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**Shaping the dome: understanding how leisure service ecosystems can
support forest ecosystem services**

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Master Thesis

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Abstract

The Portuguese Forest territory provides multiple benefits such as ecological, economic, and social, but its management faces challenges such as forest fires and land use changes. Portugal is amongst the most affected European countries by forest fires, with factors including shifting demographics, changes in land usage, and land ownership patterns contributing to forest fires. Most of the forested area is privately owned, leading to lack of maintenance and investment, resulting in the build-up of fuel for fires.

This research explores the multifaceted aspects of the Portuguese forest, encompassing the causes and consequences of forest fires, market and nonmarket goods and services, ecosystem services, service ecosystems and their relationship with leisure activities. The research included 14 expert interviews, conducted with professionals from multiple city councils, and from other public and private institutions. The interviews were executed with the intent of understanding the above-mentioned relationships between concepts. The used methodology for the project was the Gioia methodology, complemented with the development of a mental model for a more graphic and illustrative insight.

The findings revealed a diverse range of leisure activities available in Portuguese forests and their integration with forest ecosystem services is shown to have multiple benefits for individuals, communities, and economies. By engaging in leisure activities, individuals and communities were shown to develop a deeper appreciation and understanding of forest ecosystems, foster environmental awareness, and promote sustainable practices in forest management. Moreover, the integration of leisure activities in the forest ecosystem services contributes to the preservation of the forests, the protection of biodiversity, and the mitigation of climate change impacts.

This study provides insights into the integration of leisure services with forest ecosystem services and its economic, societal, and individual implications. It underscores the importance of understanding the holistic perspective of service ecosystems when considering the relationship between leisure activities and forest ecosystems. By considering this holistic point-of-view, stakeholders are able to conduct informed decisions that promote forest management practices while harnessing the potential of leisure activities for the overall wellbeing of society.

Ultimately, this research explores the intricate relationship between ecosystem services, service ecosystems, and leisure activities in forested areas. It investigates how ecosystem services contribute to the formation and sustainability of service ecosystems that cater to leisure activities. By analysing case studies and existing literature, this research identifies the synergistic interactions between these components, highlighting the reciprocal benefits and potential trade-offs. The findings underscore the importance of understanding and valuing ecosystem services in the context of leisure activities within service ecosystems, with implications for sustainable management and conservation practices.

Keywords: ecosystem services, service ecosystems, leisure activities, Portuguese forest

Resumo

O território florestal português proporciona múltiplos benefícios, como os ecológicos, económicos e sociais, mas a sua gestão enfrenta desafios como os incêndios florestais e as alterações no uso do solo. Portugal é um dos países europeus mais afetados pelos incêndios florestais, sendo que fatores como as mudanças demográficas, alterações no uso do solo e padrões de propriedade contribuem para a ocorrência destes incêndios. A maior parte da área florestal é de propriedade privada, o que leva à falta de manutenção e investimento, resultando na acumulação de combustível para os incêndios.

Esta pesquisa explora os aspetos multifacetados da floresta portuguesa, abrangendo as causas e consequências dos incêndios florestais, bens e serviços transacionáveis e não transacionáveis, serviços de ecossistemas, ecossistemas de serviços e a sua relação com as atividades de lazer. A pesquisa incluiu 14 entrevistas a especialistas, realizadas com profissionais de várias câmaras municipais e de outras instituições públicas e privadas. As entrevistas foram conduzidas com o objetivo de compreender as relações mencionadas entre os conceitos. A metodologia utilizada para o projeto foi a metodologia de Gioia, complementada pelo desenvolvimento de um modelo mental para uma visão mais gráfica e ilustrativa.

Os resultados revelaram uma ampla variedade de atividades de lazer disponíveis nas florestas portuguesas e demonstraram que a sua integração com os serviços de ecossistema florestais traz múltiplos benefícios para indivíduos, comunidades e economias. Ao envolverem-se em atividades de lazer, indivíduos e comunidades demonstraram desenvolver uma apreciação mais profunda e compreensão dos ecossistemas florestais, promovendo a consciencialização ambiental e práticas sustentáveis na gestão florestal. Além disso, a integração das atividades de lazer nos serviços de ecossistema da floresta contribui para a preservação das florestas, proteção da biodiversidade e mitigação dos impactos das mudanças climáticas.

Este estudo fornece perspetivas sobre a integração dos serviços de lazer com os serviços de ecossistema da floresta e suas implicações económicas, sociais e individuais. Ressalta a importância de compreender a perspetiva holística dos ecossistemas de serviços ao considerar a relação entre atividades de lazer e ecossistemas florestais. Ao adotar essa perspetiva holística, os intervenientes podem tomar decisões informadas que promovem práticas de gestão florestal, enquanto exploram o potencial das atividades de lazer para o bem-estar geral da sociedade.

Resumindo, esta pesquisa explora a relação entre serviços de ecossistema, ecossistemas de serviços e atividades de lazer em áreas florestais. Investiga como os serviços de ecossistema contribuem para a formação e sustentabilidade de ecossistemas de serviços que atendem às atividades de lazer. Por meio da análise da literatura existente, esta pesquisa identifica as interações sinérgicas entre esses componentes, destacando os benefícios recíprocos e possíveis compensações. Os resultados enfatizam a importância de compreender e valorizar os serviços de ecossistema no contexto das atividades de lazer dentro dos ecossistemas de serviços, com implicações para práticas sustentáveis de gestão e conservação.

Palavras-chave: serviços de ecossistema, ecossistemas de serviços, atividades de lazer, Floresta Portuguesa.

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List of abbreviations

DGRF – Direção Geral dos Recursos Florestais

ES – Ecosystem services

EC – European Commission

EU – European Union

FAO – Food and Agriculture Organization of the United Nations

FES – Forest Ecosystem Services

GM – Gioia methodology

GDP – Gross domestic product

GT – Grounded theory

NTFP – Non-timber forest products

SE – Service ecosystems

1 Introduction

1.1 Project Context

Every year, Portugal is devastated by brutal forest fires and is even considered the European country that is most affected by these fires according to the ANF|WWF report (Hernández, 2020).

In data collected by the European Forest Fire Information System, in 2020 Portugal had 67170 hectares of burnt area, in which 31725 hectares were forest and other wooded land. Fire entities and researchers mark three main contributors for this continuous scenario in the past 30 years: “(1) shifting demographics with population from rural to urban areas; (2) changes in land use with more agricultural and forested areas left unattended and absent maintenance; (3) land ownership patterns that discourage investment in forest management and fire planning” (Beighley and Hyde, 2018).

Land ownership patterns play a significant role in the occurrence of forest fires due to land ownership fragmentation. Small landowners usually lack in investment of forest planning and management, as well as technical expertise, incentives, or financial resources to invest in fire prevention and security measures. This lack of investment can then lead to a build-up of fuel for fires, making them more likely to occur and more severe (Beighley and Hyde, 2018). Moreover, the presence of forest companies or properties in large, forested land can also discourage investment in fire prevention, as profitability is usually prioritized.

Additionally, a compelling amount of the funds are allocated towards fire suppression rather than fire prevention (Beighley and Hyde, 2018), weighting about nearly three times the amount of the funding. Nonetheless, this scenario has been changing over the last years and in 2020 both fire prevention and suppression had the same relative weight when it comes to funding (AGIF, 2021). Initiatives as “Portugal Chama” and projects like “Aldeia Segura Pessoas Seguras” had a considerable impact in risk communication and citizenship support, and in 2020 the amount of telephone and digital clarifications doubled compared to the previous year (AGIF, 2021). These initiatives are estimated to have contributed to reinforce the inadequate use of fire ignitions tendencies in about 50%.

The Portuguese Forest is owned partially by public entities (3%) and private proprietors (91%), which leaves about 6% of area with no proprietor and no subsequent management system nor maintenance (ICNF, 2022). Presumably, the importance of the forest zone has direct impact on the economy, but also in terms of hydrological regimes/cycles maintenance, soil preservation against erosion, biodiversity protection and environmental support for tourism and recreational activities, as well as being a source of raw materials for local activities. Additionally, the majority of forest fires in Portugal in recent years have been caused by human actions and behavior, including deliberate acts, carelessness, negligence, and accidental ignitions.

In nowadays, the concept of forests has evolved to encompass the notion of multifunctionality (Costanza *et al.*, 1997) which created the need to not only recognize and value the tangible (market) resources, but also the environmental services and the forest landscapes as a recreational resource (Hunt *et al.*, 2005). Despite the fact that assigning monetary value to the resources is a difficult task (Christie *et al.*, 2006), indirect valuation methods offer key insights into their significance (Farber *et al.*, 2002) often contributing a large proportion of the total value of the ecosystem (Molina *et al.*, 2017). Nonmarket services represent an array of goods

and services which are not priced in markets but are capable of maintaining. The market and nonmarket services are associated with ecosystem services which are separated into four main dimensions: provisioning services, regulating services, supporting services and cultural services (MEA, 2005a). Cultural services include spiritual and religious activities, educational and nature tourism which emerged as a key economic activity, providing a platform to revitalize neglected natural forested areas. These regions offer multiple and diverse experiences that allow tourists to immerse themselves in nature while gaining a deeper understanding of the value of preserving cultural heritage. Lucas (1982) describes nature tourism as “tourism which is based on the enjoyment of natural areas and the observation of nature” and even specifies that this type of tourism “...has a low impact environmentally, is labor intensive, and contributes socially and economically to the nation”. Additionally, nature tourism has the potential to generate revenue and contribute to the economic well-being of rural communities, but it is crucial to promote responsible nature tourism that balances economic development and environmental protection (Newsome, Dowling and Moore, 2012). These “services to society”, or ecosystem services as mentioned previously, have two focal objectives: the preservation and enhancement of nature, as well as meeting society’s needs for multiple services or goods (Pelli, Haapala and Pykäläinen, 2017). However, the concept of ecosystem services illustrates a unidirectional provision of services between ecosystems and individuals, which might be inaccurate due to overlooking the fact that individuals frequently contribute to the preservation and improvement of ecosystems, having a value co-creation relationship (Comberti *et al.*, 2015). Thus, service ecosystems are an evolving concept that has gained significance in recent years due to its potential in understanding the value of the benefits ecosystems provide to society. Service ecosystems are defined as “relatively self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange” (Ng and Vargo, 2018).

The project aims to understand how to scale ecosystem services and service ecosystems, establish relationships between them and comprehend how to contextualize both in a larger global framework of value co-creation through leisure activities and tourism.

The research used the quantitative approach, based on the Gioia methodology complemented with the creation of a mental model. 14 interviews were conducted to experts in the forest sector in Portugal, which included city councilors, municipality councilmen, owners/staff of other public and private institutions. The key goals for undergoing the process of the interviews were to understand experts’ insights and knowledge regarding forests, leisure activities, and tourism, identifying the main factors, challenges, and opportunities.

Essentially, the following work is divided into 6 main sections: the introduction, which includes the overall problem contextualization and the research questions to be answered during the project; the literature review regarding mainly of the Portuguese forest, causes and consequences of forest fires, market and nonmarket goods and services, ecosystem services, service ecosystems, and leisure activities. At the end of this section the research gaps are presented; the methodology used for the research; the results of the developed work; the discussion of the results and its’ correlation with the literature review; the conclusions taken from the developed work and future research suggestions.

In conclusion, recognizing the multifunctionality of forests, the concept of ecosystem services and service ecosystems is the main goal for this project. These concepts highlight the reciprocal relationship between individuals and ecosystems in co-creating value (Comberti *et al.*, 2015), emphasizing the importance of the benefits provided by ecosystems to society.

1.2 Research questions

Considering the above data, it's important to develop research questions in order to have a guide for the development of the dissertation. The questions are the following:

- (i) Which leisure services can be provided in a forest context?
- (ii) How can leisure services cocreate value with forest ecosystem services?

The first research question focuses on identifying and analyzing the range of leisure services that can be provided within the forest context. By examining the multiple leisure activities, the study aims to uncover the diversity of recreational opportunities that can be offered by the forests.

The second research question delves into understanding the potential for leisure services to cocreate value with the forest ecosystem services. The study aims to explore the ways in which engaging in leisure activities within forested areas can enhance the provision of forest ecosystem services. The research will investigate the reciprocal relationships between recreational services and forests, examining if they can mutually benefit and contribute to sustainable forest management.

By addressing these questions, this study intends to provide insights into the integration of leisure services with ecosystem services, highlighting their potential for creating value.

2 Literature Review

The following chapter presents the key aspects of the Portuguese forest, including forest fires, market and nonmarket goods and services, ecosystem services, service ecosystems, leisure activities in forested areas, the significance of understanding forest recreation and nature tourism in forestry planning and management, a specific Portuguese example – the Passadiços do Paiva – and the research gaps. This chapter explores the causes and consequences of forest fires, examines the economic and social benefits derived from marketable and nonmarketable goods and services, analyses the various ecosystem services provided by the forest, emphasizes the interdependencies with service ecosystems, and highlight the importance of forest recreation and nature tourism.

