Community forest Management: Policy and scale of action

A case study of the Serra de Monchique, Algarve

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DECLARATION

I declare that this document is an original work of my own authorship and that it fulfills all the requirements of the Code of Conduct and Good Practices of the Universidade de Lisboa.

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ABSTRACT

The occurrence of forest fire events is becoming more frequent on our planet, affecting more people and generating devastating social, environmental, and economic impacts. The latest WWF (World Wildlife Funding) report identifies Portugal as the European country that has faced the most forest fire events in the last 30 years and as the fourth worldwide country that has lost the highest percentage of forest land area since the XXI century (with the burnt area increasing every year). Considering the Portuguese context, this research, developed under the scope of the BRIDGE (Bringing science and local communities together to reduce the risk of forest fires) project, focuses on the municipality of Monchique, located in the district of Faro (southern Portugal). Monchique has a historical backdrop of forest fires, with a significant percentage of its territory considered highly susceptible to forest fire occurrences. This dissertation seeks to ascertain whether the existing regulatory frameworks adequately acknowledge and harness local community capacities for forest management while simultaneously endeavouring to discern whether the institutional arrangements can function as catalysts for fostering a transition towards more collaborative and adaptive management approaches. Using adaptive co-management as a suitable approach for the management of Monchique's territory, the underlying argument here is that the local community possesses valuable assets that, if appropriately nurtured, can facilitate the management of the forest territory. A questionnaire to understand Monchique's community capacities was developed and applied, followed by a review and content analysis of the institutional arrangements. Findings suggest that there is an important capital within Monchique's community that can be strengthened to create better synergies, enabling the community to improve the management of its territory and consequently reduce forest fire risk.

Key words: Adaptive co-management; Forest fires; Community-based disaster risk management; Community capacity; Monchique.

RESUMO

A ocorrência de incêndios florestais está a tornar-se cada vez mais frequente no nosso planeta, afetando muitas pessoas e gerando impactos sociais, ambientais e económicos devastadores. O último relatório da WWF (*World Wildlife Funding*) identifica Portugal como o país europeu que tem enfrentado mais eventos de incêndio florestal nos últimos 30 anos, sendo o quarto país mundial que perdeu a maior percentagem de área florestal no século XXI (área ardida a aumentar todos os anos). Tendo em conta o contexto português, esta investigação, desenvolvida no âmbito do projeto BRIDGE (Unir a ciência e as comunidades locais para a redução do risco de incêndio florestal), centra-se no município de Monchique, distrito de Faro, Portugal. Monchique apresenta um panorama histórico de incêndio florestal e uma percentagem significativa do seu território suscetível à ocorrência de incêndios florestais. Esta dissertação procura averiguar se os quadros regulamentares existentes reconhecem e potenciam, de forma adequada, as capacidades da comunidade local para a gestão florestal, enquanto, simultaneamente, se esforça para discernir se os arranjos institucionais podem funcionar como catalisadores de uma transição para abordagens de gestão mais colaborativas e adaptativas. Utilizando a co-gestão adaptativa como uma abordagem adequada para a gestão do território de Monchique, o argumento aqui subjacente é que a comunidade local possui ativos valiosos que, se devidamente estimulados, podem facilitar a gestão do território florestal. Foi desenvolvido e aplicado um questionário para entender as capacidades da comunidade de Monchique e realizada uma revisão e análise de conteúdo dos arranjos institucionais. Os resultados sugerem que há um importante capital dentro da comunidade de Monchique que pode ser fortalecida para criar melhores sinergias, possibilitando que esta melhore a gestão do seu território e, consequentemente, reduza o risco de incêndio florestal.

Palavras-chave: Co-gestão adaptativa; Incêndios florestais; Gestão de base comunitária do risco de desastre; Capacidade da comunidade; Monchique.

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List of abbreviations and acronyms

Adaptive co-management	ACM
Associação dos Lesados do Incêndio de Monchique	ALIM
Bringing science and local communities together to reduce the risk of forest fires	BRIDGE
Community-based Disaster Risk Management	CBDRM
Agricultural Cooperative of the Municipality of Monchique	Coopachique
Disaster Risk Management	DRM
Disaster Risk Reduction	DRR
European Union	EU
Foundation for Science and Technology	FCT
National Institute of Nature and Forest Conservation	ICNF
Statistics Portugal	INE
Innovation laboratory	InnoLab
Instituto Superior Técnico	IST
Laboratório Nacional de Engenharia Civil	LNEC
National Forest Programmes	NFP
Monchique Municipal Master Plan	PDM
Monchique Municipal Forest Fire Defence Plan	PMDFCI
Monchique Municipal Civil Protection Emergency Plan	PMEPC
National Forest Fire Defence Plan	PNDFCI
National Plan for Integrated Rural Fire Management	PNGIFR
National Spatial Planning Policy Program	PNPOT
Monchique and Silves Mountains Landscape Reordering and Management Program	PRGPSMS
Algarve Regional Forest Management Program	PROF Algarve
Algarve Regional Spatial Plan	PROT Algarve
Research Question	RQ
Sustainable Development Goals	SDG
Sendai Framework for Disaster Risk Reduction	SFDRR
Integrated Management System for Rural Fires	SGIFR
Universidade do Algarve	UALg
United Nations	UN
World Wildlife Funding	WWF

1. Introduction

The occurrence of forest fire events is becoming more frequent in our planet, affecting more people and generating devastating social, environmental and economic impacts. This disaster phenomenon is increasing in number, area, and intensity, as a result of issues related to climate change, territorial disorder, and lack of forest management (Lourenço, 2018). Portugal, where this research is developed, is no exception and, in the last years, has faced several forest fires, namely in rural areas. The latest WWF (World Wildlife Funding) report on this type of fire, identifies Portugal as the European country that has faced more fire events in the last 30 years and as the fourth worldwide country that has lost the highest percentage of forest land area since the XXI century (with the burnt area increasing every year). Additionally, according to the WWF report, we are not prepared for this new era of “super” fires with high-magnitude and dramatic impacts, particularly in an age where climate change is our present and will be our future, therefore urging the need for action towards the adoption of adaptation and mitigation measures to attempt to reduce such impacts (Hernández et al., 2019).

After having experienced so many traumatic forest fire events, especially in 2017 and 2018, Portugal required a critical assessment of the systemic failures regarding the reduction of these types of occurrences. Part of the problem can be attributed to the property distribution characteristics, since the Portuguese territory presents a very fragmented pattern of ownership of forest lands, with small and very small-scale ownership (respectively, < 5 ha and < 1 ha) dominant in the areas that are heavily affect by forest fires (Martins et al., 2021). This mosaic pattern creates the challenge of integrating management efforts as well as joining groups that may have different capacities and motivations to comply with the regulations. In that sense, existing policy and research have long recognized that one reason for the complexity associated with fire management is the need to reach a diverse set of stakeholders (Paveglio et al., 2019). Thus, it can be argued that the lack of integration of local actors in the strategic planning and integrated management of forest territories susceptible to fires is the key failure of the system (Partidário et al., 2022). The scientific community has been exploring research regarding forest territories, taking into account that they are complex socio-ecological systems that possess multiple parts and may produce "surprises" as a result of internal interactions and feedback processes (Colfer, 2005). Disasters such as forest fires can be perceived as one of these surprises that the system may face, being considered local events that affect first and foremost local communities (Gaillard & Mercer, 2013). This is why the local scale is a crucial issue for Disaster Risk Reduction (DRR).

DRR has emerged as a critical component in achieving the Sustainable Development Goals due to the complex interactions between disasters and poverty, food availability, health care, water supply, infrastructure, urban development, climate change, and ecosystem preservation (Bello et al., 2020). Some authors argue that the complexity and uncertainty associated with these interactions reveal the necessity to employ different management tools with a more flexible governance approach, focusing on the ability to respond to environmental feedback (Olsson et al., 2004). The governance flexibility is related to how policy strategies are designed, which success may rely on an accurate comprehension

of the target group. Additionally, identifying target groups' motivations and designing policies to harness them will improve the chances of successfully influencing their behaviour (Fischer, 2012). Policies must comprehend a variety of territories and actors, which makes their operationalization dependent on the enforcement of capabilities of those at the smallest territorial scale. In this sense, the adoption of a multi-scale analysis is fundamental to understand possible gaps in action. Galiana et al. (2013) suggest that adopting a multi-scale analysis makes it possible to test and implement, at a local scale, the outputs of legislation and policies designed at European and National levels.

As already highlighted and given that disasters are local events that first and foremost affect local communities (Gaillard & Mercer, 2013), the community also becomes central in the discussion of risk reduction. In addition, forest management at the landscape level is a requirement for reducing forest fire hazards (Martins et al., 2022); hence, it can be argued that the solutions to local problems would best begin at the local level with communities representing an underutilized resource in managing the forest system (Colfer, 2005). Thus, the local scale is where implementation gaps and coordination difficulties can become more evident, making its consideration crucial.

Designing policies that employ local community capacities and recognize the need for their commitment to achieve the policy intent can be challenging, especially given the circumstances and motivations encompassing land management actions. Moreover, understanding the complexity and diversity of forest and human systems is central to managing this type of territory (Colfer, 2005).

