDG) per liter of water.

From the different techniques used in the disinfection of the plant containers, hydrogen peroxide was the substance that showed the best results and didn't affect the growth of the plants. To achieve the expected result the containers should be submerged for 30 minutes in a solution of 20% H₂O₂ (Hydrogen peroxide).

To disinfect the irrigation water the treatments should be applied in the reservoir of the water that is going to be used. The most effective treatments were:

Applying 10,2 liters of Desogerme (Desogerme SP Vegetaux) per 1000 liters of water (1% solution) ;
 Applying 42 liters of Hydrocare (Intra Hydrocare) per 1000 liters of water (4% solution).

Pine bark is used a lot by plant nurseries as a soil component that gives porosity to the soil, however because it comes from a host plant it may contribute to the dispersion of the disease. Different components that can do the same function as pine bark were tested, the maximum percentage of each tested component in the soil are: 30% for Perlite (2-6mm), Polystyrene foam grains (8-12mm), ADT cork grains (1-2mm) and 15% “falca” (shredded cork from the first debark).

Lessons learned

From this project a standard procedure was created to combat the infection by *Fusarium circinatum* in plant nurseries. Various techniques were tested for the different ways of this fungi dissemination, which are, in the case of plant nurseries, by infected seed, plant containers and the water used in irrigation. The ones that were effective in the elimination of the fungi and didn't affect the germination rate or plant growth, were summarized and described in detail.

All the results of the different case studies allowed the creation of different scientific articles, in this way sharing the results with the academic and scientific community. And the creations of a manual, easily available to plant nurseries workers with the methods tested.

This manual “Technical manual for the suppliers of forestry reproduction materials - Prevention of pine pitch canker” (“Manual técnico para fornecedores de materiais florestais de reprodução - Prevenção do cancro-resinoso-do-pinheiro”) is available online and printed. It was freely distributed to forest owners associations, diverse entities related forestry and plant nurseries, which allows the information to reach its target audience.

For further information contact

info.projetos@icnf.pt

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.inia.pt/projetos/prevcrp#:~:text=Com%20este%20projeto,%20pretende-se%20desenvolver%20estrat%C3%A9gias>





Index of Biodiversity Potential (IBP): a practical tool for forest managers

Introduction

The IBP was created in 2008 (Larrieu & Gonin, 2008) in order to help forest managers to take into account ordinary taxonomic biodiversity into routine management. It is an indirect and composite indicator which pools ten factors, identified as influencing the capacity of forest stands to support animal, plant and fungal species.

Presentation of the Index of Biodiversity Potential tool

IBP scoring is simple, fast and requires no particular taxonomic knowledge. In practice, it suffices to go through the stand by counting the elements relating to each of the ten factors and to give a score between 0 and 5 for each one. The sum of these scores gives the IBP and helps to place the stand in a range from low to high capacity.

The IBP is usable in a range of contexts, as much in productive forests as in areas given over to conservation. It can also be used as a teaching aid in that it permits making certain principles that govern taking biodiversity into account easier to understand.

The sampling method is chosen according to the objectives and the characteristics of the forest, the best way is to score IBP at the same time as another operation in the forest. For example, IBP can be scored during the visit of a stand before a thinning.

The IBP will help the manager to identify the elements favourable to biodiversity to be preserved, in particular the trees of biodiversity interest, and the factors that could be improved. A radar diagram created with IBP scores is a good way to identify these differences between the factors.

A few ways to improve each factor are proposed in the IBP educational document (Emberger et al., 2016). More generally, the diversity of ordinary species can be improved by multiplying the living habitats corresponding to the ten factors, and by ensuring their continuity, in time and space.

In the end, the IBP gives the manager a new look at the forest, and this is the reason why the IBP is often used to explain biodiversity, not only to professionals but also to owners and more generally to all people concerned with forest biodiversity.

Lessons learned

The IBP was created in France, for all types of forests in the different biogeographical regions. Soon after, the stakeholders from different European and Mediterranean countries made clear their interest in acquiring an IBP definition adapted to their own contexts. For this purpose, a methodology was proposed and an international organisation was created: the International Committee of Experts. This Committee ensure the consistency of IBP extension projects, (i) by providing scientific and technical advice on new IBP versions, (ii) by discussing ongoing projects, (iii) by pooling resources.

The first IBP extension was carried out through two Life projects: BIORGEST in Catalonia and GoProFor in Italy. Currently, this extension continues for the whole Spain and Greece through Life GoProFor Med project, while other countries are also testing IBP.

Thus, these programmes help to create synergy at the international level on a common issue: the consideration of biodiversity in forest management.

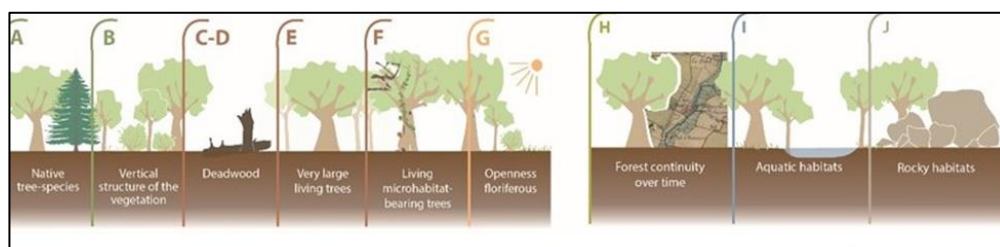


Figure 1. The 10 factors of the IBP (following Emberger et al., 2016). 7 factors related to stands and forestry management (from A to G) and 3 factors related to context (from H to J). ©CNPF

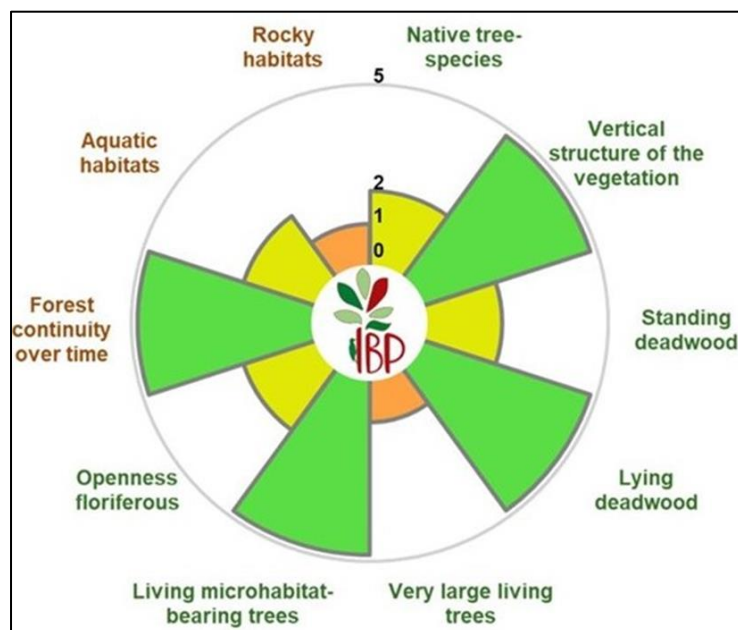


Figure 2. An example of the radar diagram for the Index of Biodiversity Potential (IBP) ©CNPF

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.cnpf.fr/nos-actions-nos-outils/outils-et-techniques/ibp-indice-de-biodiversite-potentielle>



Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.		Website FOREST4EU Project FOREST4EU Project info@forest4eu.eu
--	--	---

Biomass accounting for Sustainable Forest Management Plans using UAV data

Introduction

Forest biomass and carbon play a crucial role in the development of strategies aimed at implementing multi-objective forest management plans. Estimating forest biomass is essential for assessing carbon sequestration and the potential carbon balance of forest ecosystems. Forests, acting as significant carbon sinks, provide a valuable means to reduce atmospheric carbon levels. Accurate estimation of carbon stored in forests is vital to support climate change mitigation efforts and facilitate the transition to a low-carbon economy.

Recent research activities have shown great potential in using 3D data derived from images captured by unmanned aerial vehicles (UAVs) for forest biomass estimation. This approach has proven to reduce costs and improve estimation accuracy. In the context of OG SURF, UAV photogrammetric data was acquired using an RGB camera in five tested areas (Vallombrosa, Monte Morello, Rincine, Grosseto, Maesano, Pizzorne) to serve as a basis for extracting predictors of forest biomass. OG SURF has been working on this, as estimating forest biomass is crucial for quantifying carbon credits and additionality within the voluntary carbon market, which is currently the only available market in Italy. Additionally, establishing standard procedures for estimating business-as-usual carbon stocks is necessary according to many voluntary carbon market standards.

The UAV data provided very high-resolution data with a derived 3D point cloud density of 50 points/m², allowing for the creation of a Canopy Height Model (CHM) using an available regional LiDAR dataset for normalization. For each of the tested areas, a high-resolution biomass map with a spatial resolution of 23x23 m was derived using a model approach. The map was created by using forest inventory plots as input data, predictors calculated based on the CHM, and high-resolution forest tree species maps. In each tested area different types of spatialization models were tested, including both parametric (linear) and non-parametric models (random forest and k-nn), in order to develop the best model for estimating the biomass.

The generated maps were then validated through ground surveys and implemented into the Decision Support System Platform developed by OG SURF. This resulted in the first high-resolution biomass map for the study area, which can be used in conjunction with additional layers derived in OG SURF for various analyses in order to establish multi-objective forest management plans. The derived high-resolution biomass map is available within the Decision Support System Platform developed in the context of OG SURF.

Lessons learned

UAVs provide reliable predictors of biomass. The test areas exhibit diverse forest types and topography, and the Root Mean Square error obtained through the model approach is consistent across all areas. This indicates that the instrument's applicability can be beneficial in various contexts.

In the tested areas, the biomass map is highly accurate, as it is calibrated to the specific area. The map offers spatial information that cannot be generated using traditional data sources. It enhances the optimization of forest interventions and provides greater precision. Forest managers in the tested areas have emphasized that the biomass map serves as a valuable starting point for considering carbon credits and designing the business-as-usual scenario.

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.go-surf.it/>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI		 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	--	--	---



Keys for Forest Types Classification Schemes to support the reporting of Support Sustainable Forest Management Indicators in Various Contexts

Introduction

Tree species composition is a crucial indicator for sustainable forest management. It allows for the assessment of forest practices and ecosystem health. It provides valuable information on biodiversity, carbon sequestration, forest health, and social and economic benefits.

Tree species composition refers to the types and distribution of tree species within a forest area. It plays a vital role in determining forest structure, function, and ecosystem services. The composition of tree species directly impacts forest biodiversity, as different species provide habitats for various organisms. It also influences the productivity and resilience of the forest, as certain species may be better adapted to specific environmental conditions or exhibit different growth rates.

