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BIOPROSPECT: Conservation and sustainable capitalization of biodiversity in forested areas

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VERSION HISTORY

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ABBREVIATIONS

Term	Explanation

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FOREWORD

This document provides all related information and description of the methods, means, tools and practical guidelines regarding the coordination, management, communication and quality control of the BIOPROSPECT project.

EXECUTIVE SUMMARY

Assessing the key aspects of interaction between stakeholders and ecosystems, such as the protected forested ecosystems (D.3.6.1a), is one of the first and key actions of WP3-Tool box for the economic valuation and sustainable capitalization of biodiversity-ecosystem services. D.3.6.1a provides guidance for the identification and categorization of stakeholders and their interactions between them and the ecosystem based on the available scientific knowledge. D.3.6.1a also provides the basis to build the engagement guidelines for stakeholders (D.3.6.1b).

Section 1 (Introduction): In Section 1, the central aim and specific objectives of the project are briefly described and the terms “forested ecosystem”, “ecosystem services” and “stakeholders” are carefully defined and described. The reasons behind the need for assessing the interactions between the stakeholders and forested ecosystems are briefly discussed and the methodology for stakeholder analysis is introduced.

Section 2 (Stakeholder Analysis): In Section 2, the stakeholder analysis framework is defined based on an extensive literature review. Stakeholder analysis steps, relevant tools and approaches are described towards stakeholder identification, differentiation between and categorization of stakeholders, stakeholder relationships, and issues to consider during stakeholder analysis are selectively given.

Section 3 (Case studies): In Section 3, case studies of the use of stakeholder analysis in identifying, differentiating, categorizing, analyzing the relationships between stakeholders and the importance of stakeholder analysis in ecosystem management and ecosystem services research are given.

Section 4 (Outcomes & Further Steps): In Section 4, the general outcomes and further steps in the procedure of stakeholder involvement are briefly discussed.

1. INTRODUCTION

1.1 BIOPROSPECT Vision

The main aims of the project are to explore and document the bioprospects of forested protected areas and the ways of sustainable capitalization as a means for their wise management and conservation, to encourage cooperation partnerships and networking among economic development planners and protected area managers, as well as to develop a cross-border bioprospect assessment methodological framework and economic valuation model in order to achieve outcomes which benefit both economic development and conservation. To achieve the above-mentioned goal, the project has specific objectives and outputs (Table 1).

Table 1. *Description and expected outputs of the specific objectives (SO) of the project.*

SO Description	Outputs
1. Provide operational tools for the conservation of forest biodiversity through economic valuation and sustainable capitalization	• Manuals for: (a) Assessing the status and trends of forest services' availability and distribution, (b) Genetic pool mapping and bioprospect assessment, (c) Stakeholders engagement and public participation in the economic valuation of biodiversity • Operational models for the economic valuation of biodiversity services in forest ecosystems • Guidelines for sustainable capitalization of provisional services in terms of bioprospect for agriculture & industry, water management, tourism & recreation and education & social inclusion
2. Demonstrate the operational application forest economic valuation and capitalization benefits	• Stakeholders mobilization in 5 forested areas (including 3 Protected Areas) • Mapping and valuation of genetic pool and biodiversity services in 5 forested areas • Action plans for improved biodiversity capitalization 4 forested areas • Demonstration interventions in 3 forested areas
3. Integrate economic valuation in operational management of forested areas and policy initiatives of Balkan Mediterranean area	• One-stop-shop for economic valuation of forest ecosystem services (e-calculator, e-handbook, e-training) • Networking forested protected areas and training of managers for improved decision making • Roadmaps for promoting biodiversity valuation and bioeconomy in regional and rural development

1.2 Forested ecosystems: *the problem and the solution*

A forested ecosystem is a dynamic complex of plant, animal and microorganism communities, and their abiotic environment, that interact as a functional unit that reflects the dominance of ecosystem conditions and processes by trees (Fig. 1). Humans, with their cultural, economic and environmental needs, are an integral part of many forest ecosystems (as defined by the Convention on Biological Diversity; CBD) (Bastrup-Birk et al., 2016). Forest area has increased in Europe over the last six decades, covering today nearly 40% of the European surface (European Commission). In addition to the supply of wood, to which most forested European land is dedicated, forests provide a multitude of benefits in terms of climate regulation, human health, recreation, refuges, fresh water supply and many others (European Commission). Nowadays, European forest ecosystems face multiple natural and anthropogenic threats (European Commission). For instance, a changing climate is producing increased droughts in the Mediterranean; forest disturbances are foreseen to increase (forest fires, invasive pests) and competing socio-economic demands for forest goods and services can result in multiple drivers of forest change (European Commission).

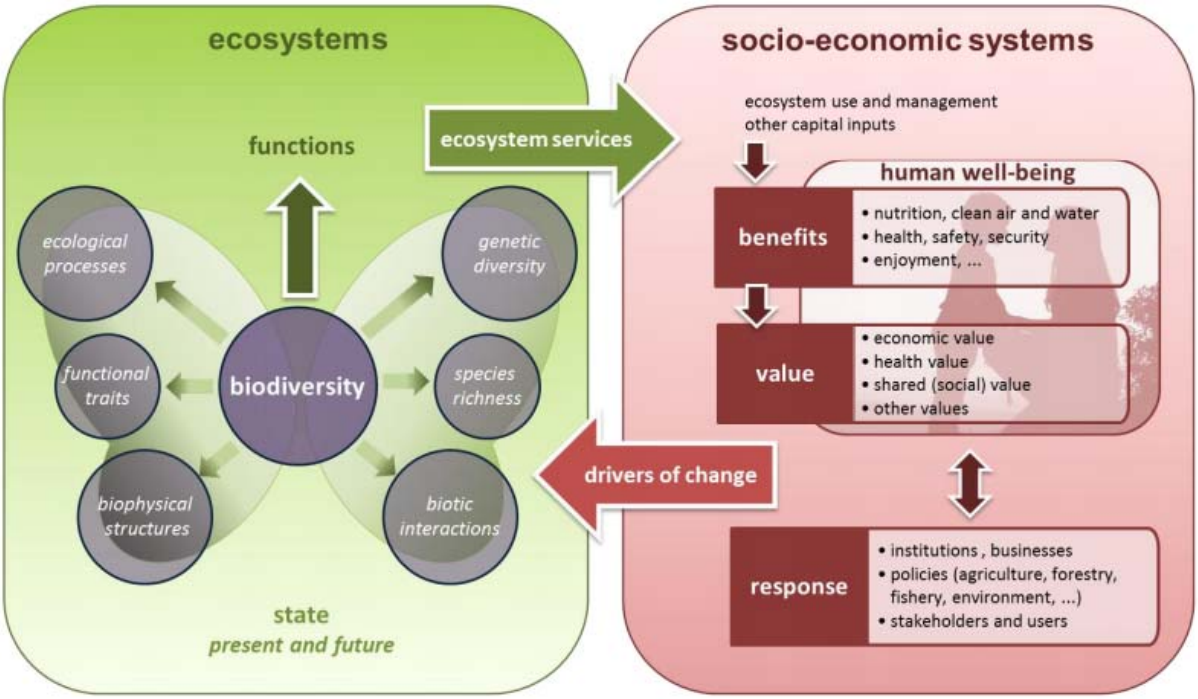

Figure 1. Conceptual framework for EU wide ecosystem assessments (From: *MAES, 2013*)

