



## REPLICATION AND TRANSFER STRATEGY

ACTION C.3: Development of a replication strategy and application in municipalities and watersheds in Spain, Portugal and Germany

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## 1. Introduction

The main output of the Resilient Forests project is to develop a Decision Support System C.A.F.E. allowing forest managers to make forest planning decisions based on data-driven at the watershed level. The DSS allows the optimization of forest ecosystem services (carbon, water, fire risk, and the eco-resilience) of forests in under climate change scenarios. In order to make these project's results to be used and have a real impact on forest management positively impact the forest management approach, it is crucial to design a transfer and replication strategy able to reach different communities of end-users. For this to be done, it is necessary to establish a framework of interaction with the relevant stakeholders. to know who the key persons are to be involved in the project. Stakeholders' interaction is understood by Slunge et al. (2017) as the activity of involving and communicating with actors who are potentially interested in or affected by scientific studies and their results during the research process and in the communication of results. This process requires understanding stakeholders' needs and priorities linked to the project. Stakeholders' interaction in Resilient Forests has been developed in the three sites where the project is carried out (Spain, Portugal and Germany).

There are two main tasks to make the DSS useful and available to the target stakeholders. These are tackled in this strategy. First, it is necessary to design and implement a framework of interaction with stakeholders aimed to show what the DSS is about, so that stakeholders can assess its potential uses for their own purposes and responsibilities, as well as identify the factors that could condition its application. Second, it is needed a training protocol so that potential users can learn about the utilization of the tool.

Therefore, this document synthesizes this two-step the process of replication and transfer strategy for the DSS CAFE.

## 2. Preliminary identification of key forest target users and stakeholders

The project partners were asked to carry out a preliminary identification through a list of key forest actors at the local and regional level, that means those related to forest management and those affected or beneficiated by the forest management actions.

- a. In the public sector, organisms such as those in charge of forest planning and management, natural parks administrations, water provision, fire risk prevention, and forest research institution.
- b. In the private sector, for instance, biomass/wood producers, water distribution, tourism and leisure businesses.
- c. In the community, actors like sector forest associations and environmental/forest NGOs.

This list should contain at least the name, level (regional or local), and contact details. It will be used to contact these actors regarding the different participatory activities to develop in the project and will be completed during the participatory activities.

These stakeholders will be invited to the workshop that is protocolised in the next section.



### 3. Mapping stakeholders

The actors invited to this workshop will carry out several exercises aimed to identify potential users and uses of the DSS. The workshop is organised around the following steps. The guide to carrying out this part is included in the *Workshop protocol annex 1*.

#### 3.1. *Mapping stakeholders*

Participants will be asked to identify -besides themselves- other stakeholders related to forest management, and to assess and classify them. This analysis or mapping consists of categorising stakeholders concerning their level of interest and influence or relevance (if they can make contributions, facilitate, or block the project or whether they will be affected by the project results).

The main steps to develop this activity are:

- a. Working in small groups to facilitate sharing and discussing ideas among participants.
- b. Participants identify actors interested or affected by forest management at the local and or regional levels.
- c. Discussion and consensus among the participants about the role of stakeholders identified: who may influence forest management and those interested in it. Stakeholders are plotted in a matrix of interest and influence previously drawn.

Gathering these results in this single matrix of Interest/Influence, the project partners account with a characterization of key actors and the role that they could play in the project (implementation of the DSS and its future developments).

#### 3.2. *Identifying socioeconomic and environmental needs dependent on the forest ecosystem and its indicators at subcatchment level.*

In a second step (see protocol) participants are asked to explore the relations between the ecosystem services provided by the forest and the socioeconomic activities of relevance in their territorial setting. The knowledge of local actors is essential to understand the nature of this relationships.

For this to be done, the exercise consists of:

- a. To clarify the concept of Ecosystem Services and their benefits.
- b. To ask participants to prioritize Ecosystem Services.
- c. Working in groups (4-5 persons), to identify benefits derived from ecosystem services and the socioeconomic activities settled in the area based on that ES provision.
- d. To invite participants to propose indicators to evaluate the contribution of those ecosystem services in the several socioeconomic activities.