2.1 The Portuguese Forest

In recent decades, there have been significant changes in land usage in Portugal and the remaining Mediterranean region. Multiple pastoral and marginal agricultural lands have been either abandoned or afforested. Natural succession led to adjustments in vegetation composition and structure where agricultural activities were once based, contributing to the spread of shrubland, forest and woodland with well-developed shrub understory (Ales *et al.*, 1992). Land abandonment, as stated previously, was one of the main causes for the fire scenario that is still seen in Portugal today. These causes resulted in higher carbon stocks and more flammable ecosystems that are susceptible to large and severe fires (Pausas, 2004; Castro and Freitas, 2009).

From an ecological viewpoint, forests and shrublands play a key role, not only preventing soil erosion and desertification, habitat restoration and preservation, and increasing biodiversity for carbon sequestration. As for shrublands, evaluating their biomass is essential for assessing fuel loads and wildfire behavior, and also for estimating carbon and biomass for energy use (Enes *et al.*, 2020)

The reported increase in forest fires in Portugal in recent decades, not only raises concerns regarding long-term negative effects of recurrent fires on the environment (Bento Gonçalves, 2017; Hosseini *et al.*, 2017) but has also drawn attention to this type of land cover. Shrublands currently cover above two million hectares of inland Portugal (ICNF, 2013). Moreover, these new shrublands are the main fuel for frequent forest fires that occur in Portugal.

In opposition, shrublands are a fundamental factor in the productivity and diversity of forest ecosystems. Vegetation is ecologically crucial because shrubs, mosses and lichens can have a direct influence on belowground processes required by nature, such as decomposition, nutrient flux, and soil nutrient accumulation (Huff *et al.*, 2018). From an environmental perspective, shrubs play an important role in soil erosion and desertification prevention, and reduce soil erosion with higher efficiency than trees (Cerdá and Doerr, 2005). Additionally, these types of vegetation also contribute to soil protection (Bochet, Poesen and Rubio, 2006), biodiversity enhancement (Mangas, 2008), habitat maintenance and restoration, and positive impact on recruitment of other species (Gomes, 2006). In the long term, shrub vegetation affects water and sediment fluxes by increasing the stability and cohesion of soil aggregates and improving water infiltration (Zuazo and Pleguezuelo, 2008).

Thus, assessing shrub biomass regrowth after fire may be useful for evaluating forest services and calculating carbon sequestration and potential energy stock, while providing information

on available shrub load that could be useful for predicting fire behavior (Botelho *et al.*, 1994; Rego *et al.*, 1994; Molina *et al.*, 2018) Regular harvesting of shrublands could, therefore, additionally help reduce the significant greenhouse gas emissions associated with these recurrent wildfires (Silva, 2006) by reducing them.

The forests of Portugal are a vital natural resource that play a crucial role in the ecological, economic, and social well-being of the country. Understanding the ecological importance of shrublands and their role within the Portuguese forest is crucial for sustainable forest management (Enes *et al.*, 2020)

2.2. The overview of causes and consequences for forest fires in Portugal

Forest fires are a part of the Earth's dynamics and their occurrence results from the interaction between the human land use and biophysical factors. The environmental impacts of wildfires range from local to global and may ultimately affect all socioeconomic and ecological categories, along with the major ecosystem reserves, which provide the basis for various human activities (Gomes, 2006).

One of the major factors for forest fires in Portugal is due to land abandonment, which amongst many other factors, is mainly due to the landowner's low income.

The literature, e.g. (Terres *et al.*, 2015) divides the stimulus for abandonment of agricultural land into three blocks, and can be seen in Figure 1:

- (i) Block 1: Poor suitability for agricultural activity due to unsuitable environmental and biophysical conditions such as the climate, soil, and terrain (areas with natural handicaps).
- (ii) Block 2: Low farm stability and growth, which include land abandonment due to the absence of generating income.
- (iii) Block 3: The adverse regional context, which include social-economic elements as immigration to the coastal cities which provide more economic opportunities.

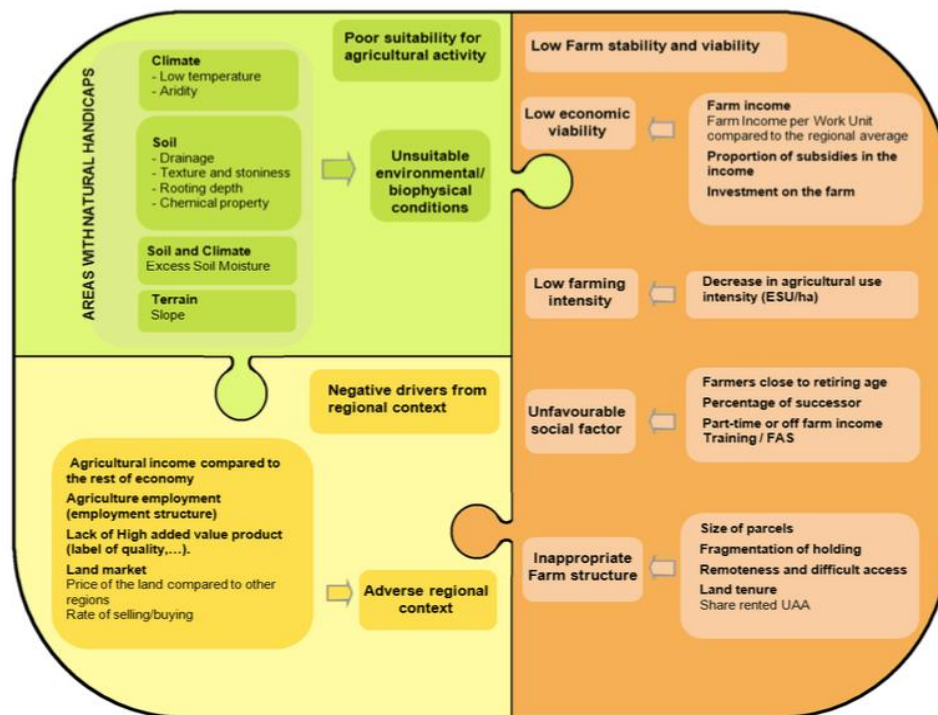


Figure 1 - Main determinants of farmland abandonment (Terres *et al.*, 2015)

According to FAO (2002), the reasons for land abandonment are multidimensional and can be distinguished as natural constraints, land degradation, socioeconomical factors, institutional framework, and demographic structure

Among the biophysical factors often cited as unfavorable for agriculture, low soil productivity, poor climate due to climate changes, steep terrains and high altitude are the most important barriers for agriculture, and therefore may increase the risk of agricultural land abandonment (Terres *et al.*, 2015). Unfavorable climatic conditions for agriculture in Europe can result either from low temperatures that limit plant growth, from a short growing season (Fischer *et al.*, 2008), or from drought and water stress that affect plant physiological processes (Hassan, 1997). Farm stability, growth and viability depends its majority on the farm's economic situation. Even though there are diverse factors that can trigger this situation, agricultural land is usually abandoned when it no longer generates a sufficiently high income (MacDonald *et al.*, 2000). The farmer's age is also considered a key factor for land abandonment and there is a clear difference between young and elderly farmers (EC, 2013). Farmers that are younger tend to be above the EU data in terms of economic size, area farmed and labor force. All other factors being equal, farmland is more likely to be extensified and abandoned when the farmer is older and near retirement age. The number of farmers nearing retirement may reflect the expected change in land and its structure over a ten-year-period (Baldock, 1996)

An exponential part of the rural abandonment also resulted from the migration from the countryside to coastal cities after the 1960's in Portugal. This abandonment and consequent shrubland growth into formerly occupied farmland are one of the main contributors for forest fires (DGRF, 2006). In a study (Levers *et al.*, 2018), regarding the landscape change in Europe,

a type of rural exodus is observed in which declining income opportunities in rural areas have led to migration to cities, which has resulted in the abandonment of agricultural land.

The consequences for land abandonment have a broad dimension of consequences according to location and time period. The literature (Ustaoglu and Collier, 2018) underlines several positive consequences as a better regulation of water balance (reducing flooding and improving the water quality), increasing the ability of ecosystems to retain pollutants and greenhouse gases, restoration of a natural habitat, and the restoration of soil and reduction of subsequent soil erosion. On the other side, there are also negative consequences which include higher threat to sustainable development of upland communities, loss of biodiversity, increased risk of soil erosion, threat to semi-natural habitats and corresponding ecosystem services, and increased fire danger due to increased plant biomass.

As mentioned previously, until 2020, Portugal had a compelling proportion of funding allocated to fire suppression rather than fire prevention (Beighley and Hyde, 2018), which was nearly three times the amount of funding. Additionally, the Portuguese forest service (PFS) has undergone numerous and frequent changes over the past four decades, which is a clear sign that policymakers and decision makers do not understand its role (Fernandes, 2014). Several attempts have been made to reform government agencies more effectively to address the growing problem of forest fires since the 2003 and 2005 devastating fires. Agencies have been reshuffled according to political calculations in what has been called “successive restructuring”. It is now clear that the existing structure of state entities is inadequate to address the growing and major fire problem in rural areas (Beighley and Hyde, 2018).

2.2 Market and nonmarket goods and services

The economy is often perceived in relation to market economic values, including rates, sales, income, and tax revenues. However, it's crucial to understand that the economical values observed in markets may be conditioned by external factors not directly transacted in markets (Letson and Milton, 2002). While global regulators and policymakers employ benefit-cost analysis, properly estimating the benefits of nonmarket goods and services can be a challenging task (List, 2003).

Indicators that measure “economic activity” and “environmental quality” play a significant role in informing policy decisions. The Gross Domestic Product (GDP) stands as the most widely used measure for assessing economic performance, yet it is important to note that the GDP solely captures market economic activity or gross income (Cleveland, Stern and Costanza, 2001). The GDP is not designed to serve as a measure of economic welfare, and it performs inadequately in this role. For example, increased crimes, pollution, fires, and sickness can contribute to the growth of the GDP due to economic stimulation activity in the market (for instance, the above-mentioned examples can contribute for more jobs), but it does diminish the overall welfare; secondly, GDP fails to account for multiple factors that contribute to the welfare, but not the market. For example, the unpaid work of mothers who take care of their children at home is not reflected in the GDP, but if they were to work and pay for childcare services the GDP would increase (Sutton and Costanza, 2002).

Similarly, nonmarket services provided by nature, such as clear water and food, are not included in the GDP. Equivalently as the example mentioned above, if these services are compromised and require restoration replacement, the GDP would rise (Sutton and Costanza, 2002). Events such as forest fires will have multiple effects, displaying multiple outcomes, which will be discussed further below.

As expected, forest fires affect multiple nonmarket forest goods and services that play a key role in society, which include air and water quality, soil productivity, and habitat for native fauna and flora, carbon sequestration and culture heritage (Venn and Calkin, 2011).

In addition, each of the nonmarket services exhibits a diverse range of potential responses to forest fires according to a complex set of human management and natural environment factors. Table 1 displays the positive and negative outcomes of forest fires on nonmarket goods.

Nonmarket forest service	Positive fire effects	Negative fire effects	Sources
Air quality		Respiratory health Reduced visibility	(Sandberg, Ottmar and Peterson, 2002)
Water quality	Increase in water quantity	Increase in flood risk Increase in sediments and debris causing damages and reducing the effective life of infrastructures	(Neary, Ryan and DeBano, 2005)
Soil productivity	Short time increase in plant growing nutrients	Reduced soil porosity Potential hydrophobic soils Nutrients are volatilized	(Neary, Ryan and DeBano, 2005)
Recreation	Improve in wildflower viewing, habitat hunting success, fish habitat	Debris on activities such as hiking and biking Campsite destruction	(Keane <i>et al.</i> , 2002; Neary, Ryan and DeBano, 2005)
Habitat for flora and fauna	Low severity fire will favor native plants adapted to wildfire Long term improvement of aquatic habitat quality Short-term increase in wildlife foods and habitat diversity	Fuel accumulation due to long time of fire suppression Short-term highly negative impact on amphibians and fish	(Rieman <i>et al.</i> , 2003)
Carbon sequestration	Frequent forest fires will limit fuel accumulation,	Potential release of carbon emissions	(Ryan <i>et al.</i> , 2012)

	making future fires less severe		
Culture heritage	Forest fires consistent with historical fire regimes may maintain cultural heritage	Hard-wearing forest fires may be detrimental or destroy cultural heritage	(Calkin <i>et al.</i> , 2013)

Table 1 - Positive and negative impacts of forest fires on nonmarket forest values. Adapted from: (Venn and Calkin, 2011)

Thus, each nonmarket good unveils a diverse array of potential responses to forest fires depending on a complex set of environmental and human management aspects. Nonmarket or intangible goods resources incorporate conceptual, oral, and behavioral traditions, most of which overlap. Most market goods and services are limited and irreplaceable once lost, while nonmarket though often endangered, can be renewed and expanded throughout generations from various forms of creativity (Ryan *et al.*, 2012).

2.3 Ecosystem Services

Forests are key components for habitats and biodiversity and also for providing a wide range of ecosystem services that are essential for human well-being. There is growing evidence that biodiversity contributes to forest ecosystems functioning and ecosystem services provision (Brockerhoff, 2017).

Ecosystem services (ES) are defined by MEA (2005) as “...benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling”.

The ES are interrelated and contribute to the well-being of human communities (FAO, 2015; Haines-Young, 2010; MEA, 2005). In order to secure the continued provision of ecosystem services, forest landscapes must be managed in a way that takes into account the various functions of forests and ensures their sustainability. As population grows and climate changes increase, pressure on forest resources escalates (DeFries, 2010; Hanewinkel, 2013).

