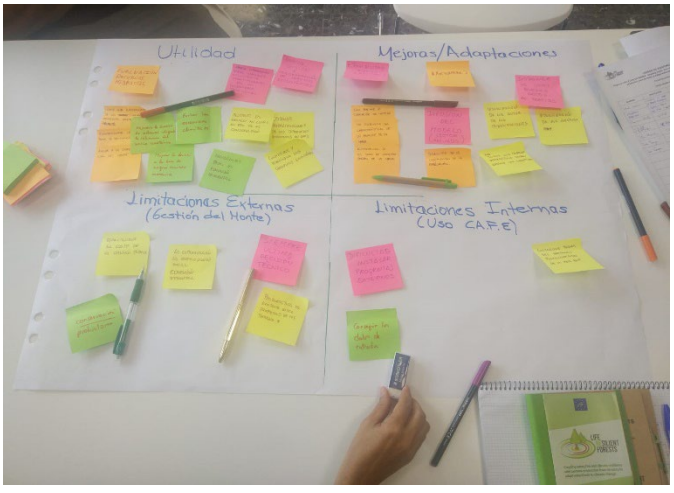
Resilient Forests
REPLICATION AND TRANSFER STRATEGY
Report



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1. Introduction

This report presents the results of stakeholder interaction developed from the Replication and Transfer Strategy in the project Resilient Forests through two main activities: Workshops at municipal and regional levels and training courses. The first activity aimed to present the DSS tool at local and regional levels as a part of the participative designing of the DSS where participants gave their views on the DSS adjustment needs, explored the DSS usefulness, and analysed the capacities required to use and implement it. Also, they identified possible constraints for implementing the forest management models indicated by the model. The second part aimed to build capabilities in the use of the DSS through intensive training on its setting up, functionalities, and running practical cases of forest management.

These transfer activities were carried out in Serra (Spain) and Ceira (Portugal). This report presents the results to each site and then a joint analysis highlighting relevant outcomes of these stakeholders' interaction.

2. Replication in Spain at the watershed and municipality level

This report presents the results of the stakeholders' participatory activities to replicate and transfer the implementation and the use of DSS C.A.F.E. at watershed and municipal levels. These activities involved:

- Municipal workshop in Serra municipality.
- Workshop with regional public administration (Conselleria and Diputación)
- Training course in the use of the DSS C.A.F.E.