Understanding tree species composition is essential for promoting sustainable forest management. It helps identify potential threats, such as invasive species or imbalances in species diversity. It also informs decisions related to forest restoration, conservation, and the promotion of specific tree species for particular objectives, such as timber production, carbon sequestration, or habitat conservation.

However, when it comes to Sustainable Forest Management Indicators, different organizations may require different classification schemes for forest tree species. This can pose a challenge for forest managers when reporting data. Therefore, it is important to provide them with user-friendly tools, such as keys or tables, that facilitate the transition between different classification systems and make the process easier for them. GO-SURF, in response to this challenge identified by forest managers involved in forest management plans, has attempted to solve this issue in the Tuscany Region where four different forest types classification schemes are established. These include the European Forest Types classification scheme, the Tuscany Forest Types Classification Scheme, the National Forest Inventory Classification Scheme, and the Corine Land Cover Italy 4-level classification Scheme. In this context, GO-SURF has developed user-friendly tables in collaboration with experts to guide forest managers in classifying forest types according to the different nomenclature systems. This allows forest managers to use the forest types classification system with which they are most familiar, and then use the table to transitioning the types from one system to another. This facilitates the reporting of various Sustainable Forest Indicators in different contexts, such as at the European, national, and regional levels, as required by different authorities.

Lessons learned

In the context of the Tuscany region, the inconsistency of forest classification systems has been identified as a problem by forest managers, leading technicians to duplicate their work in classifying forests. This also sometimes results in the use of different systems that are not comparable. The initiative to develop keys for transitioning between different classification systems has been well received by managers involved in the OG, and these keys are now being utilized by others OG of the project, as they are made available on the GO-SURF website.

This issue has also been observed in other Italian contexts, including forest inventories, where different countries employ different classification systems. For biodiversity monitoring, GO-SURF has emphasized the need for standardization efforts, even through simple solutions such as transition tables.

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.go-surf.it/>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for the content.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI		 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
---	---	--	---



The ARCHI method: a tool for diagnosing the vitality of trees

Introduction

Vitality of trees is conditioned by genetics, as well as by two fluctuating factors: aging on the one hand and environmental constraints on the other. Diagnosing vitality is therefore a question of defining both the stage of development and the physiological state. We are able to calculate the age of a tree by counting the rings on a core of wood taken from the base of the trunk. The trouble is that this chronological age is not correlated with development. How long does the youth stage, adult stage and maturity last? Moreover, the classic measurements of diameter and height are of no help, the oldest subjects not being systematically the largest or the tallest. However, the architecture of a tree, that is to say the way in which it is built and repaired, constitutes a real biological signature of its vitality, this is the principle of the ARCHI method.

ARCHI methodology and typology

Vitality of trees is conditioned by genetics, as well as by two fluctuating factors: aging on the one hand and environmental constraints on the other. Diagnosing vitality is therefore a question of defining both the stage of development and the physiological state. We are able to calculate the age of a tree by counting the rings on a core of wood taken from the base of the trunk. The trouble is that this chronological age is not correlated with development. How long does the youth stage, adult stage and maturity last? Moreover, the classic measurements of diameter and height are of no help, the oldest subjects not being systematically the largest or the tallest. However, the architecture of a tree, that is to say the way in which it is built and repaired, constitutes a real biological signature of its vitality, this is the principle of the ARCHI method.

The vitality of a tree must constantly be evaluated. After planting, to judge the quality of the resumption of growth; during development, to adapt the type of pruning, its frequency and its intensity; following an environmental constraint, to anticipate the reversible or irreversible nature of a decline; at the time of a mechanical diagnosis, to estimate the physical resilience capacity of a subject deemed to be fragile; also at the end of life, to recognize the natural or premature nature of mortality.

Six physiological states are assigned to the young, adult and mature stages of development.

The senescence inevitably leads to a natural death.

- **Healthy:** a tree without any significant symptom of crown degradation and whose architecture is in accordance with its development stage.
- **Stressed:** a tree that undergoes stress, which can be seen by changes in its architecture (impoverishment of ramification, mortality, possibly the appearance of epicormic shoots, etc.), without it being possible for the observer to instantly decide on its future restoration or further degradation, based on the assessment.
- **Resilient:** a tree whose crown development resumes normal architectural dynamics, after a deviation from the normal. This is mainly thanks to the development of orthotropic epicormic shoots in the upper canopy.
- **Crown retrenchment:** a tree in the dynamic formation process of a new, secondary crown below the original canopy, which eventually dies.
- **Fallback:** a tree that does not have a living upper canopy but continues to function with unaltered lower branches from its original structure. The tree does not form a secondary crown, so it is not in a crown retrenchment process.
- **Irreversible decline:** a tree with a degraded crown (impoverished ramification, abnormal mortality) without any viable restoration process (epicormic shoots are almost absent or, on the contrary, abundant but (almost) all of the ageotropic type).

Lessons learned

The ARCHI method is aimed at foresters, ecologists, arborists, teachers and researchers. There is a good correlation between the six physiological states and the width of the wood rings or the NDVI index (Normalized Difference Vegetation Index) measuring the photosynthetic activity of the foliage. For several tree species, a dichotomous ARCHI key has been developed in order to support, facilitate and objectify the architectural analysis of individual trees. These keys are tree species specific. Currently (2023) ARCHI keys are available for the 18 following species: *Quercus* (*robur*, *petraea*, *pubescens*, *ilex*, *suber*), *Fagus sylvatica*, *Platanus x acerifolia*, *Castanea sativa*, *Cedrus atlantica*, *Pinus pinaster*, *Pinus sylvestris*, *Pinus nigra* (*ssp. nigra*, *ssp. laricio* var. *corsicana*, *ssp. salzmannii*), *Abies alba*, *Pseudotsuga menziesii*, *Picea abies*.

The ARCHI keys can be downloaded from: <https://www.cnpf.fr/archi/>.

An app based on the principle of ARCHI keys, which can be used on tablets and phones, is under development.

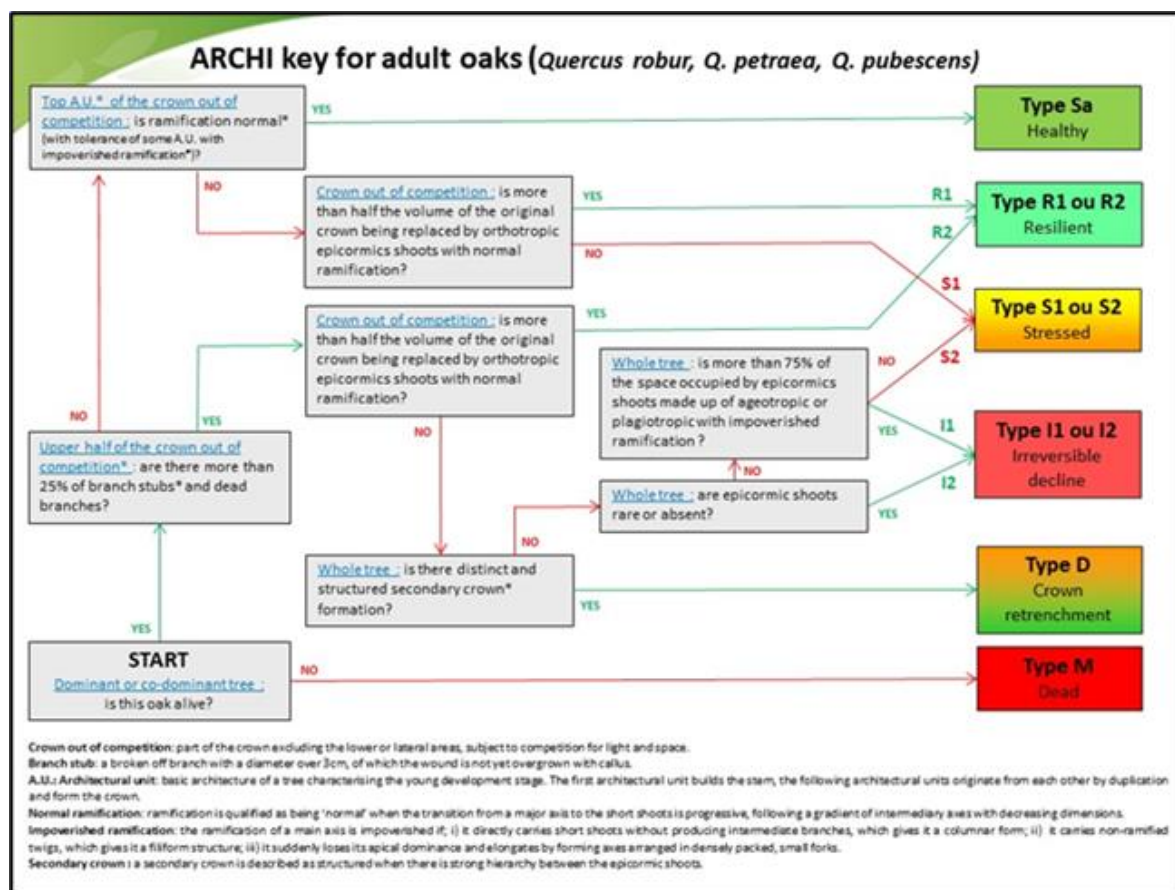


Figure 1. Presentation of the ARCHI key for adult oaks (*Quercus robur*, *Q. petraea*, *Q. pubescens*).

©CNPF

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.cnpf.fr/nos-actions-nos-outils/outils-et-techniques/archi>



Funded by the European Union

Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.

REPUBLICA FRANÇAISE

CNPF

FOREST4EU

FOREST4EU Project

FOREST4EU Project

info@forest4eu.eu

Website



Vigil'encre: participatory science tool for epidemiological surveillance of chestnut ink

Introduction

Chestnut ink disease is transmitted by roots. Pathogens are soil microorganisms originating from Asia introduced to Europe at the end of the 19th century. INRAE scientists have developed a Vigil'encre application to provide information on chestnut tree diseases, identify symptoms and report the location of affected stands. Vigil'encre is available on download platforms. Vigil'encre users thus participate in research carried out by INRAE on chestnut ink.

Presentation of the Vigil'encre application

The Vigil'encre application is intended for owners of forest plots or chestnut orchards, but also for all forest users and the general public.

It is organized around three functions, which are:

- Inform about chestnut tree diseases;
- Identify symptoms and diseases;
- Report chestnut trees showing symptoms.

On the Vigil'encre homepage (Fig. 1A) there are several windows and documentation on the chestnut tree (biology, distribution, use, recognition), ink disease, other diseases (chestnut canker, *Phytophthora ramorum*, Cynips). An owner, technician or forest manager wishing to have help in establishing a diagnosis on their dying chestnut trees can use the "identify" function (Fig. 1B). The symptoms observed can thus be compared to those illustrated in Vigil'encre. For ink, symptoms can be observed at the roots or crown, at the trunk or leaves. Possible confusion with other diseases or symptoms is indicated on the home page (Fig. 1A). By opening the "Report" page (Fig. 1C), it is possible to report symptoms attributable to ink, Canker and Cynips.