Forests and biodiversity are strongly interconnected. On the one hand, biodiversity largely depends on the integrity, health and vitality of forested areas (European Commission). On the other hand, a decrease in forest biodiversity will lead to losses in forest productivity and sustainability. Therefore, sustainable forest management is oriented to support the provision of forest goods and services, and to enhance biodiversity levels (European Commission).

1.3 The concept of ecosystem services: *definitions and description*

Forest ecosystem functions support the provision of ecosystem services to humans (Fig. 1). Ecosystem services are the benefits people derive from an ecosystem (IUCN), in other words are the direct and indirect contributions of ecosystems to human well-being (BISE). The publication of the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment (Program), 2005) made the concept of ecosystem services popular amongst academics, policy-makers and practitioners (Raum, 2018).

In this context, ecosystem functions are a subset of the interactions between the ecosystem structure and the processes that underpin the capacity of an ecosystem to provide goods and services (European Commission) (Fig. 1). Therefore, information and assessments of forest functions and services is of paramount importance for the design and implementation of effective sustainable forest management options and forest related policies at the European level (European Commission).

The ecosystem services are mainly divided into 3 categories: a) the provisioning, b) the regulating and c) the cultural ecosystem services (MAES, 2013) (Table 2).

Table 1. Millennium Ecosystem Assessment ecosystem services classification (From: MAES, 2013)

Provisioning (material benefits obtained from ecosystems)	**Regulating** (benefits obtained from the regulation of ecosystem processes)	**Cultural** (non-material benefits obtained)
• Food • Fresh water • Fibre, timber • Genetic resources • Biochemicals • Ornamental resources	• Air quality regulation • Water purification and water treatment • Water regulation • Erosion regulation • Climate regulation • Soil formation • Pollination • Pest regulation • Disease regulation • Primary production, Nutrient cycling	• Spiritual and religious values • Aesthetic values • Cultural diversity • Recreation and ecotourism • Knowledge systems and educational values

In terms of forested ecosystems, provisioning services are those related to forest production of biomass, water and energy (Mapping and Assessment of Ecosystems and their Services, 2014) or otherwise the material benefits obtained from a forested ecosystem (Table 2). Regulating (or maintenance) services are the benefits humans get from ecosystem through their regulation of ecological processes such as climate change, hydrological cycle or sediment transport (Mapping and Assessment of Ecosystems and their Services, 2014). Cultural services include the non-material outputs of forest ecosystems. According to MAES (2014), culture services are the physical settings, locations or situations that produce benefits in the physical,

intellectual or spiritual state of people (Mapping and Assessment of Ecosystems and their Services, 2014) (Table 2).

1.4 Assessing the interactions between stakeholders and forested ecosystems

1.4.1 Who are the stakeholders?

Different definitions are used for the term "stakeholder" such as:

- Those who have a stake on ecosystem services (Raum, 2018)
- All those who affect, and/or are affected by, the policies, decisions, and actions of the system (Grimble et al., 2015)
- Any group or individual who can affect or is affected by the ecosystem's services (Hein et al., 2006)

1.4.2 How are the stakeholders interacting with forested ecosystems?

In general, humans may, on the one hand, be benefited or affected by the services provided by a forested ecosystem and, on the other hand, influence the processes of the ecosystem that are determining the ecosystem services provided (Fig. 2). Forests are complex systems (Filotas et al., 2014). Incorporating in this already complex system the factor "stakeholders" results in an increased complexity due to the variety of stakeholders exist in terms of influence and interest, the complex interactions and relationships between the different groups that can affect or be affected by the ecosystem services provided by a selected forested ecosystem.

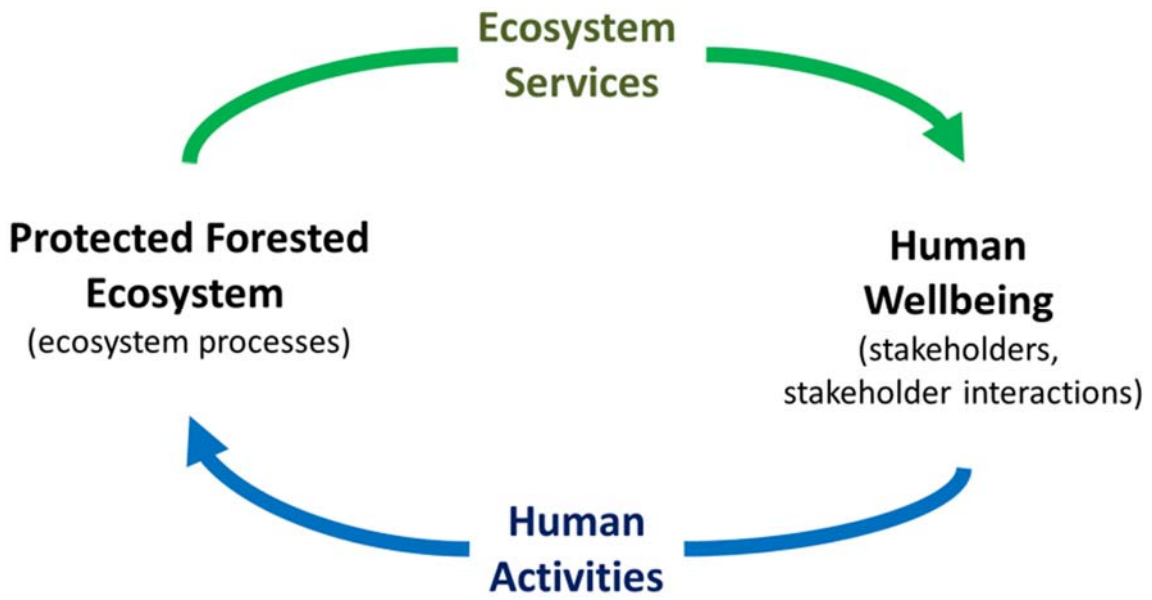

Figure 2. The relationship between a protected forested ecosystem and human wellbeing (Adapted from Brauman et al., 2014).