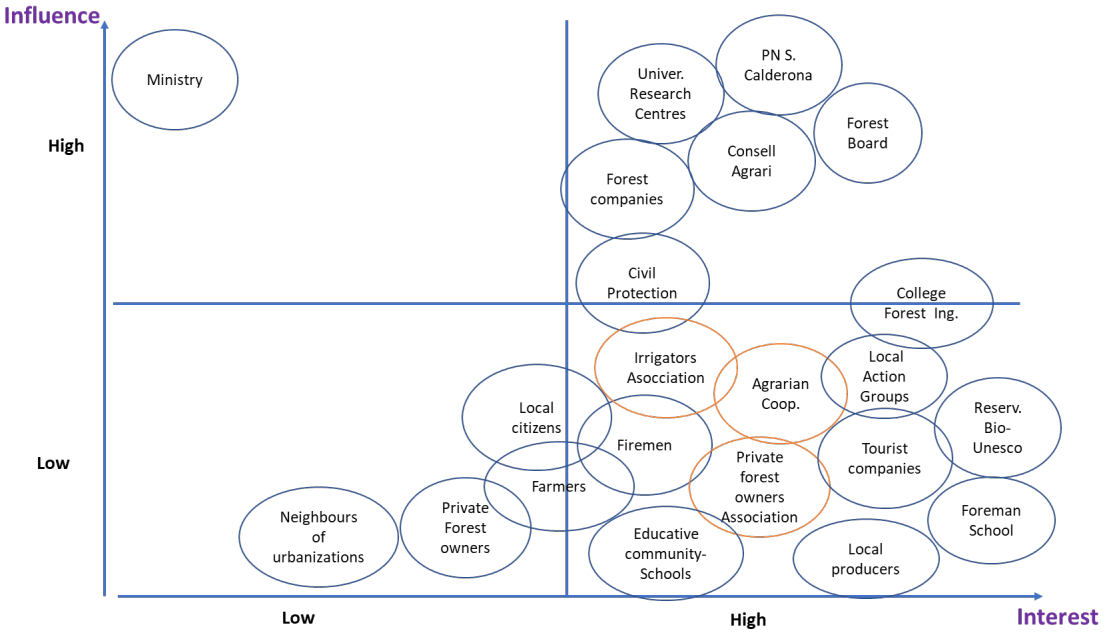
2.1. Mapping stakeholders

Initial identification of stakeholders was carried out through a list including forest actors linked to forest activity at the regional and municipal administrative levels and some private sector actors. This list was presented in the *Deliverable No. 9*

2.1.1. Mapping stakeholders

The second stage in this process was the municipal-level characterization of stakeholders, carried out in the first local workshops accordingly to their influence and interest in forest management. This methodology allows us to broaden the spectrum of actors and obtain information on how they could influence the use of DSS and the forest management approach. After listing the stakeholders, participants plotted each in the matrix as is shown in Figure 1.

Figure 1. Serra. Stakeholder analysis through their influence and interest.

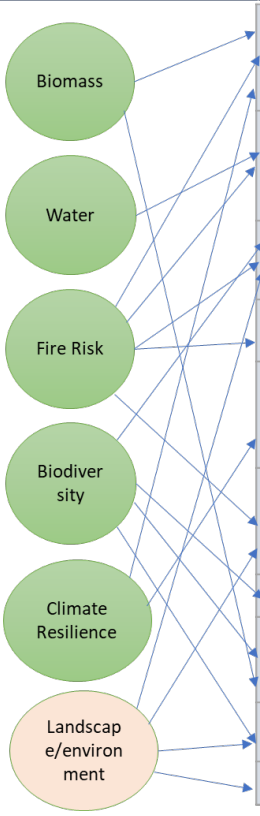


In total, *19 stakeholders* were mentioned from the *private sector* and *9* from the *public sector*. The matrix of influence/interest shows that most stakeholders are considered with high interest but low influence in forest management. It is noted that a level of influence is gained when the actors are associated, such as the agrarian cooperatives, forest owners' association, and irrigators association, showing a greater incidence of collective action.

2.1.2. Identifying socioeconomic and social needs dependent on the forest ecosystem and its indicators at subcatchment level.

In the local workshop, the project team explained the concept of ecosystem services, its relation to forest management and socioeconomic benefits. Once raised this awareness among the participants about the links between these concepts, they were invited first to prioritize the ecosystem services they considered most important in their forest area. Second, they identified local socioeconomic activities most dependent on these ecosystem services included in the DSS. They identified the Landscape/environment as another significant ES to be included because it allows for setting many socioeconomic dynamics in the municipality. The result of this exercise is synthesized in Figure 2.

Figure 2: Serra-Spain. Socioeconomic activities and its dependence on Ecosystem Services.



Ecosystem Services	Socio-economic Activities	Indicators
	Pellet production, planed logging, Forestry cooperatives	Kg/pellets Number of biomass companies Number of jobs Number of forestry uses
	Urban provision, Nuclear power plant, Agriculture and livestock uses, hunting	Liters / aquifers Water bill reduction Number of water concessions M^3/ irrigators' community
	Rural tourism, trekking, sport activities, recreational activities. Awareness-rising paths. Horse riding through livestock trails, astroturism	Number of visitors Number of business licences
	Management of cultural, historical and architectural heritage Protection of heritage and human life	Number of protected heritage elements Number of jobs
	Rain-fed Agriculture (olive, truffle, grapevine)	Number of productive/farms Kg/olives Kg/truffles Number of agricultural cooperatives
	Retail, restaurants, hotels	Number of room/bed availability Number of overnights Numbers of jobs Number of business licences
	Educational activities about the natural species of the Natural Park	Number of activities/year
	Forestry uses: beekeeping, medicinal plants, grazing, hunting	Number of beekeeping boxes. Kg/honey Kg medicinal herbs Km^2 /Managed hunting area
	Real estate investment (second homes), attraction of new business related to building activities	Number of people registered by year Number of business licences
	Masonry (reconstruction of dry stone walls).	Number of companies/business

This activity showed that participants are aware of how essential the provision of Ecosystem Services is to maintain the socioeconomic benefits derived from them. Figure 2 shows how ES, such as biodiversity, reduction of fire risk, and landscape, are determinants for most economic activities settled in the area. These are related to rural tourism and recreational activities derived from attracting new settlers or those who invest in a second home.