Figure 1. Presentation of the different modules of Vigil'encre designed to meet the tool's three functions (inform, identify, declare).

©INRAE

For each problem, precise information is requested on the site where the report is made and the type of chestnut tree stand. It is possible to geolocate the report and submit photos of the symptoms observed. This information will make it possible to confirm the diagnosis carried out and to populate a database. To confirm the diagnosis, INRAE offers Vigil'encre users the possibility of sending soil and/or plant samples in order to carry out a diagnosis in the laboratory. The procedures to follow are detailed on the homepage. The map of the reports made is also provided (Fig. 2).



Figure 2. Mapping of alerts issued on Vigil'encre.

©INRAE

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://ephytia.inra.fr/P/157/Vigilence>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.		 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	---	--



Marteloscope

Introduction

A marteloscope is a practical tool for training in silvicultural management. In groups, participants walk through a forest plot and simulate thinning by choosing the trees that they think should be cut (hammering). Software then makes it possible to simulate the impact that this cutting would have on the forest: economic profitability, improvement in the quality of the wood in the long term, preservation of biodiversity, etc.

Methodology and results

The size of a Marteloscope should be fixed to 1 hectare with side lengths of 100 x 100 m. Size and form should be tailored to the planned use of the Marteloscope and the geography and local conditions. So, they may in exceptional cases differ from the regular rectangular shape.

A 1 ha plot (chestnut, oak and beech stand) for the marteloscope has been located in Corrèze at Meilhards. This site is now operational to welcome groups and to carry out hammering exercises (first day in April 2023).

In addition, 10 reference sites have been located in Dordogne. The interest of these reference sites is that they present a great diversity of types of chestnut stands (pure and mixed) of all ages as well as different types of management applied (renewal with stump crushing for example).

The interest of martelosopes and reference sites is that they represent a practical tool for training in silvicultural management.



Figure 1. Example of the marteloscope tool, a training programme designed to analyse hammering. Sylvain Gaudin © CNPF

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

gregory.sajdak@cnpf.fr

<https://ec.europa.eu/eip/agriculture/en/find-connect/projects/sylviculture-de-pr%C3%A9cision-en-nouvelle->



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 	 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu	Website 
--	---	--	--



Label Bas Carbone: a national forest carbon offsetting framework

Introduction

Carbon sequestration is an ecosystem service that forests and foresters provide to society. This action focuses on assessing the forest carbon balance of the Fumel area.

Methodology and results

A study on the wood resource was conducted in 2014 on the territory of the community of municipalities of Fumel Vallée du Lot and Montflanquinois. Having such data for this territory is valuable: these measurements were re-mobilized in the framework of the SPNA project to derive information on the "carbon balance" of local forests. The calculations show carbon stocks of 931 ± 120 thousand tons of carbon in the biomass and 672 thousand tons of carbon in the soil and litter. The flux study shows that the territory's forests are still a net carbon sink, although the dieback of chestnut coppice is a concern and could turn local forests into carbon sources.

The LBC is a French standard for carbon offsetting projects. It is used to label the contribution of companies and communities to CO₂ sequestration projects in the forest.

Currently there are 3 validated methods for labeling forest carbon offset projects:

- Afforestation of agricultural land or bushy wastelands;
- Reconstitution of degraded forests (storm, fire, intense dieback);
- Conversion of good thickets into high forests on stumps.

The community Fumel Vallée du Lot also sees it as an opportunity to promote the renewal of dying chestnut trees, as the forest is an important local resource for many businesses.



Figure 1. Label Bas Carbone post fire planting. Bernard Petit © CNPF

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

olivier.gleizes@cnpf.fr

<https://ec.europa.eu/eip/agriculture/en/find-connect/projects/sylviculture-de-pr%C3%A9cision-en-nouvelle-aquitaine.html>



Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.		Website FOREST4EU Project FOREST4EU Project info@forest4eu.eu
--	--	--

Specific silvicultural itineraries to optimize the production of quality timber and economic yield of *Pinus pinaster*

Introduction

Four silvicultural scenarios have been developed that take into account timber quality. The silvicultural scenarios are:

Standard silvicultural scenario (M2): In the M2 silvicultural scenario there will be timber harvesting in 3 thinnings and in the final felling.

Short shift silvicultural scenario with subsidies (M4): In the silvicultural scenario M4 we will have timber harvesting in 1 thinning and in the final cut.

No management silvicultural scenario (M8): The no management silvicultural scenario from the initial planting, with a density of 1250 trees/ha, must assume that there is natural mortality, at least in the poorer seasonal qualities. This effect can be of the order of 10-20 % in number of trees of about 5-10 % in volume at the end of the shift. In this analysis we have assumed it to be 10 % in volume, although this may be lower than values that may occur in reality. We also assume it to be uniform across all grades, although it may be more logical to assume a higher incidence in smaller individuals. In the silvicultural scenario M8 we will only have timber harvesting in the final cut.

Multi-product silvicultural scenario (MG2): For the MG2 silvicultural scenario, two possible alternatives will be considered, with plantation and with natural regeneration, which means two totally different economic scenarios.

MG2 with plantation: In the silvicultural scenario MG2 we will have timber harvesting in 2 thinnings and in the final cut.

MG2 with natural regeneration followed by thinning after 5 years: In the MG2 silvicultural scenario with natural regeneration we will have timber harvesting in 2 thinnings and in the final felling.

Lessons learned

Four silvicultural models have been developed taking into account timber quality. The main conclusion we can draw from this economic analysis is that the minimum site quality that ensures economic profit is in medium sites (dominant height from 16 m to 20 years) for any silvicultural scenario of prices and interest on money. In lower quality sites it is only possible to obtain profitability if good natural regeneration is possible and with the help of subsidies for non-self-financing treatments. The next conclusion is that the silvicultural scenario MG2 is the best in all qualities and scenarios, except for quality 7 m with an interest rate of 2 %. With this silvicultural regime a higher profitability is achieved than in the M2 scenario, the second best in all cases, but with the advantage of needing 5 years less to achieve it and it is also achieved with one less silvicultural action. If we compare the MG2 scenarios with and without planting, it shows that natural regeneration is more profitable, mainly because of the savings from not having to plant, which is more expensive than the thinning that has to be done with natural regeneration.

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.sigcamaderadecalidad.info/>

José Luis Villanueva, Project coordinator, Cesefor, e-mail: joseluis.villanueva@cesefor.com



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 FORESTRY HEART, research 4 EU	 Gestión Forestal para Bosques de Madera de Calidad	 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu	Website 
---	--	---	---	--

Mapping of forest roads to support touristic activities

Introduction

Mapping forest roads is important for various aspects related to sustainable forest management. In the context of guiding forestry companies towards multifunctionality beyond just production, especially if aiming for certification under PEFC and FSC standards for forest services, it is necessary to map and keep records of other indicators, including forest road infrastructure and their functionality. In this context, expediting the mapping of existing forest roads and identifying potential issues is crucial for intervention.

From a tourism and accessibility perspective, it is also essential to determine which means of transportation can be used on these roads (walking, biking, accessibility for people with disabilities). In this context, GO-SURF, in its test areas, used GNSS receivers to map existing roads and classified them based on their functionality, thereby preliminarily identifying existing and potentially accessible routes, while also identifying any maintenance issues.

The result led to the mapping of the existing road network and its condition, which is a prerequisite for identifying additional trails to open up within the forest.

Lessons learned

Using low-cost GNSS receivers and/or mobile app development, it is indeed possible to map forest road infrastructure quite easily. Unfortunately, due to a lack of management over the past 30 years, some of the old routes and trails have been lost in certain areas. This discrepancy has resulted in a reduced level of existing and usable road infrastructure for tourism purposes compared to what was expected based on regional technical maps.

However, looking to the future, with the assistance of GNSS receivers, it will be possible to identify additional potential routes to be opened up.

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.go-surf.it/>





Funded by the European Union

Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for



UNIVERSITÀ DEGLI STUDI FIRENZE
DAGRI
DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI



 FOREST4EU

 FOREST4EU Project

 FOREST4EU Project

 info@forest4eu.eu

Website



Support multi-object forest management plans through easy-access information

Introduction

To support sustainable forest management aimed at maximizing ecosystem services through new silvicultural practices, it is essential to have access to a range of information that enables forest managers to quickly retrieve data, with the ultimate goal of achieving certification for ecosystem services.

In this context, PRI.FOR.MAN, which has developed a decision support system in the Friuli Venezia Giulia region, provides various user-friendly graphical interface access to diverse information. In this context PRI.FOR.MAN DSS provide user-friendly information regarding (i) the Forest Types Categories that define the classification of forested areas based on specific criteria such as land use, productivity, conservation; (ii) Availability of Existing Forest Management Plans, that outline strategies and objectives for the sustainable management of forest resources in a specific area, that guide management actions over time; (iii) Forest Roads: The network of forest roads is vital for accessibility and forest area management not just for wood mobilization but also for touristic activities; (iv) Annual Growth of wood: This value indicates the average annual growth of forest resources and influences the capacity of resource renewal; (v) Presence of Disturbances: This may include events like fires, diseases, or insect infestations that affect tree health and require specific management actions; (vi) Environmental Constraints: These encompass considerations related to environmental conservation and protection, (vii) Protective Role of Forest Vegetation: This concerns the significance of forest vegetation in providing ecosystem services such as soil protection and water cycle regulation; (viii) Location of Biotopes, Parks, and Regional or State Reserves: These are ecologically significant sites or protected areas requiring special management for biodiversity conservation; (ix) Natura 2000 Sites: These are designated sites within the European Union's Natura 2000 network, necessitating specific conservation and development measures based on prevailing regulations.

All these elements are fundamental for sustainable forest management, which aims to balance the utilization of forest resources with the conservation of the natural environment. They provide essential information for forest managers to develop multi-objective forest management plans and actions that are not only linked with wood mobilization but also with biodiversity conservation, tourist activities, and the monitoring of forest health. Before the PRI.FOR.MAN, this information was already available online but scattered across various local authority websites. The PRI.FOR.MAN project has allowed for the consolidation of these data into a single container, the Decision Support System (DSS), designed specifically for the forest context.

Lessons learned

Harmonizing information and making it available in user-friendly systems is crucial to ensure data accessibility. Otherwise, users trying to navigate across different portals may struggle to access the information, leading to its underutilization. Without the use of information, it becomes challenging to plan multi-objective management strategies, and there's a risk of abandonment of forested areas.