However, with the exception of primary goods such as food, fuel, and fiber, most ecosystem services have no market value. This means that protection of these services is infrequently considered in economic decisions, contributing to their continued decline. According to the literature (MEA, 2005), ecosystem services that have been degraded over the past 50 years include fisheries, water supply, waste treatment and detoxification, water purification, protection from natural hazards, air quality regulation, regional and local climate regulation, erosion regulation, spiritual fulfilment, and aesthetic enjoyment. According to the authors, and as can be seen in Figure 2, ecosystem services are classified into four main categories: provisioning services (products that are obtained from ecosystems), regulating services

(benefits from regulating ecosystem processes), cultural services (nonmaterial benefits from ecosystems) and supporting services (which include all services necessary for the production of the remaining ecosystem services).

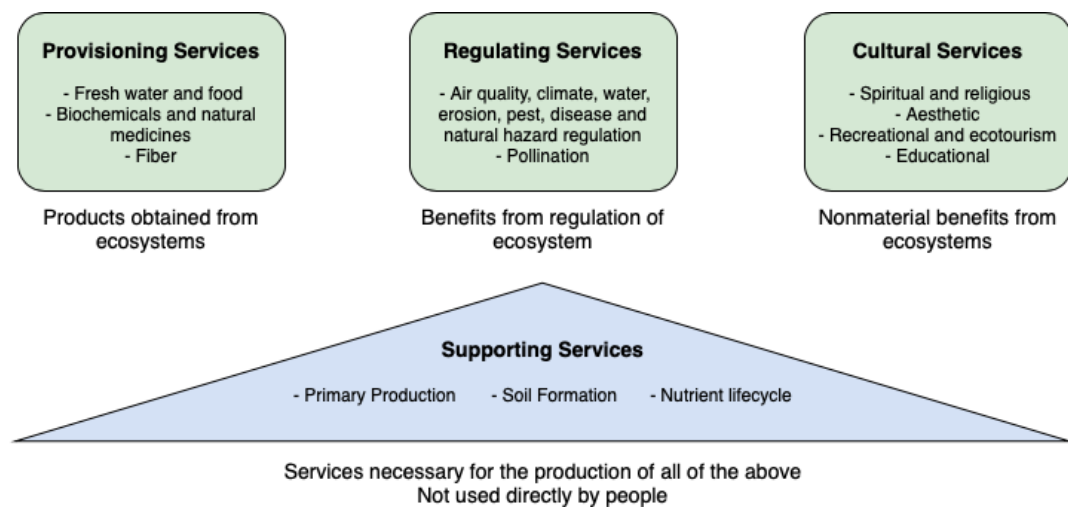


Figure 2 - Ecosystem Services (adapted from: MEA, 2005)

The ecosystem services can also be divided into two main categories: market goods and nonmarket goods. Market goods are the ones used in daily life such as fiber, wood, provision of food and fuel, and nonmarket goods are not as easily perceived (for example, water filtration and climate regulation). As a result, the relationship between the ecosystems and the services they provide may be more subtle and less obvious than in other activities (Liagre *et al.*, 2015).

Sustainable multifunctional management is at the core of the EU forest policy (DeFries *et al.*, 2010; Bouwma *et al.*, 2018) which oversees 1.4 million km² of forest lands, representing about 3% of the global forests and benefiting around 520 million people (7% of the world's population). In particular, the EU Forestry Strategy emphasizes the importance of “balancing different forest functions, meeting demands and providing vital ecosystem services” (EC, 2013). It supports conservation and management actions that aim to “maintain, enhance and restore the resilience and multifunctionality of forest ecosystems as a core component of the EU's green infrastructure, providing key environmental services and raw materials for urban and rural areas” (EC, 2013).

In 1997, the overall value of global ecosystem services was estimated to be approximately \$33 trillion per year, a figure significantly higher than the GDP at that time. However, the value of ecoservices in 2011 was estimated to be \$125 trillion a year, which represents an increase in the economic evaluation of environmental services (Costanza, 2014). Nevertheless, forest ecosystem services are considered by the literature (Silvis, 2013; Krugman, Obstfeld and Melitz, 2023) a market failure which represents an “economic pursuit based on individual self-interest who does not lead to what is best for society as whole-privately optimal choices”. Additionally, a few FES are defined as public goods that present non-rivalry and non-exclusion characteristics:

1. Non-rivalry represents the moment a good is provided to a consumer. Specifically for forest services, an example of a non-rivalry are the wilderness areas protected by or for one agent, which will benefit all others who have access to the area.

2. Non-exclusion: a consumer cannot prevent others from using the service.

In Portugal, the forest sector represents 2.6% of the GDP and 5.3% of the workforce, the sector (which includes forest industries and related services) is one of the three major ones in the Portuguese economy in terms of added value and employment, as well as it represents 12% of the totality of exports (the second largest in the country) (Mendes and Gluck, 1998). The literature claims that the sector is divided into three key forest products: pine wood and the wood industry (carpentry, furniture, etc.), pulpwood and paper, and the cork industry. These sectors are diverse in terms of ownership structure and forest management, as well as industrial business structure. Non timber forest products (NTFP) are products – other than wood – derived from the use of forests, such as pine nuts and fruit, resin, mushrooms, and other types of biomasses. NTFPs are byproducts of forestry who are not as profitable, but has been shown by the literature (Mendes and Proença, 2005) to have a high economic value.

From the perspective of positive externalities, the fact that ecosystem services cannot be accurately priced in the traditional markets, means that providers of these services/resource users do not take prices into account when making decisions about land or resource use, resulting either in underuse or overuse of important ecosystem services (Prokofieva, 2016).

2.4 Service ecosystems

The ongoing evolution of the scope of service related research emphasizes the significance of comprehending the aspects of interaction of relationships (Grönroos, 1995) and interaction (Gummesson, 1987) in the process of value creation. The service ecosystem is a concept defined as “a relatively self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange” (Vargo and Lusch, 2016).

As per Vargo and Lusch (2004, 2008, 2011) the creation of value involves multiple actors that engage in interactions with the intention of enhancing the well-being of both themselves and the system. Therefore, it is emphasized that value is not originated solely from actions taken by individuals. Instead, the value emerges through interactions among actors, whether direct or mediated by goods, within a specific context (Vargo and Lusch, 2017). Ergo, value is co-created reciprocally through interactions among multiple actors, and new value arises when resources obtained from various source are merged within the context of each actor’s life (Chandler and Vargo, 2011; Vargo, Wieland and Akaka, 2015).

When it comes to service ecosystem in the forest-based sector, the strategies formulated emphasize the significant contribution of “services to society” resulting from sector operations (Food and Agriculture Organization of the United Nations, 2011; EC, 2013; FTP, 2013). Since the concept of service ecosystem is at a higher societal and individual level than the mere business approach illustrated in the previous concept, this category is presented separately. “Services to society” – or service ecosystems – refer to the sustainable management and utilization of natural resources, which aim to preserve and enhance ecosystem services while providing society with a range for goods and services. Furthermore, the forest-based sector’s role in the promotion of rural employment and income generation is given significant emphasis (Pelli, Haapala and Pykäläinen, 2017).

2.5 Leisure activities in forested areas

Nature tourism is emerging as a crucial economic activity, and it plays a significant role in reinvigorating and utilizing the natural resource of an area, which can be many times neglected and left for abandonment (Brandão, Barbieri and João, 2015).

These types of territories offer exceptional opportunities for visitors to witness the splendour of nature and understand the importance of preserving natural heritage. Furthermore, nature tourism has the potential to generate revenue for conservation and bring economic benefits to rural communities and remote areas. Nonetheless, recreational activities in protected areas pose a risk as they can result in irreversible environmental damage, despite providing economic growth and social development in the region. As a result, promoting responsible nature tourism that does not conflict with economic development and environmental protection is crucial (Newsome, Dowling and Moore, 2012). Nowadays, the importance of conservation and sustainable practices must not be overstated. These offer extensive opportunities to attract investments and promote nature protection. To ensure these practices are compatible, responsible planning and management suited for protected areas is crucial (López-del-Pino and Grisolia, 2018). The implementation of sustainable and responsible management has positive effects on enhancing local sustainability, especially through visitor reduction, and can serve as a source of funding for managing, maintaining, and conserving the protected area (Buckley, 2011; López-del-Pino and Grisolia, 2018).

If development and education efforts are put towards conserving protected areas, the growth of activities within them can be a positive for the environment. This can serve as an innovative and efficient way to ensure the sustainability of the area in the regions they are located (Brandão, 2015).

Nature tourism can be classified into two main categories: the soft nature tourism and the hard nature tourism (Turismo de Portugal, 2006). In Table 2 we can observe the main activities, the motivation, and the profile of the users.

	Soft Nature Tourism	Hard Nature Tourism
Main Activities	Low intensity activities (walks, excursions, etc.)	Nature sports (hiking, climbing, kayaking, rafting, canoeing, mountain biking, etc.) and special activities (birdwatching, hunting, etc.) which require previous knowledge
Motivation	Interact with nature, discover new landscapes, photography, rest from the daily life, etc.	Do sports activities, nature contemplation, get a more profound knowledge of nature and environmental education.
User profile	Couples (with or without children), retired tourists, groups.	Students, sports fans, young people between the ages of 20 to 25

Table 2 - Soft and hard nature tourism (adapted from: Turismo de Portugal, 2006)

The soft nature tourism represents 80% of the total number for nature travels, while hard nature tourism only represents 20%. Around 22 million trips lasting one or more nights make up the primary demand for international Nature Tourism in Europe, where it is the main purpose of travel. This volume is equivalent to roughly 9% of all leisure trips taken by Europeans (Turismo de Portugal, 2006).

The processes of post-industrial development, along with the fast-paced urban lifestyle, have raised significant concerns regarding rural areas and their potential as ecotourism destinations. These areas, with natural or man-made attractions, offer visitors the opportunity to escape the bustle of urban life and indulge in leisure activities surrounded by nature (Hajimirrahimi *et al.*, 2017). Forest tourism serves as a strategic tool for sustainable development aimed at preserving natural resources while fostering long-term tourism growth without compromising the integrity of the natural environment (Lane, 1994a, 1994b; Azadi *et al.*, 2016).

The sector holds significant importance for the advancement of rural areas and the sustainable development of advanced economies, while also contributing to the reduction of regional disparities. Within the context of sustainable economic development, smaller businesses in rural areas play a strategic role, with the tourism sector emerging as a particularly noteworthy contributor (Peña, Jamilena and Molina, 2011).

2.5.1 The significance of understanding forest recreation and nature tourism in forestry planning and management in Europe

In recent years, it has become increasingly clear that European societies desire more from their forests than just timber and other industrial exploitations. As discussions around the relationship between forest management operations and biological diversity have developed, contemporary forest policies now prioritize the various functions of forests, particularly the ecosystem services associated with recreational activities and tourism. The delivery of multifunctional forest services has thus emerged as a crucial focus in forest policies throughout Europe over the last decade (McNeely, 1994).

This new approach to forest management in Europe poses challenges for institutions and actors operating at the intersection of the forest ecosystem and human society, including forest managers and their institutional structures. Historically, forest managers have been trained to maximize the timber value of the forest resources. However, they must now balance a variety of prioritized services that society demands from them, thus having a primary challenge of determining how to implement new policies effectively (Bell *et al.*, 2009).

Forest management in Europe is deeply rooted in tradition and has been institutionalized through legislation, education, norms, practices, and values in the respective countries. Initially, the institutional framework around forest resources was also designed to maximize timber output and revenue, and as a result, forest products have become more significant components of the rural economy in many European countries, contributing significantly to the national economy in heavily wooded areas. However, policies that promote the prioritization of the recreation and other ecosystem services are now placing demands on forest managers, impacting the institutional framework around forest resources and imposing new constraints (Bell *et al.*, 2009).

To illustrate the potential conflict between recreation and management implications, the example of the Black Forest Nature Park will be presented. Over the past few decades, there has been a growing societal emphasis on nature sports and outdoor recreational activities in Germany (Mann and Absher, 2008). However, this trend has had a noticeable impact on the environment, particularly in areas with limited suitable natural landscapes in close proximity to urban or densely populated areas. As a result, there has been a surge in recreational demands, which has led to both ecological and social repercussions. This has resulted in significant and costly problems for managers in Germany, such as high traffic volume, vandalism, littering, and non-compliance with rules and regulations. Apart from making general improvements to the site or sports infrastructure, planners and managers often focus on concentrating the use of certain parts of an area to alleviate pressures on ecologically sensitive areas (Schemel, Erbguth and Reichholf, 2000). This is a common management strategy employed to ensure the sustainable use of natural resources while still meeting the recreational demands of visitors (Roth and Lee, 2004).

In terms of recreation and tourism, the focus of planning has shifted from top-down approaches to more process-oriented and collaborative management styles, which emphasizes public involvement. There is now a greater emphasis on incorporating a range of interests and defining overarching concepts and area-specific objectives for the purpose of area development and management (Breuste and Landschaftspflege, 2012). To find suitable solutions to conflicts, planning instruments such as round tables (Mayerl, 2005) and task groups have become increasingly important. In light of recent societal changes and leisure trends, it is widely recognized that reliable information on recreation conflict is a necessary prerequisite for an effective and efficient recreation planning system. Quantitative measurements of recreation can provide a foundation for planning and management to track changes in use patterns and resource conditions (Mann and Absher, 2008).