2.2. Forests management decisions provided by the tool vs current management approach in each area (evaluation of the usefulness of the tool).

This part aimed to know how forest management decisions are currently taken and in what measure the DSS C.A.F.E. could enhance them. Stakeholders' answers to the four questions made are presented in the following points.

2.2.1. To what extent the DSS could support the activities carried out by the participant stakeholders, in particular public administrations?

Current Forest management decisions	Improvements forest decision-making with C.A.F.E.
- Forest management actions are determined in the Municipality Forest Management Plan and the Local Fire Prevention Plan - Some municipal forest management plans are in a drawer, neither updated nor executed due to insufficient resources.	- To elaborate Forest Management Plans at the regional level. - To prioritise areas to act, maximizing ES considered essential in Forest Management and Fire Prevention Plans. - To optimize financial resources from the regional administration and from grants. - To prioritise and zoning to award public grants to forest private owners - To address forest actions hired for regional and municipal administration. - Provides visibility and transparency in planning and forestry actions avoiding changes by politicians.
- Forest interventions are planned based on the technicians' knowledge and their fieldwork. They do not have accurate (data) information about ES and other environmental variables.	- New vision about ES. The DSS allows knowing ES presented in the territorial area not included in traditional inventories. - Select better and tailored solutions to forest problems. - Give scientific support to technicians' decisions is taken. - Modelling natural areas allows evidencing positive and negative consequences of forest interventions.
- In some cases, necessary forest interventions are blocked by positions against forest management by private forest owners but also at the political level and other societal groups.	-C.A.F.E. could help environmental education, providing scientific evidence of benefits derived from forest management.

2.2.2. *What is the potential of the DSS, also considering the possibility to develop the tool or add new functionalities, to support other future actions to be undertaken by the stakeholders?*

- *Information related to variables and ES: the* necessity to include the basal area in thinning intensity, erosion risk, variables linked to fire prevention, and monetary variables to measure economic forest management benefits. Difficulty to obtain information required by the models.

- *Easiness to implement and use*: the DSS should be more intuitive and easier to use (enhance visualization). The difficulty of using it could add workload to technicians; they need time to learn how to use it. The DSS should have access to other data or sources of information such as forest inventories and maps.

- *Accessibility:* The DSS should be available to other organisms, entities and societal groups that could know and follow forest management interventions and be informed, enabling participative governance.

- *Consider potential shocks:* Models will require to consider plagues, diseases, and meteorological events that could affect the outcomes of the DSS

- *Potential innovations:* Use the DSS to support the implementation of the Payments for Environmental Services (PES) system. The DSS will allow quantifying and valuing externalities and costs associated to the management, paying based on the level of the ES provision, payment by results instead of by surface.

2.2.3. Which internal factors (e.g., skills, available resources) would condition/constrain the use by stakeholders of the DSS?

Stakeholders identified as internal constraints:

- *Technical knowledge and capacities:* Most technicians will need to improve their technical knowledge to use and interpret the outcomes of the DSS.

- *Time to learn and use the DSS:* Technicians have a considerable load of bureaucratic tasks, and using DSS would imply a new load. Services require additional personnel, and implementing DSS requires more financial resources associated with technical personnel.

- *Informatic security*: System departments in the organisms and services could restrict installations for security reasons, even if they are free software.

- *Cultural constraints:* Some technicians could trust in their own criteria more than the DSS results.

- *Trust in the DSS results*: Inputs that feed the models must be reliable.

2.2.4. Which external factor could condition/constrain the implementation of the forest management solutions provided by the DSS?

Between external limitations to implementing the forest management proposed by the DSS are:

- *Cultural and environmental education:* There is a need to change views about forest management in various societal groups, even at the political and administrative level. The DSS could help change these visions against forest management, supporting based data-driven solutions to forest management problems.