Carrying out this activity allows for complementing the socioeconomic characterization of each area and evidence the need to protect and ensure the Ecosystem Services provision through sustainable forest management adapted to each area accordingly with local priorities and preferences for which the DSS is essential.

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

Forests DSS are developed to help managers to make forest planning decisions based on technical and scientific knowledge and offer different management alternatives adapted to the territorial environmental conditions and managers' preferences/priorities. Although many Forest DSS have been developed (Borges, Nordström, Garcia-Gonzalo, Hujala, & Trasobares, 2014), their effective implementation still needs to be improved. Scholars concerned about factors that limited DSS uptake agreed that meeting users' needs is critical to effectively adopting these DSS tools in forest management planning (Dalemans et al., 2015; Vacik et al., 2015; Pastorella et al., 2016). Evaluating applicability and usefulness imply considering the value added to final users using new technologies such as forest DSS (Pastorella et al., 2016). If the DSS does not meet users' demands, forest decisions will be guided by managers' practical knowledge rather than in solutions based on using a decision support tool (Stewart, Edwards, & Lawrence, 2013). Considering these factors, Resilient Forest assessed the DSS usefulness perception of the potential users in improving their current decision-making process in forest management tasks. This usefulness evaluation of the DSS is included in all participatory activities: workshop protocol, personal interviews, and training courses. Analysing these answers Resilient Forest team will have a rough aide about the possibilities that DSS CAFE will be implemented and meet the objectives project.

The project includes a participatory design of the DSS which involves gathering stakeholder feedback about the changes the tool would require to meet their forest management needs. The information provided allows the project team to introduce tool enhancements when is possible. To facilitate this stakeholder's feedback, a specific open question is included in the workshop protocol, personal interview guide, and training course guide. These questions are:

- 4.1. *To what extent the DSS could support the activities carried out by the participant stakeholders, in particular public administrations?*
- 4.2. *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?*
- 4.3. *Which internal factors (e.g., skills, available resources) would condition/constrain the use by stakeholders of the DSS?*
- 4.4. *Which external factor could condition/constrain the implementation of the forest management solutions provided by the DSS?*

These questions are of relevance because the acceptance and implementation of DSS rely not only on its functions and features or on its usefulness; external factors could also block the tool's applicability. Forest DSS literature highlighted that aspects such as the background and the profession of the forest managers or decision-makers could affect the effective uptake of DSS. Furthermore, socioeconomic, cultural, and territorial conditions may influence forest decisions supported by these DSS tools (Pastorella et al., 2016). Although such factors are out of the control of the project, it is necessary to know and evidence them in order to anticipate some change alternatives. Throughout the different participatory activities, stakeholders are invited to analyse what factors could constrain the use of DSS in their organizations/services and external factors such as political, cultural or regulatory that could block implementing the forest



management approach derived from the DSS. The procedure to conduct this analysis is explained in the *workshop protocol, personal interview guide and training course guide*.

## 5. References

- Borges, J. G., Nordström, E. M., Garcia-Gonzalo, J. T., Hujala, T., & Trasobares, A. (2014). Computer-based tools for supporting forest management. The experience and the expertise world-wide. Umea, Sweden.
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- Vacik, H., Borges, J. G., Garcia-Gonzalo, J., & Eriksson, L. (2015). Decision Support for the Provision of Ecosystem Services under Climate Change: An Editorial, 3212–3217. <https://doi.org/10.3390/f6093212>



## 6. Annexes

### Local Workshop Protocol

#### Aims of the local workshop

The first local workshop has the aim to advance in the processes of dissemination and participatory development of the DSS that allows:

1. Evaluate the usefulness and potential of the DSS by the participants (end users) in the management competences they are in charge
2. Evaluate and prioritize the ecosystem services of the basin (mountain) and identify the socio-economic activities (and indicators) associated with them.

#### How we consider the Ecosystem Services and benefits

To characterize the socioeconomic activities (and its indicators) affected or impacted by the different forest strategies, it is necessary to clarify their relations to the benefits derived from the ecosystem services. This requires a clear definition of ecosystem services, their characteristics and the benefits derived from them. Ambiguous definitions, and scarce understanding of ecosystem complexity led to confusion and error in valuing the benefits obtained from ecosystem services, called a double counting<sup>1</sup> problem. To avoid this difficulty, in Resilient Forest we propose to work with the definitions provided by Fisher et al., (2009:645) which called *ecosystem services* as the aspects of ecosystems utilized (actively or passively) to produce human well-being. This definition considers that services are an ecological phenomenon and they do not have to be utilized directly. In their framework they distinguish between intermediate and final services like the economic accounting systems.