2.5.2 Passadiços do Paiva (Paiva Walkways): a Portuguese example

The Paiva walkways were inaugurated in 2015 and are a popular tourist destination that provides visitors with the opportunity to experience nature while walking along the Paiva river (Rocha *et al.*, 2017). The construction of the Paiva walkways was made possible through a tourism development strategy aimed at uniting the region's nature, heritage, and traditions, which was supported by the Arouca Geopark and the Arouca City Council. This initiative has revitalized the surrounding area and introduced new economic and social dynamics.

The number of annual visitors of the walkways between 2016 and 2019 was 76443, and the nationality of the visitors was mainly Portuguese (89.9%), Spanish (5.1%) and French (2.4%) (Bernardo, 2018). Since its inauguration, the Paiva walkways have generated an economic impact in local businesses, lodging, supermarkets, transportation services, restaurants and touristic entertainment companies (Duarte, Belém and Bernardo, 2018). According to the statistics provided by (INE, 2019), data shows the economic development in Arouca is clear, as can be seen in Figure 3:

	Guests (No.)	Overnight stays (No.)	Revenue (thousand/€)
2014	5988	8691	342
2015	8346	13479	468

2016	11907	18580	674
2017	14542	20232	755

Table 3 - Economic growth in Arouca from 2014 to 2017 (number of guests, overnight stays, and total revenue of hospitality establishments). Source: (INE, 2019)

As data shows, the annual average has a growth of roughly 42% to 44% between the years of 2015 and 2016. Nevertheless, the annual variation in 2016/2017 was the lowest shown on the indicators due to a wave of forest fires in the region of Arouca in the summer of 2017.

The hospitality establishments became scarce for the growing number of visitors to the region, which led to the opening of new lodging units. Up until 2014, there were two units in the local lodging category, and eleven units in the tourism enterprises category. Since the opening of the walkways in 2015, this number has increased exponentially in both categories, with seventy-one units of lodging and nineteen tourism enterprises currently registered in the National Tourism Registry (INE, 2019).

It is undeniable that tourists have profoundly impacted and transformed the dynamics of the region, promoting the development of new businesses, both directly and indirectly linked to the tourism sector, and the creation of jobs, particularly in lodging, local commerce, transportation services, tourist activities and restaurants (Bernardo, 2018).

During the years, the Association for the Defense of the Paiva Valley (SOS Rio Paiva) has raised some concerns regarding the impacts on the landscape and ecosystem due to the high tourist influx in the region. The association has highlighted several worrying situations over the years, including the cutting of riverbank vegetation, waste along the walkways, access issues for emergency services, and changes to the well-being of local communities. Several sources of pollution have also been identified as illegal discharges from wastewater treatment of plant and pig farms, leading to the prohibition of bathing in the Arouca and Castelo de Paiva municipalities during 2017, 2018 and 2019 due to the presence of salmonella. Nevertheless, extra measures were taken by SOS Rio Paiva, including entrance fees and limits on the numbers of visitors (SOS Rio Paiva, 2015).

2.6 Research gaps

The literature review displays the importance of leisure activities both in ecosystem services and service ecosystems. As mentioned above, leisure activities will impact the four main categories of ecosystem services (provisioning services, regulating services, cultural services and supporting services) both in negative and positive ways. Similarly, leisure activities and tourism will also affect and influence service ecosystems, having societal, economic, ecologic, and individual repercussions.

The research gap found in the literature review regards the lack of a framework that will encompass the relationships between leisure activities, ecosystem services and service ecosystems. With the literature, it was possible to understand that there are existing services with positive impacts but there is no systematization on how to establish relationships between concepts.

The aim of the research is to understand how to scale ecosystem services and service ecosystems and comprehend how to contextualize both in a larger global framework of value

co-creation through leisure activities and tourism. Thus, this will help with the understanding of possible existing relationships in order to comprehend how ecosystem services and the service ecosystems can valorize the Portuguese forest and its recreational tourism.

3 Research Methodology

The following chapter presents the methodology used in the scope of the dissertation. In the first section a comparative analysis of multiple qualitative research approaches is presented, in order to understand the diverse advantages and disadvantages of each method. The most adequate methodology will be used to answer the research questions, and will be presented in the second section, alongside with a detailed description of the different steps and procedures used.

3.1 Existing approaches

Charmaz (2014) states that *grounded theory* is “(...) a set of principles and practices, not prescriptions or packages”. This methodology is a tool for qualitative research that focuses on the creation of a conceptual framework or theories through building an inductive analysis. Grounded theory is seen as structured, yet flexible – it aims to generate theory that is grounded on data.

However, according to (Glaser, 1978) grounded theory is a multi-faceted process that requires a lot of time a theoretical sensitivity, which might not be fully developed by novice researchers. Grounded theory may be applied when there is a compromise between the demands of the approach and the resources available.

The *Gioia methodology* (GM) is a qualitative approach to develop a data analysis that can meet the rigorous standards of trustworthy research (Gioia, Corley and Hamilton, 2013; Magnani and Gioia, 2022). The GM balances the conflicting need to develop new concepts inductively, while meeting the high standards of rigor demanded by leading journals.

Moreover, the GM involves the development of data analysis through three major phases: (i) the creation of analytical codes and categories that are assembled into a data structure that includes first-order codes (informant-centred) and second-order themes (theory-centred), as well as aggregate dimensions; (ii) the development of a grounded theory model through the ongoing comparison of data over time and across informants; (iii) the presentation of the findings in form of a detailed, data-driven narrative that typically uses the second-order themes and aggregate dimensions and frequently references the first-order informant’s quotes (Gioia, Corley and Hamilton, 2013).

Overall, the Gioia method is compatible with standards applicable to quantitative research due to its disciplined approach to data collection and coding. It focuses on generating a more simple theoretical model concerning complex problems (Magnani and Gioia, 2022).

Mental models can be used to complement the Gioia methodology and serve as personal, internal depictions of the external reality, which enables individuals to interact with their surroundings. These models are individually constructed, shaped by one’s distinct life experiences, encounters and perceptions, functioning as cognitive frameworks who facilitate reasoning, decision-making, and ultimately influence individual behaviours, playing a pivotal role in filtering and assimilating information by acting as a filtering and storing mechanism (Jones *et al.*, 2011). Mental models provide predictive and explanatory power for understanding interactions, allowing a simpler, illustrative and more graphic interface who connects themes, facilitating the visualization of information (Gentner and Stevens, 2014).

3.2 Method used in the project

For this project, the chosen method was a qualitative approach which involved interviewing experts in leisure activities and forested areas, with the aim of constructing and analysing a mental model that encompasses the diverse viewpoints, beliefs, and perspectives of each interviewee.

The execution of the mental model will allow a knowledge representation of the data collected using the Gioia methodology, which results in a “powerful explicative and predictive tool for the subjects with the world, and a dependable source of knowledge” (Barquero, 1995). Overall, the Gioia methodology influenced the data structure by dividing the data collection into codes with different orders and dimensions.

Mental models serve as graphical depictions of data, illustrating the connections between themes and how these are broken into smaller factors. Mental models provide an effective means for sharing and updating knowledge, as they facilitate visual stimuli and possible discussions (Gentner and Stevens, 2014)

3.3 Sampling

The inclusion of participants in qualitative research is crucial for capturing a wide range of perspectives and generating rich insights. This allows the exploration of multiple viewpoints, opinions, and interpretations.

The sample consisted of 14 interviews with different stakeholders. The focal point was to have a diverse sample to gather diverse information in different contexts. The interviewees represented different municipal councils from the north of Portugal, several forest-related organizations and forest management companies that work in partnership with the municipalities, which can be seen in Table 4.

Institution Type	<i>Interviewee's position</i>	<i>No.</i>
Municipalities	Councillor	2
	President	2
	Civil protection coordinator	2
Associations and other private institutions	Ex-president	2
	Project manager	1
	General director	1
	Biologist	1
Other public institutions	President	1

Table 4 - Institutions, positions, and number of interviewees

3.4 Data collection and analysis

In order to understand the Portuguese panorama when it came to used methods, perceptions, thoughts and challenges of the forest-based sector, semi-structured online interviews were conducted with open questions. Before the data collection process was started, a protocol was developed (Appendix 1: Data collection protocol) that served as a base for the semi-structured interviews that would be made. The interview script (Appendix 2: Interview script) was developed keeping in mind that the interviewees were experts on the subject and there were three main dimensions: the landscape management, ecosystem services, and service ecosystems.

During the data collection, 14 interviews with experts were conducted. This period of the research was executed between March 28th and June 12th of 2023, and the interviews duration ranged between 30 to 70 minutes via Zoom or Microsoft Teams, all of them recorded for further analysis. The main goals for the conduction of the interviews were to gain comprehensive understanding of the experts' insights and knowledge related to forests and leisure activities and tourism; identify the main factors, challenges and opportunities associated with leisure tourism in forested areas; understand the potential impacts of leisure tourism in forested areas; to contribute to the existing body of knowledge on the intersection of forests and leisure tourism through expert interviews; to examine the correlation between ecosystem services and service ecosystems.

At the end of each interview, the focal point was to show a collaborative mental model in which the interviewee could erase, add, or move boxes, contents, and arrows. In order for this to be possible, a basic mental model was conducted with information gathered from the literature review (Appendix 3: Literature-based mental model). The finished result of the collaborative mental model resulted in a final mental model which included the feedback from the interviewees and was merged with data from the literature review.

After being recorded, which resulted in 561 minutes of interviews, all the data was transcribed and analysed in the NVivo software, following the Gioia methodology. The raw data was highlighted and coded according to themes, maintaining it structured. The data structure is a key component to demonstrate rigor in qualitative research, allowing for a later graphic representation of the progression of information and creation of mental models.

4 Results

The present chapter provides an analysis of the results obtained from the research conducted for the project. Building upon the above-mentioned methodology, the investigation delved into three dimensions: landscape management, ecosystem services, and service ecosystems.

The culmination of this research journey involved 14 expert interviews, followed by the transcription, coding, and subsequent analysis of the gathered information. Through the adoption of the Gioia methodology, the study embraced the three dimensions as a means to elucidate the multifaceted aspects of the subject matter.

This chapter encompasses the key findings, insights, and implications that derived from the examination of the interviews data. The results shed light on the intricate dynamics, challenges, and opportunities associated with landscape management, the benefits of ecosystem services, and the interplay with service ecosystems. This chapter also provides critical contribution to the existing body of knowledge in the field and paves the way for further research.

4.1 Landscape management

The landscape management dimension includes all the extra information surrounding the project. This includes fire prevention topics, challenges, and valorization projects. In Table 5, the categories 2 and 3 are described, as well as the number of files where each one was mentioned.

Category 2	Category 3	Files
Fire prevention		12
	Biodiversity	4
	Certify owners	3
	Conservation assurance	8
	Controlled burns	7
	Habitat restoration	3
	Plantation of native species	9
	Population awareness and training	9
	Removal of invasive species	7
	Surveillance of forested areas	8
Challenges		9
	Absence of active management	6
	Negligence	6
	Rural abandonment	3
Valorization projects		7

Casa das florestas das serras do Porto	1
Conducted studies	2
Community engagement	4
Programa dos bairros saudáveis	1
Projeto aldeia segura	1
Projeto condomínio das aldeias	3

Table 5 - Landscape management

The category 2 regarding fire prevention includes the following category 3 themes: biodiversity, certify owners, conservation assurance, controlled burns, habitat restauration, plantation of native species, population awareness and training, removal of invasive species and surveillance of forested areas. Fire prevention has emerged as a prominent and extensively discussed topic due to its significant influence on ecosystem services, service ecosystems, as well as forest leisure activities. The preservation of biodiversity and the restoration of habitats are perpetually under threat as a result of potential fire incidents. Hence, it is of utmost importance to ascertain the certification of landowners, ensure effective conservation measures, and survey the forested area. In a more technical way, controlled burns, the plantation of native species and the removal of invasive ones are crucial for fire prevention.

Regarding the challenges, the absence of active management, negligence and rural abandonment were the main factors described by the experts.

“The main problem lies in the fact that, firstly, it is necessary for people to intervene and take charge, considering that the majority of management efforts are non-existent. Forest management in these territories relies solely on natural regeneration, and no further actions are taken.”

Councilman of a municipality, regarding the absence of active management

“We must strive to change this mentality without offending sensibilities, as it is essential to also respect this ancestral knowledge. However, we need to raise awareness that a significant portion of wildfires stems from the improper use of fire.”

President of a city council, regarding negligence

“People began to have different lives, living off services and, I don't know, working with the city, transportation, everything. The economic model completely changed. The forest started to... It must have dried up, abandoned.”

President of civil protection of a municipality, regarding rural abandonment

Additionally, the study uncovered valorization projects within the landscape management dimension. These projects, such as Casa das Florestas das Serras do Porto, Programa Aldeia Segura and Projeto Condomínio das Aldeias, play a pivotal role in promoting the sustainable use of forest resources and ecosystem services. These projects highlight the importance of integrating stakeholders and communities into landscape management practices to foster the sense of ownership and responsibility.