- *Fragmented and abandoned forest private properties:* In these forest areas, it is challenging to develop forest interventions; sometimes, if the owner exits, does not permit to act on his property or does not have financial resources to pay for the intervention.

- *Excessive and contradictory normative framework*: There are multiple protection figures simultaneously. Almost the entire forest is under any protection figure. Also, the planning instruments such as Natural Resources Management Plan (PORN) and Master Plans for Use and Management (PRUG) need to be updated to the changing conditions of the protected areas.

- *Outdated forest management and fire prevention plan in the municipalities*: These need to be updated to allow acting the regional administration (Conselleria).

2.3. Training course (results)

The training course was carried out at the Universitat Politècnica de València with 12 participants following the guide content in the Transfer Strategy document: presentation of the DSS C.A.F.E., explanation of ecosystem services and forest management relation, DSS structure, modelling part, installation, and optimization exercises with practical cases.

Participants were guided in all the steps with the time needed to learn how to install the tool and then step by step until they could run the practical cases.

Additionally, an initial and final survey was applied during the course to know participants' profile, their expectations about the course, and previous knowledge of DSS use from which the following results were:

- *Participants' profile*: 50% were forestry and forest engineering professionals, 75% were currently working, and 16% were students (PhD and master) in the same area.
- *Previous knowledge*: At the beginning of the course, 58% declared not having knowledge and any experience using DSS and eco-hydrologic simulation. At the end of the training, participants declared improving quite a lot of this knowledge and they could use the tool autonomously together with supporting material (videos, tutorials, manuals).
- *Meeting training expectations*: the overall participant's expectations about the training course were improving forest management using the DSS tool. The majority declared that meeting their initial expectations regarding forest management through prioritizing Ecosystem Services was new for some of them. They recognized their need to learn about programming to understand the tool functions better, and they needed more time to learn and practice with additional simulation cases.
- *Contributions to improve the training course*: Participants expressed that the course is quite complete for an introductory part, and they would add more training hours to practice with more cases.

3. Replication in Portugal at the watershed and municipality level

The Transfer Strategy was applied in Portugal through two activities:

- Local workshop in Ceira municipality
- Training course on the use and implementation of DSS C.A.F.E.

The training course also included a final stakeholders' participatory activity to gather their views on the usefulness of the DSS in enhancing their forest management activities.

3.1. Mapping stakeholders

First, stakeholders' identification was carried out through a list including forest actors linked to forest activity at the regional and municipal administrative levels and some private sector actors. This list is in *Deliverable No.* 9.

3.1.1. Mapping stakeholders

The second stage in this process was the municipal-level characterization of stakeholders, carried out in the first local workshop using a matrix of influence and interest. This methodology allows us to broaden the spectrum of actors and obtain information on how they could influence DSS implementation and the forest management approach, as is shown in Figure 3.

A total of 20 stakeholders were mentioned, most of them from the public sector. Participants expressed some divergences in mapping stakeholders according to their level of influence and interest, placing some stakeholders in two or more quadrants of the matrix. Finally, they plotted only the actors on which they agreed.

Stakeholders on which there was no agreement were: the Agency for the Integrated Management of Rural Fires (AGIF) (diverged level of interest but share a high level of influence), municipality councils, and associations of forest producers (high level of interest but diverged in the level of influence); the Republican National Guard (GNR) which is in charge by supervising the forest management actions was mapping in two opposite areas; and the Firefighters placed in three of the four quadrants of the matrix.

Figure 3. Ceira- Portugal. Stakeholder analysis through their influence and interest in forest management