1.4.3 Importance: Why is it necessary to assess these interactions?

Understanding the economic and socio-cultural values of a forested ecosystem and the services it provides to humans is important for local, national and global policy and decision-making (Scholte et al., 2015; Turner et al., 2010). The quantification (i.e. valuation) and integration of these services into decision-making is crucial for sustainable development (Turner et al., 2010). The values that are attributed to ecosystem services are dependent upon the views and needs of those influenced by/influencing the services, the stakeholders (Hein et al., 2006; Vermeulen and Koziell, 2002). On the other hand, the services supplied by an ecosystem determine the relevant stakeholders (Hein et al., 2006). Therefore, there is a mutual and dynamic relationship between stakeholders and services (Hein et al., 2006) that should be taken into account when aiming at the sustainable capitalization of forested protected areas (Section 2.2).

1.4.4 Methodology: How to assess these interactions?

As described previously (Section 1.4.2), these interactions are actually defining the relations between ecosystem function, ecosystem services, human wellbeing and human activities that, in turn, influence forest ecosystem function (Fig. 2). The appropriate tool to relate the before-mentioned elements is ***stakeholder involvement*** (Seppelt et al., 2011). Stakeholder involvement refers to participation of interest groups (i.e. representatives of local affected authorities, politicians, civil society organizations and businesses) in a planning or decision-making process (Hauck et al., 2016). According to Seppelt et al. (2011), stakeholder involvement covers three aspects:

a. Stakeholders help to identify relevant ecosystem services (suitable indicators for ecosystem services assessments change as markets evolve, requiring local stakeholders to continuously re-evaluate the appropriate indicators).

b. Stakeholders provide ground-truthing (i.e. accuracy confirmation) for the development of management options.

c. Stakeholders evaluate possible management options (by ranking them or by assigning weights of importance to different services).

According to Hauck et al. (2016), stakeholder involvement:

a. Is an essential element in environmental management and decision-making (Young et al., 2013).

b. Is critical in the context of ecosystem services (Harrington et al., 2010; Hauck et al., 2013).

c. Enhances quality criteria for information and knowledge:

- Credibility of information
- Legitimacy (by the democratic character of the process and inclusion of contributions, values and opinions of different stakeholders; Sarewitz and Pielke, 2007)
- Relevance of information to the needs of decision makers (ensured by including the respective stakeholders and their needs into the research process; Weichselgartner and Kasperson, 2010)

d. Results in much richer knowledge (due to the experiential knowledge that stakeholders bring on the table).

The levels and forms of stakeholder involvement are multiple (Hauck et al., 2016). Important stakeholders, depending on the aim of the research (Grimble, 1998), should be identified, engaged and analyzed in a reiterating way in order to assess the dynamic interactions between them and the forested ecosystem. ***Stakeholder analysis*** is a methodology (i.e. a group of tools and not a single tool) that not only offers stakeholder identification but can be used to generate knowledge beyond that. Different definitions can be found in literature for stakeholder analysis such as:

- Stakeholder analysis is an approach to assess the stakes of various interested parties in a system in more detail (Grimble et al., 1994)
- Stakeholder analysis is the methodology for gaining an understanding of a system and for assessing the impact of changes to that system, my means of identifying the key stakeholders and assessing their respective interests (Grimble, 1998)

According to Reed et al. (2009), stakeholder analysis is defined as a process that:

- Defines aspects of a social and natural phenomenon affected by a decision or action
- Identifies individuals, groups and organizations who are affected by or can affect those parts of the phenomenon
- Prioritizes these individuals and groups for involvement in the decision-making process.

2 STAKEHOLDERS ANALYSIS: A LITERATURE REVIEW

2.1 Stakeholder analysis framework

To proceed with a stakeholder analysis, selected key methodological steps may be followed. According to Reed et al. 2009, six key methodological steps are allocated to three phases: A) the context identification, B) the application of key stakeholder methods and C) any further actions to be taken (Reed et al., 2009) (e.g. stakeholder engagement; Fig. 3). Stakeholder analyses start by understanding the context in which they are to be conducted by identifying the focus (step 1) and the system boundaries (step 2) (Reed et al., 2009).

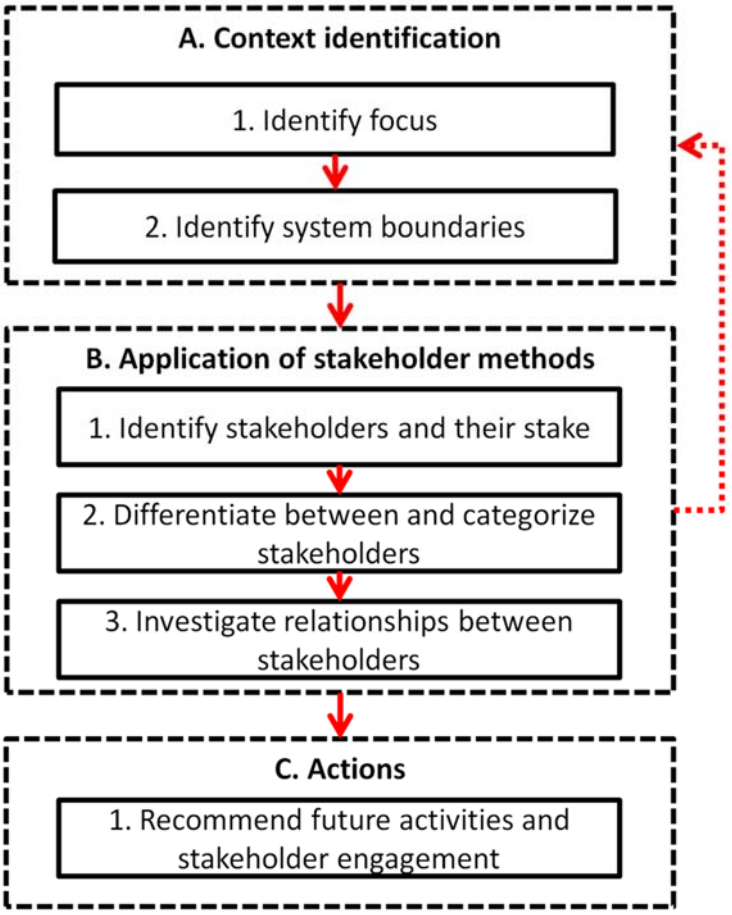

Figure 3. Schematic representation of the methodological steps for stakeholder analysis (From: Reed et al., 2009)

Within this context, certain methodological approaches should be followed to identify the stakeholders and their stake (step 3), differentiate between and categorize stakeholders (step 4) and investigate the relationships between the stakeholders (step 5).