Communities with limited capacities facing disruptive events such as forest fires risk delaying recovery or prolonging dysfunction to which they were subjected (Sherrieb et al., 2010). Vulnerability is a pre-existing state that allows a natural hazard to become a disaster, considering not only the infrastructure's quality and location, but also societal elements. (Bello et al., 2020, p.12) In that sense, research has shown how crucial local capacity is to the establishment and maintenance of forest fire-mitigation measures, thus requiring a more profound understanding of how different community features (e.g. participation, shared vision, human capital) may affect its capacity to adapt to those occurrences (McCaffrey et al., 2013). The social, economic, and environmental problems caused by forest fire events are linked to complex structural causes, not only related to the policies itself, but also to the capacity of the communities on a smaller scale to act upon it.

The municipality of Monchique, the study area where this research has been applied to, has several features that seem to constitute a good setting for proposing a capacity assessment, to subsidise the application of more collaborative management methods. In particular, it is possible to emphasize the fragmentation pattern of the forest property, the social capital, the historical record with fires and the biophysical composition. Thus, the approach of adaptive co-management (ACM) was chosen once it has been gaining attention in the scientific field due to its potential to provide valuable insights on coping with change, specifically when dealing with situations of complexity and uncertainty such as the forest territory management (Plummer et al., 2012).

The focus of this research on capacity and ACM is aligned with the 2030 Agenda for Sustainable Development and the Sustainable Development Goals, namely Goals 11 (sustainable cities and

communities) and 17 (partnerships for the goals). This research has been developed through a review of the institutional arrangements that can act as catalysts for a shift towards more collaborative and adaptive management, as well as through an analysis and understanding of the capacity domains that perform well and those that need to be developed by the community of Monchique.

This thesis has been developed under the scope of the BRIDGE - Bringing science and local communities together to reduce the risk of forest fires – Project. This is a research project that began on March 15, 2021, and that has been funded by the Foundation for Science and Technology (FCT) under the call for Scientific Research and Technological Development Projects on Preventing and Fighting Forest Fires. A consortium of three institutions is developing the project: the Instituto Superior Técnico (IST), the project coordinator, the Laboratório Nacional de Engenharia Civil (LNEC), and the Universidade do Algarve (UAlg). Based on an anticipatory approach focused on preventing and mitigating the risk of forest fires, the BRIDGE project relies on people's traditional knowledge of the fragility of the territory and the most appropriate protective behaviours. In BRIDGE, the mobilization and involvement of the local community is a central condition of the project as a research approach. The project´s aim is to build knowledge with the community and generate greater social awareness of the risk of rural fire, fostering continued commitment to the agreed risk reduction strategy.

1.1 Objectives

The objective of this research is to analyse the articulation between the regulatory tools and local community capacity for forest management while searching for implementation gaps within institutional arrangements. To achieve this purpose, the following Research Question (RQ) was drawn: “How do forest management regulatory tools recognize the capacities of the local community and foster collaborative management?”.

The proposed research work focuses on the municipality of Monchique, located in the district of Faro (southern Portugal), which has a history of forest fires and a large portion of the territory classified as highly susceptible to the occurrence of new forest fire events. Thus, this work attempts to address the following four specific objectives:

I. Analyse existing regulatory tools and assess if and to what degree the capacities of local communities are acknowledged.

II. Verify the extent to which the instruments provide institutional support for collaborative management.

III. Comprehend the capacities of the local community and existing barriers to manage the forest territory;

IV. Reflect on different approaches towards the current regulatory structure to enable community forest management.

1.2 Structure of the dissertation

In order to achieve the defined goals, the present dissertation was structured into five chapters, which are presented in the following paragraphs.

The first being the introduction, which provides an overview of the research scope and its objectives and structure.

Chapter two focuses on the literature review of the key themes relevant to this research. Thus, this dissertation´s state of the art encapsulates the themes of disaster risk reduction (DRR), Community-based Disaster Risk Management (CBDRM), Adaptive co-management (ACM), and Capacities. The drive towards an approach that looks at risk reduction from a more community-based perspective comes not only from the work developed by the BRIDGE project, but also from global trends, which allow to perceive local involvement as fundamental to the success and sustainability of any project. The literature review on ACM also comes from this perspective of empowering the local scale to take responsibility for the management of the forest territory which, in the Portuguese case, is mostly private. The conceptualization of a collaboration between residents fits well with the profile of the parcelling of the territory of the case study: Monchique. This variety of key concepts addressed attempted to provide a theoretical subsidy for the analyses and proposals presented in the following chapters.

Chapter three presents the case study, establishing the setting in which the research was conducted, highlighting relevant factors such as biophysical aspects, socio-economic setting, and the presence of BRIDGE project within the area. In addition, this chapter presents the case study analysis, which comprises the capacity questionnaire, aiming to measure the local community capacities, and the content analysis, which provides an understanding of how collaborative management is covered by institutional arrangements. The instruments and methodologies used to analyse the case draw on data from the literature review.

The following chapter, chapter four, presents the discussion on the results obtained, relating it to the information gathered on the literature review and the case contextualization.

Finally, chapter 5 presents the final remarks and recommendations for future studies.

2. Literature review

2.1 Disaster Risk Reduction and Management

The management of environmental resources within complex social-ecological systems proves itself challenging, constituting a need for management approaches that can effectively navigate the intricacies and uncertainties inherent in such systems (Becker et al., 2015). The unpredictability of natural disasters adds a new layer of complexity to the management of ecosystems (Colfer, 2005). Disasters can be defined in numerous ways, yet among the most commonly used is the one provided by the United Nations International Strategy for Disaster Reduction, which characterizes them as “a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources” (UNISDR, 2009, p.10).

Traditional disaster management approaches have usually been founded on the 'disaster cycle' as seen in Figure 1, a model that divides the cycle into stages (before, during, and after a disaster) that require distinct types of intervention (mitigation, readiness, reaction, and recovery). This formulation was specially popularized since it facilitates management organizations to allocate tasks and resources within a given point of the cycle; however, as argued by Twigg (2015), given its complexity, disasters cannot be compartmentalized as set by the model because this could lead to fragmentation of actions. Thus, planning and implementing solutions aiming for Disaster Risk Reduction (DRR) require holistic models and frameworks, where the tasks are intertwined and not limited to particular models of intervention or periods in time (Twigg, 2015).

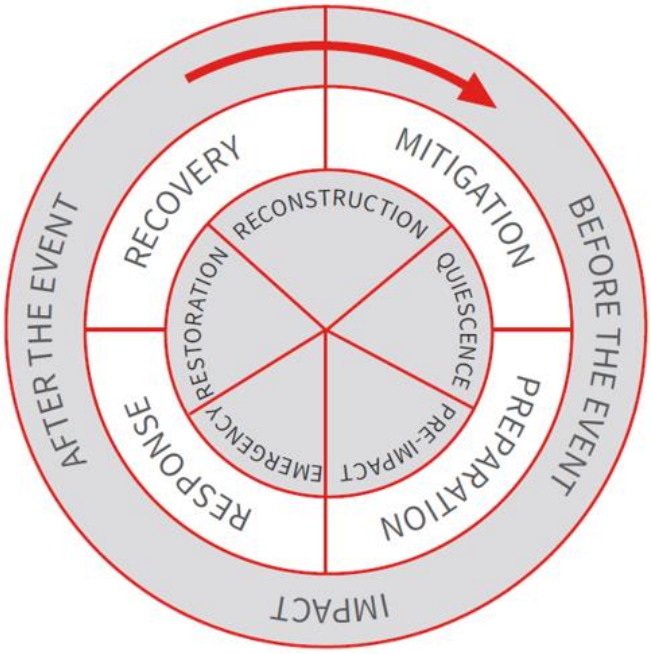

Figure 1 - Disaster cycle. Source: Adapted from Twigg (2015).

The intensity of disaster patterns has made risk reduction a significant topic of concern, although it has not been, immediately recognized as a field of study and practice (Ofei-Manu & Didham, 2017).

Nevertheless, the international arena has been drawing upon this matter for many years, leading to international policy instruments. An example of such instruments is the Hyogo Framework of Action, which was agreed, in Kobe (Japan) in January 2005, by the United Nations (UN) state members at the Second World Conference on Disaster Reduction (Ofei-Manu & Didham, 2017).The Hyogo Framework of Action comprised "five priority areas, namely: governance and institutional arrangements; risk identification and early warning; knowledge and education, underlying risks and preparedness; and response" (Ofei-Manu & Didham, 2017, p.4). This framework has been widely used as a reference of DRR actions by governments and civil society organizations at national and local levels (Twigg, 2015).

Currently, the UN system's successor to the Hyogo Framework is the Sendai Framework for Disaster Risk Reduction 2015–2030, approved at the Third World Conference on Disaster Risk Reduction in Sendai, Japan, in March 2015. As the name points out, this framework was designed with the expectation that its use may reduce substantially disaster risk vulnerability and impacts (as social, environmental, or economic assets). It has four priority areas of action: (i) understanding disaster risk; (ii) strengthening disaster risk governance; (iii) investing in disaster risk reduction for resilience; and (iv) enhancing disaster preparedness for effective response (Twigg, 2015). The Sendai Framework is a key tool for achieving the Sustainable Development Goals (SDG), laying out worldwide targets for the mitigation and avoidance of disaster-related losses, approaching risk management as an integral component of economic, social, and environmental activities, and reflecting a paradigm change from the idea of disaster risk (Bello et al., 2020).