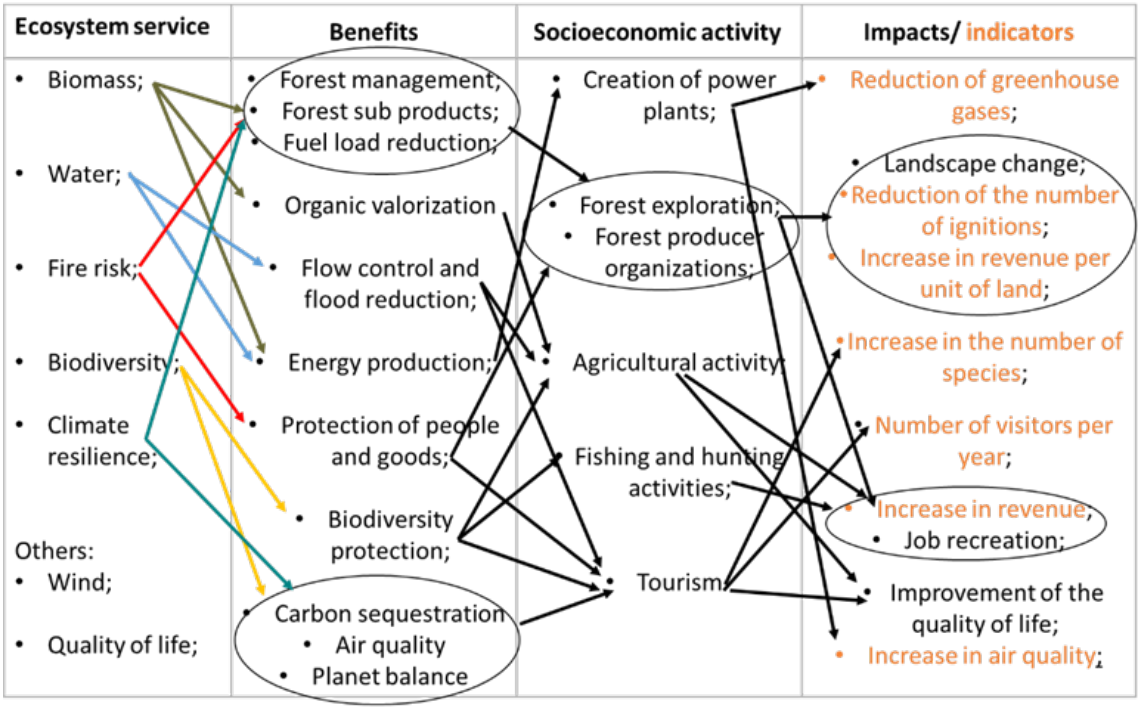
High influence – Low interest	High influence – High interest
• President of the Republic • Ministry of Internal Administration (MAI) • Social and sport institutions (e.g., Benfica institution) • Media	• Portuguese Institute of the Sea and Atmosphere (IPMA) • AFOCELCA (private company from the Navigator group and the ALTRI group). Support the firefighting activities • Owners and Citizens • National Emergency and Civil Protection Authority (ANEPC) • Portuguese Environment Agency (APA) • Management Entities - ZIF (Forest Intervention Zones) • Forest Sappers • Association for the Development of Industrial Aerodynamics (ADAI).
Low influence – Low interest	**Low influence – High interest**
• Plant nurseries (private).	• Forestry companies (private) • Local associations • Parish councils.

3.1.2. Identifying socioeconomic and social needs dependent on the forest ecosystem and its indicators at subcatchment level.

The result of this activity is presented in *Figure 4.* Following the workshop protocol, participants were asked to analyse which benefits were derived from each ES included in the DSS and then economic activities most depended on these ES.

Most benefits derived from ES allow activities such as tourism, agriculture, and biomass production. The reduction of *fire risk* is identified as needed for allowing forest management activities such as fuel load reduction and forest products) and for the protection of people and goods. B*iodiversity* is identified as related to the quality of life and encourages tourism and recreational activities. *Climate resilience* is associated with carbon sequestration and air quality, which boots tourism activities.

Figure 2: Ceira-Portugal. Socioeconomic activities and their dependence on Ecosystem Services.



3.2. Forests management decisions provided by the tool vs current management approach in each area (evaluation of the usefulness of the tool).

This usefulness evaluation was done through the first local workshop and in the training course following the workshop protocol. Stakeholder's answers are presented in the next points.

3.2.1. To what extent the DSS could support the activities carried out by the participant stakeholders, in particular public administrations?

- The DSS can be important for associations of forest producers or agents of landscape transformation and the forest management entities such as Integrated Areas of Landscape Management (AIGP)
- The participants consider that the tool can provide a path and support for the decision of research work in planning for forest associations.
- The participants do not consider how the tool can be helpful for inspection and for civil protection services of municipality councils.
- To support decision-making to prioritise Ecosystem Services
- To help to select forest intervention required in a specific area.
- The tool helps to optimize forest management and to select the best management to increase biodiversity and its protection and promote carbon sequestration.
- It could help to elaborate the forest management plans.