*The benefit is* that point at which human welfare is directly affected, but to obtain a gain in welfare likely requires other inputs such as labour, knowledge, or equipment. For instance, soil formation and water regulation as intermediate services derived in constant stream flow (final service) that provided benefits as water for irrigation, water for hydro-electric power, drinking water (the same ES can generate multiple benefits). In this case, to obtain these benefits other inputs as capital (build) and resources (labour) are required to make possible its delivery to beneficiaries. Also, some functions and processes of ecosystems are considered services if there are human beneficiaries such as the carbon sequestration process from which humans have a direct benefit. Pollination is another service from which humans benefit, but they do indirectly, through the provision of food, which is the good or benefit that we can apply in an economic valuation.

Benefits lead to the generation of socioeconomic activities which include the production, distribution and/or the consumption of these material or immaterial

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<sup>1</sup> Double counting refers to erroneous practice of counting intermediated services in the value of final services.

benefits. These socio-economic activities generate impacts on some socio-economic variables which are possible to measure through indicators.

Next figure illustrates with some examples the logic sequence of concepts linking ES (either intermediate or final) and indicators.

Intermediate Service	Final Service	Benefit	Economic activity	Impact	Indicator
Primary Production Soil formation Nutrient cycling	Water provision	Irrigation water	Agriculture	Increase employment	No. employs
	Biomass	Heating provision	Pellet production	Reduce fossil-fuel use	% Reduction Fossil-fuel use
	Reduce Fire Risk	Lives and capital protection	-Commercial -Touristic -Recreational	Reduce rural abandon	% Increase inhabitants
	Climate Resilience	Availability Forest products	Wood production/ medicinal plants	Reduce fire events	% Increase incomes
	Biodiversity	Recreation	Tourism-guided routes	Increase tourism & employment	No. Visitors No. Employes

### Criteria for participant selection

This participatory exercise is targeted to the municipalities which are under the influence of the basin or have a forest in their area, and to the technicians who work in the municipalities in the forestry, environmental and socioeconomic issues. They have valuable knowledge of the local socioeconomic and environmental dynamics. Potential participants could include local members of the advisory board and official governmental members. These stakeholders have information about a broader range of stakeholders related to forest management which could be important to engage in the ongoing participatory actions of the project.

### Number of participants

The maximum number of participants recommended to carry out this workshop is 15.

### Recording and reporting

It is advisable to have the audio recorded and taking notes of the participatory parts of the workshop. The consent of the recording should be obtained from all participants. Reporting outcomes might follow the sequences of the sections of the workshop presented below.

### Informed consent

Ensure you have informed consent to undertake the workshop. This means telling the participants what will happen with the research, giving them the option to withdraw,



confirming that their statements will be anonymous (unless otherwise agreed) and asking the participants to respect this confidentiality for other participants (i.e., not to betray confidentiality when they talk with others about the workshop).

### Section A: Presentation and utility of the DSS

1. Start with an introduction asking all the participants to introduce themselves and the organization/municipality on behalf of which they participate and the functions they carry out.
2. Presentation of the project (including an introduction of ecosystem services emphasizing in those included in the DSS and considering the concepts specified above).
3. Explanation about how the tool works and the results that are possible to obtain (Try to avoid deepening on the technical process of the tool)
4. Explore the perception of the usefulness of the tool for the management activities carried out by the participants and/or the basin management needs.