The urgent need to lower disaster risk is acknowledged and reaffirmed in the 2030 Agenda for Sustainable Development. This Agenda demonstrates how disasters affect a variety of development-related factors and how there are specific opportunities to achieve SDGs by reducing disaster risk (Bello et al., 2020). The UN seems to relate disaster risk reduction mainly with SDG 11 (Make cities and human settlements inclusive, safe, resilient, and sustainable). However, several other SDGs and targets can also contribute to disaster risk reduction and resilience-building, even if they don't explicitly mention it (for example SDG 9 - Industry, Innovation, and Infrastructure: by developing resilient infrastructure; SDG 13 - Climate Action: by addressing the need to combat climate change and its impacts; SDG 16-Peace, Justice, and Strong Institutions: through the strengthening of institutions; among others). Thus, global frameworks, such as the 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030, outline sustainable development paradigms once "these instruments are intended to lead the various players in the development process in a coordinated, interconnected, government-led Disaster Risk Management (DRM) effort" (Bello et al., 2020, p.7).

Disaster Risk Management, as defined by the UN, is a "systematic process of using administrative directives, organizations, and operational skills to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster" (UNISDR, 2009, pg. 10). Zwi et al. (2013) describes DRM as a term that includes several related concepts such as disaster response, relief, preparedness and mitigation (Zwi et al., 2013). Bello et al. (2020) emphasizes that "DRM must be based on a comprehensive strategy for minimizing the impacts, as well as the economic and social effects of disasters by reducing communities' vulnerability to them and by

enhancing their coping capacity" (Bello et al., 2020, p.7). In comparison with DRR strategies, DRM is used more specifically to refer to aspects of operational practice, whilst the term DRR is applied in a broader sense to cover policy, strategic, institutional (Twigg, 2015).

Some authors suggest that there is a need to move towards DRM to, consequently, reduce disaster risk. For example, Shah et al. (2020) developed a study on institutional arrangements for disaster risk management. Presenting evidence from Pakistan, these authors stress out the need for the national government to "strengthen the lower tier of disaster governance through capacity building, enhancement of capabilities, allocation of appropriate resources, and establishment of independent offices at each district level" (Shah et al., 2020, p.9).

Ofei-Manu & Didham (2017) emphasize that the lack of capacity and the absence of an effective and systematic assessment framework to tackle the existing gaps (such as lack of participation, insufficient knowledge and skill, lack of leadership and ownership, communication gaps, among others) are key factors leading to difficulty in incorporating risk reduction measures into national development plans (Ofei-Manu & Didham, 2017). Following on that, Buergelt & Paton (2014) argue that to achieve an effective DRR, the focus should be primarily on enhancing community capacity through the development of strategies that accommodate natural and human ecosystem interdependency (Buergelt & Paton, 2014), creating conditions that encourage participation and enable the sense of ownership, promoting the sustainability and longevity of the initiatives (Yore et al., 2018).

Thus, recommendations gathered from Shah et al. (2020) to mark a paradigm shift in risk reduction can be summarized as the need for: (i) the national government to strengthen the lower tier of disaster governance through capacity building, enhancement of capabilities, allocation of appropriate resources; (ii) the national government to establish at all levels, vertical and horizontal collaboration mechanisms to improve coordination among and between stakeholders; (iii) involving the local community; (iv) mainstreaming disaster risk reduction into concrete action.

Scientific research seems to show that there is a strong correlation between local capacity and the level of disaster risk reduction ability of a given country, being capacity considered a core component of risk reduction (Ofei-Manu & Didham, 2017). In that sense, a community capacity assessment is needed to pinpoint possible capacity gaps related to risk reduction, comprehend desirable capacities, and make suggestions on how to attain these capacities (Badji et al., 2011). Having or acquiring the necessary capacities to effectively address the potential risk is a key factor to guarantee a successful implementation of DRR measures. Moreover, it can be highlighted that the Hyogo Framework of Action's five priority areas, as well as the four priority areas of the recently adopted SFDRR require capacity development issues and measures, as part of the action agenda to be achieved (Ofei-Manu & Didham, 2017).

Besides guaranteeing the existing capacity(ies) for action, the proper scale of action is also fundamental for achieving the intended results towards risk reduction. Gaillard & Mercer (2013) draw on that when they state that there is a disconnection between the local and the global scale, especially in the field of disaster studies (Gaillard & Mercer, 2013). This mismatch between scales leads to demands for

decentralization and institutionalization of DRR at the local level, a paramount and an integral component for creating a culture of safety and resilience (Shah et al., 2020). This scale down gives the community a key role in the DRR actions, thus, supporting the development and strengthening of concepts such as Community-based Disaster Risk Management (CBDRM).

2.2 Community-based Disaster Risk Management

CBDRM is an approach within the notion of DRR presented in the last section, which encompasses a similar definition to DRM, however considering people at the centre of the decision-making and implementation processes. In CBDRM research, the communities considered to be at risk are actively engaged in the identification, analysis, search for solutions, monitoring, and evaluation of the disaster risks they face, so they can reduce their vulnerabilities and enhance their coping capacities (Tanwattana, 2018). Due to its limited efficiency, risk reduction projects require a new structural configuration to achieve its full potential. In this sense, CBDRM seems to be a potential instrument to reconfigure the relations between civil society and the governmental institutions, through the empowerment of communities (Maskrey, 2011).

There are several interpretations around the concept of community and, given its centrality in CBDRM, understanding the delimitation of this term is fundamental. Thus, community can be perceived through several lenses, such as given by (i) geographic boundaries (Norris et al., 2008); (ii) links and social networks between people (Wellman et al., 1979); and (iii) social structures in a given location (Theodori, 2005). It is possible to find several conceptualizations of community in the literature. Räsänen et al. (2020) provided an approach to this concept using three different perspectives (Table 1); (i) placed-based community, as a spatially defined entity; (ii) interaction-based community, which delimitation is based on the social networks; and (iii) community of practice and interest, referring to specialized networks of actors who perform together and share a common practice (Räsänen et al., 2020). Concerning communities at risk, the physical dimension is a crucial component, although must be connected to the knowledge of other important 'community' aspects, such as shared values, interests, and social structures (Twigg, 2015). The reason why, in the scope of this research, it has been adopted the Place-based conceptualization.

Table 1 - Description of types of community. Source: Adapted by Räsänen et al. (2020).

Types of community	Description
Place-based community	"Totality of individuals and social structure within a geographical location. In addition, the community embrace organizations, institutions and authorities within the place" (Räsänen et al., 2020, p.2).
Interaction-based community	Network of interactions between people. The interaction-based community is tightly connected to the concept of social capital, which can be divided into strong social networks (bonding capital), weaker social networks (bridging capital), and linkages between those of power and citizens (linking capital)" (Räsänen et al., 2020, p.2).

Types of community	Description
Community of practice and interest	"Network of specialized and/or professional actors that engage in common actions, imagine a shared identity and align activities towards a shared goal. These communities are by definition informal, meaning that they organize themselves, and actors within them can include authorities, civil society organizations and local residents" (Räsänen et al., 2020, p.2).

CBDRM approach emphasizes the importance of community participation, particularly the engagement of minorities and vulnerable populations. More than being informed about the processes related to risk reduction, community members should be given ownership and responsibility over it, making them its primary proponents. Additionally, some authors argue that local governments' or foreign assistance agencies' external dependency is reduced through strengthening local capacity to care for themselves (Sjöstedt & Sturegård, 2015). However, even if individuals and communities, due to their innate abilities, could take several responsibilities and ensure several duties in the aftermath of disasters, they would still frequently require outside help (Gaillard & Mercer, 2013). In this sense, the support of political instruments that ensure this exogenous assistance to the community is essential. The underlying premise of community-based approaches to risk reduction is that communities' potential may be fulfilled when it is fostered within the framework of harmonious partnerships between the government and civil society, based not just on local participation and ownership but also on political and financial support being provided by national institutions (Maskrey, 2011).

Research from Abarquez & Murshed (2004) share some essential features of CBDRM gathered from past experiences, highlighting the forementioned central role of community, the application of multi-sectoral and multi-disciplinary approaches, and the notion that various community members and groups within the community have different vulnerabilities and capacities (Abarquez & Murshed, 2004). Thus, CBDRM can be seen as processes through which disaster risk reduction issues are addressed and local capacities strengthened, tending to be a successful approach given its ability to mobilize and unlock the application of resources and know-how at the community level (Maskrey, 2011).

The patterns of disaster occurrence and losses have been shifting due to climate change, pressure on land and settlement, and socio-economic factors, causing the increase in relevance of the community-based disaster management strategy (Kafle & Murshed, 2006). Nonetheless, despite this changing scenario, the context of disaster science still hinge heavily on traditional command-and-control structures and top-down approaches, emphasizing scientific knowledge and government intervention over local actions (Gaillard & Mercer, 2013). An important shift seems to arise from the idea that local communities are not helpless and always display (local) individual and/or collective capacities in some form (Gaillard & Mercer, 2013). Additionally, a study by Shaw (2016)illustrates that the community-based approach corrects the so-called defect in top-down approaches of development planning and disaster management, which often ignore community needs and capacities. This suggests that top-down hierarchy fails to reach the most vulnerable groups due to lack community participation (Shaw, 2016).

The ineffectiveness of top-down policies in averting disasters has prompt practitioners, supported by social scientists, to advocate for an alternative bottom-up framework for reducing disaster risk (Gaillard & Mercer, 2013). CBDRM approach, for instance, has combined top-down and bottom-up approaches, with a focus on strengthening the bottom-up aspect (Sjöstedt & Sturegård, 2015). Tanwattana (2018) emphasizes that the planning process of this approach is not limited to a set of determined actions, but it is based on a shared set of values and commitment of the community. This communal aspect requires flexibility and adaptability for the successful implementation of the approach (Tanwattana, 2018).