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

Giorgio Alberti, Professor, University of Udine, Italy, e-mail: giorgio.alberti@unud.it

Luca Cadez, University of Udine, Italy, e-mail: luca.cadez@uniud.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

https://lookerstudio.google.com/u/0/reporting/2f6c2f81-b78f-446c-ab07-96571d7b6984/page/p_w5k3gvls6c



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGROALIMENTARI, AMBIENTALI E FORESTALI	 PRI.FORE.MAN. Shared Private FOREst MANAGEMENT in Eastern Alps	 FOREST4EU in FOREST4EU Project y FOREST4EU Project info@forest4eu.eu Website 
---	--	---	--

Community forest arrangements as ideal instance for the realization of the profit- sharing model of PRIFORMAN Project

Introduction

Community forest arrangements are tools for the development of business networks in forestry sector, to valorise public and private agro-silvo-pastoral lands, encourage provision of ecosystem services and conservation.

They're among the instruments recommended by the TUFF and other provisions of the Italian legal system for the associated management of forests. They offer the possibility of participation not only to companies, but also to small forest owners, regardless of the size of the area of land. This enables small forest owners to "join forces" to manage their forests and possibly outsource their management, thus overcoming the problem of 'inactive' owners (lack of physical presence of owners in the area), the problem of 'fragmentation' of forests properties and the possible lack of forestry management knowledge.

The creation community forest arrangements, with the application of the profit-sharing model created by PRI.FOR.MAN, gives the possibility of an allocation of profits not limited to timber extraction, but provided by multifunctional management based on the desiderata of the contractors and the reference regulations. This binome 'community forest agreement - profit-sharing model represents a sustainable model both from the economic point of view (as it allows not only a reduction in costs, but also an increase in profits), the environmental point of view (as it ensures proper management of forests), and the social point of view (as it represents a form of participatory forest management, which could also help to maintain the population of mountain areas).

From the social and technical meetings held during the project emerged some critical issues that need to be addressed in the project follow-up. The first difficulty encountered was to contact all the forest owners. Afterwards was noticed a general owners' mistrust in delegating the management of their funds to third parties for prolonged periods of time, even in the face of clear and reliable legal and technical instruments. Moreover, they showed a common preference to sell the standing forest in order to have a high periodic income rather than opting for an annualisation of profits from shared management, and the preference of purchasing contracts with utilisation companies for individual utilisations, rather than the possibility of taking multi-year management with the associated risks.

During the PRI.FOR.MAN project was produced the contract proposal with the application of the profit-sharing model, but it still need to be signed up by forest owners. The now ongoing NET4GO Project, in Veneto, will focus on putting into practice this innovation.

Lessons learned

Community forest arrangements are multifunctional tools that provides economical, environmental and social, allowing to overcome many difficulties linked to forest management. They're the most suitable instrument for the implementation of the profit-sharing model devised within the Project and for the success of community forest management. However, to be applied and overcome the general owners' mistrust it's highly necessary to explain the given possibilities, by giving examples of realities that achieved positive outcomes (D'Adderio, 2023).

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

Giorgio Alberti, Professor, University of Udine, Italy, e-mail: giorgio.alberti@unud.it

Luca Cadez, University of Udine, Italy, e-mail: luca.cadez@uniud.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

https://lookerstudio.google.com/u/0/reporting/2f6c2f81-b78f-446c-ab07-96571d7b6984/page/p_w5k3gvls6c





Funded by the European Union

Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.



UNIVERSITÀ DEGLI STUDI FIRENZE
DAGRI
DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI



FOREST4EU

PRI.FOR.MAN.
Shared Private FOREST MANAGEMENT in Eastern Alps

 FOREST4EU Project
 FOREST4EU Project
 info@forest4eu.eu

Website



Sharing-profits methodology for community forest arrangement

Introduction

The economical objective of PRI.FOR.MAN Project was to develop a new sharing-profit methodology to recognise the adequate profit from timber harvesting to each private forest owner in the context of community forest management.

The concept of "condominium" associated with forest areas has already been used in some initiatives of shared forest management, but in this case the innovation regards the method of profit-sharing. In fact, the easy profit-sharing method by adopting a millesimal system, thus based on surface area alone (similar to that used in condominium management), would have penalised small owners, who represent a very significant portion in the Italian context. In order to reach forest owners it's necessary to guarantee them a congruous timber annual payment that could induce them to assign the management of their area to an external logging company (private or public). On the other hand it's necessary to guarantee the external manager adequate financial reward for timber logging and harvesting.

The wood stock is determined by using drone and photogrammetry, then its effective value is expressed in function of the main relevant variables: accessibility, assortments and timber market value.

With regard to the annual quota due to each owner, it is made up of two components: a fixed one and a variable one. The fixed one is directly proportional to the surface of the shared forest (and will tend to be low), while the variable component is directly proportional to the ratio between the volume of each individual parcel (V_{ui}) and the total volume of the forest area. Some issues about the application of the sharing-profits methodology emerged in the case study in Tarvisio and need to be addressed in the project follow-up. Forest owners showed a common preference to sell the standing forest (in order to have a high periodic income rather than opting for an annualisation of profits from shared management), and the preference of purchasing contracts with logging companies for individual utilisations (rather than the possibility of taking multi-year management with the associated risks).

Lessons learned

The application of the sharing-profits methodology created by PRI.FOR.MAN gives the possibility of an allocation of profits not limited to timber extraction, but provided by multifunctional management based on the desiderata of the contractors of the community forest agreements and the reference regulations. It represents a sustainable model both from the economic point of view (as it allows not only a reduction in costs, but also an increase in profits), the environmental point of view (as it ensures proper management of forests), and the social point of view (as it represents a form of participatory forest management, which could also help to maintain the population of mountain areas). Even if underlying this proposal there is a careful assessment of available forest resources, a planning of their utilisation and timber market evaluation, still social awareness that need to be implemented because it's not easy to face the initial mistrust of the forest owners.

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

Giorgio Alberti, Professor, University of Udine, Italy, e-mail: giorgio.alberti@unud.it

Luca Cadez, University of Udine, Italy, e-mail: luca.cadez@uniud.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

https://lookerstudio.google.com/u/0/reporting/2f6c2f81-b78f-446c-ab07-96571d7b6984/page/p_w5k3gvls6c



Creation of clonal seed orchards for the conservation of Douglas-fir germplasm

Introduction

Many Douglas-fir stands are more than sixty years old, and traditional silvicultural approaches cannot be separated their regeneration from the availability of suitable seedlings. At present, Douglas-fir seedlings are mainly purchased from foreign nurseries, which does not always guarantee their suitability/adaptability to the Tuscan environment. For this reason, it is essential to have FRM of high phenotypic, genetic and adaptive quality suitable for the Tuscan areas. In order to qualify the regional forest nursery chain for the production of Douglas-fir planting stock, it is important to introduce innovation and quality into the Tuscan nursery chain of this species. With the technical support of CREA-FL (Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria Foreste e Legno), the Do.Na.To project has created two clonal seed orchards, located at two contrasting altitudes above sea level, for the conservation of Douglas fir germplasm starting from material selected within the best phenotypes of the IUFRO field experiment of provenances and progenies, located at Faltona (Arezzo) and Vallombrosa (Firenze), and constituting the reference for the ex-situ germplasm bank at national and international level. Scions collected from superior phenotypes were collected from the most higher branches in the crown and used for these clonal seed orchards. They were created on public land managed by the Unions of Mountain Municipalities of Mugello and Pistoia Apennines. These grafts will assure Douglas fir germplasm conservation and the medium- long term supply of genetically tested propagation materials.

Lessons learned

Genetic conservation and production of high-quality propagation material is very important for Douglas-fir, as it is usually managed by strip clear-cutting followed by seedling plantation (strongly integrated by natural regeneration in good seed years). Instead of buying seedlings from abroad, it's very important to reduce the chance of pest introduction by FMP and guarantee the conservation of local adapted genetic material, especially in the current context of climate change.

For further information contact

David Pozzi, Project manager, Italy, e-mail: davidpozzi@agro-dendrostudio.it

Sabrina Raddi, Professor, University of Florence, Italy, e-mail: sabrina.raddi@unifi.it

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.progettodonato.it/>





Funded by the European Union

Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.



UNIVERSITÀ DEGLI STUDI FIRENZE
DAGRI
DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI



Do.Na.To.
Douglasie Naturali Toscana

 FOREST4EU

 FOREST4EU Project

 FOREST4EU Project

 info@forest4eu.eu

Website



Good practices in Do.Na.To Project communication and technical formation

Introduction

Forestry innovative projects are very important from a technical, operational and even experimental point of view, but if there is no way of transferring the knowledge and the scientific results obtained to the territory and to the supply chains, they are an end in themselves. For this reason, the importance of communication on the management of Douglas fir forests has proved to be crucial for the dissemination of knowledge and innovation in Tuscany, a region where this species has a long history of over 100 years of silviculture and still a great potential.

Within the Do.Na.To. project, Compagnia delle Foreste, a publishing company specialised in the forestry sector, was the partner in charge of communication, with the aim of reaching as many stakeholders as possible through various information products and platforms. In particular, it took care of the image of the operating group and provided information on the activities carried out and the results achieved through: website, newsletters, brochures, interviews and videos.

The Accademia dei Gergofili also organised three conferences to promote the initial, intermediate and final results of the project, with publication of the proceedings attended by academics, researchers and forest managers on the themes of: The role of Douglas-fir in climate change mitigation and adaptation; Future perspectives for Douglas-fir cultivation in Tuscany; Valorisation of Tuscan Douglas-fir wood products; Revitalisation of the Tuscan regional nursery for the production of quality seedlings; Historical Vallombrosa stands contribution to the Do.Na.To. project; Demonstration areas for natural regeneration of Douglas-fi. In addition, in order to stimulate knowledge acquisition within the partnership, a series of guided tours were organised in Germany to show demonstration sites to stakeholders with the aim of learning new knowledge about Douglas fir management and exchanging views with experts from other European countries.

This was very important to visualise the medium to long term effects of the silvicultural protocols applied and to obtain detailed information on the possible impacts of Douglas fir management.

Lessons learned

The contacts and experience gained by the partners are an important asset, as are some communication products that, by highlighting the potential of the species and the know-how acquired, will be able to publicise the results of Do.Na.To. and the experts who contributed to it, even after the project has ended. Good communication is certainly useful for involving partners and stakeholders. The project was successful and had a very structured communication strategy, which gives it a good chance of being replicated in other Italian and Mediterranean contexts.