**Open question to all participants:** *Considering the competences in which you work (forest management, planning, taxation, promotion of activities, or any other), in relation to which of them and in what sense, do you think this support tool for forest management could be useful? {Make sure the answers are sufficiently supported}*

**Open question to all participants:** *We have seen in a synthetic way how the model works, what aspects it takes as starting points, and what kind of results it allows to obtain. Can you think of anything that has not been included in the tool and that you consider could be useful for the development of your activity? I am referring to some ecosystem services not contemplated, some requirements/conditioning of forest management, other variables of forest management than those used by the model.*

5. Identify the requirements for the implementation of the DSS (normative, political, technical, financial)

**Open question to all participants:** *The DSS generates various models of forest management, assuming that it is feasible to carry out these management changes. However, the possibility of making decisions on forest management is often subject to or limited by several constraints (regulatory, financial, political). Can you think of any constraint that could limit or condition the possibility of carrying out the type of management that this model analyses?*



## Section B: Identification of socio-economics variables

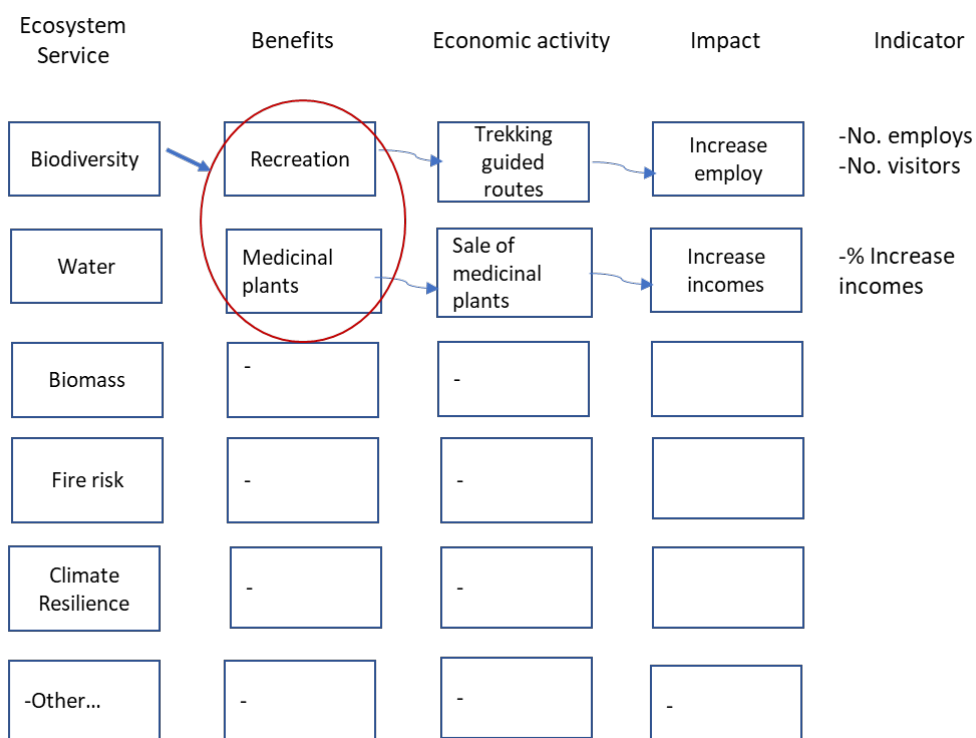
- 6. Prioritisation of the Ecosystem Services.** Give a piece of paper to all participants [Show the slide that contain the ecosystem services included in the DSS] and ask them to write down following this guide question:

*The DSS include a series of ecosystem services (remember them on a slide). We are going to ask you to order them (obviously from your point of view) from highest (number 1) to lowest (number 5/6?) importance for the well-being and development in your municipality. Please add shortly some reasons to choose the first one.*

- 7. Identification of socioeconomic activities and their indicators.**

Start explaining the activity to all participants then splitting them into groups (6-8 persons). Carry out this activity using post-its and a flipchart for each group and follow this guide question:

*As municipal technicians, you know well the economic activities and services that are developed in your territories and the relationship they may have (that is, how they may be affected or depend on) with the ecosystem services considered in the DSS*



In each group:

- List on the flipchart the ecosystem services included in the DSS (ask if they consider that any one which is not included in the DSS to list (If there is any, write with different colour). Add on the flipchart four more columns for benefits, socioeconomic activities, impacts, and indicators.