- The tool could support societal awareness in services ecosystem preservation, such as saving water consumption.

3.2.2. What is the potential of the DSS, also considering the possibility to develop the tool or add new functionalities, to support other future actions to be undertaken by the stakeholders?

- Participants consider that it is important to improve the tool interface to be more *user-friendly and easier to use* (simplified for technicians). Also, the possibility to include error warning messages while the tool is being operated.
- Regarding *management models*, they consider that it is necessary to have a greater number, both general and specific.
- They are concerned about maximizing land use management to increase *fire resilience.*
- Considering the specific territorial characteristics, it could be helpful if the tool would suggest the specie (tree) more appropriate to maximize.
- For academic users, it would be helpful to know the robustness and sensitivity analyses.
- The tool would be adapted to use in such as Portuguese fragmented forest property.
- It would be helpful to have and *online tool* without installation.
- The *concept of fire risk must be adapted* to the Portuguese reality. There are different concepts associated with fire risk; i) "risco de incêndio" usually translated for "fire risk" is based on the value of the assets that are present on the land (loss potential); ii) "perigosidade" which means the structural risk - depends on land use, slope and burned areas, and iii) "perigo de incêndio" or fire danger which is related with the more favorable meteorological conditions for wildfires. It was asked if the danger is considered because it differs from the fire risk concept considered in the tool. In the municipalities, they are interested in danger since it allows them to act more quickly.

3.2.3. Which internal factors (e.g., skills, available resources) would condition/constrain the use by stakeholders of the DSS?

- There is a need to improve *technical skills* and contact more qualified technicians. Programming knowledge also would be needed.
- Personnel would require *time to learn how to use* the tool.
- Possible *difficulty in obtaining data* required by the DSS models.
- They see complex tool installation and its replication.

3.2.4. *Which external factor could condition/constrain the implementation of the forest management solutions provided by the DSS?*

- Most of the municipalities do not have property registration which limits the landscape management, which is in the hands of Integrated Areas of Landscape Management (AIGP)
- The ecosystem services are very transversal to several services and entities. If a civil protection service had to prioritize the provision of water or climate resilience or biodiversity would not be part of it.
- The national legislation is considered a limitation. In the municipalities, the civil protection services have restrictive transformation and forest management rules. After the 2017 large wildfires, there were significant changes in legislation; the municipalities are still adapting and need to meet goals and objectives. There is probably no space to use this tool given their workload, at least in the civil protection services (municipality council). They have legal requirements to monitor if the rules to plant, maintain and manage the owners' forest areas are being complied, and they do not have much flexibility to change (from the owner to the council).
- From private owners, poor knowledge about forest management and resistance to change.
- The current management plans have been done for ten years and could constrain the use the tool.

3.3. Training course (results)

This activity was carried out in ADAI, Lousã-Coimbra Portugal with 11 participants following the guide content in the Transfer Strategy document: presentation of the DSS C.A.F.E., explanation of ecosystem services and forest management relation, DSS structure, modelling part, installation, and optimization exercises with practical cases. In addition, participants were invited to evaluate the usefulness of the DSS, adaptations needed to be implemented, and limitations of using the tool and implementing the forest management models derived from the DSS. These results have been integrated into point 2 of this report.

An initial and final survey was applied during the course to know participants' profiles, expectations about the course, and previous knowledge of DSS use. Some results are presented as follows:

- *Participants' profiles*: 90% were forestry and forest engineering professionals, 45% with master studies, and 100% were currently working. Participants came from different organisms at the national and municipal levels.
- *Previous knowledge*: At the beginning of the course, 72% expressed knowing something about DSS and having some experience in using it. 90% declared to

have between some and enough knowledge in forest management and 50% knew eco-hydrologic simulation. At the end of the training, participants declared improving much of this knowledge, especially in using DSS and in eco-hydrological simulation. Regarding the use of the DSS, 63% declared that they could use the tool autonomously together with supporting material (videos, tutorials, manuals).