For further information contact

David Pozzi, Project manager, Italy, e-mail: davidpozzi@agro-dendrostudio.it

Sabrina Raddi, Professor, University of Florence, Italy, e-mail: sabrina.raddi@unifi.it

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.progettodonato.it/>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNICHE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI	 Do.Na.To. Douglasiete Naturali Toscana	 FOREST4EU Website  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu 
---	---	---	---



FOREST4EU partner: UNIFI

OG: SURF

OG's country: Italy

Type of Innovation: Social

GO SURF: decision support system for a participatory approach to forest management

Introduction

The European Forests, Biodiversity and Social Strategy, together with the Italian National Forest Strategy, recognize the critical importance of sustainable forest management in addressing new challenges. These challenges include the increased severity and frequency of natural disturbances such as windstorms, droughts, and insect infestations, as well as the diverse and sometimes conflicting social demands placed on sustainable forest management and forest systems. So, it is essential to engage both public and private forest owners and forest company and civil society in the decision-making process give them also access to stadardized information regarding forest resources.

Among the possible innovations useful to the sector, Decision Support Systems for Forestry (DSSF), which are complex computer systems designed to assist users in decision-making processes through a set of tools, data, and analysis models, are recognized as an important tool for the implementation of forest management for the provision of multiple ecosystem services. In fact, FDSS represent a useful tool for enhancing the environmental, economic, administrative, legal, and social aspects associated with sustainable forest management.

However, despite the availability of advanced technologies, in the past, other examples of Forest Decision Support Systems (FDSS) have disappointed end users' expectations, mainly because their use was limited to experts due to excessive complexity or logic that deviated from the users' perspective. This often highlighted how the gap between the world of research and practical application is seen as one of the reasons why SSDs are not effectively implemented.

In this context, OG SURF adopted a participatory approach in the development of the DSS, allowing for open dialogue among all stakeholders involved in forest management and the creation of a system based on the actual needs of identified users. It should be noted that, on the scientific side of the partnership, it would have been possible to develop a more complex system. However, this would have risked not being adopted by the target users because it would have been too complicated and less relevant to their actual needs. In this approach, every phase of system development was discussed to ensure it met the real needs of users. In details, for the development of the SSDF, the four key components were examined: the problem analysis system, the knowledge management system, the results presentation system, and the development language. The four key components were analyzed recursively to guide the development process, employing a participatory approach for each of them. Firstly, the "problem analysis system" was examined by identifying

the target users of the OG SURF system and the needs to be addressed (Table 1). The identification of target users was carried out by involving ten individuals within the partnership, while analyzing the results and architecture of similar SSDF systems developed in other territorial contexts.

The analysis of the actual needs of each of the target users then guided the "knowledge system," which in the case of OG SURF consists of the data hosted within the SSDF and the analysis tools used to query the data and generate information for decision-making. Subsequently, a detailed analysis of the "results presentation system" was conducted, which guided the technical implementation of the SSDF. During this analysis, it became evident that the application should have a web-based Geographic Information System (Web-GIS) interface designed to streamline the use of spatial analysis tools and enable report generation. Finally, considering the first three key components of the SSD, the technicians responsible for developing the platform chose the "system development language".

Lessons learned

In the case of the OG SURF project, the participation of various stakeholders involved in different aspect of forest management has improved the outcomes in the development of FDSS. However, a participatory approach also has some disadvantages: it requires time and resources (Carberry et al., 2002), the identification of appropriate stakeholders is necessary, and stakeholders must agree on process objectives. In the case of OG SURF, the opportunity to establish an Operational Group within the PEI-AGRI initiative allowed for the identification and involvement of various stakeholders from the inception of the operational group through measure 16.1 of the PSR. This helped create alignment in process objectives, which were realized through measure 16.2 of the PSR in the development of the application.

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.go-surf.it/>





Funded by the European Union

Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.



UNIVERSITÀ DEGLI STUDI FIRENZE
DAGRI
DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI





FOREST4EU

FOREST4EU Project

FOREST4EU Project

info@forest4eu.eu

Website





Characterisation of the genetic diversity of the chestnut heritage, soil biodiversity and biofertility in Emilia-Romagna, Italy

Introduction

The aim of the project was to set up a collective study shared by the scientific community and chestnut growers to find out about the genetic variability of chestnut germplasm and to enhance and promote the role of the chestnut grower as a 'guardian' of biodiversity and land protection.

The scientific data collected characterised the genetic diversity of Emilia-Romagna's chestnut-growing heritage and the broad biodiversity and biofertility present in the soils, highlighting the genetic variability of the region's different varieties of chestnut fruit and identifying for each variety the most suitable soil characteristics for its cultivation.

In particular, the analyses highlighted the 'diversity' of chestnuts and distinguished all the different varieties in the area under study, from the 'Carrarese' to the 'Pelosa', the 'Svizzera', the 'Pastanese', the 'Biancherina' and others. DNA analyses have shown that the different types of Marroni, a typical product of Emilia-Romagna, share the same DNA profile with extraordinary precision, proving that all plants derive from a single strain of Marroni from the Apennines.

Varieties recognised as being at risk of extinction were taken from the collection fields available in Emilia-Romagna (Granaglione and Zocca) and were placed in special catalogue fields at two actual partner companies that became their custodians.

Subsequently, the quality of the organic substance was verified by applying indices that provide indications of the capacity of the soil to conserve or dissipate the organic carbon present. Thus, after specific sampling and analysis, the microbial biomass, metabolic quotient (qCO_2), microbial quotient ($qMic$), mineralisation quotient (qM) and soil biological fertility index (IFB) were evaluated, to highlight alarm and early warning situations with regard to organic matter content and possible loss through mineralisation.

In addition, soil and its biodiversity were studied using the biological quality index (QBS-ar) at some geopedologically different sites, suitably selected from those from which genetic material is taken. It emerged that the soil of the chestnut grove is a habitat for an enormous quantity and variety of organisms.

Lessons learned

For companies in the Apennines a niche strategy is needed, built on the exclusivity and excellence of local products, in particular chestnuts, through the valorisation of traditional chestnut cultivation, for better environmental sustainability, soil care and protection of biodiversity, adaptation to climate change and product quality.

For further information contact

Carla Paola Scotti, Project Coordinator, Italy, email: scotti@pedologia.net

Livia Antisari, Professor, University of Bologna, Italy, email: livia.vittori@unibo.it

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.pedologia.net/it/BIODIVERSAMENTE-CASTAGNO/cms/Pagina.action?pageAction=&page=InfoSuolo.47&localeSite=it>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE ALIMENTARI, AMBIENTALI E FORESTALI	 BIODIVERSAMENTE CASTAGNO	FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	---	---	--



CASTANIBUS

Introduction

CASTANIBUS unites the BIODIVERSAMENTE CASTAGNO and CASTANI-CO OGs, whose primary objectives are to identify and share "guidelines for the study, preservation and valorisation of the chestnut tree and the best management of chestnut groves to obtain a quality product", to revalorise the "culture of chestnut cultivation" and the role of the chestnut grower as a quality producer and guardian of the mountain territory.

CASTANIBUS was a two-day journey that networked all the realities that revolve around the chestnut tree and the need for protection and development in the Apennines, from carbon sequestration to the protection of biodiversity, fostering a proactive and constructive exchange between researchers, GO partner farmers and regional officials, with the main players involved in chestnut cultivation in Emilia Romagna.

Concentrating the participants on the coach made it possible to favour an exchange of experiences and opinions on the reality of chestnut cultivation, but above all to bring the comparison to the field by visiting chestnut groves and Metati.

The bus tour made it possible to make the best possible use of the travelling time from Bologna, the place of departure, to Marola, facilitating an exchange of experiences and opinions on the reality of chestnut cultivation, but above all to take the comparison to the field by visiting chestnut groves and Metati.

The trip was full of speeches and moments of discussion concerning the current situation and future prospects of regional chestnut cultivation after extremely difficult years for producers due to the Chinese wasp, which has now been eradicated thanks to the interventions of the Regional Phytosanitary Service.

Lessons learned

The partnership between the actors of the OGs demonstrated the effectiveness of 'networking', a fundamental condition for sharing and integrating in practice market requirements with environmental and scientific innovation, and human, historical, cultural and landscape heritage.

The bus tour with the various territorial actors active in the chestnut sector was a good way to stimulate and bring them into the field. One of the most important result was the desire and the concrete possibility of activating a Regional Plan for Chestnut Growing as a result of the cooperation between the Emilia-Romagna Region and the Consortia of Chestnut Growers, some of which were united in a coordination, and other public and private stakeholders.

For further information contact

Carla Paola Scotti, Project Coordinator, Italy, email: scotti@pedologia.net

Livia Antisari, Professor, University of Bologna, Italy, email: livia.vittori@unibo.it

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.pedologia.net/it/BIODIVERSAMENTE->

[CASTAGNO/cms/Pagina.action?pageAction=&page=InfoSuolo.47&localeSite=it](https://www.pedologia.net/it/BIODIVERSAMENTE-CASTAGNO/cms/Pagina.action?pageAction=&page=InfoSuolo.47&localeSite=it)

<https://ec.europa.eu/eip/agriculture/en/find-connect/projects/castani-co-%E2%80%99Cil-sequestro-di-carbonio-nel-sistema.html>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRO-ALIMENTARI, AMBIENTALI E FORESTALI	 	 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	--	--	---

Use of Bite technology for tree infusion in chestnut groves

Introduction

Traditionally, in fruit tree crops phytosanitary control has always been done by canopy spraying, that caused a high product dispersion in the environment, high delivery time of application, less absorption and lower results in responding to phytosanitary attacks. In chestnut groves this control method is either too burdensome and inapplicable due to the considerable size of the plants or even non applied at all.

Endotherapy can be applied to chestnut trees regardless of their height and location, take less time than traditional methodology and don't dissipate the product, with better results. A single tree treatment requires roughly 10 minutes and, since more trees can be treated simultaneously, a chestnut farmer can manage to treat a chestnut grove in 1 or 2 days.

The device requires no electricity to operate and reduces water consumption by more than 99% compared to spraying treatments (water consumption is a few ml per tree, therefore an absolutely negligible quantity). The cost of the device is around 1300 € and the cost of a commercial *Trichoderma* package is around 200 €; however, as the product is very concentrated (billions of spores) it will be sufficient for 5 years or more, depending on the scale of application.

One of the advantages of using the Bite technology, is that unlike other pressure endotherapeutic tools, it penetrates the internal tissues of the tree with a very thin needle that causes a little wound, that can be recovered in about a week. For rapid and optimal absorption of the injected suspension, it is necessary that the treatment is carried out during the vegetative season, when the trees are at their maximum transpiration rate.

Lessons learned

This innovative, low-impact instrument has shown very good results in the phytosanitary control of tree diseases, with no environmental impact, a minimum impact on the plant, and a reduced time-consumption for the application.

Given the reduced time required for the treatments, the high cost of the instrument can be reduced by organizing chestnut growers in a consortium, in order to make a community purchase to recover the expense.