Following the second phase, actions (phase C) should be taken for recommending future activities and stakeholder engagement (D 3.6.2b).

2.2 Context identification

Stakeholder analyses need to be initiated by understanding the context in which they are to be conducted (Reed et al., 2009). It is therefore essential to establish a clear focus of the issue under investigation with clear system boundaries of the social and ecological phenomenon. Only in such a specific context it is possible to determine those who are affected or can affect decisions relating to the issues under investigation. Participatory approaches (see next sections) require the involvement of stakeholders in the identification of the focus and boundaries (Reed et al., 2009) (feedback effect; Fig. 3).

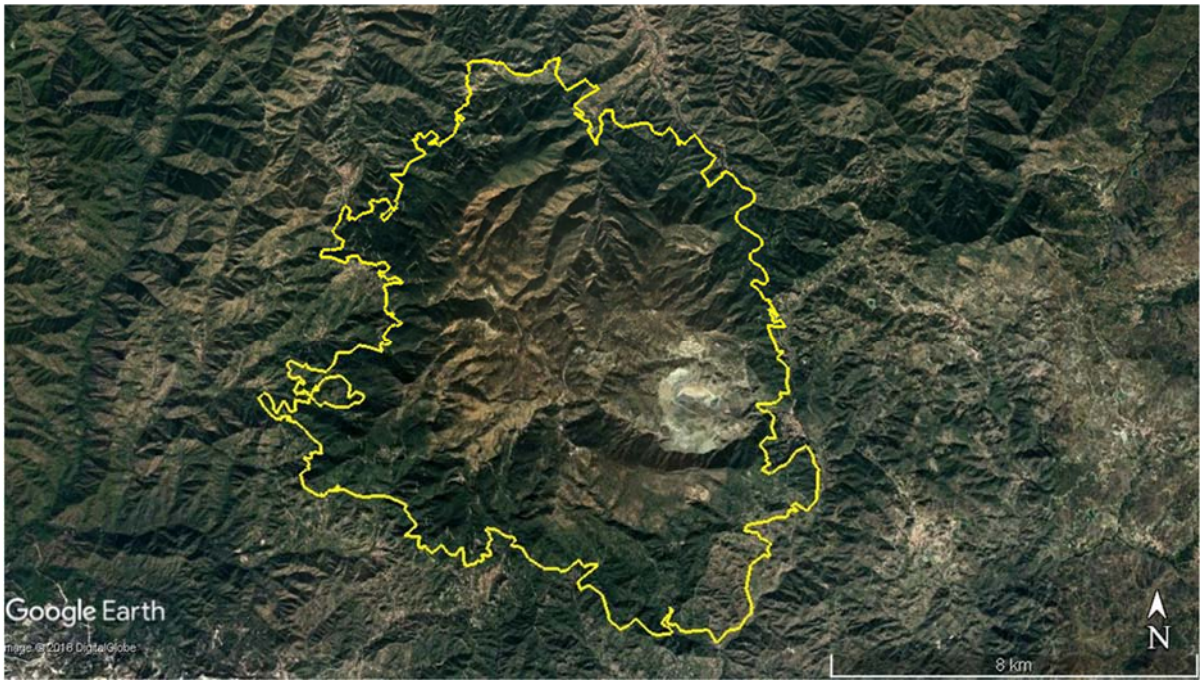

Figure 4. Geographical boundaries of Troodos national forest park, Cyprus.

Taking in to consideration the central aim of this project (Section 1.1), the system boundaries are described by the definition given for the term "forested protected ecosystem/area" (Section 1.2) and the ecosystem services under investigation (Section 1.3) deriving from the selected ecosystem (Fig. 3). System boundaries in literature are initially determined geographically, in other words, by selecting and describing the study area/site (Castillo et al., 2005; McNally et al., 2016; Raum, 2018). A forested protected area has distinct geographic boundaries (Fig. 4). Within these boundaries, certain ecosystem processes are taking place resulting in ecosystem services that can be utilized by relevant stakeholders. For example, Raum (2018) in an attempt to present a stakeholder analysis example using key natural resources in relation to ecosystem services, the forests in UK, thoroughly describes the study areas and based on the study areas initially explores the ecosystem services provided and who has a stake on these services.

The issue under investigation can be as general as the before mentioned (Raum, 2018) or it can be more specific. In an attempt to explain the initial steps for stakeholder analysis, Grimble (1998) gives another example. In case that the issue is the occurrence of rapid destruction and degradation of a forest area, the underlying causes of which are unclear, the main objectives of the research would then be to gain a better understanding of how the various stakeholders involved in forest management are contributing directly or indirectly to this degradation (Grimble, 1998). In this case, the focus of the stakeholder analysis would be based on "who is contributing directly or indirectly to degradation" and the system boundaries are shaped around the specific objective. In other words, system boundaries are initially set by the area under investigation, the problem (i.e. the degradation) and the stakeholders that are contributing to this issue. The questions that can be asked to the initially selected stakeholders at this stage (Grimble, 1998) are shown in the box below.

Questions to be addressed to the stakeholders at the stage of context identification:

- **What direct goods and services do you extract from the resource?**
- **What indirect (including environmental) goods and services do you provide? What restrictions do you face over the use of the resource?**
- **What de jure (i.e. legally recognized) and de facto rights or claims do you have over using and managing the resource?**
- **What are the forms and degree of management of the resource in question?**
- **What do you see as your decision-making environment?**
- **What factors do you perceive as lying within your control and what outside your control?**

2.3 Identification of stakeholders

Each stakeholder involved in the analysis should have a stake in the phenomenon under investigation (Reed et al., 2009). According to Reed et al. (2009) identifying stakeholders is usually ***an iterative process***, during which additional stakeholders are added as the analysis continues (Reed et al., 2009). Stakeholder's identification can be done using methods such as, documentary reviews, expert opinion, focus groups, semi-structured interviews, snow-ball sampling (see Section 2.2.2.2), or a combination of these (Raum, 2018; Reed et al., 2009).

Stakeholders can be relatively easily identified when the boundaries of the phenomenon (Section 2.2.1) are clearly defined (Reed et al., 2009). However, there is a risk that some stakeholders may be accidently omitted and as a consequence not all relevant stakeholders of the phenomenon may be identified (Reed et al., 2009). On the other hand, it is often not possible to include all stakeholders and a line must be drawn at some point, based on well-founded criteria established by the research analyst e.g. geographical criteria (the boundaries

of the forested area) or demographic criteria (e.g. nationality or age) depending on the focus of the analysis (Reed et al., 2009).

The identification and selection of stakeholders is required at an early stage to allow the next steps of stakeholder analysis to proceed. However, the verification and possible revision of the list of stakeholder included should be kept in mind through the whole process (Grimble, 1998).