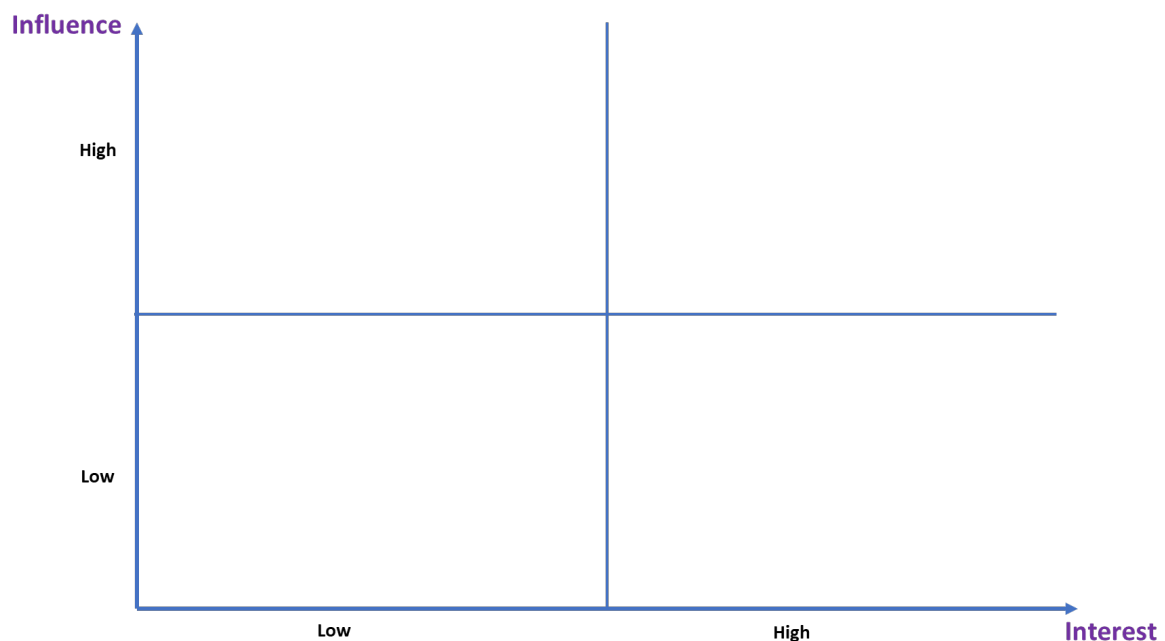
- b. Start a 3–4-minute round asking them to think and write individually on the post-it the benefits obtained in their community for these ES (one benefit per post-it).
- c. Cluster the related benefits and ask the participants to link them with ecosystem services that they consider depend on the most.
- d. Ask them to write individually on the post-it the socioeconomic activities derived from these benefits (one activity per post-it) that are developed in their territories related/linked to or dependent on the identified benefits.
- e. Put an arrow connecting benefits and socioeconomic activities on the flipchart.
- f. Ask them to identify some impacts derived from these socioeconomic activities in the community (one impact per post-it).
- g. For every impact ask them to suggest (verbally) an indicator and write them on the flipchart in the indicator column.

## 8. Mapping stakeholders

This exercise allows us to assess and analyse stakeholders to prioritise them for engagement in classifying according to the typology of who should be *involved*, *consulted*, *informed*, and *collaborate*.

Do this exercise with all participants together using a flipchart and post-its.

- a. Draw a matrix Interest/influence on the flipchart to characterize the stakeholders.





- b. Ask the participants to identify and write on the posts-it: What stakeholders which activity or wellbeing or (interest) is associated with the forest management?
- c. Ask them to place in the box what they consider agrees with their level of influence and/or interest<sup>2</sup>.