Drawing on this, Sjöstedt & Sturegård (2015) states that CBDRM is an ongoing process that requires the ability to adapt, in order to avoid becoming stagnant. Additionally, other authors highlight that a network of adaptive capacities (resources with dynamic qualities) can be used in communities to adjust to disturbances or hardships (Norris et al., 2008), and thus fostering the communities' capacity to adapt to such events. Furthermore, literature shows the relevance of the local scale and its actors in disaster risk reduction and management, since it is context specific and shaped by local patterns of exposure, vulnerability, adaptive capacities and resilience (USAID & GNDR, 2019). The use of the appropriate scale of action also accompanies the need for projects being founded on an understanding of the complexities of vulnerability, and of the interdependencies of the risks that may cause such vulnerability (Yore et al., 2018).

Some projects using the CBDRM approach are led by entities (such as government and non-government, public and private, local and national entities) working together with the community, while others are completely driven by the community (Zwi et al., 2013). The underlying rationale is that the empowerment and ownership by local stakeholders, either at the community or municipal level, as well as the linkages across scales seem, to be crucial to unlock economic and political resources that are needed to manage risks (Maskrey, 2011). Thus, implementing a CBDRM approach at the local level is a key intervention for enhancing community capacity, increasing public awareness, and reducing risk (Shah et al., 2020). Regarding the cross-scale linkages and the consolidation of new dynamics, Sjöstedt & Sturegård (2015) highlights that policies and regulations should endorse the efforts and accomplishments of communities to counteract mistrust or resistance that may exist in such relationships.

Yore et al. (2018) research identifies the main challenges when implementing a CBDRM project, namely the dominancy of the top-down culture, the lack of trust between civil society and organizations, the difficulties in continued government funding and maintaining participation momentum (Yore et al., 2018). As to this last issue, there is a common concern around the risk-related initiatives that may be discontinued once the external support is ended, to which Kafle & Murshed (2006) state that unless the efforts of managing the risk of disaster are sustainable at both individual and collective (community) level, it may become difficult to reduce the associated vulnerability and losses.

In addition, the literature shows that ownership, alongside with sustainability and participation are the three pillars of the CBDRM approach, with Sjöstedt & Sturegård (2015) arguing that for a success implementation of any project, its ownership as well as its maintenance should belong to the community.

Thus, a shift towards increasing the community's ownership by building local capacity to handle the project is needed (Shaw, 2016).

Finally, the CBDRM approach incorporates not only risk reduction, but also the promotion of resilience as key components (Zwi et al., 2013), addressing the root causes of vulnerabilities, and transforming the structures that generate inequality and underdevelopment (Kafle & Murshed, 2006). By fostering safety and resilience, this approach main objective is to lessen the dangers and vulnerabilities that communities must deal with when facing risk disaster. Thus, the key aspect of CBDRM is that it should maintain a local viewpoint and place the community at the centre of the whole process, from disaster preparation and planning to response, recovery, and reconstruction (Sjöstedt & Sturegård, 2015).

2.3 Adaptive co-management

The study and use of methods for navigating the dynamics of social-ecological systems is expanding, with approaches that often place a strong emphasis on building adaptive capacity, learning, and collaboration among stakeholders (Plummer et al., 2013). Adaptive co-management (ACM) lies under this scope, as the "emergent archetype of this fuzzy boundary between governance and natural resources management" (Plummer et al., 2013, p.10). This concept is described by Olsson et al. (2004) as a flexible community-based system tailored to specific places and operated within various organizations at different levels. ACM is based on the convergence of two independently developed notions, adaptive management, and co-management (Fabricius & Currie, 2015), emerging as an approach or strategy that holds a promise for social-ecological systems in the face of complexity (Plummer et al., 2013).

A collaborative management, or co-management, is defined by Carlsson & Berkes (2005) as the sharing of power and responsibility between the government and local resource users (Carlsson & Berkes, 2005). Whereas adaptive management is a systematic process which relies on continuously enhancing management policies and procedures through learning from operational program outcomes (Whelan, 2002), work developed by (Fabricius & Currie, 2015) implies that the first notions usually point towards ACM when successive cycles of participation, learning and doing occur (Fabricius & Currie, 2015). Table 2 summarizes the concepts of adaptive management, co-management, and adaptive co-management, describing the concept, reason of design, object of emphasis, and temporal scope.

Table 2 - Comparison of the concepts of: Adaptive management, co-management and adaptive co-management. Source: Adapted from Fabricius & Currie (2015).

	Adaptive management	Co-management	Adaptive co-management
Concept	Learning by doing process	Joint or shared decision making, conflict resolution, or management process	Joint management through learning by doing collaboratively

	Adaptive management	Co-management	Adaptive co-management
Designed for	To continually improve management policies and practices by learning from the outcomes of previously employed policies and practices	Designed as an alternative approach from the top down to a consensus based and decentralized approach	Designed to enhance resilience and manage complex systems which transcend multiple levels and scales
Emphasis on	Learning and experimentation through implementing. Monitoring and adjusting in real space and time	Sharing of rights, responsibilities, and power across a range of relevant stakeholders	Joint management and learning by doing, (local and scientific knowledge), sharing of rights, responsibilities, and power by relevant stakeholders at multiple scales
Temporal scope	Medium to long term, multiple cycles of learning and adapting	Short to medium term, creates snapshots	Medium to long term, multiple cycles of learning and adapting

ACM is not the answer to all management challenges (Plummer, 2009), but has been a useful approach for dealing with complex scenarios (Carlsson & Berkes, 2005). Studies have found a positive correlation between the application of adaptive governance principles and local indicators of sustainability (Fabricius & Currie, 2015). Over a medium to long time horizon, adaptive management creates relationships (both horizontal and vertical) for shared learning-by-doing between multiple actors (Plummer et al., 2012), handling divergent interests and providing the flexibility needed to adjust the behaviour to changing circumstances (Becker et al., 2015). Consisting in a systematic approach that builds up knowledge by learning from the management itself, recognizing ACM as an evolutionary process seems to promote a shift towards social processes that stimulate innovation and flexibility (Armitage et al., 2009).

The goal of ACM is enhancing actors' adaptability, here understood as the capacity to anticipate, respond, and manage societal and climatic unpredictability, in order to lessen its effects (Becker et al., 2015). Particularly in the case of forest management, local communities represent an underutilized resource, despite being the ones who have the biggest stakes in managing the forests well (Colfer, 2005). Research conducted by Fabricius & Currie (2015) indicates that there are three types of adaptive communities along gradients of adaptive capacity and governance capacity. Figure 2 represents the conceptualization outlined by the authors, where (i) “powerless actors” are the ones with low adaptive capacity and weak capacity; (ii) “coping actors” are communities that have the capacity to adapt, but are not managing social–ecological systems; and (iii) “adaptive manager”, which correspond to communities that have both the capacity to adapt and the governance capacity to sustain and internalize this

adaptation, also highlighting existence of enabling aspects (Fabricius & Currie, 2015). A given community can transition from “powerless spectators” to “adaptive managers” through what can be perceives as the enablers of ACM, that include having adequate endowments of natural resources, leadership, vision, knowledge networks, polycentric institutions, enabling policies and motivation, as shown below. It is also important to highlight that only when both adaptive and governance capacities are strong enough, the ACM can be effective (Fabricius & Currie, 2015).

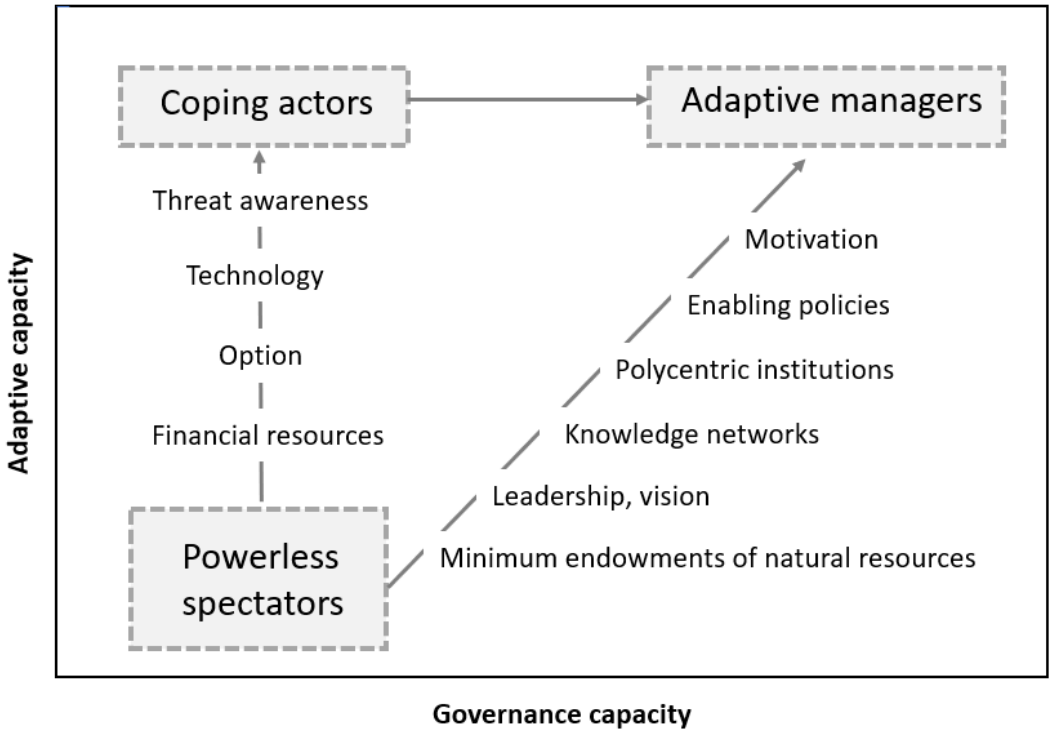

Figure 2 - Types of adaptive communities. Source: Adapter from Fabricius & Currie (2015).