“In addition to that, we have the “Aldeia Segura” project. “Aldeia Segura” aims to bring people together, with a village “leader” responsible for knowing everything about the residents of that village. This leader acts as the central figure, fostering unity and enhancing safety in the event of an approaching or threatening wildfire. They are the “responsible person” who oversees and implements the necessary preventive measures, leading to an evacuation and ensuring the gathering of people in a central location.”

Councilman of a municipality, regarding the “Aldeia Segura” project

The alignment of these categories and dimensions with forest leisure activities, ecosystem services, and service ecosystems is evident throughout the results. The fire prevention strategies identified in the landscape management dimension directly contribute to maintaining a safe environment for leisure activities in forested areas. Additionally, the conservation and restoration efforts outlined in the category 3 level themes align with the provision of ecosystem services, as they enhance the resilience of forest ecosystems. In a similar note, the valorization projects exemplify the concept of service ecosystems, as they involve various stakeholders working together to co-create value and promote sustainable practices within the landscape.

Overall, the obtained results from the landscape management dimension provide valuable insights into fire prevention strategies, challenges, and valorization projects, showcasing their relevance to the project core context of forest leisure activities, ecosystem services and service ecosystems.

4.2 Ecosystem services

Within the ecosystem services dimension of the project, the analysis focused on the following category 2 themes: cultural services, provisioning services, regulating services, and supporting services. These themes encompass multiple aspects regarding the benefits provided by forests and their alignment with forest leisure activities, ecosystem services, and service ecosystems. Similar to the landscape management dimension, Table 6 is divided into three columns: category 2, category 3 and the number of files in where they were mentioned.

Category 2	Category 3	Files
Cultural services		12
	Nature tourism	12
Provisioning services		1
Regulating services		4
	Carbon credits	3

CO2 retention	2
Droughts	2
Supporting services	2
Natural regeneration	2

Table 6 - Ecosystem services dimension

Cultural services are considered a category 2 theme, with a specific focus on nature tourism as a category 3 theme concept. The inclusion of nature tourism within cultural services highlights the role of forest in attracting visitors and providing recreational opportunities. Forest leisure activities contribute to the cultural value of forests and their ability to enhance the human well-being of individuals and communities.

Provisioning services were not delineated into category 3 level due to absence of specific second-order themes in the interviews but remain an integral part of ecosystem services. Provisioning services encompass the tangible goods provided by forests such as timber and non-timber products such as resin. While the interviews did not provide farther insights into specific provisioning services, it is essential to understand their relevance in the given context.

Regulating services are crucial for the maintenance of the balance and resilience of ecosystems. The category 3 themes include carbon credits, CO2 retention, and drought mitigation. These aspects highlight the vital role of forests in carbon sequestration, climate regulation, and their ability to mitigate the impacts of droughts. The regulation of ecosystem processes and the provision of essential services contribute to the sustainable functioning of forest ecosystems, aligning with the concept of ecosystem services.

“The initial phase involved conducting a territorial analysis and characterization, followed by a second phase of identifying specific areas for quantifying their ecosystem services and ultimately measuring “carbon credits” to enter the market for potential sale. These carbon credits can be traded as a means to offset carbon emissions.”

President of a city council, regarding carbon credits

“Now, our challenge is to keep these green mountain ranges flourishing, preserving both the vegetation and the water resources, which includes controlling the eucalyptus cultivation that has been depleting some water sources.”

Councilman of a municipality, regarding droughts

Supporting services encompass the category 2 themes of natural regeneration, form the foundation for the provision of the ecosystem services. Natural regeneration regards the inherent ability of forests to self-renew and recover from damaged, thereby ensuring the perpetuation and long-term sustainability of the forest ecosystems. This service allows the provision of a wide range of ecosystems services, including cultural, provisioning, and regulating.

As a result, forest leisure services are closely linked to cultural services, as nature tourism provides opportunities for recreation and engagement with forest ecosystems. Ecosystem services encompass the broader framework in which these leisure activities are situated, recognizing and embracing the multifunctional benefits and values that forests provide. Service ecosystems reunite the interdependent relationships between ecosystems, services, and the individual and community beneficiaries, emphasizing the interconnected and mutual dependence between natural systems and societal wellbeing.

In conclusion, the results obtained from the ecosystem services highlight the crucial importance of forest in providing cultural, regulating, provisioning, and supporting services. These findings contribute to understanding the benefits of forests, reinforcing the importance of considering ecosystem services and service ecosystems in forestry planning and management practices.

4.3 Service ecosystems

Regarding the service ecosystems, this dimension aggregates three key categories: market services, nonmarket services, and partnerships. As it can be seen in the Literature Review, services can be separated into two sectors, market and nonmarket. Thus, market services include the ones who can be measured and that have an impact in the economic activity or gross income of the sector. Contrarily, nonmarket services can't be measured in the GDP because it fails to account for multiple factors that contribute to the welfare, but not the market.

Category 2	Category 3	Files
Market services		12
	Awareness-raising activities	10
	Catering industry	2
	Certification	10
	Endogenous products	3
	Hospitality	2
	Forest leisure activities	10
	Touristic organizations	3
Nonmarket services		6
	Societal effects	4
	Eventual ecological impacts	3
	Individual wellbeing	4
Partnerships		9
	2BForrest	2
	AGIF	4
	GNR	3

ICNF	7
IPMA	2
Civil protection	6
Forest firefighters	3

Table 7 - Service ecosystem dimension

Market services encompass a diverse range of services that are commercially oriented and aimed at meeting the needs of forest leisure activities and tourism. The categories 3 within this dimension include awareness-raising activities, the catering industry, certification, endogenous products, hospitality, forest leisure activities, and touristic organizations. These categories highlight the multiple market services that contribute to the enhancement of the experience of individuals that engage in forest leisure services.

Given the theme of the dissertation, it is crucial to emphasize the contents pertaining to leisure services, especially those encompassed within the category of “forest leisure activities”. Table 8 shows the multiple types of forest leisure activities that were indicated by the experts.

<i>Sub-category 1</i>	<i>Sub-category 2</i>	<i>Files</i>
<i>Hard tourism</i>		10
	BTT and motorized vehicles	8
	Canoeing	1
	Rafting	2
	Rock climbing	1
	Walking and trails	9
<i>Soft tourism</i>		8
	Camping	1
	Contemplation circuits	2
	Educational tours	2
	Equestrian trails	3
	Hunting	1
	Walkways	3
	Wildlife observation	3

Table 8 - Forest leisure activities category detail

With regards to services that directly influence local economies, there are notable sectors such as the catering industry, the hospitality sector, organizations focused on endogenous products, as well as touristic establishments offering transportation and tour-related services. These

sectors play a significant role in providing economic support and contributing to the overall development of the region. The provision of these services within the forest context emphasizes the significance of understanding the demands of forest visitors and participants in ecosystem-based leisure activities.

“Therefore, even people from Porto, Lisbon, and other large urban cities come to visit these localities, they will undoubtedly leave behind some economic contribution, whether it's at a café, a restaurant nearby, the local gas station, or even through activities that may emerge and stimulate local production, such as honey, aromatic plants, or other goods that can be produced.”

President of a forest protection association, regarding market services

“The number of visitors has increased, along with the average length of stay, overnight stays, job opportunities, and business volume.”

President of a city council, regarding market services outcomes after investing on forest leisure activities

Nonmarket services are not directly monetized or exchanged in the traditional market transactions and cannot be directly measured in terms of monetary revenue within the GDP. However, they provide numerous other benefits to both society and individuals. The category 3 themes encompass societal effects, eventual ecological effects, and individual wellbeing. The categories also recognize societal and individual benefits (which may include mental and physical health improvement, enhanced community cohesion, and the intrinsic value associated with experiencing nature. Although they may not contribute directly to economic output, they play a critical role in enhancing the overall quality of life, environmental sustainability, and societal welfare.

“Firstly, typically the tourist who visits is the nature tourist who enjoys hiking trails. They are conscientious tourists who, instead of creating problems, contribute to problem-solving. Wherever they go, they tend to assist in cleaning up any debris they come across, and this is a reality that has been observed.”

President of a city council, regarding ecologic impacts in the region

“Of course, there are direct health benefits associated with engaging in physical activities. While I won't delve too much into that aspect, it is common knowledge that when people come to hike or go for runs, there are a variety of physical and mental health benefits involved. However, even without engaging in sports, something as simple as having a picnic, walking a dog, spending time with family, or participating in volunteer activities can bring about a sense of well-being and fulfillment.”

Member of a non-profit organization, regarding individual wellbeing

The final category 2 (from Table 7) regarding partnerships underscores the collaborative nature of service ecosystems and the importance of coordinated efforts among multiple stakeholders. These partnerships exemplify the collective actions between agencies, organizations and institutions working together to ensure the provision of services related to forest leisure activities, ecosystem services, and the overall wellbeing of forest ecosystems. The involvement of such entities in partnership initiatives signifies the recognition of interdependencies and shared responsibilities within the service ecosystem.

Forest leisure activities are directly intertwined with the provision of market services, as these cater to the specific needs of individuals and communities engaging in leisure activities in forested areas. On the other hand, ecosystem services encompass both market and nonmarket goods and services, recognizing the various benefits that forests provide to society. Lastly, service ecosystems capture the intricate web of partnerships and collaborations necessary for the provision and sustainability of services related to forest leisure activities and ecosystem services.

Concluding, the findings regarding service ecosystems shed light on the diverse range of services and partnerships involved in supporting forest leisure activities and ecosystem services. It is crucial to emphasize the importance of understanding and managing service ecosystems to ensure the provision of the services, the conservation of ecosystem services, and the promotion of sustainable forest leisure activities.

4.4 Mental model

The mental model, as mentioned above, acts as visual representations of data, displaying the relationships between various themes and their constituent elements. They serve as powerful tools for conveying and updating knowledge, as they stimulate visual stimuli and foster meaningful discussions.

Following the interviews, the literature-based mental model was presented to the experts, allowing them to actively participate by removing, adding, and repositioning concepts within the model. This facilitated the consolidation of their opinions and beliefs into a single visual representation.

The final mental model (Figure 3) integrated the expert opinions on the matter, effectively combining them with the information gathered from the literature review.

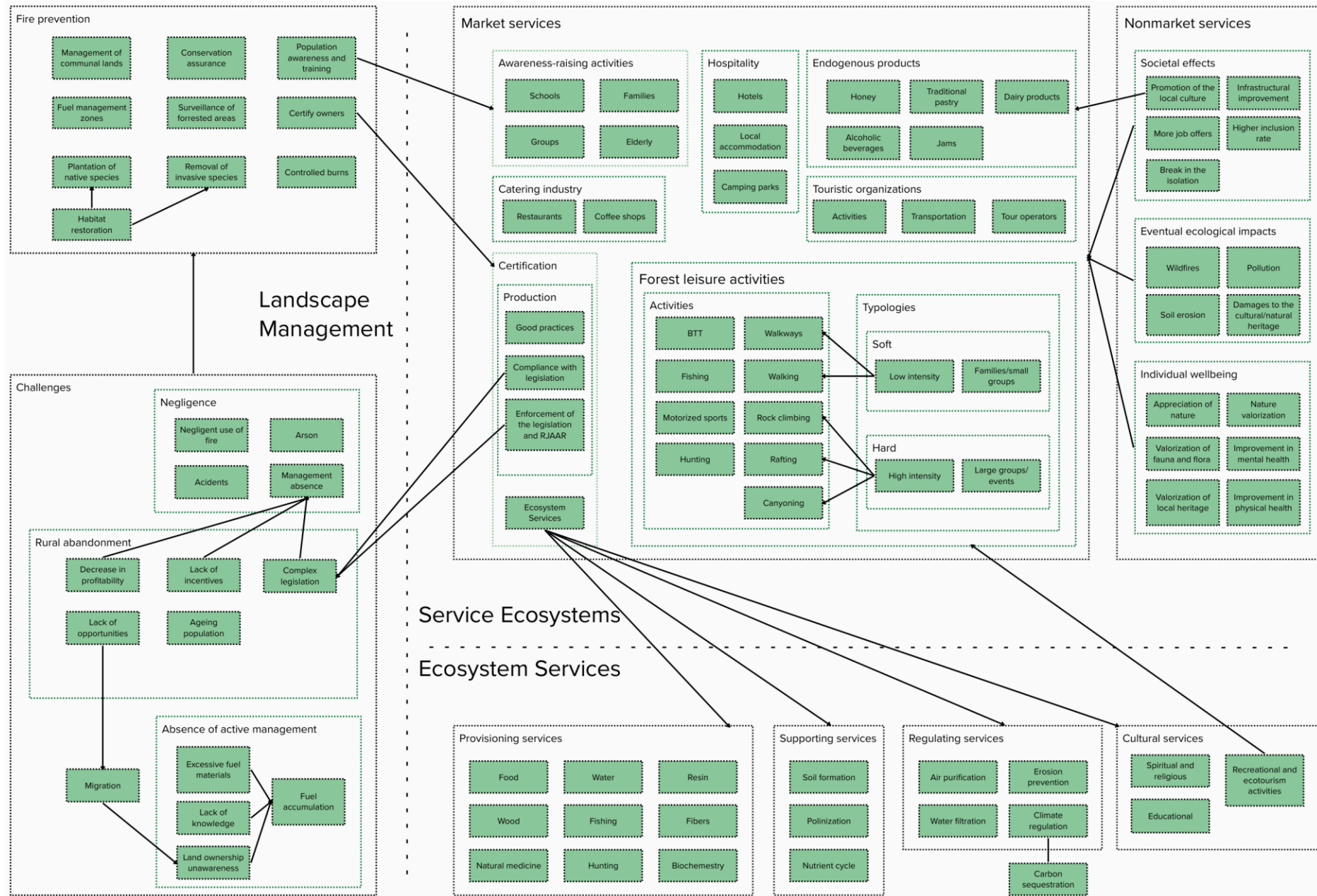


Figure 3 - Final mental model

The mental model is divided into three main topics (such as the Nvivo coding structure): landscape management, service ecosystems and ecosystem services.