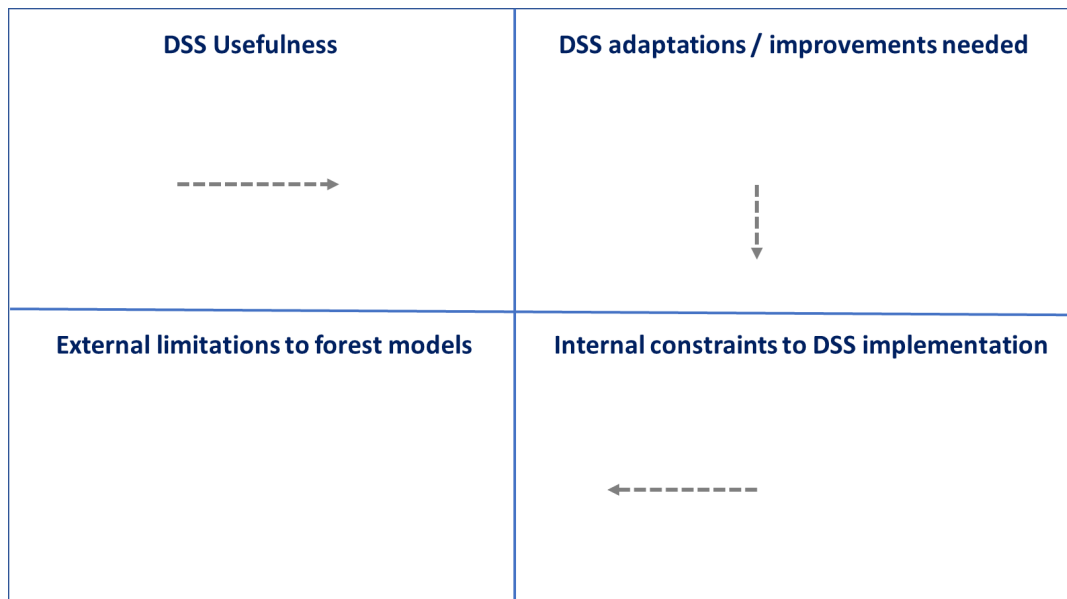
**9. Participatory evaluation of usefulness of the DSS, Adaptations and improvements needed, internal constraints to the DSS implementation, external limitation to implement forest models derived from the DSS.**

Do this exercise using a flipchart and post-its and split participants into groups of 4-5 persons by the affinity of belonging to level of responsibility in forest management activities (public administrative groups, technicians' groups, private companies, academic sector). Assign a coordinator to each group to guide the activity.

- a. Draw a matrix divided into four quadrants on the flipchart and write down each as follows:

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<sup>2</sup> *Boxes analysis*: The boxes provide information of the levels of engagement. Thus, stakeholders with high interest and high influence located in the *collaborate* box are those which are most beneficial to engage in order to obtain relevant information, resources and permissions. Those with high influence but low interest (the *involve* box) should be engaged because they may have influence on the success of the project. The group with high interest and low influence (the *consult* box), should be kept informed and maintain interactions due to their high interest could be influential by forming alliances with other more influential stakeholders. Those with low influence and low interest (the *inform* box) are stakeholders with less need to consider for engagement but also they should be adequately updated (Durham E., Baker H., Smith M., 2014).



- b. Be sure that participants have enough post-its and start a 3–4-minute round asking them to think and write individually on the post-it about the DSS usefulness for the forest management tasks they or their organizations or services carried out (one idea per post-it).
- c. Ask the participants to explain the group idea before placing the post-it on the first quadrant (top left side)
- d. Continue to the top right side, asking them to think and write on the post-it the DSS adaptations or improvements needed to be helpful in their forest management tasks (one idea per post-it).
- e. Asking them to think and write on the post-its possible internal constraints to implement the DSS tool in their service or organization (one idea per post-it). Ask them to explain the group idea before placing the post-it on the bottom right side.
- f. Asking them to think and write on the post-its external limitations (normative, social, political) to implement the DSS forest management models (one idea per post-it). Ask them to explain the group idea before placing the post-it on the bottom left side.

## References

- Durham E., Baker H., Smith M., M.E. & M. V., 2014. The BiodivERSA Stakeholder Engagement Hand- book. BiodivERSA, Paris.
- Fisher, B., Turner, R.K., Morling, P., 2009. Defining and classifying ecosystem services for decision making. *Ecol. Econ.* 68, 643–653.  
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## Semi-structured interview - Guide.

### Objectives

1. To advance in the stakeholder engagement process.
2. Delve into the DSS's usefulness and possible contributions to improving the forest management tasks in the municipal or/and autonomic domains.
3. To reduce possible gaps between the DSS design and its effective use through the interviewee contributions.

### Semi-structured Interview

It is defined as a guided interviewing and listening tool in which some of the questions are pre-determined and other questions, and topics could arise during the interview. Although interviews appear informal and conversational are controlled a structured following a guide or checklist (Durham et al., 2014). In this case, it is used to engage stakeholders selected in a two-way dialogue about the potential use of the DSS and factors that are limited or facilitate its implementation.