The establishment of ACM requires enabling policy conditions for collaborative action, further to routine policy review and assessment, this requires a deeper analysis once that institutional arrangements either enable or disable real power and responsibility sharing (Armitage et al., 2009). For Olsson et al (2004), the emergence of ACM systems might require the creation of new institutions, although these institutional structures may also emerge as a result of organizational change within existing (institutional) setups (Olsson et al, 2004).

Armitage et al. (2009) argue that this type of management approach will fail to develop, unless policy environments are supportive of multi-level learning networks (Armitage et al., 2009). These include a greater emphasis on assessment, allocating more funds to the development of social sources of learning and adaptation, fostering flexible institutions and bureaucracies, designing policies to function in a rapidly changing world, utilizing a diverse range of knowledge sources, and explicitly considering the role of power (Armitage et al., 2009). Rules and incentives at higher levels help the development of ACM, which has the potential to make social-ecological systems more adaptable to change (Olsson et al., 2004).

ACM has also commonly been associated with the decentralization of natural resource management (Fabricius & Currie, 2015). For Armitage et al. (2009), centralized bureaucracies present limitations in

their ability to cope with uncertainty and to respond to rapid social–ecological transformations (Armitage et al., 2009). This decentralization is compatible with a more flexible policy environment hat foster experimentation (Berkes, 2009). Hence, decentralization should be taken to an appropriate level, congruent with the scale of the ecosystem being managed (Fabricius & Currie, 2015).

Although a single model or framework of ACM does not exist, it is possible to find in the literature a certain agreement around common ACM components (Plummer, 2009). Huitema et al. (2009), for example, followed by other authors such as Becker et al. (2015),have sustained that ACM rests on four institutional recommendations that can, each, in a different way, increase adaptability. These authors suggest that the institutional prescriptions of ACM are: (i) polycentric structure; (ii) public participation; (iii) bioregional approach; and (iv) experimentation (Huitema et al., 2009).

Polycentric systems are more capable to cope with change and uncertainty because the particularities of the geographical context can be dealt with at the appropriate scale. The high degree of overlapping and redundancy makes the entities less vulnerable, since if one unit fails, others may take over their functions (Huitema et al., 2009). A polycentric structure is also linked to the experimentation prescription, since it can entail lower barriers “to testing new ideas and experimenting with multiple approaches to provide creative alternatives and locally customized solutions” (Becker et al., 2015, p.2). A management system with multiple centres of power (polycentric) is suggested by the literature on ACM as beneficial in comparison to monocentric approach (Huitema et al., 2009). The reason is that “a distribution of power, overlapping responsibilities, and an added advantage of local knowledge promote a diversity of problem framing, policies, and learning from each other that can foster adaptability” (Becker et al., 2015, p.9).

Public participation may have different meanings, ranging from consultation, discussions with the public, co-decisions, among others. Huitema et al. (2009) however, refers to it as the collaboration between governmental and non-governmental stakeholders (Huitema et al., 2009). By establishing links among decision makers and the public, this collaboration can enhance efficiency and quality of problem solving (Becker et al., 2015), foster social learning and reinforce trust among actors, the latter being considered important foundations for adaptability and motivation (Folke et al., 2005). Public participation, by opening the decision-making process and utilising the information and creativity that is available within society, would improve the quality of decision making (Huitema et al., 2009).

The bioregional approach is based on the notion of fit between institutions and social-ecological systems (Folke et al., 2005), aiming a compatibility or congruence between the ecosystem and the institutions created to manage the human activities affecting this system, considering a natural rather than jurisdictional boundaries as the basis for task and founds allocation (Becker et al., 2015). This can be achieved through effectively creating a collaboration, by transferring existing responsibilities or by combining existing jurisdictions (Huitema et al., 2009). Implementation of the bioregional approach may help to boost ACM trough better integrating a variety of interests (up and downstream) and making more efficient use of resources (Becker et al., 2015).

As presented by the literature review, information and learning are the basis on which ACM relies on to deal with complexity and uncertainty, thus requiring a high degree of experimentation to test hypotheses, monitor results, and create new approaches (Armitage et al., 2009). “The experimentation prescription can apply in two ways: (i) in the classical sense of testing hypotheses on the response of the water system to different management interventions; or (ii) as the introduction of a certain management approach with subsequent monitoring of the effects and, if needed, adjustment of the approach” (Becker et al., 2015, p.3). Experimentation in that sense implies the probing of the system, monitoring the responses, and adjusting accordingly (Huitema et al., 2009). That generates improved procedures and common values that are able to build cooperation and trust among the actors, which are the essential ingredients in moving from reactive adjustment to proactive anticipation (Becker et al., 2015).

Table 3 presents a summary of these prescriptions as well as a brief description of the proposed concepts according to the authors.

Table 3 - Institutional prescriptions of ACM according to Huitema et al. (2009). Source: Adapted from Becker et al. (2015).

Prescription	Characteristic aspects
Polycentric structure	- Emphasis on the lowest possible jurisdictional level. - Higher jurisdictional levels responsible for oversight and diffusion of innovations.
Public participation	- Taking part and exert influence, by ordinary citizens, stakeholders, or their collectives, in the processes of government and/or governance.
Bioregional approach	- Natural boundaries rather than jurisdictional boundaries are the basis for task allocation. - Problems and resultant interventions are considered from the perspective of consequences in the entire regions.
Experimentation	- Planned interventions in the social-ecological system, and the monitoring of their results, to learn about ecosystems functioning while managing.

Another important aspect proposed by Colfer (2005) is that ACM stands upon three components: the horizontal, which consists of a work within the community, where the actors of a given location work together to solve problems of that territory; the vertical, where local community and stakeholders at other scales are linked and create mechanisms that enables cooperation, communication, and conflict resolution; and the diachronic, were all actors learn together overtime.

With a different aim, Carlsson & Berkes (2005) research list a set of advantages of the ACM method, such as the allocation of tasks within the different scales that the system needs to operate, bringing together a variety of different capacities and comparative advantages, and the exchange of resources

that may lead to a more symmetric relationship between government and community, power, and risk sharing (Carlsson & Berkes, 2005). Armitage et al. (2009) address with these advantages pointed out by Carlsson & Berkes (2005), highlighting that ACM is a potential tool in a suite of governance options to modify unsustainable social–ecological feedbacks, addressing it with collaborative processes and recognition that multiple sources and types of knowledge are relevant to problem solving (Armitage et al., 2009).

The important role of knowledge on this approach is also mentioned by Olsson et al. (2004), when proposing that ACM should revolve around the creation of arenas involving different actors for knowledge sharing and collaborative learning (Olsson et al., 2004). This continuous learning process can be understood as an advantage of this approach, since it enables stakeholders to share responsibility, explore their goals, come to a mutual understanding, draw lessons from their institutions and practices, and adapt (Fabricius & Currie, 2015).

A systematic review of the literature on ACM conducted by Plummer et al. (2012) shows that the ACM arrangements have been studied most frequently at a regional scale, but that a local focus was also prevalent. This study also demonstrates that forestry is among the most frequent types of resources or environmental aspects considered in this approach. Within the context of forest management, Colfer (2005) presents the definition of ACM being “a value-adding approach whereby people who have interests in a forest agree to act together to plan, observe, and learn from the implementation of their plans while recognizing that plans often fail to achieve their stated objectives. ACM is characterized by conscious efforts among such groups to communicate, collaborate, negotiate, and seek out opportunities to learn collectively about the impacts of their actions” (Colfer, 2005, p.17). The author also states that the recognition of the unique knowledge that forest people have on their environment can serve the dual purpose of improving management and empowering local communities to have a stronger voice in shaping policies that better align with their needs and the environment's requirements (Colfer, 2005).

In contexts where non-industrial private forest owners prevail, uncoordinated individual management effort may be insufficient to achieve a successful forest management (Martins et al., 2022). Regarding specifically the wildfire risk, the collaboration among multiple actors has been suggested as the path to reach consistent fuel management at a landscape level (Martins et al., 2022). However, an adaptive process such ACM requires willingness and capacity of the local community to act on their own and on their environment’s interests (Colfer, 2005), since it is an approach that relies on the presence of, or the untapped potential within social capital as an essential foundation for collective action.

2.4 Capacity

There are many definitions that comprehend the term capacity. Kafle & Murshed (2006), for example, describe capacities in the context of risk reduction and define it as the assets, resources, and skills available within a given group, being a community, society, or organization, that can be used to reduce the risks or effects of a disaster (Kafle & Murshed, 2006). Such capacity, as presented by Nielsen-Pincus et al. (2018), can manifest in many forms, from local government agencies to informal

neighbourhood groups, on different scales and sectors (Nielsen-Pincus et al., 2018). Thus, the concept of capacity seems to be intrinsically related to scale, existing in different tiers as presented by Levinger (2021): “the multiple levels of capacity are nested and interconnected; capacity entails tight coordination across multiple capacity levels (the horizontal view) as well as performance at each operational level (the vertical view)” (Levinger, 2021, p. 10).