The questions that can be asked to the initially selected stakeholders at this stage (Grimble, 1998) are shown in the box below.

Questions to be addressed to the stakeholders at the stage of stakeholders identification:

- **Who do you perceive as the other main stakeholders to be?**
- **What the relationships between different stakeholders are?**

The important stakeholders to be initially involved in the process could be easily identified when considering the ecosystem services under investigation. However, it should be kept in mind that the same stakeholders can be related to different ecosystem services and vice versa.

2.3.1 Approaches for stakeholder identification

A recent study, based on environmental and natural resource management practitioners interviews, reports approaches for stakeholder identification that are classified in eight categories (Colvin et al., 2016):

a. ***Geographical footprint***: Based on the geographical scope of a given project or issue, this approach to stakeholder identification is followed by constructing a footprint of project impact. Within that footprint, all individuals are considered to be stakeholders. The geographical footprint approach can also be applied in terms of a community. Where a project is considered to be specific to a local community, the extent of the community is considered the boundary of the project or issue footprint.

b. ***Interests***: This approach is based on an understanding of the socio-ecological context of a given environmental and natural resource management issue, and assumptions about the interests triggered by the issue (e.g. financial, lifestyle, sense of place, moral). An analysis of expected and potential interests is conducted to identify relevant stakeholders. This approach may occur through a formalized stakeholder or risk analysis process. Alternatively, the interests approach may be more informal; a practice of brainstorming potential interests which may be triggered by the issue.

c. ***Influence***: the influence approach to stakeholder engagement involves analysis or brainstorming of all who may be able to influence the issue or project.

d. ***Intuition***: The use of intuition represents both the use of implicit skills and understanding of the social dimension of natural resource management issues, as well as a response to a lack of a definitive structure or process for identification.

e. ***Key informants and snowballing***: The use of key informants could occur at the outset of an engagement project, particularly where there is a localized scope to the issue, to inform subsequent processes of stakeholder analysis and engagement.

f. ***Past experiences***: past experiences of practitioners could exert a more direct influence on the identification of stakeholders, with past issues used like a template for identification of stakeholders in emergent issues, or past experiences with stakeholder groups used as a prompt for relevant groups for engagement in a current issue.

g. ***Stakeholders self-selection***: stakeholders can self-select for engagement in projects or issues of concern. The self-selection of stakeholders tends to be through individuals or groups choosing to engage with an established project or program.

h. ***Use of media***: The use of the media approach involves looking to the traditional news media, general online searching for statements or evidence of interested parties, and the use of social media. This may relate specifically to the project or issue of concern, or may be media research conducted on similar issues.

2.3.2 Methods for stakeholder identification

A recent study, based on literature review, reports three main methods for stakeholder identification (Reed et al., 2009):

a. ***Focus groups***: Small groups that brainstorm stakeholders, their interests, influence and other attributes, and categorize them. This method is rapid and thus cost-effective, adaptable, makes it possible to reach group consensus over stakeholder categories, and is particularly useful for generating data on complex issues that require discussion to develop understanding. The weakness of this method is that is less structured than other and thus requires facilitation for good results.

b. ***Semi-structured interviews***: interviews with a cross-section of stakeholders to check/supplement focus group data. It is useful for in-depth insights into stakeholder relationships and to triangulate data collected in focus groups. However, it is time-consuming and it makes it difficult to reach consensus over stakeholder categories.

c. ***Snow-ball sampling***: According to this method, individuals from initial stakeholder categories are interviewed, identifying new stakeholder categories and contacts. Using this

method makes it easy to secure interviews without data protection issues and fewer interviews are declined. There is though the chance that the sample is biased by the social networks of the first individual in the snow-ball process.

Other methods can also be found in literature (Luyet et al., 2012). Performing the identification process with several heterogeneous persons can minimize failing to identify some stakeholders. On the other hand, involving all possible stakeholders may increase the complexity and the cost of the participation process. The challenge is to find the optimum balance between these risks (Luyet et al., 2012). The choice of a specific identification technique will mainly depend on the project context, the project phase and the available resources (Luyet et al., 2012).

2.3.3 Examples of stakeholder identification in forested ecosystems

Different or combination of approaches and methods can be utilized depending on the issue to be researched (Table 3).

Table 2. Examples of approaches and methodologies used to identify stakeholders in different forest-related studies.

Related aim of the study	**Approaches and methods used**	**Reference**
- Uncover the stakeholders with an interest in forest ecosystem services - Analyze their particular stakes, roles and positions on different levels.	- Literature review (keyword analysis of official sites of organizations) - Stakeholder-led identification (based on expert interviews)	(Raum, 2018)
- Compare and contrast the use and perceptions of upstream residents, downstream residents, tourism officials, and conservation organizations regarding the value of 30 ecosystem services provided by the Wami River and its estuary in Tanzania - Investigate their perceptions of the main threats to this system.	- Interviews with key informants - Snow-ball sampling	(McNally et al., 2016)
- Develop and test a framework for stakeholders analysis of forest and wood-based industry clusters at the State of North Rhine-Westphalia (NRW) in Germany	- Literature review	(Mrosek et al., 2010)
- Understand the interaction of rural people with tropical dry forests.	- Participant observation - Interviews with key informants	(Castillo et al., 2005)

Identified stakeholders should then be differentiated and classified to further enrich stakeholder mapping (Raum, 2018).

2.4 Differentiation between and categorization of stakeholders

Stakeholders should be characterized in order to understand the power relations between them and their specific interest in the issue. A variety of criteria and related methodologies have been proposed in the literature and summarized in previous review studies (Luyet et al., 2012; Reed et al., 2009). There is generally no systematic approach to both the choice and the use of the mentioned criteria. They depend on the project context and objectives (Luyet et al., 2012). Methods to characterize and classify stakeholders tend to follow two broad approaches: i) top-down ‘‘analytical categorizations’’ and; ii) bottom-up ‘‘reconstructive methods’’ (Dryzek and Berejikian, 1993; Reed et al., 2009).

A recent study, based on literature review, reports three main methods for stakeholder *differentiation and categorization* (Reed et al., 2009):

2.4.1 Analytical (top-down) categorizations

Analytical categorizations methods in which classification of stakeholders is carried out by those conducting the analysis based on their observations of the phenomenon in question (Reed et al., 2009). Criteria such as, level of interest and influence, cooperation and competition, cooperation and threat, urgency, legitimacy and influence are used for these categorizations (reviewed in Reed et al., 2009). Most popular methodologies in forest management and ecosystem services are the below mentioned.

a. ***Interest-influence matrix***: according to this method, stakeholders are placed on a matrix based on their relative interest and influence (De Lopez, 2001)(Fig. 5). It can be fulfilled within focus group setting (see Section 2.2.2.2), or individually by stakeholder during interviews (see Section 2.2.2.2) or by researcher / practitioner. It makes it possible to prioritize stakeholders for inclusion and makes power dynamics explicit. According to Reed et al. (2009), there is always the risk that prioritization may lead to the marginalization of certain groups.