For further information contact

Salvatore Moricca, Professor, University of Florence, Italy, email: Salvatore.moricca@unifi.it

Rodolfo Picchio, Professor, University of Tuscia, Italy, email: r.picchio@unitus.it

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.psingeca.it/it>



Carbon accounting for PES

Introduction

Forests offer more than just wood and non-wood materials; they provide a wide range of additional services, including creating habitats for biodiversity, purifying water, and regulating floods and climate. Their ability to sequester carbon, provide cooling effects, and supply renewable raw materials, food, and medicines is essential in combating climate change, transitioning to a circular bioeconomy, and promoting overall societal health.

The economic sustainability of the EU's forest sector continues to be a fundamental aspect of sustainable forest management. Moreover, this economic sustainability is critically significant for preserving the various advantages that forests offer to society, particularly for ensuring the livelihoods of rural communities. Both public and private payments for forest ecosystem services offer an alternative means to secure funding for multifunctional and protective forest management and the sustainable upkeep of ecosystem services. In this context, it is important to establish methods for quantifying these ecosystem services.

Among the services with a potential market, carbon is the most developed. In Italy, there is no formalized market yet, and activities are primarily in the voluntary sector. In this scenario, calculating the Business as Usual (BAU) and offsetting resulting from management is crucial. To have a picture of the BAU, it's essential to find methodologies as standardized as possible and accurately quantify carbon. In our case, using ground biomass data, we were able to derive a model using an area-based approach, integrating remote sensing data (Sentinel-2 satellite) for various tree species, and then converting this value into carbon as 0.5 of the biomass. At this time, this data has not been used to enter the carbon credit market but solely to establish a reference framework for the BAU and to initiate proposed management changes, with the intention of calculating offsets later on.

Lessons learned

Remote sensing data can be valuable in quantifying biomass at the company level when integrated with ground data. This approach has enabled the precise assessment of biomass and the identification of various forest types. However, to date, it has not been possible to quantify the credits resulting from management offsets, but rather to establish an initial reference framework.

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://fortrack.it/>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNICHE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI		 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	---	--	--

Questionnaire for the assessment of the willingness to pay for cultural-tourist ecosystem services

Introduction

The OG conducted an experimental analysis on the Monte Nerone area to evaluate the willingness to pay for the implementation of tourist-recreational services. The study area is located in the Marche Apennines, 60 km from the coast (a very touristic area), it's easily accessible and has a good road network.

The object of the research was to assess the value of the ecosystem services provided by the forest. The data collection was done through a questionnaire to the visitors, preceded by a brief description of the area attempting to inform visitors of its cultural, architectural and environmental, naturalistic and landscape values.

The questionnaire asked for biographical information, educational qualification, average income bracket, frequency of visit, and an evaluation of the main ecosystem services the area was able to provide (providing a grid of ecosystem services characterising the area as support for the answer).

The evaluation was carried out with a double key, on the one hand assessing the evaluation of the importance of the various ecosystem services for the users (e.g. the landscape, biodiversity, etc., with answer scores of 1-7), and on the other asking how the Nerone area responded according to their perception. These two parameters were considered as fundamental to determine their willingness to pay. In the end, participants were asked to survey express their interest and their willingness to pay for a parking space (assessment per vehicle not per person, per day). The money collected would be reinvested in the area to improve services and maintain the area.

Lessons learned

After the data analysis, a willingness to pay 7/8 euros was estimated. Most visitors are willing to pay for an access point with information and toilets and then go on an excursion. There was no ostracism only very few answers the environment belongs to everyone and they are not willing to pay.

No real implementation has followed so far. Difficulties in data collection (number of questionnaires about 90 completed, some filled in poorly, not usable). The thesis collector who collected the data took advantage of the possibility of collecting the information at events, but in general it is very difficult to find people. An attempt was made to collect data on Facebook but they were not found to be reliable. The people interviewed were very willing to answer, but these questionnaires are often too long for people who were passing by on holiday.

It is also difficult to balance between the level of detail one would like to achieve and the immediacy of the answers. If you want very large samples and detailed information, the period is very long.

For further information contact

Carlo Urbinati, Professor, Polytechnic University of Marche, Italy, email: c.urbinati@staff.univpm.it

Danilo Gambelli, Associate Professor, Polytechnic University of Marche, Italy, email: d.gambelli@staff.univpm.it

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.innovaturale.it/pei-agri/gruppi-operativi/bancadati-go-pei/biodiversita-e-servizi-ecosistemici-foreste-e-territorio>



Pine Wood Nematode

Introduction

This project aimed to overcome the constraints caused by PWD, combining new forms of forest management, fight, methods of early detection of infected trees and decrease their impact, control the natural dispersion of the insect vector (*Monochamus galloprovincialis*), reduce costs of disease control actions and contribute to restore the confidence of landowners for the maintenance, plantation and management of new areas of maritime pine. It is also intended to analyze the types of trees that can be infected, the influence of forest fires on the natural dispersion of PWN, to evaluate the emergence and flight of the vector under different climatic conditions, to minimize the risk of forest operations during their flight period and to create zones of active containment where it is possible to act more effectively to avoid the dispersion of PWN to the non-infected pine forests.

Phases and conclusions

1. Creation of an Active Containment Zone (ZCA), with borders, and it was observed that the Pine Wilt Disease (MPD) spread approximately 6 km in a year, within a maritime pine (*Pinus pinaster*) stand, without roads paved and with very limited access. Arrangement of multi-funnel traps along the border area of the transect.
2. Determination of early tree detection methods potentially infected- Assess the risk of disease installation in trees with different ages/dimensions. It was observed that larger pine trees are more likely to be selected by *Monochamus galloprovincialis* and becoming infected by the Wood Nematode Pine (NMP), mainly in populations with a low incidence of DMP.
3. Evaluation of new methods for controlling the natural dispersion of vectors infected with MPN- Evaluate the period of emergence and flight of the vector in different climate conditions. During 2021, 527 were captured in the traps installed in Seia. specimens of *M. galloprovincialis*. The largest number of insects was captured in the second week of October (131 copies, corresponding to 24.9% of the total captures). In the traps installed in Soure, only 62 specimens were captured and the peak of catches (61% of the total) occurred earlier than in Seia, between 11 June and July 9.

Lessons learned

Based on the commercialized trap model, and taking into account the results obtained in the test carried out in 2020, two changes were made to the collection cup to test the decrease in catches of non-target species. The experimental design used was the Latin square with rotation of the position of the traps weekly and the Galloprotect 2D-Plus attractant was identical for all. The results obtained reveal that the three trap models used captured 44 specimens of the target species *M. galloprovincialis*, in quantities statistically similar. It can be concluded that the use of the collection cup modified by the manufacturer is suitable for obtaining a targeted capture of the target species, which is the insect vector of PMN, being a considerable evolution with ecological importance as it causes a residual impact in the remaining entomofauna, namely auxiliary species (predators) or protected. The results of the project were affected by the delay in the financial subvention, Several presentations were made, but lacks of a broad dissemination of the lessons learned.

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://inovacao.rederural.gov.pt/2/114-gi-pin-gestao-integrada-do-pinhal-nematode-da-madeira-do-pinheiro>

fnapf.geral@gmail.com - <https://federacaoflorestal.pt/>

https://inovacao.rederural.gov.pt/images/imagens/Docs_GO/29-OG_GI_PIN.pdf



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	   FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	--

Assessment of the drudgery of work during the planting phase

Introduction

In the context of climate change, planting appears to be a major tool for guaranteeing the adaptation and sustainability of forests, with species that will respond better to tomorrow's climates and provide a response to situations where natural regeneration is blocked. In recent years, planting has been given a boost with the introduction of the recovery plan, with the aim of planting 45,000 hectares in addition to the 50,000 hectares already planted annually. However, these operations are causing difficulties, as expressed by the various players, particularly forestry operators. Indeed, these operations are recognised as arduous and give rise to work-related illnesses and accidents, such as musculoskeletal disorders.

The aim of the PIF project was to develop plantation management methods that meet the social and environmental expectations expressed by stakeholders. One of the aims of the project was to identify the phases of work carried out by the workers during planting and to assess the arduousness of each of them, in order to identify possible recommendations for reducing this hardship.

Methodology and results

Seven work sites were monitored between the end of the winters of 2020-2021 and 2021-2022. The aim was to study contrasting work sites in order to assess the effects of different conditions on the difficulty of the work (posture, duration or number of strokes required to put the soil in the ground). Two or three workers were monitored and filmed for one hour. This monitoring made it possible to complete an evaluation grid and thus obtain an overall rating for the arduousness, duration and average number of movements for each stage of the planting process. The phases encountered during the various monitoring sessions include moving between each plant, stripping, digging the hole, planting and compacting. The average duration of a tree planting cycle on the various sites is 32 seconds. This time may vary depending on the site, the individual and the attention given to planting. The phases of making the hole and planting the seedling appear to be the most arduous and the most repetitive. Posture, but also repetitiveness and therefore the duration of the phases, are major factors in the arduousness. The different contexts studied do not seem to have had any major effect on the postures of the planters. This difficulty is accentuated when there are stumps, coarse elements or slash on the site. Mechanised preparation of the soil has a direct impact on reducing the number of strokes and therefore reduces the workload. Difficulties in moving around the sites, carrying heavy loads and the distance from the plant storage

area also increase the workload. The 'individual' factor is still the main result when it comes to the actual difficulty of the practices. This effect varies according to body size, age, level of experience in the job, but above all the 'manner' in which the work is carried out by the forestry operator. This could also be linked to the effort put into the pickaxe by the planter, which could not be measured during the study.

Lessons learned

The assessment of postures and durations highlighted the arduous nature of the act of planting, particularly when work sites are unprepared, in terms of slash management. Difficulties in moving around (no path in the plot or difficult access to it) combined with carrying heavy loads cause additional difficulties for the planter. The numerous trips to and from the planting site also make the work even more time-consuming. Preparing the planting site, when it is very cluttered (with many stumps or coarse elements), directly facilitates the planter's work. We can assume that slower work, with gestures that are sometimes more adapted, and less repetition of tasks carried out during and between days, would allow forestry workers to spare their bodies to a greater extent. Another lever could be to optimise the planting tool, in particular the pickaxe, which is the only possible tool on unprepared land. We can also work at plot scale and on the organisation of the work site, in particular by looking at the management of the seedlings, the cleaning of the plot and the clearing of paths for the planters. Following this study, technical sheets were drawn up to reduce the difficulty of the various stages encountered during a planting project.



Figure 1. Team of planters on a worksite.

© INRAE, AgroParisTech

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.reseaurural.fr/centre-de-ressources/projets/plantations-innovantes-en-foret-innover-pour-installer-des-plantations>

<https://renfor.hub.inrae.fr/projets/pif>





Innovative tool to reduce the arduousness of technical planting operations: the redesigned planting pickaxe

Introduction

In the context of climate change, planting appears to be a major tool for guaranteeing the adaptation and sustainability of forests. In recent years, planting has undergone a major boom with the introduction of the economic relaunch plan. However, the various players involved, particularly forestry operators, have expressed difficulties with these operations. These operations are acknowledged to be arduous and give rise to work-related illnesses and accidents, such as musculoskeletal disorders. Frontal bending is the main biomechanical stress to which operators are subjected.