Inside the main dimension of “landscape management” there are two main categories which represent the fire prevention efforts and the challenges faced. The prevention category encompasses the management of communal lands, fuel management zones, habitat restoration which is connected with the plantation of native species and removal of invasive ones, the surveillance of forested areas, controlled burns, certifying owners (which connects with the certification category in the market services), and population awareness and training which also connects with awareness-raising activities in the market activities category for the service ecosystems dimension. The fundamental challenges can be classified into three distinct categories: negligence, rural abandonment, and the absence of active management. Negligence encompasses four primary causes, namely, the negligent use of fire, arson, accidents, and the absence of effective management practices. The absence of active management is a consequence of declining profitability, inadequate incentives, and intricate legislation, all falling within the realm of rural abandonment. The scarcity of opportunities in rural areas leads to migration, subsequently resulting in a lack of awareness and understanding regarding land ownership and fire safety measures among the aging population. In addition to the lack of awareness regarding land ownership, the absence of knowledge and the presence of excessive fuel materials contribute to fuel accumulation within the category of absence of active management.

The “ecosystem services” dimension encompasses four categories of services: provisioning, supporting, regulating and cultural. Provisioning services encompass the services and good that nature provides to humans which include food, fresh and potable water, resin, wood, fishing, fibers, natural medicine, animals from hunting and biochemistry. Regulating services are the benefits from the regulation of the ecosystem and include air purification, erosion prevention, water filtration and climate regulation. Carbon sequestration was one of the themes that were mentioned by multiple experts during the interviewing phase of the dissertation. Cultural services include educational, spiritual, and religious services, as well as the main focus of the project, forest leisure activities. At last, the supporting services are the ones necessary for the production of the previous services. These are not directly used by individual, but include soil formation, pollination, and nutrient cycle regulation.

“Service ecosystems” can be broadly categorized into two main groups: market services and nonmarket services. As mentioned above, market services are the ones that have a direct market value and are actively bought and sold in economic transactions. The main market service for this project is the forest leisure activities, which then divides itself into activities and typologies. Typologies encompass the two potential approaches, namely the soft approach characterized by low intensity activities typically undertaken by small groups and families, such as walking or hiking along trails, and the hard approach which necessitates high intensity and is often pursued by larger groups or scheduled as part of specific events. Subsequently, an array of sectors that contribute to the enhancement of local economies are presented, including the hospitality sector (hotels, local accommodation, and camping parks), the catering industry (restaurants, coffee shops), touristic organizations (activities, transportation, and tour operators), and the sale of endogenous products (such as honey, traditional pastries, dairy products, alcoholic beverages, and jams). The municipalities and other organizations emphasized the importance of certification for both production (maintaining good practices, being compliant with the legislation and reinforcing the RJAAR) and ecosystem services, as

well as developing awareness-raising activities for the communities which are currently being done with elderly people, groups, schools, and families. Regarding nonmarket services, they encompass the intangible benefits and valuable effects that are provided to society but cannot be directly measured in monetary terms. These services contribute to the overall well-being, environmental sustainability, and cultural richness of a community or region. While they may not have a market value, their significance and impact are essential for the quality of life and the long-term sustainability of a society. The three main categories are the societal effects (promotion of local culture, infrastructural development, increase in job offer, higher inclusion rate and break in the isolation), the eventual ecological issues which may or not arise (wildfires, pollution, soil erosion and damages to the cultural and natural heritage), and individual wellbeing (nature, fauna and flora, and local heritage valorization, improvement in mental e physical health, and appreciation of nature).

The mental model is a valuable form of displaying information, and encompasses all of the experts' opinions, beliefs, concerns and thoughts regarding leisure activities, and its' correlation with ecosystem services and service ecosystems. Overall, understanding the mental model of context, service ecosystems, and ecosystem services is crucial for comprehending the intricate dynamics and interdependencies involved in managing the value co-creation that occurs between the forest leisure activities, ecosystem services and service ecosystems.

5 Discussion

The discussion chapter presents a critical analysis of the results obtained from the research conducted in this dissertation, considering the interplay between the findings and the existing literature on the subject. The synthesis of the results and their alignment with the literature contribute to an understanding of the complex dynamics between landscape management, ecosystem services, service ecosystems and leisure activities in forested areas.

Thus, regarding the landscape management dimension, the results pertaining to fire prevention highlight the key importance of biodiversity conservation, controlled burns, certification of landowners, conservation assurance, removal of invasive species and plantation of native ones, population awareness and training, and surveillance of forested areas. These results support the existing literature on effective strategies for mitigating the risk of wildfires and preserving the integrity of forested landscapes. The challenges that were identified, such as the absence of active management, negligence, and rural abandonment, also resonate with previous approaches to addressing these issues. The above-mentioned valorization projects align with the literature's emphasis on the significance of community involvement and collaborative efforts in landscape management.

In the ecosystem services dimension, the results associated with cultural services, specifically nature tourism, align with the literature emphasizing the role of forests in attracting visitors and providing recreational opportunities. The recognition of provisioning services, although not specified by the experts in the interviews, is also consistent with the literature's acknowledgment of the tangible goods derived from forests. The regulating services identified included carbon credits, CO₂ retention, and drought mitigation (Hosseini *et al.*, 2017), also reinforce the literature's emphasis on the role of forests in climate regulation and ecological balance (MEA, 2005b; Terres *et al.*, 2015). The supporting services, particularly natural regeneration, align with the literature's recognition of the foundational role that forests play in sustaining ecosystem functions and processes.

Furthermore, the service ecosystem dimension portrays the interplay between service provision and the diverse stakeholders involved. The market services identified, encompassing the awareness-raising activities, the catering industry, endogenous products, hospitality, touristic organizations, certification, and recreational services align with the literature's emphasis on meeting individual's needs and preferences when engaging in forest leisure activities. The nonmarket services also correspond to the literature's recognition of the broader benefits and value derived from the forest leisure activities, such as societal effects, eventual ecological effects, and individual wellbeing (Vargo and Lusch, 2016). The partnerships identified exemplify the collaborative nature of service ecosystems and reinforce the emphasis on coordinating efforts among multiple stakeholders to ensure the provision of services related to forest leisure activities and ecosystem services (Sutton and Costanza, 2002).

As a result, Figure 4 illustrates a comprehensive multi-level approach comprising three interconnected tiers that communicate and mutually influence one another, regarding the ecosystem services and the service ecosystem.

The bottom layer illustrates the ecosystem services and the four main categories: cultural services, regulating services, provisioning services, and supporting services. The second and middle layer represents the social-ecological interface, which demonstrates possible effects from the usage of ecosystem services by humans. These effects include wildfires, heritage damages, soil erosion, and pollution (the same as the eventual ecological impacts in the mental model). The final and top layer portrays the service ecosystem impacts that leisure activities

have in locations. From an economic standpoint, these activities have implications for tourist companies, local cuisine, and accommodations, as well as local commerce and the sale of endogenous products. On an individual level, the activities have an impact on individuals, influencing their well-being, health, learning, and even shaping their perception of nature and the valorization of heritage. Lastly, in terms of societal effects, leisure activities foster the promotion of local culture, social inclusion, infrastructure improvements, and employment opportunities.

The service ecosystem is described as a self-contained and self-adjusting system of actors connected by shared institutional arrangements and mutual value creation through service exchange. According to Vargo and Lusch (2017) value creation involves multiple actors interacting with the intention of enhancing their well-being and that of the system. It emphasizes that value is co-created through interactions among actors within a specific context (Gummesson, 1987).



Figure 4 - Leisure activities effects on ecosystem services and service ecosystem (source: author)

Considering the broader context of the literature review, the discussions on forest fire effects, ecosystem services, and leisure activities in forested areas intertwine with the concept of service ecosystems. Forest fires have profound impacts on non-market goods and services, highlighting the need for their protection and preservation. The understanding of ecosystem services provided by forests is crucial for assessing their value and the benefits they offer to individuals,

society, and the economy. Moreover, integrating leisure services with forest ecosystem services not only enhances individuals' well-being, but also promotes social inclusion, infrastructure development, and employment opportunities.

The research questions presented in this research, namely, the exploration of leisure services in forested areas and the investigation on how these services co-create value with forest ecosystem services, directly address the identified research gap. This gap, which pertains to the lack of a comprehensive framework that encompasses the relationships between leisure activities, ecosystem services, and service ecosystems, has been acknowledged.

In conclusion, this study explored the leisure activities that can be provided in the context of the Portuguese forests and analysed how these services co-create value with forest ecosystem services and service ecosystems. The findings highlighted the multiple range of leisure activities available, ranging from trail running to contemplation walks. The integration of leisure services and forest ecosystem services was found to yield economic benefits through tourism and recreation-related spending, while also promoting societal well-being and individual fulfilment. By engaging in leisure activities, individuals become more aware of the ecosystem services provided by forests, contributing to their conservation.

6 Conclusion and future research

This study explored multiple aspects of the Portuguese forest, including the causes and consequences of forest fires, market and non-market goods and services, ecosystem services, service ecosystem, and forest leisure activities.

Through 14 expert interviews, valuable insights were gathered regarding the relationship between forest leisure activities, forest ecosystem services, as well as the economic, societal, and individual benefits of their integration. The 14 interviews were conducted to key stakeholders from the forest and leisure tourism sector. This included experts who hold positions in municipal councils, association and other private institutions, as well as private institutions.

As expected, the experts presented challenges in terms of accessibility due to their high-ranking positions within the diverse above-mentioned organizations. Nevertheless, the 14 conducted interviews were successful, and the saturation point has been reached due to the diverse answers regarding their experience, knowledge, and opinions.

The results have highlighted the importance of understanding the concept of service ecosystems within the service-dominant logic framework. The service ecosystem perspective emphasizes the co-creation of value through interactions among actors in a context. Specifically in the forest-based sector, strategies focusing on “services to society” contribute to the sustainable management of natural resources while providing goods and services to society, including the promotion of rural employment and income generation.

Nevertheless, there are still avenues for further research to expand upon the findings and knowledge acquired thus far. Further research could delve deeper into specific leisure services that can be provided in a forest system (e.g. trail running), examining their impact on forest ecosystem services and the ways in which they are able to co-create value. Furthermore, investigating the effectiveness of integration of forest leisure activities with forest ecosystem services in achieving economic, societal, and individual outcomes would be valuable.

Additionally, conducting comparative studies across specific and different forested regions or countries could provide interesting insights into the transferability of results and the development of a framework for best practices for sustainable forest management and leisure services integration. Longitudinal studies that track the long-term impacts of forest leisure activities on forest ecosystem services and service ecosystems, and the correspondent economic, societal, and individual benefits would also contribute to a deeper understanding on the subject.

In conclusion, this study has laid the groundwork for understanding the relationship between leisure services, forest ecosystem services and service ecosystems in the context of the Portuguese forest. Future research can build upon these findings and foundations to further explore the knowledge in this subject, ultimately informing decision-making processes and promoting the sustainable management and utilization of forest resources for the benefit of individuals, communities, and the environment.