This method classifies stakeholder to “Key Players”, “Context Setters”, “Subjects” and “Crowd” (Fig. 5). This can help in specifying who will be engaged. “Key Players” are stakeholders that have high interest in and can largely influence a particular phenomenon (in this case an ecosystem service; see Raum, 2018). “Context setters” are greatly influential but have low interest. Due to that they may represent a significant risk and therefore they should be monitored and managed (Reed et al., 2009). “Subjects” have great interest but they cannot be influential by themselves. They may become influential when in alliance with other stakeholders (Reed et al., 2009). “Crowd” consists of stakeholders that have low interest and power. There is low need to consider them or to engage them.

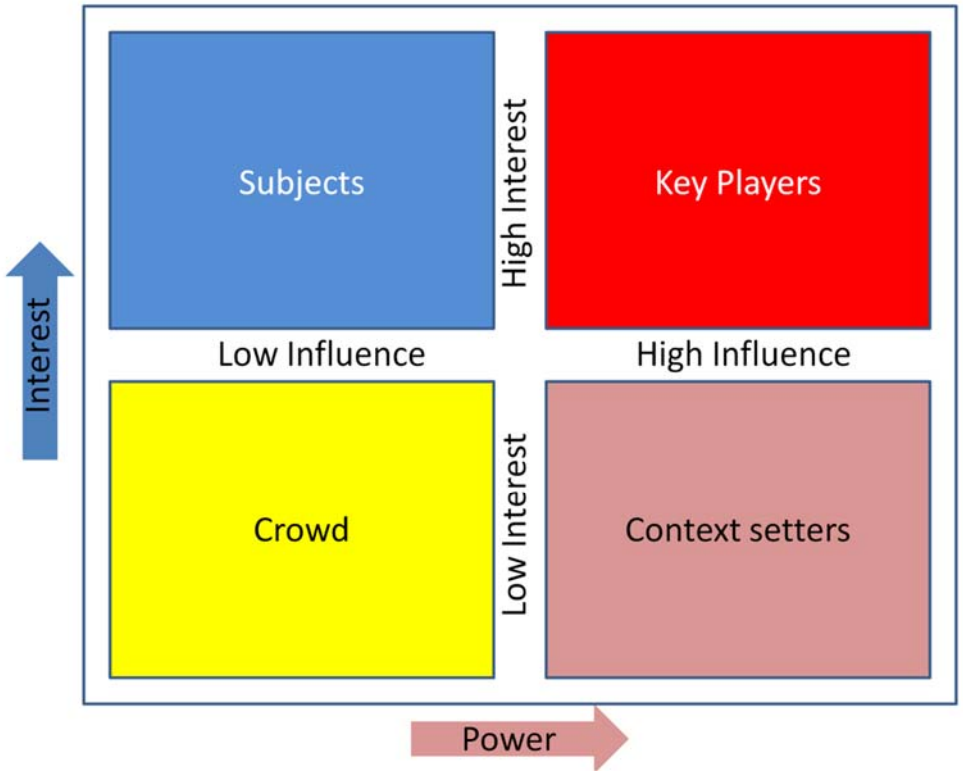

Figure 5. Schematic representation of an interest-Influence matrix.

b. ***Radical transactiveness:*** ''radical transitiveness'' (Hart and Sharma, 2004) focuses on opening two-way dialogue with stakeholders considered as peripheral. This typically includes those who are remote, weak, poor, uninterested, isolated, or non-legitimate, but whose views may be disruptive. According to Hart and Sharma (2004), this enables powerful and peripheral stakeholders to influence each other and avoid potentially disruptive relationships in the future. In addition Hart and Sharma suggest that peripheral stakeholders may hold knowledge and perspectives that can help predict potential future natural resource problems and identify innovative opportunities for future management.

2.4.2 Reconstructive (bottom-up) categorizations

These methods are often used to overcome the limitations set by the analytical methodology (e.g. marginalization of "powerless" stakeholders). Bottom-up methods allow categorizations and parameters influencing categorization to be defined by the stakeholders themselves (Reed et al., 2009). In this way, stakeholder analysis reflects their concerns (Hare and Pahl-Wostl, 2002).

c. ***Stakeholder-led stakeholder categorization***: stakeholders themselves categorize stakeholders into categories which they have created. Therefore, the stakeholder categories are based on stakeholder perception. The weakness of this method is that different stakeholders may be placed in the same categories by different respondents, making

categories meaningless. Card-sorting method is an example of stakeholder-led stakeholder categorization. During the categorization process for a sustainable water management project each stakeholder was asked to sort cards listing all the stakeholders in a city water system into groups according to their own criteria. It was used as an approach of identifying the structure of groupings and interactions between stakeholders' from the stakeholders' perspectives so that the models developed during the research would reflect the understanding of the stake- holders themselves (Hare and Pahl-Wostl, 2002).

d. ***Q methodology***: stakeholders sort statements drawn from a concourse according to how much they agree with them, analysis allows social discourses to be identified. Different social discourses surrounding an issue can be identified and individuals can be categorized according to their 'fit' within these discourses. This methodology does not identify all possible discourses, only the ones exhibited by the interviewed stakeholders (Reed et al., 2009).

e. ***Strategic Perspectives Analysis****:* uses interviews or workshops with stakeholders to identify and compare the goals of different groups, and the perceived opportunities and constraints they have to reach their goals (Dale and Lane, 1994). In this way categories of stakeholders who share similar goals are identified (Reed et al., 2009).

2.5 Relationships between stakeholders

Methods have been developed to investigate the relationships between stakeholders in the context of a particular phenomenon. According to Reed et al. (2009), there are three principal methods that have been used to analyze stakeholder relationships.

a. ***Actor-linkage matrices***: Is a commonly used method for describing stakeholder interrelations (Biggs and Matsaert, 1999). This require stakeholders to be listed in the rows and columns of a table creating a grid so that the interrelations between them can be described, using key words (Reed et al., 2009). It can determine whether the relationships between each stakeholder are of conflict, complementary, or cooperation. It can be done within focus group setting (see Section 2.2.2.2), or individually by stakeholders during interviews (see Section 2.2.2.2) or by researcher/practitioner. It is relatively easy and requires few resources. However, it can become confusing and difficult to use if many linkages are described (Reed et al., 2009).

b. ***Social network analysis***: It is used to identify the network of stakeholders and measuring relational binds between stakeholders through the use of structured interview/ questionnaire. It gives insight into the boundary of stakeholder network, the structure of the network and identifies influential stakeholders and peripheral stakeholders. However, it is time-consuming and the questionnaire is a bit tedious for respondents. It is usually performed by specialists. Social network analysis can ensure that key stakeholders are not marginalized.

c. ***Knowledge mapping***: It is used in conjunction with social network analysis. It involves semi-structured interviews to identify interactions and knowledge. Knowledge mapping identifies stakeholders that can collaborate as well as those with power balances.