The aim of the PIF project was to develop plantation management methods that meet the social and environmental expectations expressed by stakeholders. One of the aims of the project was to determine the various characteristics of the planting tool that would improve ergonomics and optimise the efficiency of the actions carried out by the operator.

Methodology and results

Three tools were selected and two series of tests were carried out with two different teams of workers in contrasting soil and climate conditions. The tool characteristics evaluated were: the length of the handle and its composition, the weight of the tool, the width of the pick and the width of the axe. The workers highlighted the need for a light, easy-to-handle pickaxe with a wide blade (necessary for stripping and making manual pot planting), as well as a long axe and a wooden handle. They also expressed the desire to be able to test other tools with longer handles. The aim of the second test was to determine the effect of the length of the tool handle on the operators' frontal flexion. Workers were asked to plant first with a conventional tool with a handle measuring one metre and then with a longer handle measuring one metre and thirty centimetres. Four experienced workers had to strip the soil using the tool's pick to gain access to the soil (stripping phase) and then split the soil with the axe and pick to create the location for the seedling (planting phase). Frontal flexion was measured by filming the operations during these two phases, and the videos were processed using Kinovéa software. The angular kinematics data showed that the length of the tool handle had an effect on the planter's posture, and that a longer handle would allow the planter to straighten up and reduce biomechanical stress.

There were differences between individuals, which can be explained in part by the size of the individuals, but also by the techniques and postures adopted. However, the number of workers tested was not sufficient to carry out statistical tests and therefore to establish the significance of the results.

Lessons learned

This work enabled us to identify a type of pickaxe that would optimise the planting of forest plants. The length and width of the pane and the axe were reworked to improve seedling placement and limit the number of pickaxe strokes. The length and material of the handle will be adapted to the user. The length of the handle and the material of the handle will have to be adapted to the user. It is important to note that the prototypes created during the PIF project were a great success with the operators, some of whom have continued to work with them. The various results suggest that workers need to have a range of different tools at their disposal, rather than a single tool, in order to adapt to the different sites and conditions they encounter. It would also be useful to continue testing these tools on a wider panel of operators, and also in contrasting soil and climate conditions, in order to be able to statistically determine the benefits and limitations of the tool, and also to refine the recommendations according to operator profiles.



Figure 1. Planter using a pickaxe on a worksite: slot planting of a calocedar root ball on prepared ground.
Sylvain Gaudin © CNPF

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://renfor.hub.inrae.fr/projets/pif#:~:text=Le%20projet%20%C2%AB%20Plantations%20Innovantes%20en,exprim%C3%A9es%20par%20les%20diff%C3%A9rents%20acteurs.>





Technology at the service of forest

Renewal mapping with drone and GPS to stake out the stand

Introduction

In the context of climate change, planting appears to be a major tool for guaranteeing the adaptation and sustainability of forests. In recent years, planting has undergone a major boom with the introduction of the French recovery plan. Most of the work carried out to renew forest stands is conducted manually, and the work site preparation phase has not benefited from any major technological advances, allowing the areas to be planted to be mapped while taking into account the constraints of the terrain. Foresters have expressed a strong interest in improving the staking stage, which accounts for 35% of the time spent during the planting process and is traditionally carried out using a compass and a decametre. As part of the PIF project, the ONF and the FCBA have developed a new mapping and staking method, based on the use of a drone and a centimetre-accurate GPS.

Methodology and results

The first stage of this method involves flying over the area to be planted using a drone capable of providing photos with optimum resolution (1 to 2 cm/pixel) and geo-referenced using RTK (Real Time Kinematic) to around 1 cm. It takes ten minutes of flying time to cover 15 hectares. If the drone is not RTK-compatible, it is possible to add positions taken from a mobile GPS, as long as these points have been marked out on the ground beforehand. The photos taken during the flight are then assembled using software and the GPS coordinates recorded, to produce an orthophotograph.

The orthophotograph produced will be used to define the future planting scheme. It will make it possible to identify the contours of the plot and the traffic routes, as well as to calculate the area to be planted and to position the future planting lines. This is a longer stage, depending on the complexity of the plot. The information gathered will enable a more accurate assessment to be made of the quantity of plants required and the time needed to complete the work properly. Following computer processing, a map will be generated incorporating the planting scheme. The data will then be transmitted automatically to a GPS via a server, and can be used directly by operators in the field to position the planting lines.

The use of the drone combined with the use of a centimetre-precision GPS by the worker has made it possible to optimize the installation of the planting lines, with productivity three times higher than with the traditional method, and to improve its ergonomics.

Lessons learned

The use of a drone, combined with the use of a centimetre-precision GPS by the worker, has made it possible to optimize the installation of the planting lines, with productivity three times higher than with the traditional method, and to improve ergonomics. Nevertheless, the use of drones remains costly and requires staff trained in their use. Flights require significant material and financial investment, as well as special administrative arrangements. This new mapping and staking method is currently being tested in the Grand Est region by several ONF work agencies. Work is also underway to develop these tools and integrate them into machines for mechanized preparation before planting, plantation maintenance or even to keep track of the location of partitioning networks on a plot of land.



Figure 1. Field materials used to optimize the installation of the planting lines.

© INRAE

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://renfor.hub.inrae.fr/projets/pif#:~:text=Le%20projet%20C2%AB%20Plantations%20Innovantes%20en,exprim%C3%A9es%20par%20les%20diff%C3%A9rents%20acteurs.>





Group management trial

Introduction

The fragmentation of private forest properties, with no sustainable management document, represents a real challenge for the development of sustainable forest management. To involve small owners, it is necessary to rely on dynamic local owners. The originality of this project is that the owner is a municipality, which could potentially lead to a revival of forestry on a massif-wide scale and thus provide information on an applicable method and on the juridical difficulties of this type of initiative. In fact, there are around 300 communal forest properties in Normandy not subject to the forestry legislation, for which the mayors often have ambitions, which could be inspired by this initiative and simultaneously lead many small neighbouring private forests towards sustainable management. This operational group aims to support the development of sustainable public-private management of forests in Normandy. The aim is to create a regional approach based on experiments in grouped public-private forest management, as well as common tools for consultation between the various organisations involved.

Methodology and results

The area selected was the upper part of the Becdal ravine in the communes of Quatremare and Mesnil Jourdain (27). The massif comprises 35 hectares of forest divided into 38 properties, with 10 hectares belonging to the municipality and more than thirty private forest owners owning the remaining area. The stands, soil and climate (current and future) were characterised, in order to define potentially interesting silvicultural projects. The majority of participants expressed the wish not to disrupt the landscape of the valley, and a financial balance will be pursued between income and expenditure to enable renewal without investment by the owners, apart from income from harvesting. Initially, there was no support for owners to join a structure, as each owner wanted to maintain his or her autonomy. If actions can be grouped together without being modified, then the possibility of a regrouping will be conceivable. The French National Centre for Forest Ownership (CNPF) was able to identify a strong desire from owners to conserve a high level of biological diversity. Stands and forest management in general were discussed and demonstrated in the field. Landowners were given technical factsheets corresponding to their stands, which raised a high degree of interest, and were analysed and discussed during individual interviews. The stands for which silvicultural

action is accepted are those affected by dieback and/or biotic attacks. In order to offset the cost of reforestation and ensure sufficient revenue, it was proposed that living trees should be harvested by thinning. For non-declining stands, thinning was also proposed on the basis of biodiversity conservation criteria. The volume of wood cut is likely to be small and from a variety of species, which makes it difficult to commercialise. However, by grouping together, it is possible to offer sufficient volume to interest buyers. The CNPF has launched a call for proposals to estimate the volume and value of the thinning. This was sent to all the owners to obtain their agreement before the call for proposals was launched. However, the municipality's agreement could not be obtained before the end of the project. As a result, the worksite in the communal forest could not be approved, blocking the effective launch of the overall worksite.

Lessons learned

The municipality's commitment enabled a calm and effective dialogue, leading to the mobilisation of a number of private owners. To gain the trust of the owners, the preferred method was to approach them collectively and individually. This method led to a felling and reforestation project being proposed for 4 landowners representing 15 hectares in the commune.

In communal forests, the procedures for submitting land to the forestry legislation are very demanding, generating a caution and a long reflection period. In the absence of submission to the forestry legislation and of a Standard Management Agreement, it is not possible to draw up a sustainable management document for the communal forest, which then remains ineligible for subsidies. It seems difficult to envisage joint management unless private owners align themselves with the worksites, service providers and buyers identified by the national forestry office. The current situation is that the forestry code is designed to completely and systematically separate public management from private management. A national review of changes to the forestry code should therefore be considered in order to envisage joint management.

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.xn-reseau-national-agricultures-ruralits-bkd.fr/centre-de-ressources/projets/fpp-egg-forets-privées-et-publiques-essai-de-gestion-groupee>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 	 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	---	--

Innovative tools for collaborative forest management

Introduction

Wood production, biodiversity conservation, protection against natural risks, public reception for recreational activities, carbon storage... The forest provides multiple services at the origin of sometimes contradictory management issues which can generate conflicts between players. To reconcile all of these issues, the tools available to forestry stakeholders are increasingly numerous: remote sensing, field protocols, models, participatory approaches, etc. If these tools are co-constructed, articulated between them and shared with all stakeholders, they can contribute to the success of sustainable forest management.

Methodology and results

LiDAR technology, Sylvaccess model, diagnosis of the sensitivity of a stand to logging, protocol for characterizing mature forests... So many tools available to stakeholders in the territory and the timber industry to better understand and manage their forests. The OUI-GEF project aimed to help these actors take advantage of these tools and create multi-partner and concerted forest management.

Carried out in three Regional Natural Parks (PNR), OUI-GEF is structured around three specific objectives.

The first consisted of providing a more detailed understanding of the forest resource, its ecosystem services, the behaviour of certain species sensitive to climate change such as spruce or fir, and knowing where the islands of old wood necessary for the preservation of the biodiversity.

The second objective was to identify the conditions for mobilizing the resource (access, slopes, dragging distance) and the potential economic, environmental and social impacts of logging, and to study the behaviour of private forest owners in order to determine their motivations for exploiting their forest.

The third objective aimed to promote the sharing of knowledge between stakeholders, an essential issue to achieve multi-partner and concerted forest management in the territories.

OUI-GEF has resulted in the creation of numerous tools and methods for the benefit of stakeholders and managers, including:

- An innovative method for carrying out a forest inventory, based on LiDAR technology;

- Automatic mapping of the accessibility of forest stands in mountain areas using Sylvaccess software;
- A method for diagnosing the sensitivity of a stand to felling and estimating the effect of the intervention;
- Operational models to map forests with a protective function (avalanches and rockfalls);
- A simplified field protocol to identify mature forests, an essential element of the old woodland network.