Concerning the more local sphere, community capacity, as defined by Chaskin (1999), is the interaction of human, organizational, and social capital existing within a given community that may operate through informal social processes and/or organized efforts by individuals, to solve collective problems and improve or maintain the well-being of that collective. Community capacity has gained prominence as an important component of a successful plan/program implementation. Although it is still a concept with a broad definition, it can be understood and measured through different lenses. Some authors argue that the concept of community capacity is closely related to the concept of community empowerment. For example, Laverack (2008) stresses that the concepts of empowerment and capacity of a community can overlap, in a sense that both rely on social organization, and both are achieved through the systematic building of knowledge, skills and competences at the local level (Laverack, 2008). As for Gibbon et al. (2002), both terms, as well as community development, are employed to describe a process that increases the assets and attributes from which communities are able to utilize to improve their lives Gibbon et al. (2002).

Another term that the literature presents related to the definition of capacity is resilience. Donoghue & Sturtevant (2007) argue that theses definitions have minor differences but are fundamentally the same, emphasizing the ability of communities to adapt to change. Thus, opportunities to develop both individual and group abilities to meet needs and adjust to changes in forest management are more likely to arise or be established in communities with higher capacity (Donoghue & Sturtevant, 2007). Studies also seems to show that communities have the same tendency to react to stress in several ways as individuals do. This process arises from the distinctive capacities a society embodies before encountering a hazard, rather than just the additive outcome of individual responses in the wake of a problem (Sherrieb et al., 2010). The capacities of managing the forest territory seem to be also influenced by one´s background. Regarding the diversity of people living in fire prone areas, Eriksen & Prior (2011) refers that people´s ability to understand, interpret and evaluate risk varies based on the different ways people establish their knowledge base (Eriksen & Prior, 2011). Fostering mechanisms that introduce context to wildfire management and, in turn, offer 'experience' to individuals without prior exposure is a critical factor in bolstering the cultural preparedness of periurban communities for wildfire risk management (Eriksen & Prior, 2011).

It is also important to consider that characteristics of social context may influence peoples’ capacity and willingness to act upon the policy tools, being, therefore, necessary to promote the engagement of communities on the forest management, namely on those localities where social diversity is growing. Engagement encompasses more than simply taking part in risk management procedure, it facilitates the sharing of information and collaborative problem-solving among communities, as well as between community members and agency representatives; nonetheless, its practical implementation is not as

firmly established, particularly at the local level where local stakeholders put organizational programs into action (Eriksen & Prior, 2011). Additionally, the effectiveness of the territorial management instruments varies according to the capacity of each of the management scales, with Ingram (1990) suggesting that capacity programs operate under the assumption that the target groups will exhibit adequate incentive or motivation to engage in the activity or modify their behaviour if they are adequately informed and equipped with the required resources (Ingram, 1990).

Thus, capacity can be seen as a resource, being, therefore, critical that the agencies and practitioners consider the different elements that constitute a capable community, so that the programs and projects can intentionally enhance the capacity domain that may be weaker in a particular community (Gibbon et al., 2002). The reasons behind varying levels of success among different communities in achieving positive social, economic, and environmental outcomes has emerged as a keen interest in the policy community, in an attempt to explore strategies to enhance the capacity of these communities while accomplishing such favourable results (Marré & Weber, 2010).

In this way, capacity cannot be understood as a static characteristic intrinsic to a community, but rather as a set of skills and connections, which differ according to the context. Donoghue & Sturtevant (2007) suggests that the assets of a community are perpetually evolving, fluctuating in response to factors such as population migration, shifts in regional and global economies, natural and human-induced disruptions in the environment, and various influences that shape the composition of communities(Donoghue & Sturtevant, 2007). Compared to other characteristics of risk, such as exposure and vulnerability, capacity is more dynamic, human-centred, government-related, and has timely assessment aspects (Nakasu et al., 2022), in addition to being dependent on the opportunities or constraints that the community may face (Gibbon et al., 2002).

Concerning studies on community capacity, Laverack (2008) argues that the understanding that the concept can be broken into different areas of influence is critical to the development of capacity. These different attributes and characteristics that collectively make up the community's capacity are referred by several authors as “capacity domains” (Laverack, 2008). The literature provides evidence that de use of domains as a tool for analysing he concept presents a potential value when trying to form an in-depth understanding of the concept and its implications on a given community.

Table 4 systematises the main authors who address the capacity concept as well as the proposed domains for analysis. The literature (Bopp et al., 2000; Chaskin, 1999; Easterling et al., 1998; Goodman et al., 1998; Laverack, 2008) seems to present a consistent characterization of the domains, with a vast majority of the articles set within the health promotion literature, however the conceptualization of the domains is transversal, given its multi-dimensional construction. Lempa et al. (2008) stresses that the domains “underscore relationships across multiple social levels and can be applied to both geographic communities and communities of shared identity”(Lempa et al., 2008, pg. 299). There is a coherence in the propositions made by the authors, where it can be seen, for example, that domains such as leadership, skills, sense of community and participation are recurrent.

Table 4 - Capacity domains. Source: Adapted from Gibbon et al. (2002).

Source	Domains
Goodman et al., 1998	Leadership; citizen participation; skills; resources; social and inter-organizational networks; sense of community; understanding the community history; community power; community values; critical reflection.
Easterling et al., 1998	Skills and knowledge; leadership; sense of efficacy and confidence; social capital; culture of learning.
Chaskin, 1999	Sense of community; level of commitment among community members; mechanisms of problem solving; access to resources.
Bopp et al., 2000	Shared vision; sense of community; communication; participation; leadership; resources, knowledge and skills; ongoing learning.
Laverack, 2008	Participation (active involvement); leadership; organizational structures; problem analysis; mobilization of resources; critical awareness; networking with other actors.

The approach of capacity domain has proven to be a useful tool when it comes to gaining a deeper understanding of the reality and demands of a given community, nevertheless the broad concept of community capacity requires a multidimensional set of measures (Marré & Weber, 2010). The difficulty when approaching this topic of capacity measurement relies on the challenges of capturing the dynamics of community. Donoghue & Sturtevant (2007) emphasize that measures of capacity should not only reflect on the inherent complexity of the concept but also the temporal dimension (Donoghue & Sturtevant, 2007). In addition, capacity can be influenced by social networks, past experiences, and other changing factors, and, therefore, cannot be measured well by statistical data (Nakasu et al. 2022).

Despite the difficulties of measuring the concept of capacity, especially with regard to communities, this concept has been consolidated as a key to disaster resilience (Nakasu et al., 2022). Imbaya et al. (2019), emphasize that, regarding the participation in any development initiatives, the concept of capacity has become increasingly important when it comes to reducing the challenges faced by communities (Imbaya et al., 2019). Because the development of capacity depends on the involvement of individual community members in local activities, participation is fundamental to the concept of capacity building (Goodman et al., 1998). For Lovell et al. (2014), communities that lack capacity are less likely to mobilize the skills and resources they possess to address the challenges their own system faces (Lovell et al., 2014). Thus, participation is fundamental to the capacity to reduce exposure and sensitivity to shocks and pressures through preventative measures and useful coping mechanisms (Levinger, 2021).

3. Case study

3.1 Contextualization

The area selected for this study is the territory of the Municipality of Monchique, which is located in the Algarve region, southern Portugal. Monchique is part of the district of Faro and is subdivided into three parishes, Monchique (centre), Marmelete (west) and Alferce (east). It is bordered to the north by the municipality of Odemira, to the east by Silves, to the south by Portimão and Lagos, and to the west by Aljezur (**Figure 3**).