### Criteria for interviewees selection

This participatory exercise targets the technicians who work on the municipality's forestry, environmental and socioeconomic issues. Potential interviewees could include local members of the advisory board and official governmental members. These stakeholders are crucial to engaging due to their knowledge of forestry, environmental and socioeconomic dynamics at the local level. These stakeholders are expected to participate previously in an introductory presentation and descriptions of the project and the DSS functionality.

### Conducting the interview

One of the advantages of conducting these interviews is allowing stakeholders to fully express their views and provide a narrative of their knowledge and experiences of forest management at the local level. Based on Durham et al. (2014), to carry out the interview is important to consider the following:

- Develop a checklist of the information the interviewer wants to cover (through a discussion with the research team)
- Become familiar with the guided questions before the interview.
- Be sure that the interviewee sitting is comfortable and appropriate.
- Introduce yourself respectfully and develop a rapport.
- Ask permission if you want to record the interview, or if it is necessary, provide a consent form.
- Maintain an open attitude to what the interviewee says and be sensitive, listening, and questioning.



## Guided Questions

Use these questions as a checklist to guide the interview. These are divided into three main topics as follows:

### 1. Knowing the forest management responsibilities of the Service/organizations has.

- a) What are forest management activities carried out by your service/organization directly?
- b) What are forest management activities delegated to other organizations/institutions?
- c) How does your service/organization/municipality currently carry out the planning of forestry actions?

### 2. Exploring the utility of the DSS

- a) Considering the type of analysis and results provided by the DSS, do you think it could be helpful for any of the activities carried out by your service/organization/municipality? In what sense and for what exactly?
- b) If so, would it improve/enrich the way decisions are currently made?
- c) Do you think it would improve your job performance? How?

### 3. Explore constraints to DSS implementation.

- a) Do you think it is feasible that your service (or others) used this tool (or another similar one) to carry out their responsibilities? What would be the pros and cons of incorporating this type of tools?
- b) What type of limitations (regulatory, political, financial, technical) may exist to implement the forest management models proposed by the DSS?
- c) At what level or area of the administration do you consider that the decision-making power or the responsibility would lie to overcome the limitations identified?

## References

Durham E., Baker H., M. Smith, Moore E., Morgan V., 2014. The BiodivERsA Stakeholder Engagement Hand- book. BiodivERsA, Paris.



## Training course on the use of DSS-C.A.F.E. Guide

### Objectives

1. To advance in the dissemination and demonstration process of the DSS
3. Delve into the DSS's usefulness and possible contribution to improving forest management at subcatchment and catchment levels.

### Criteria Selection for participants

This course targets personnel in public administration services at the regional or local level in charge of forest management activities.

### Training Course on DSS C.A.F.E.

This guide aims to facilitate a checklist with the main content required to develop a course training on the operationalization of the DSS C.A.F.E.

### Developing a Training Course on DSS C.A.F.E.

#### 1. Presentation of the DSS C.A.F.E.

- a. Brief introduction to the resilient Forest Project (objectives)
- b. Forest management based on Ecosystem Services (Quantification and optimization)
- c. DSS Potential (How much, Where, When How)

#### 2. Apply Initial survey to participants to evaluate:

- Their previous knowledge in Forest Management and use of DSS tools and in Eco-Hydrological models.
- Perceptions about the difficulty of using DSS and the training course.
- Expectations about the training course

#### 3. DSS Structure

- a. How the DSS works internally
- b. Simulation – Optimization – Visualization

#### 4. Modelling part

- a. How is the process-based model and how is it in CAFE?
- b. BIOME-BGC\_MuSo Model
- c. RHESSys model
- d. TETIS model

#### 5. Installation

- a. Brief explanation of how CAFE has been built.
- b. Installation, Run and Start

#### 6. Practical exercises



- a. Previous steps: A case study
- b. Knowing how to work: Model to use and metrics to optimize.
- c. Management plan: How much? where? when? How?

**7. Apply the final survey to participants to evaluate:**

- Contribution of the training to improve their knowledge in Forest Management, Eco-Hydrologic models, and use of DSS C.A.F.E.
- Final perception about the difficulty of using DSS and the training course.
- How well the participant's expectations about the training course were met.
- Participant contributions to improving the training course.