An analysis of approaches to valorizing local wood resources which highlights the processes by which the value of local wood is built during the creation of a Wood Energy platform or an AOC (controlled designation of origin).

An online educational game to understand how forest wood, properly managed, transported, stored and burned, can advantageously replace other non-renewable resources to heat our homes.

The challenge for the years to come is to continue the dissemination of tools and the sharing of knowledge resulting from the project. An online geocatalogue to encourage transfer. This geo-referenced metadata base brings together information on the data used by researchers and stakeholders involved in forest management: maps, field surveys, stand analysis grid, etc. It is accompanied by appropriate instructions for concrete issues in order to support the realization of forestry projects.

Lessons learned

OUI-GEF has made it possible to develop operational and transferable tools offering stakeholders and managers the opportunity to better understand forests, their populations, their functions, etc. The active involvement of PNR project managers has encouraged strong mobilization of local stakeholders to participate in tests, respond to surveys and provide feedback on project output

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.psdr-ra.fr/boite-a-outils/filiere-bois-foret>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.		 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	---	--

Using UAV photogrammetric data to support multi-objective forest management plans

Introduction

In the Italian and European context, there is an increasing demand for forest and agroforestry companies to focus on multifunctionality. Furthermore, in recent years, the possibility of certifying some ecosystem services and multifunctional services has emerged. The first step toward certification is to have a sustainable forest management plan that details these aspects.

In the case of the OG SURF project, to obtain spatial data covering the entire forested areas within the project intervention zones, a fixed-wing UAV was used to derive some of the multifunctionality indicators. High-resolution orthophotos, for instance, were utilized to map forest types linked to biodiversity and conservation. Infrared orthophotos were employed to identify the presence of standing deadwood, which serves as a proxy for biodiversity analysis related, for example, to saproxylic insects. Additionally, roads and trails were mapped to identify potential tourist routes. The UAV has enabled the accurate mapping of some of these indicators, which are subsequently integrated into the decision support system. These data can be used to develop multifunctional and multi-objective management plans.

Lessons learned

The cost of the UAV used for mapping is indeed quite high, but companies have the option to collaborate with service providers rather than purchasing one themselves. The generated data, however, are crucial for developing multi-objective management plans. Compared to traditional survey methods, these data save time in terms of fieldwork. The use of this data also provides standardized information across the entire area, which is valuable for working towards certification of ecosystem services.

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.go-surf.it/>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI		 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	---	--	--

Decisional Support System to support the revision of forest management plans

Introduction

The Common International Classification System of Ecosystem Services (CICES) categorizes ecosystem services into three primary groups: i) provisioning, ii) regulation and maintenance, and iii) cultural, and they can be evaluated both in terms of their physical attributes and their economic value.

A physical assessment relies on biophysical models of ecosystem services that take into account the functions and processes of ecosystems necessary to provide the specific service. Within the GO-FORTRACK, were employed various spatial approaches to quantify physical aspects related to some ecosystem services. Specifically, we developed maps for carbon, biomass, and forest types, which can be associated with ecosystem services related to prediction, regulation, and maintenance. These maps were then integrated into a simple decision support system within the project's test areas, enabling forest managers to access this information at the individual forest parcel scale.

It was decided to derive this information at the forest parcel scale because, in the context of Italian forestry laws, which require that a forest management plan be approved by the relevant public authority, it is always necessary to describe each individual parcel and provide quantitative data. This system can help maintain parcel records and automatically generate the parcel cards/reports required by law.

Lessons learned

This straightforward report automation tool allows forest managers to save time on report and plan writing, which can then be allocated to other forest management-related activities. It can significantly reduce the costs associated with the drafting and development of a forest management plan.

Additionally, the availability of various maps within the system aids in the analysis of plan objectives and interventions, providing a more detailed knowledge framework.

For further information contact

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://fortrack.it/>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI	  FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	---	---

A User-Friendly Platform for Bridging the Gap between Carbon Credit Demand and Supply

Introduction

At the beginning of CO2 Marche project, the market of additional Carbon credits was still not very popular in Italy. For that, in the context of sustainable forest management certification, was created a new platform for the voluntary sustainability credit exchange. The goal of the platform is to connect demand and supply of carbon credits deriving from Sustainable Forest Management in a voluntary trading market for tonnes of stored carbon with additionality criteria (not counted by the Italian government under the Kyoto and Paris Agreements). Also for the offer, the platform is accessible not only to the project partners, but to any operator wishing to undertake the carbon certification and counting route.

When an acquirer is interested in supporting a specific additional project, the first thing is to specifically identify the area's characteristics and the kind of activity that will be put in practice, in order to quantify the entity of the positive impacts generated. The control of the quality of the additional credits is accounted by the Inspection Body, which will annually verify compliance with the requirements of the PEFC standards.

Forests certified according to Sustainable Forest Management (SFM) are able to store more carbon than unmanaged (i.e. uncut) and untended forests; they contribute to climate change mitigation; they prevent natural and environmental hazards such as forest fires, hydrogeological disruption, soil erosion; they protect biodiversity and the landscape; they offer tourist-recreational attractions and forest products and by-products, along with culture, traditions and work for skilled forest workers.

Lessons learned

From the point of view of the ecosystem services generated, if these values were confirmed for all the certified areas of the project, Bosco di Marca Group, the active management actions would lead to the absorption of several thousand tonnes of CO2, contributing in parallel to the creation of new business opportunities for forest managers. In fact, taking into consideration the additional actions, in terms of management (e.g. conversion of coppice to tall trees), that could be carried out in beech forests and areas with mixed deciduous trees (which account for approximately $\frac{2}{3}$ of the certified surface area), it would be possible to store up to a maximum of approximately 24,000 tonnes of CO2 more each year (i.e. 24,000 sustainability credits). This is without taking into account the presence and increase of other co-benefits derived from Forest Sustainable Management that are not directly measured, such as increased biodiversity, improved water resource management, reduced erosion phenomena, and a positive image linked to tourism related to nature enjoyment.

For further information contact

Marco Perrino, Project Coordinator, Italy, email: marco.perrino@dream-italia.net

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.co2marche.it/>



Developing a Novel Martelloscope for Assessing Biodiversity and Growing Stock Volume with the aid of a Digital Twin

Introduction

As part of the OG, an experimental martelloscope was used, where trees were surveyed through acquisition with the Geoslam ZEB Portable Laser Scanner system, which made it possible to recreate a 3D digital twin. Then, for each of the trees surveyed and forming part of the martelloscope, dendromicrohabitats were then obtained by means of traditional surveying, which made it possible to derive the Index of Potential Biodiversity (IBP) for each tree, in order to be able to introduce the quantification of biodiversity into the forest management plans and provide the users of the "gymnasium" an output in relation not only to productive interventions (wood growing stock) but also silvicultural interventions that take into account the biodiversity parameters.

Operationally, in a 1-hectare area of transitional beech stand, each individual tree (tree or sucker) was numbered, measured (crown insertion height and total height) and georeferenced, and its calculated volume and position data recorded in special software. In addition, each individual tree or stump was checked for the presence of dendrothelia (alterations, cavities, cracks in the stem and branches) that may constitute microhabitats for various plant and/or animal species and increase the ecosystem value of the stand in terms of biodiversity.

Lessons learned

The use of new technologies is becoming more and more widespread in the analysis and monitoring of forest stands, and in particular forestry application of mobile LiDAR is becoming more widespread as it allows a considerable reduction in survey time and costs and returns good data accuracy, whereas up to now it has been used mainly in the building and infrastructure sector. Furthermore, the monitoring and quantification of biodiversity variation based on silvicultural choices made with the martelloscope is a useful added value for forest sustainable management, ecosystem services enhancement, as well as production aspects.

For further information contact

Carlo Urbinati, Professor, Polytechnic University of Marche, Italy, email: c.urbinati@staff.univpm.it

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.innovarurale.it/pei-agri/gruppi-operativi/bancadati-go-pei/biodiversita-e-servizi-ecosistemici-foreste-e-territorio>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI		 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu Website 
--	---	--	---

Training for Forest Technicians, Researchers, and Employees on Fundraising and Communication Topics as Assets for Ecosystem Services Enhancement Projects

Introduction

During the project a specific internal training within the GO focused on fundraising and formation on the transfer of knowledge, in order to increase communication skills of the partnership aimed at disseminating the concept of the environmental service of forests and a collective recognition (also economic) of this service, thanks also to the creation of a carbon credit exchange platform. The main focus was enabling the forest technicians, researchers and employees involved in the project to raise funds and seek financing for forest sustainable management, with a view to attributing a recognised economic value to the storage of carbon (PES - Payment for Environmental Services) in order to improve the communication approach towards interested entrepreneurs, to involve forest and private individuals potentially interested in both the purchase of Sustainability Credits and the PES (Payment for Ecosystem Services) of Ecosystem Services. Beside that, many field initiatives were organized and a series of digital and paper material have been shared in order to disseminate the project results in the territory and raise awareness and interest on sustainable forest management and ecosystem services.

Lessons learned

The sale of sustainability credits and payment for ecosystem services, other than the traditional sale of timber it's an important objective of the OG and can be improved thanks to a good communication strategy and empowering specific communication skills of OG members. During the formation participants have learnt new useful knowledge that will be put in practice adding value to the project and showed interest in the topics addressed showed interest in the meetings, even if were held online due to the Covi-19 emergency.

For further information contact

Marco Perrino, Project Coordinator, Italy, email: marco.perrino@dream-italia.net

Francesca Giannetti, Assistant Professor, University of Florence, Italy, e-mail: francesca.giannetti@unifi.it

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

Further information

<https://www.co2marche.it/>



 Funded by the European Union Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.	 UNIVERSITÀ DEGLI STUDI FIRENZE DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGROFORESTALI, ALIMENTARI, AMBIENTALI E FORESTALI	 CO₂ S.Fo. Marche	 FOREST4EU  FOREST4EU Project  FOREST4EU Project  info@forest4eu.eu	Website 
--	---	---	--	--

FOREST4EU

THE TEAM



FOREST4EU Project



forest4eu.eu

CONTACTS



FOREST4EU Project



info@forest4eu.eu



PARTNERS



UNIVERSITÀ
DEGLI STUDI
FIRENZE



GOZDARSKI INŠTITUT SLOVENIJE
SLOVENIAN FORESTRY INSTITUTE



cesefor
FORESTRY HEART, research gate



etaflorence
renewable
energies



Regione Toscana



Centar kompetencija d.o.o.
za istraživanje i razvoj



Faculdade
de Ciências
da Universidade
de Lisboa



Funded by
the European Union

Funded by the European Union (Grant n. 101086216). Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.