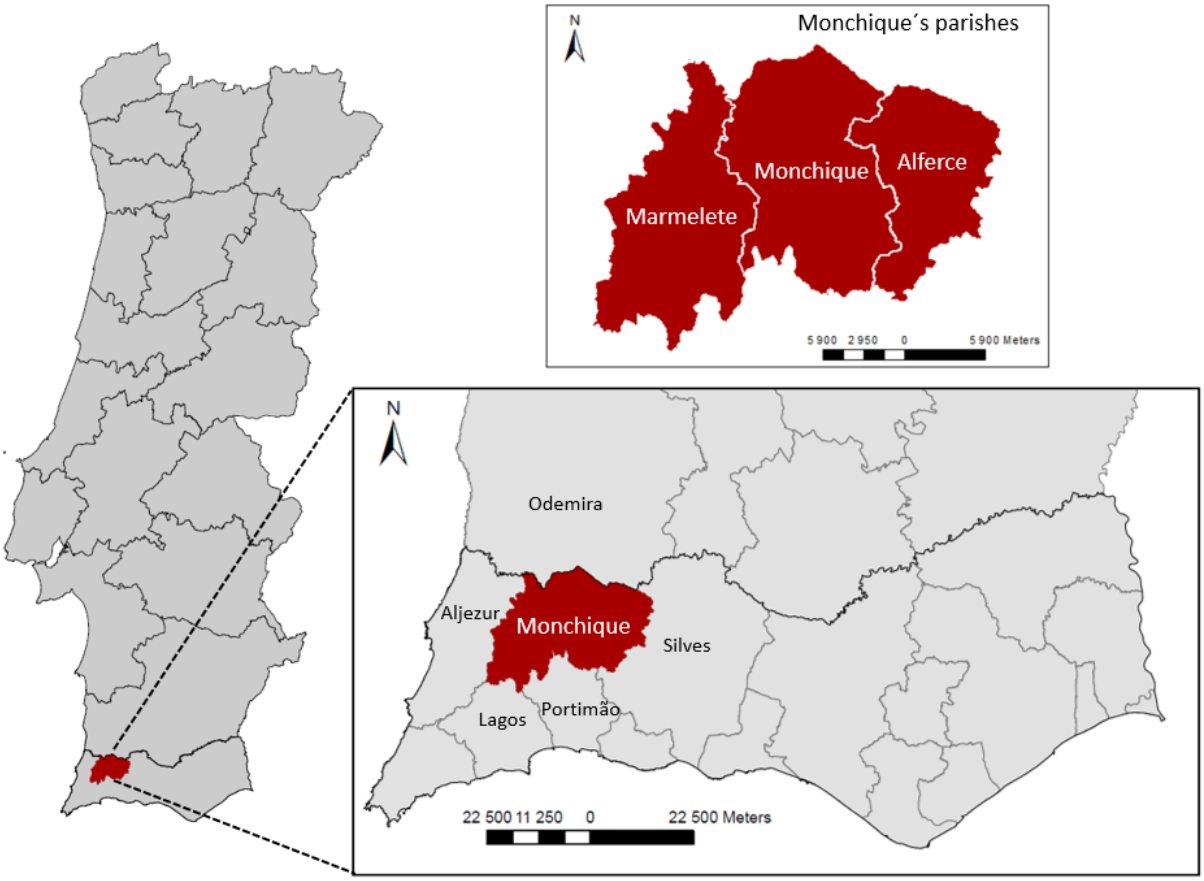

Figure 3 - Monchique territorial limits.

The municipality of Monchique has been facing a continuous decrease in the number of people living in that territory, as can be observed in Figure 4. Between 1960 and 2021, Monchique has lost more than 60% of its population (going from 14779 to 5462 inhabitants), being possible to highlight that only between the last two census (2011 and 2021) that territory has lost almost 10% of the resident population. This contrasts with the apparent demographic dynamic of the Algarve region, which has been showing a positive variation (16%) over the same period (2011-2021) (PORDATA, 2023d).

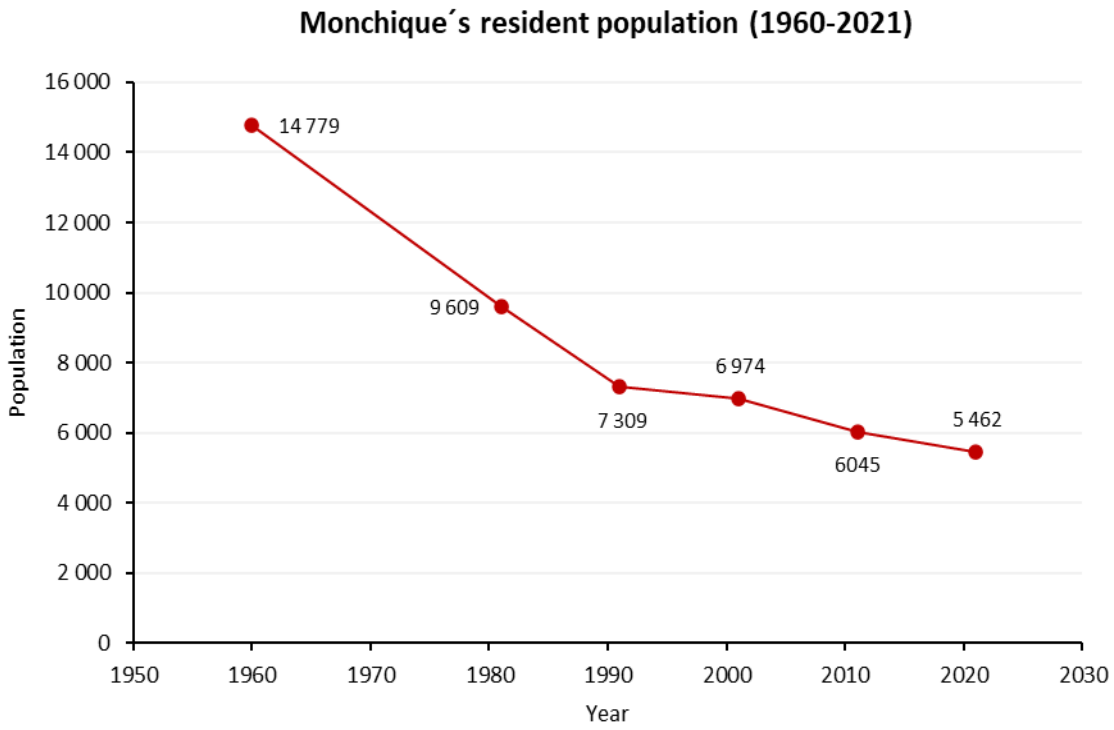

Figure 4 - Monchique´s resident population (1960-2021). Source: PORDATA (2023).

When analysing the disaggregated data provided by the Statistics Portugal (INE) for Monchique's parishes, it is (also) possible to observe a population decrease in the three parishes: Alferce (11%), Marmelete (11%) and Monchique (9%)(INE, 2022a).

This decline in population numbers has led to a drop in Monchique's population density, turning it in the Algarve region's municipality with the lowest population density (approximately 14 people per km^2), being Olhão is the region's most densely populated municipality with approximately 340 inhabitants per km^2 (PORDATA, 2023d). Regarding the parishes of the study area population density, Monchique, which is the consolidated urban centre, has the highest density with approximately 27 inhabitants per km^2 whilst Marmelete has almost 5 and Alferce 4 inhabitants per km^2 (INE, 2022b).

Despite this downward trend, there has been an exponential growth of foreign residents in Monchique (Figure 5), mainly arriving from European countries such as the United Kingdom and the North Ireland (INE, 2021). In 2008, 497 foreigners lived in the study area, contrasting to the 934 recorded in 2022, being this upward trend especially pronounced after 2014 (PORDATA, 2023a). When comparing to the other municipalities of the Algarve region, Monchique shows a higher variation of foreign nationality living in its territory (from 8,64% in 2011 to 13,13% in 2021) (INE, 2023).

In terms of this population distribution within the municipality, data shows that they settle mainly in the parishes of Alferce and Marmelete, where the foreign population corresponded, in 2021, to 22.5% and 20.06% of the total parish population, respectively (INE, 2021).

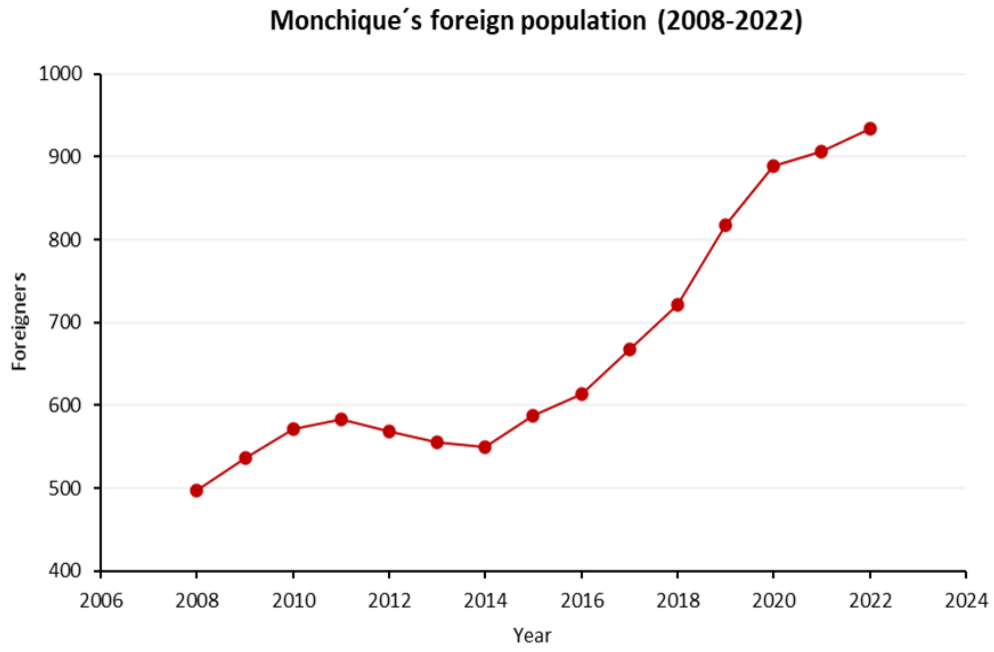

Figure 5 - Monchique´s foreign population (2008-2022). Source: PORDATA (2023).

The age distribution of the population of Monchique, between the years 1960 and 2021, can be illustrated by Figure 6. The 0-14 years old age group fell between 1960 and 1991 but has remained stable since 2001. The 15-64 years old age group, which represents the active-age population, is in decline as opposed to the over-65 years old population whose is increasing (PORDATA, 2022).