References

- AGIF (2021) *Sistema de gestão integrada de fogos rurais. Relatório de atividades 2020*. Agência para a Gestão Integrada de Fogos Rurais.
- Ales, R.F. *et al.* (1992) 'Recent changes in landscape structure and function in a mediterranean region of SW Spain (1950–1984)', *Landscape Ecology*, 7(1), pp. 3–18. Available at: <https://doi.org/10.1007/BF02573953>.
- Azadi, H. *et al.* (2016) 'Agricultural Land Conversion Drivers in Northeast Iran: Application of Structural Equation Model', *Applied Spatial Analysis and Policy*, 9(4), pp. 591–609. Available at: <https://doi.org/10.1007/s12061-015-9160-4>.
- Baldock, D. (1996) *Farming at the Margins: Abandonment Or Redeployment of Agricultural Land in Europe*. IEEP and LEI-DLO (vol. 1).
- Barquero (1995) *La representacion de estados mentales en la comprension de textos desde el enfoque teorico de los modelos mentales*. Tesis doctoral. Universidad Autonoma de Madrid.
- Beighley, M. and Hyde, A.C. (2018) 'Portugal wildfire management in a new era assessing fire risks, resources and reforms', *Centro de Estudos Florestais-Instituto Superior de Agronomia/Universidade de Lisboa: Lisboa, Portugal* [Preprint].
- Bell, S. *et al.* (eds) (2009) *European Forest Recreation and Tourism*. 0 edn. Taylor & Francis. Available at: <https://doi.org/10.4324/9780203872079>.
- Bento Gonçalves, A.J. (ed.) (2017) *Wildfires: perspectives, issues and challenges of the 21st century*. New York: Nova Science Publishers (Natural disaster research, prediction and mitigation).
- Bernardo, V. (2018) *Visitantes internacionais dos Passadiços do Paiva: motivação, experiência, satisfação e canais de distribuição*. Escola Superior de Hotelaria e Turismo do Instituto Politécnico do Porto.
- Bochet, E., Poesen, J. and Rubio, J.L. (2006) 'Runoff and soil loss under individual plants of a semi-arid Mediterranean shrubland: influence of plant morphology and rainfall intensity', *Earth Surface Processes and Landforms*, 31(5), pp. 536–549. Available at: <https://doi.org/10.1002/esp.1351>.
- Botelho, H. *et al.* (1994) 'Prescribed fire behavior and fine fuel consumption in Northern Portugal and Galiza maritime pine stands'. Available at: <https://doi.org/10.13140/2.1.1904.1282>.
- Bouwma, I. *et al.* (2018) 'Adoption of the ecosystem services concept in EU policies', *Ecosystem Services*, 29, pp. 213–222. Available at: <https://doi.org/10.1016/j.ecoser.2017.02.014>.
- Brandão, C.N., Barbieri, J.C. and João, C.D.M. (2015) 'O TURISMO INDÍGENA E SUA INFLUÊNCIA NO DESENVOLVIMENTO LOCAL SUSTENTÁVEL: UM ESTUDO NA RESERVA INDÍGENA SÃO MARCOS - RORAIMA', *Revista de Gestão Social e Ambiental*, 8(3), p. 3. Available at: <https://doi.org/10.5773/rgsa.v8i3.973>.
- Breuste, J. and Landschaftspflege, B.A. für N. und (2012) *Implementation of landscape ecological knowledge in European urban practice*. Stand: Januar 2012. Laufen: ANL (Laufener Spezialbeiträge, 2012,[1]).
- Buckley, R. (2011) 'Tourism and Environment', *Annual Review of Environment and Resources*,

- 36(1), pp. 397–416. Available at: <https://doi.org/10.1146/annurev-environ-041210-132637>.
- Calkin, D.E. *et al.* (2013) ‘Estimating US federal wildland fire managers’ preferences toward competing strategic suppression objectives’, *International Journal of Wildland Fire*, 22(2), p. 212. Available at: <https://doi.org/10.1071/WF11075>.
- Castro, H. and Freitas, H. (2009) ‘Above-ground biomass and productivity in the Montado: From herbaceous to shrub dominated communities’, *Journal of Arid Environments*, 73(4–5), pp. 506–511. Available at: <https://doi.org/10.1016/j.jaridenv.2008.12.009>.
- Cerdá, A. and Doerr, S.H. (2005) ‘Influence of vegetation recovery on soil hydrology and erodibility following fire: an 11-year investigation’, *International Journal of Wildland Fire*, 14(4), p. 423. Available at: <https://doi.org/10.1071/WF05044>.
- Chandler, J.D. and Vargo, S.L. (2011) ‘Contextualization and value-in-context: How context frames exchange’, *Marketing Theory*, 11(1), pp. 35–49. Available at: <https://doi.org/10.1177/1470593110393713>.
- Charmaz, K. (2014) *Constructing grounded theory*. 2nd edition. London ; Thousand Oaks, Calif: Sage (Introducing qualitative methods).
- Christie, M. *et al.* (2006) ‘Valuing the diversity of biodiversity’, *Ecological Economics*, 58(2), pp. 304–317. Available at: <https://doi.org/10.1016/j.ecolecon.2005.07.034>.
- Cleveland, C.J., Stern, D.I. and Costanza, R. (eds) (2001) *The economics of nature and the nature of economics*. Cheltenham, UK ; Northampton, MA, USA: Edward Elgar (Advances in ecological economics).
- Comberti, C. *et al.* (2015) ‘Ecosystem services or services to ecosystems? Valuing cultivation and reciprocal relationships between humans and ecosystems’, *Global Environmental Change*, 34, pp. 247–262. Available at: <https://doi.org/10.1016/j.gloenvcha.2015.07.007>.
- Costanza, R. *et al.* (1997) ‘The value of the world’s ecosystem services and natural capital’, *Nature*, 387(6630), pp. 253–260. Available at: <https://doi.org/10.1038/387253a0>.
- DeFries, R.S. *et al.* (2010) ‘Deforestation driven by urban population growth and agricultural trade in the twenty-first century’, *Nature Geoscience*, 3(3), pp. 178–181. Available at: <https://doi.org/10.1038/ngeo756>.
- DGRF (2006) *National Forest Strategy Portugal*.
- Duarte, A., Belém, M. and Bernardo, V. (2018) ‘Marketing place - The study of Paiva Walkways in Arouca UNESCO Global Geopark (Portugal)’, in. *8th International Conference on UNESCO Global Geoparks*.
- EC (2013) *A new EU forest strategy: for forests and the forest-based sector*.
- Enes, T. *et al.* (2020) ‘Large Scale Shrub Biomass Estimates for Multiple Purposes’, *Life*, 10(4), p. 33. Available at: <https://doi.org/10.3390/life10040033>.
- FAO (2002) *Land tenure and rural development*. 3. Rome, p. 56 p.
- Farber, S.C. and Costanza, R. (2002) ‘Economic and ecological concepts for valuing ecosystem services’, *Ecological Economics*, 41(3), pp. 375–392. Available at: [https://doi.org/10.1016/S0921-8009\(02\)00088-5](https://doi.org/10.1016/S0921-8009(02)00088-5).
- Fernandes, P. (2014) *Forest fires in Portugal: dynamics, causes and policies*. Edited by F. Reboredo. Springer (World Forest series).

- Fischer, G. *et al.* (2008) *Global agro-ecological zones assessment for agriculture (GAEZ 2008)*. Food and Agriculture Organization of the United Nations (ed.) (2011) *The European forest sector outlook study II: 2010-2030*. Geneva: United Nations.
- FTP (2013) 'Horizons Vision 2030 for the European forest-based sector'. Available at: https://www.forestplatform.org/wp-content/uploads/2020/03/FTP_renewed_Vision_2030.pdf.
- Gentner, D. and Stevens, A.L. (eds) (2014) *Mental models*. New York: Psychology Press.
- Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013) 'Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology', *Organizational Research Methods*, 16(1), pp. 15–31. Available at: <https://doi.org/10.1177/1094428112452151>.
- Glaser, B.G. (1978) *Theoretical sensitivity*. Mill Valley, Calif: Soc. Pr (Advances in the methodology of grounded theory).
- Gomes, J.F.P. (2006) 'Forest fires in Portugal: how they happen and why they happen', *International Journal of Environmental Studies*, 63(2), pp. 109–119. Available at: <https://doi.org/10.1080/00207230500435304>.
- Grönroos, C. (1995) 'Relationship marketing: The strategy continuum', *Journal of the Academy of Marketing Science*, 23(4), pp. 252–254. Available at: <https://doi.org/10.1007/BF02893863>.
- Gummesson, E. (1987) 'The new marketing—Developing long-term interactive relationships', *Long Range Planning*, 20(4), pp. 10–20. Available at: [https://doi.org/10.1016/0024-6301\(87\)90151-8](https://doi.org/10.1016/0024-6301(87)90151-8).
- Hajimirrahimi, S. *et al.* (2017) 'Rural Second Homes and Their Impacts on Rural Development: A Case Study in East Iran', *Sustainability*, 9(4), p. 531. Available at: <https://doi.org/10.3390/su9040531>.
- Hassan, H. (1997) 'Natural Habitats and Ecosystems Management in Drylands: An Overview', *Environment Department Papers*, 51.
- Hernández, L. e cols (2020) 'Um planeta em chamas.Proposta ibérica da WWF para a prevenção de incêndios', *ANP|WWF e WWF-Espanha* [Preprint].
- Hosseini, M. *et al.* (2017) 'Effects of fire occurrence and recurrence on nitrogen and phosphorus losses by overland flow in maritime pine plantations in north-central Portugal', *Geoderma*, 289, pp. 97–106. Available at: <https://doi.org/10.1016/j.geoderma.2016.11.033>.
- Huff, S. *et al.* (2018) 'Quantifying aboveground biomass for common shrubs in northeastern California using nonlinear mixed effect models', *Forest Ecology and Management*, 424, pp. 154–163. Available at: <https://doi.org/10.1016/j.foreco.2018.04.043>.
- Hunt, L.M. *et al.* (2005) 'Remote tourism and forest management: a spatial hedonic analysis', *Ecological Economics*, 53(1), pp. 101–113. Available at: <https://doi.org/10.1016/j.ecolecon.2004.06.025>.
- ICNF (2013) *Áreas dos Usos do Solo e das Espécies Florestais de Portugal Continental*.
- ICNF (2022) *Perfil Florestal, Instituto da Conservação da Natureza e das Florestas*.
- INE (2019) 'Estatísticas do Turismo 2018'.
- Jones, N. *et al.* (2011) 'Mental Models: An Interdisciplinary Synthesis of Theory and Methods', *Ecology and Society*. 16th edn. Available at: <http://www.ecologyandsociety.org/vol16/iss1/art46/>.

- Keane, R.E. *et al.* (2002) *Cascading effects of fire exclusion in the Rocky Mountain ecosystems: a literature review*. RMRS-GTR-91. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, p. RMRS-GTR-91. Available at: <https://doi.org/10.2737/RMRS-GTR-91>.
- Krugman, P.R., Obstfeld, M. and Melitz, M.J. (2023) *International economics: theory & policy*. Twelfth edition, global edition. Harlow, England London New York Boston San Francisco Toronto Sydney Dubai Singapore Hong Kong Tokyo Seoul Taipei New Delhi Cape Town Sao Paulo Mexico City Madrid Amsterdam Munich Paris Milan: Pearson.
- Lane, B. (1994a) 'Sustainable rural tourism strategies: A tool for development and conservation', *Journal of Sustainable Tourism*, 2(1–2), pp. 102–111. Available at: <https://doi.org/10.1080/09669589409510687>.
- Lane, B. (1994b) 'What is rural tourism?', *Journal of Sustainable Tourism*, 2(1–2), pp. 7–21. Available at: <https://doi.org/10.1080/09669589409510680>.
- Letson, D. and Milon, J.W. (2002) *Florida coastal environmental resources: a guide to economic valuation and impact analysis*. Gainesville, Fla.: Florida Sea Grant College Program.
- Levers, C. *et al.* (2018) 'Archetypical patterns and trajectories of land systems in Europe', *Regional Environmental Change*, 18(3), pp. 715–732. Available at: <https://doi.org/10.1007/s10113-015-0907-x>.
- Liagre, L. *et al.* (2015) *Sustainable Financing for Forest and Landscape Restoration. Opportunities, Challenges and the Way Forward*.
- List, J.A. (2003) 'Using Random nth Price Auctions to Value Non-Market Goods and Services', *Journal of Regulatory Economics*, 23(2), pp. 193–205. Available at: <https://doi.org/10.1023/A:1022259014448>.
- López-del-Pino, F. and Grisolia, J.M. (2018) 'Pricing Beach Congestion: An analysis of the introduction of an access fee to the protected island of Lobos (Canary Islands)', *Tourism Economics*, 24(4), pp. 449–472. Available at: <https://doi.org/10.1177/1354816617740065>.
- Lucas, P.H.C. (1982) 'How protected areas can help meet society's evolving needs', in *National parks, conservation, and development. The role of protected areas in sustaining society. Proceedings of the World Congress on National Parks*, Bali, Indonesia: Smithsonian Institution Press, pp. 72–77.
- MacDonald, D. *et al.* (2000) 'Agricultural abandonment in mountain areas of Europe: Environmental consequences and policy response', *Journal of Environmental Management*, 59(1), pp. 47–69. Available at: <https://doi.org/10.1006/jema.1999.0335>.
- Magnani, G. and Gioia, D. (2022) 'Using the Gioia Methodology in international business and entrepreneurship research', *International Business Review*, p. 102097. Available at: <https://doi.org/10.1016/j.ibusrev.2022.102097>.
- Mangas, J.G.; L. (2008) 'The priority value of scrubland habitats for carnivore conservation in Mediterranean ecosystems', *Biodivers. Conserv.*, 17, pp. 43–51.
- Mann, C. and Absher, J.D. (2008) 'Recreation conflict potential and management implications in the northern/central Black Forest Nature Park', *Journal of Environmental Planning and Management*, 51(3), pp. 363–380. Available at: <https://doi.org/10.1080/09640560801979527>.
- Mayerl, D. (2005) *Planning for Biosphere Reserves*. Berlin, Germany: Springer.