3 CASE STUDIES ON THE USE OF STAKEHOLDER ANALYSIS IN ECOSYSTEM MANAGEMENT

3.1 A framework for integrating systematic stakeholder analysis in ecosystem services research: Stakeholder mapping for forest ecosystem services in the UK (Raum, 2018)

a. ***Aim:*** to provide a better appreciation of systematic stakeholder analysis in ecosystem services research by, first, presenting an illustrative stakeholder analysis for forests in the UK.

b. ***Methodology:*** In this exploratory study, a qualitative approach was adopted, using a literature review and interviews to identify the stakeholders with a stake in the provisioning, regulating and cultural ecosystem services of forests, to distinguish their characteristics, and to examine their relationships at different levels.

- Study area: UK forests
- Data Collection and stakeholder mapping:
    - **Stakeholder identification:** an ***exploratory qualitative approach*** was adopted to uncover the stakeholders with an interest in forest ecosystem services and to analyze their particular stakes, roles and positions on different levels. A combined approach was chosen in this study using ***literature review*** through a keyword analysis of official websites of organizations and a ***stakeholder-led identification***, based on expert interviews.
    - **Stakeholder differentiation and categorization:** literature review was chosen in this study through a ***keyword analysis of stakeholder websites***, to distinguish between a wide range of stakeholders with an interest in the different ecosystem services, and a ***stakeholder-led categorization*** combined with an ***extended interest-influence matrix*** for a more detailed differentiation of a number of key stakeholders. The interviews for the extended interest-influence matrix were based on the following questions (Reed, 2008):
        - How would you assess the degree of interest in forest ecosystem services? (low, medium, high)
        - How would you assess the degree of their influence over these services? (low, medium, high);
        - What are the reasons for their interest in and influence over forest ecosystem services?
    - **Stakeholder relationships:** ***Actor-linkage maps*** (or matrices) in combination with a ***thematic narrative analysis*** (based on exploratory interviews) were used to examine the relationships between the stakeholders.

c. ***Outcome:*** The illustrative example then informed the design of a conceptual framework for the systematic application of stakeholder analysis in ecosystem services research. The comprehensive framework consists of a three-phase model entailing the planning phase, the execution of the actual stakeholder analysis phase, and the subsequent actions. The framework incorporates stakeholders and ecosystem services on a geographical, institutional and ecosystem level.

d. ***Conclusions***: systematic stakeholder analysis can be used to develop future activities linked to ecosystem services, including new policy or instruments, stakeholder engagement activities, and decision-making processes.

3.2 Assessing the utility of stakeholder analysis to Protected Areas management: The case of Corbett National Park, India (Rastogi et al., 2010)

a. ***Aim:*** To test the potential utility of stakeholder analysis to protected area management.

b. ***Methodology:*** Using Corbett National Park, India, as a case study, stakeholder analysis was used to identify important stakeholder groups and assess their relationships, relative power and importance. This exercise was undertaken to assist the managers of the park with future strategy formulation and implementation.

- Study area: Corbett National Park, India
- Data Collection and stakeholder mapping:
    - **Stakeholder identification:** To identify stakeholders, including those who may not be directly apparent, they used the '***reputational approach***', which involved consulting knowledgeable individuals for their suggestions to enumerate the stakeholders; the '***focal approach***', which involved consulting key stakeholders of the park to prepare a list of stakeholder groups and the '***snow ball technique***', which involved consulting each stakeholder to list other potential stakeholders until no new stakeholder groups could be identified. To decrease the bias associated with creating artificial categories, they listed all stakeholder groups regardless of their interests and influences.
    - **Stakeholder differentiation and categorization and stakeholder relationships:** Secondary data were then collected to ascertain the socioeconomic background of the various stakeholders and to determine their expressed views regarding CNP. To do this, they consulted research reports, newspaper reports, newsletters, and leaflets/fliers distributed by stakeholders. Primary data were then collected through ***structured and semi-structured interviews*** with representatives from each stakeholder group. To encourage the discovery of unexplored themes and issues, the authors used the formal questionnaire as a guide during interviews. This allowed interviewees to speak freely and raise important issues. A total of 194 interviews were conducted between March and April 2006, covering all stakeholder groups. We also used '***participant observation'*** during public meetings to document routine interactions among stakeholders. For this study, the following stakeholder characteristics were used:
        - Knowledge of policy i.e. the mandate of the park: Knowledge level helped us to identify stakeholders who oppose policy due to misunderstandings or lack of communication. The authors accounted only for familiarity with the protected area mandates and then classified stakeholders into three

categories of knowledge: High, moderate, and low. It is important to mention that the authors did not account for traditional/ indigenous/ scientific knowledge about the park.

- Position (i.e., level of support to park): To ascertain the support for the protected area, were corded each groups' stated position, their position as perceived by others, and potential means of expression for this position. Stakeholders were then categorized into three classes: support (high/moderate), neutral, oppose (low/moderate).
- Interests (the advantages and disadvantages offered by the park, as perceived by the stakeholders): This was key to the relationship with the protected area.
- Alliances/ Interactions with other stakeholders: Potential/ existing alliances could make a weak stakeholder stronger, or provide a way to influence several stakeholders by dealing with one key stakeholder.
- Resources that a stakeholder may mobilize to oppose/ support the protected area: This was important in ascertaining the power of stakeholders.
- Leadership: To identify vocal and influential stakeholders.

The data were then sorted to list the stakeholders, and draw their profiles. Subsequently, the authors analyzed their positions and interests. In this study, 'power' measures the resources that a stakeholder can mobilize to express their support/ opposition towards the protected area. Individual respondents claiming to possess both the resources and the ability to mobilize resources were determined as having high power. Those with one or the

c. ***Outcome:*** The results demonstrated stakeholder analysis to be a simple, yet effective, method that can help protected area managers understand the social dimensions of their undertaking, without waiting for long-term policy changes. The results revealed possible stakeholder alliances, and those that may need strengthening to guarantee the welfare of CNP. Divergent opinions on the same issue were also discovered.

d. ***Conclusions***: Addressing low levels of knowledge and misplaced information may be of strategic importance in reducing conflict against a protected area. This research also helps theorize previously unexplored relationships among stakeholders in India, using the framework of stakeholder theory. Repeating the exercise on a regular basis could help protected area managers monitor stakeholder interactions and political positions over time.