- *Meeting training expectations*: The overall participant's expectations about the training course were improving forest management using the DSS tool and being able to use the DSS tool autonomously. Participants declared meeting their initial expectations.
- *Contributions to improve the training course*: Participants suggested including some explanations given during the course in the Manual. Some had asked a DSS training for a specific project. Also, some participants suggested more training time and simplifying the interface for final users.

4. Joint analysis: final reflections

Stakeholders' interaction in Serra (Spain) and Ceira (Portugal) has allowed the dissemination, calibration, and improvement of the DSS C.A.F.E. Contributions from stakeholders related to the tools' installation, functionalities, models, and outcomes have let the team project introduce feasible tools' adjustments, such as improving the user's interface, complementing input data according to territorial cases, and implementing the calibration needed. Training courses let to test the feasibility of using the DSS, overcoming difficulties in installation and functionalities, and understanding and interpreting DSS outcomes by participants.

Additionally, participatory activities aimed at evaluating the DSS usefulness at the regional and municipal administration levels have given a broader perspective of the scope of the DSS in changing the current forest management approach. In this sense, some aspects are highlighted from stakeholder interaction; similarities and differences in the Serra and Ceira case are as follows.

- Identification of Ecosystem Services and socioeconomic benefits.

Participants expressed high awareness about the relationship among forest management, provision and protection ES, and generation of socioeconomic benefits. They could identify all the socioeconomic activities dependent on the ES provision at sub catchment level in both countries and indicators to measure these activities' impact on socioeconomic and environmental sustainability.

- *The usefulness of the DSS in supporting forest management activities.*

In both Serra and Ceira municipalities, the DSS C.A.F.E is considered helpful for forest management planning in public administration, *quantifying ecosystem*

services, knowing territorial potential and prioritizing them according to the environmental conditions and societal preferences. Participants showed a strong interest in providing and protecting ecosystem services through forest management in both cases. In Serra, the DSS was perceived as very important to support not only the Municipality Forest Management Plans but also to support the interventions made by the forest technicians, to *justify the necessity and the use of financial resources.*

At the regional level the DSS was considered in both countries helpful in designing and developing forest management plans prioritizing Ecosystem Services, *optimizing financial resources*, and focusing on priority areas such as those to increase fire resilience. Implementing the DSS could provide *visibility and transparency* to forest management planning avoiding changes by political reasons.

A shared view was the role that DSS could play in *improving societal culture and education,* creating awareness through science-based arguments about the necessity of forest management to maintain the provision of ecosystem services.

- *DSS Improvements to meet users' needs.*

Introducing this question in stakeholder interaction activities evidenced DSS adjustments considered needed by potential users. Some are easy and feasible, such as *improving the user interface* to be friendlier and *complementing data* for specific areas. Including more metrics was considered important in both sites, such as economics variables and other ecosystem services, as well as possible shocks such as plagues and meteorological events. All these requirements will imply a more complex use of DSS.

- *Internal constraints to implement the DSS.*

A concern shared in both countries was the need to improve the *technical knowledge and capacities* of technicians from the forest services in using and interpreting DSS results due to the scarcity of personnel, the bureaucratic tasks they must focus on, and the lack of *time to learn*.
In the case of Serra, participants identified possible cultural constraints by technicians who could trust in their own criteria than on the DSS outputs, some expressed that the DSS should complement their practical and territorial knowledge to decide on forest interventions.

- *External limitations to implement forest management proposed by the DSS.*

In Ceira, *legal regulations* limit forest management by municipalities which must monitor rules compliance by private forest owners who are predominant in the area. There is a need for *institutional coordination* to provide ecosystem services in charge of different institutions that need to be more effectively coordinated.

In both countries, *Cultural and educational visions, and positions* against forest management interventions in private owners and other societal groups could difficult introduce a new forest management approach. The prevalence of *private and fragmented forest property* limits any forest intervention, and the existence of *varied and overlapped normative frameworks* (e.g., PORN, PRUG, Natura 2000).

- *Training course outcomes*

This activity in both countries allows for to transfer of knowledge not only in installing and using the DSS but also in multi-objective forest management; for some participants, this approach gives a new vision of Ecosystem Services provision. Participants' feedback allows the team project to enhance the course content and supporting material to install and use the DSS.