- McNeely, J.A. (1994) 'Lessons from the past: forests and biodiversity', *Biodiversity and Conservation*, 3(1), pp. 3–20. Available at: <https://doi.org/10.1007/BF00115329>.
- MEA (2005a) *Ecosystem and Human Well-Being: Synthesis*. Washington, DC: Island Press.
- MEA (2005b) *Ecosystems and human well-being*. Edited by Millenium Ecosystem Assessment. United States of America: Island press.
- Mendes, A. and Gluck, P. (1998) *National forest planning in Portugal*. Freiburg, Germany.
- Mendes, I. and Proença, I. (2005) 'Estimating the Recreation Value of Ecosystems by Using a Travel Cost Method Approach'.
- Molina, J., Silva, F.R.Y. and Herrera, M.Á. (2017) 'Economic vulnerability of fire-prone landscapes in protected natural areas: application in a Mediterranean Natural Park', *European Journal of Forest Research*, 136(4), pp. 609–624. Available at: <https://doi.org/10.1007/s10342-017-1059-y>.
- Molina, J.R. *et al.* (2018) 'Prescribed fire experiences on crop residue removal for biomass exploitations. Application to the maritime pine forests in the Mediterranean Basin', *Science of The Total Environment*, 612, pp. 63–70. Available at: <https://doi.org/10.1016/j.scitotenv.2017.08.182>.
- Neary, D.G., Ryan, K.C. and DeBano, L.F. (2005) *Wildland fire in ecosystems: effects of fire on soils and water*. RMRS-GTR-42-V4. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, p. RMRS-GTR-42-V4. Available at: <https://doi.org/10.2737/RMRS-GTR-42-V4>.
- Newsome, D., Dowling, R.K. and Moore, S.A. (2012) *Natural Area Tourism: Ecology, Impacts and Management*. 2nd edition. Bristol, UK: Channel View Publications.
- Ng, I.C.L. and Vargo, S.L. (2018) 'Service-dominant logic, service ecosystems and institutions: an editorial', *Journal of Service Management*, 29(4), pp. 518–520. Available at: <https://doi.org/10.1108/JOSM-07-2018-412>.
- Pausas, J.G. (2004) 'The GCTE Network: Plant functional traits in relation to fire in crown-fire ecosystems', *Ecology*, 85.
- Pelli, P., Haapala, A. and Pykäläinen, J. (2017) 'Services in the forest-based bioeconomy – analysis of European strategies', *Scandinavian Journal of Forest Research*, 32(7), pp. 559–567. Available at: <https://doi.org/10.1080/02827581.2017.1288826>.
- Peña, A.I.P., Jamilena, D.M.F. and Molina, M.Á.R. (2011) 'Impact of Market Orientation and ICT on the Performance of Rural Smaller Service Enterprises*: JOURNAL OF SMALL BUSINESS MANAGEMENT', *Journal of Small Business Management*, 49(3), pp. 331–360. Available at: <https://doi.org/10.1111/j.1540-627X.2011.00332.x>.
- Rego *et al.* (1994) 'Biomass and aerial structure characteristics of some Mediterranean shrub species'. Available at: <https://doi.org/10.13140/2.1.2297.3446>.
- Rieman, B. *et al.* (2003) 'Status of native fishes in the western United States and issues for fire and fuels management', *Forest Ecology and Management*, 178(1–2), pp. 197–211. Available at: [https://doi.org/10.1016/S0378-1127\(03\)00062-8](https://doi.org/10.1016/S0378-1127(03)00062-8).
- Rocha, D. *et al.* (2017) 'Paiva Walkways: an example of sustainable management in Arouca', in. *Geoparks: pathways of sustainable tourism for development*, Ponta Delgada, Açores.
- Roth, W.-M. and Lee, S. (2004) 'Science education as/for participation in the community',

Science Education, 88(2), pp. 263–291. Available at: <https://doi.org/10.1002/sce.10113>.

Ryan, K.C. *et al.* (2012) *Wildland fire in ecosystems: effects of fire on cultural resources and archaeology*. RMRS-GTR-42. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, p. RMRS-GTR-42. Available at: <https://doi.org/10.2737/RMRS-GTR-42>.

Sandberg, D.V., Ottmar, R.D. and Peterson, J.L. (2002) *Wildland fire in ecosystems: effects of fire on air*. RMRS-GTR-42-V5. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, p. RMRS-GTR-42-V5. Available at: <https://doi.org/10.2737/RMRS-GTR-42-V5>.

Schemel, H.-J., Erbguth, W. and Reichholf, J.H. (2000) *Handbuch Sport und Umwelt: Ziele, Analysen, Bewertungen, Lösungsansätze, Rechtsfragen*. 3., vollständig überarb. und wesentl. erw. Aufl. Aachen: Meyer und Meyer (Edition Sport und Umwelt).

Silvis, H.J. (2013) *Economic viewpoints on ecosystem services*. Wageningen (Statutory Research Tasks Unit for Nature and the Environment (WOT Natuur & Milieu), 123).

SOS Rio Paiva (2015) ‘Passadiços em Arouca continuam a preocupar S.O.S. Rio Paiva’. Available at: <https://www.riopaiva.org/imprensa/> (Accessed: 17 February 2023).

Sutton, P.C. and Costanza, R. (2002) ‘Global estimates of market and non-market values derived from nighttime satellite imagery, land cover, and ecosystem service valuation’, *Ecological Economics*, 41(3), pp. 509–527. Available at: [https://doi.org/10.1016/S0921-8009\(02\)00097-6](https://doi.org/10.1016/S0921-8009(02)00097-6).

Terres, J.-M. *et al.* (2015) ‘Farmland abandonment in Europe: Identification of drivers and indicators, and development of a composite indicator of risk’, *Land Use Policy*, 49, pp. 20–34. Available at: <https://doi.org/10.1016/j.landusepol.2015.06.009>.

Turismo de Portugal (2006) ‘Turismo de Natureza: 10 produtos estratégicos para o desenvolvimento do turismo em Portugal’. Turismo de Portugal.

Ustaoglu, E. and Collier, M.J. (2018) ‘Farmland abandonment in Europe: an overview of drivers, consequences, and assessment of the sustainability implications’, *Environmental Reviews*, 26(4), pp. 396–416. Available at: <https://doi.org/10.1139/er-2018-0001>.

Vargo, S.L. and Lusch, R.F. (2004) ‘Evolving to a New Dominant Logic for Marketing’, *Journal of Marketing*, 68(1), pp. 1–17. Available at: <https://doi.org/10.1509/jmkg.68.1.1.24036>.

Vargo, S.L. and Lusch, R.F. (2008) ‘Service-dominant logic: continuing the evolution’, *Journal of the Academy of Marketing Science*, 36(1), pp. 1–10. Available at: <https://doi.org/10.1007/s11747-007-0069-6>.

Vargo, S.L. and Lusch, R.F. (2011) ‘It’s all B2B...and beyond: Toward a systems perspective of the market’, *Industrial Marketing Management*, 40(2), pp. 181–187. Available at: <https://doi.org/10.1016/j.indmarman.2010.06.026>.

Vargo, S.L. and Lusch, R.F. (2016) ‘Institutions and axioms: an extension and update of service-dominant logic’, *Journal of the Academy of Marketing Science*, 44(1), pp. 5–23. Available at: <https://doi.org/10.1007/s11747-015-0456-3>.

Vargo, S.L. and Lusch, R.F. (2017) ‘Service-dominant logic 2025’, *International Journal of Research in Marketing*, 34(1), pp. 46–67. Available at:

<https://doi.org/10.1016/j.ijresmar.2016.11.001>.

Vargo, S.L., Wieland, H. and Akaka, M.A. (2015) 'Innovation through institutionalization: A service ecosystems perspective', *Industrial Marketing Management*, 44, pp. 63–72. Available at: <https://doi.org/10.1016/j.indmarman.2014.10.008>.

Venn, T.J. and Calkin, D.E. (2011) 'Accommodating non-market values in evaluation of wildfire management in the United States: challenges and opportunities', *International Journal of Wildland Fire*, 20(3), p. 327. Available at: <https://doi.org/10.1071/WF09095>.

Zuazo, V.H.D. and Pleguezuelo, C.R.R. (2008) 'Soil-erosion and runoff prevention by plant covers. A review', *Agronomy for Sustainable Development*, 28(1), pp. 65–86. Available at: <https://doi.org/10.1051/agro:2007062>.

Appendix 1: Data collection protocol

SHAPING THE DOME

Data Collection Protocol

Maria Inês Lago

Target: Experts

Purpose

Identify and determine the current situation regarding leisure activities in forested areas in the north of Portugal. It is targeted to survey and verify the stakeholder's experiences and goals regarding leisure activities that add value to forested areas in Portugal. The interviews will identify needs, motivations, assess the current situation and understand pain-points, future prospects, and opportunities.

In order to identify the previous points, semi-structured interviews will be conducted to experts in municipalities, other public institutions, and private institutions.

Goals

The aim for conducting the interviews is to have a deeper understanding of the Portuguese case regarding forest recreational activities and the overall panorama involved. The interviews will include a sample of individuals in order to gather useful information for the development of a new service for forest valorization and exploitation.

Logistical aspects

- The individuals of interest are identified, and then convenient dates and times are scheduled for the interviews.
- The interviews can be conducted remotely or face-to-face.
- The interviews are expected to last about 30 to 70 minutes.
- If the recording of the interview is not approved by the participants, notes will be taken.
- The recordings will be kept within the project team and other stakeholders related to the study.
- If asked by the participants, information will be kept anonymous.

The script for the interviews will have questions regarding the topics to be addressed in its duration. Since the interviews are semi-structured, the questions are purposely intended to be used as a guide for discussion. The topics are not final, and their order might be altered based on the flow of the conversation with each participant.

The questions will follow the topics:

1. Introduction questions regarding the background and current projects of the participants.
2. Exploratory questions regarding forest and forest recreational activities.
3. Questions about possible pain points, opportunities, and future goals.

Appendix 2: Interview script

Protocol

Participant:

Date:

Hour:

Introdução

Bom dia/Boa tarde (nome do participante). O meu nome é Inês Lago e sou estudante do mestrado em engenharia de serviços e gestão na Universidade do Porto. Esta entrevista servirá de apoio à conclusão da minha dissertação relativamente a serviços de lazer em zonas florestais portuguesas.

Desta forma, o objetivo desta conversa será entender o panorama das atividades recreacionais em zonas florestais, e o seu impacto económico e social nas zonas descritas. A meta final do projeto será a criação de serviços para a valorização do território florestal português.

Antes de darmos início à entrevista, será importante reforçar os seguintes pontos:

- 1) Quero que veja este momento como uma conversa, ao invés de uma entrevista. Sempre que achar relevante, pode introduzir temas relacionados com o âmbito do projeto.
- 2) Não existem respostas erradas ou certas. O objetivo desta conversa é de entender a sua experiência relativamente ao assunto, e que melhorias poderiam ou deveriam ser efetuadas.
- 3) Compreendo que provavelmente já falou do assunto com outras pessoas, mas peço que durante a entrevista considere que está a expor o assunto como se fosse a primeira vez. É do interesse do estudo entender todo o panorama relativo ao assunto em questão.
- 4) Toda a informação recolhida será posteriormente analisada e caso pretenda manter o anonimato, deverá informar-me.

Para efeitos de tratamento de dados é necessário gravar a entrevista. A gravação não será exposta publicamente fora da equipa do projeto ou outros interessados. Desta forma, gostaria de lhe pedir permissão.

(Se autorizado, começar gravação)

(Se não autorizado) Compreendo. Dessa forma estarei a tirar apontamentos durante a sessão, mas a minha atenção estará direcionada para a nossa conversa.

Alguma questão antes de iniciarmos?

Questões – Singulares (utilizadores)

Para compreendermos o contexto, vamos começar com umas perguntas simples.

- Pode descrever o papel da associação na promoção de atividades relacionadas com a floresta?
- Quais são as atividades mais procuradas por utilizadores na zona em que a associação atua? (passadiços, trilhos, escalada, etc.)

Para cada atividade perguntar:

- Que riscos de provocar incêndio/ignição identifica em cada atividade mencionada? -> risco da atividade provocar um incêndio
 - Como se podem gerir/mitigar esses riscos?
- Que riscos associados a incêndios em curso identifica em cada atividade mencionada?
 - Como se podem gerir/mitigar esses riscos?
- Pode descrever o papel da associação na organização/gestão de atividades de lazer em zonas florestais?
- Como é que a associação colabora com outros stakeholders (proprietários florestais, comunidade local ou entidades estatais/financiadoras)?
- Têm algum tipo de apoio de alguma entidade?
 - (não) acredita ser fulcral ter algum tipo de apoio para um maior sucesso da organização?
 - (não) como conseguem atuar sem este tipo de incentivos?
 - (sim) como faz a gestão desses apoios?
- Consegue partilhar um exemplo de um projeto recente bem-sucedido?
 - O que considera importante para estes projetos serem bem-sucedidos?
- Quais são os maiores desafios da associação relativamente a atividades de lazer em zonas florestais?
 - Existe algo que poderia ajudar na mitigação destes desafios?
 - Como lida com as regras de preservação florestais?
- Quais os maiores benefícios de atividades de lazer em zonas florestais, tanto para o utilizador comum como para a economia local?
- Que planos tem a associação para o desenvolvimento da zona florestal?
 - E atividades de lazer?

Outros tópicos:

- Envolvimento das populações nos projetos (desafios, dificuldades...)
- Exemplos de ações de sensibilização
- Projetos Europeus

Appendix 3: Literature-based mental model