3.3 Understanding the Interaction of Rural People with Ecosystems: A Case Study in a Tropical Dry Forest of Mexico (Castillo et al., 2005)

a. ***Aim:*** Understand the interaction of rural people with tropical dry forests.

b. ***Methodology:*** The analytical tools used in the study included stakeholder identification, environmental history and social perceptions. The two main social groups in the study were ejidatarios, who own most of the territory, and avecindados, who possess no land but have high population numbers. Through an interpretative methodological approach the authors documented the vision and meaning that rural people give to their natural and social worlds.

Qualitative research methods such as ***semi-structured interviews*** and ***participant observation*** were used. ***Surveys*** were also used to collect descriptive socio-economic and attitudinal data. Information gathered in the form of texts was analyzed using the Atlas.ti software version 4.2 for qualitative analysis (http://www.atlasti.de). To begin the process of meeting and getting acquainted with local dwellers the authors talked and listened to people in the villages during our first visits. Three ejidos and one community of avecindados adjacent to the Biosphere Reserve were selected to initiate the investigation. A total of 150 people participated in the study.

c. ***Outcome:*** The agricultural development model promoted by the Mexican government for decades was identified as the main driver of ecosystem transformation. Rural people, who arrived recently in the region, were proud of the pasture-lands that were transformed from tropical forests. Conservation policies implemented during the last two decades were viewed as impositions although people recognized the value of services provided by ecosystems. This case study has helped to unravel the main dimensions of the human system and how it relates to structures of signification. The social panorama unveiled can be used as an initial basis to promote further research on

d. ***Conclusions***: The social panorama unveiled can be used as an initial basis to promote further research on the social-ecological system of the Chamela-Cuixmala region and to develop future participatory management schemes.

3.4 Collaborative mapping of ecosystem services: The role of stakeholders' profile (García-Nieto et al., 2015)

a. ***Aim:*** Explore differences in the perception of spatial distribution of ecosystem services supply and demand between different stakeholders through collaborative mapping.

b. ***Methodology:***

- Study area: two study sites of the Andalusia region (Spain): Sierra Morena eastern region and Nacimiento watershed.
- Data collection and stakeholder mapping: Participants were chosen following the levels of influence on environmental management and interest on the ecosystem services' state as defining criteria on the basis of an ***influence- interest matrix*** (Reed et al., 2009).

c. ***Outcome:*** Regarding stakeholder analysis, the authors identified high influence stakeholders, characterized with a high degree of interest on the ecosystem services' state and with high influence in the environmental management. High influence stakeholders were linked to different stages of policy cycle (e.g., protected area and local development agents, environmental and protected area managers or researchers). On the other hand, the authors identified low influence stakeholders, characterized with a high degree of interest on the ecosystem services' state and with low influence in environmental management, meaning that stakeholders generate an immediate influence in parts of the territory through their actions both at individual or collective levels (e.g., farmers, hunters, forestry laborers or local livestock farmers' association). Water provision, food from agriculture, livestock, erosion control, climate regulation, water purification, nature tourism, recreational hunting and tranquility were collaboratively mapped. Agriculture land-use and the protected area surface were also assessed in order to find patterns in ecosystem services supply, meanwhile the role of urban areas was assessed for ecosystem services demand.

d. ***Conclusions***: Low and high influence stakeholders have different perceptions of the spatial distribution of ecosystem services and the scale of their demand. The authors call for the recognition of these knowledge differences (experiential and technical) and their inclusion in decision making processes regarding landscape planning.

4 OUTCOMES AND FURTHER STEPS

4.1 A framework for assessing the interactions between stakeholders and forested ecosystems

The values that are attributed to ecosystem services are dependent upon the views and needs of those influenced by/influencing the services, the stakeholders (Hein et al., 2006;

Vermeulen and Koziell, 2002). The dynamic nature of the interactions between stakeholders and forested ecosystems through the influence of stakeholders on ecosystems processes and their interest in ecosystem services implies the necessity for stakeholder involvement in ecosystem management and decision-making.

Here in d.6.3.1a, a basic conceptual structure on how to proceed with the initial steps of stakeholder involvement (i.e. stakeholder analysis methodological steps) are presented together with paradigms of studies from literature (see Section 3).

Taken together, (i) the identification of the context in which stakeholder analysis will be conducted, (ii) the selection of the appropriate methodology (i.e. single or combination of methods) and (iii) the future actions to be followed for assessing the interactions between the stakeholders and protected forested ecosystems (i.e. stakeholder engagement) depend on the aim of the study, the ecosystem services to be evaluated and the resources available.

4.2 Further actions towards stakeholder involvement

Stakeholder analysis is particularly important at the beginning of a study. However, it may be necessary to repeat it during different phases of the stakeholder involvement procedure.

Based on the basic conceptual structure (framework) presented here, practical guidelines for stakeholder engagement will be built and the levels of stakeholder participation in the valuation of ecosystems services provided by protected forested ecosystems will be clearly defined.

The levels of participation (as presented by Luyet et al., 2012) are defined as:
1. ***Information***: explanation of the project to the stakeholders.
2. ***Consultation***: presentation of the project to stakeholders, assortment of their suggestions, and then decision making with or without taking into account stakeholders input.
3. ***Collaboration***: presentation of the project to stakeholders, collection of their suggestions, and then decision-making, taking into account stakeholders input.
4. ***Co-decision***: cooperation with stakeholders towards an agreement for solution and implementation,
5. ***Empowerment***: allocation of decision-making over project development and implementation to the stakeholders.

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ANNEX A: Literature sources for stakeholder analysis tools

Method	Literature
Stakeholders Identification	
• Focus groups	Harrell and Bradley, 2009; Leung and Savithiri, 2009
• Semi-structured interviews	Harrell and Bradley, 2009
• Snow-ball sampling	Goodman, 1961

Differentiation between and categorization of stakeholders	
• Interest-Influence matrix	Wasserman and Faust, 1994
• Radical transactiveness	Hart and Sharma, 2004
• Stakeholder-led stakeholder categorization	Hare and Pahl-Wostl, 2002
• Q methodology	Watts and Stenner, 2005
• Strategic Perspectives Analysis	Dale and Lane, 1994
Relationships between stakeholders	
• Actor-linkage matrix	Biggs and Matsaert, 1999
• Social network analysis	Wasserman and Faust, 1994
• Knowledge mapping	Vail, 1999

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