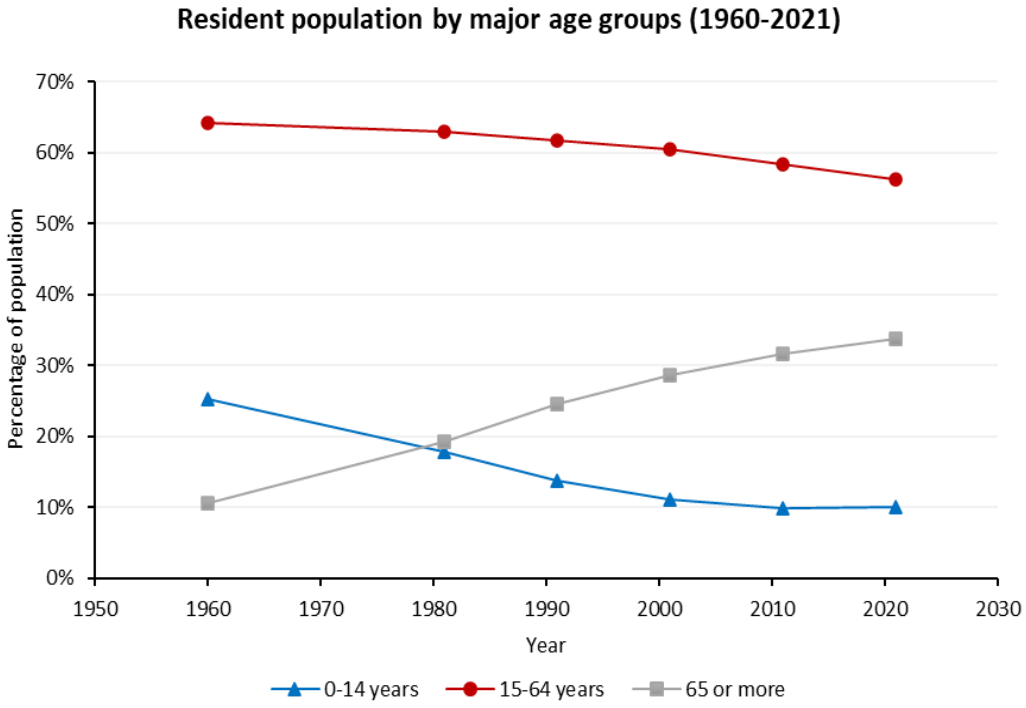

Figure 6 - Resident population according to the Census: total and by major age groups (1960-2021).

Source: PORDATA (2022).

In the last two decades, there have also been profound changes in the distribution of the working-age population by sector of activity. Particularly, it is possible to emphasize the reduction in the weight of the primary sector (from 36.4 to 8.5%), the increase in the population working in the tertiary sector (from 44.1 to 72.0%), and the maintenance of the population working in the secondary sector (19.5%) (Rodrigues et al., 2021).

In relation to other economic incomes associated to the territory of Monchique, it is possible to highlight the rather stable contribution of tourism, agriculture, hunting, and forestry activities to the gross value added. Some of these economic activities have been showing higher fractions when compared to the mainland Portugal, indicating the municipality's greater specialization in these activities (do Carmo et al., 2020). The touristic sector is noteworthy to highlight, once the related indicators show, over the last ten years, a favourable evolution of this sector in the municipality of Monchique (Rodrigues et al., 2021). According to PORDATA, in 2022 the municipality had 17 tourist accommodations, with approximately 1500 overnight stays per 100 inhabitants and 47% of foreign guests in tourist accommodations (PORDATA, 2023b, 2023c, 2023e).

In terms of forest fires, Monchique's territory and respective population has faced several occurrences of this nature in recent years. The last one, with high intensity and major impacts, occurred in 2018. It started in the parish of Monchique (although it mostly spread to the parish of Alferce) and affected other municipalities in the Faro district besides Monchique (namely Silves and Portimão) and a small part of the municipality of Odemira (which is part of the Beja district in the Alentejo region). This fire resulted in a total burnt area of around 280 km^2, with 68.35% of the area burnt being in the municipality of Monchique.

Regarding the biophysical characterization of the region, Monchique has the mountain (Serra in Portuguese) as a structuring element of its landscape, being possible to highlight two main points: Picota (773 m) in the east and Fóia (902 m) in the west, the latter being the highest point in the Algarve region.

Monchique's municipality has more than 80% of its territory with slopes greater than 15% (Annex I), which conditions the suitability for some land uses, such as agriculture. Thus, this topographical composition causes difficulties in managing combustion areas, leading to higher maintenance costs, as well as making it difficult to extinguish forest fires when they occur. In addition, the study area has specific meteorological and vegetation characteristics, combining strong winds, low relative humidity and fine fuel in plant formations prone to rapid and intense fires (such as eucalyptus, for example) that favour severe forest fires (BRIDGE Project, 2022).

According to the Land Use and Occupancy Chart (COS) 2018 of the municipality of Monchique (Annex II), there are two land use classes that are predominant in the municipality, occupying approximately 90% of its territory: Forestry (66%) and Bushes (26%) (BRIDGE - Internal report, 2022).

Monchique's artificial lands correspond to only 0.7% of the whole municipality area, with the parish of Monchique consolidated as the urban centre where most of the artificialized territory is located. In relation to the study area-built structure, it is distributed linearly along the main accessibility

infrastructures. In the vicinity of this area, it is possible to find most of the agricultural areas (which do not exceed 5% of the territory), presented mainly in terrace fields (socalcos in Portuguese) (do Carmo et al., 2020). The territory under study is also characterized by a land ownership structure that is highly fragmented (Figure 7 **-** Monchique´s land ownership limits. Source: Adapted from (CMM, 2022).), based mainly on properties that usually have an area below 2.5 hectares (do Carmo et al., 2020).

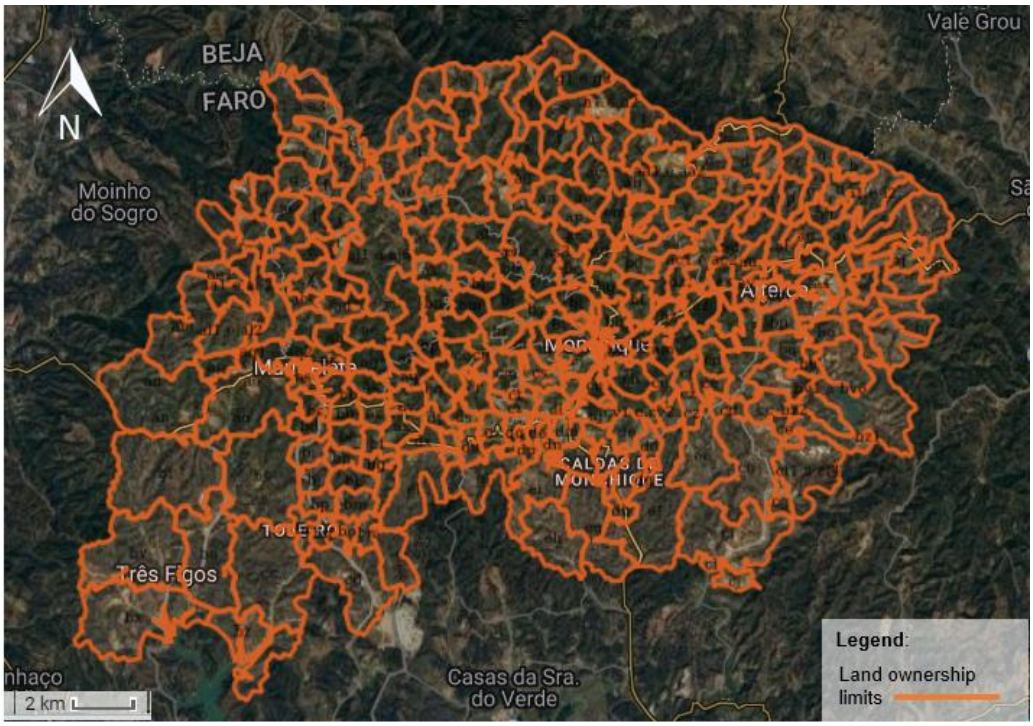

Figure 7 - Monchique´s land ownership limits. Source: Adapted from (CMM, 2022).

The COS 2018 also reveals that eucalyptus plantations occupy about 45% of Monchique's forest area. Despite its extensive plantation in the region, data reveals a considerable reduction in the profitability of forestry production, further revealing "a decline in profitability associated with the market and external economic drivers with effects on the production costs and reduction of local productive capacity, increasing abandonment of forested areas" (Partidário et al., 2022, p.6).

In addition to the paper production, there are other characteristic products of Monchique, such as Medronho (a fruit). Medronho has a high production potential in the area although it has high harvesting costs (around 60%) in relation to the unit selling price of its liquor (key product), so in practice the value received by the producer is rather low (do Carmo et al., 2020). There is also a strong tradition, in this area, related to the extractive industry, in particular the mining of nepheline syenite stones with four sites dedicated to its extraction (Rodrigues et al., 2021).

Due to its biophysical characteristics, the municipality of Monchique is highly vulnerable to several natural and mixed phenomena, such as soil erosion, floods and forest fires (do Carmo et al., 2020). Figure 8 was extracted from the structural fire risk chart drawn up by the ICNF (the National Institute of Nature and Forest Conservation) and show that the study area is mostly classified at high and very high levels of forest fire risk. It is also possible to observe that there is a predominance of dispersed

occupation of the territory with a concentration of built fabric in the centre of the municipality (parish of Monchique). Most of the buildings are located in zones classified as being at very high risk of forest fires.

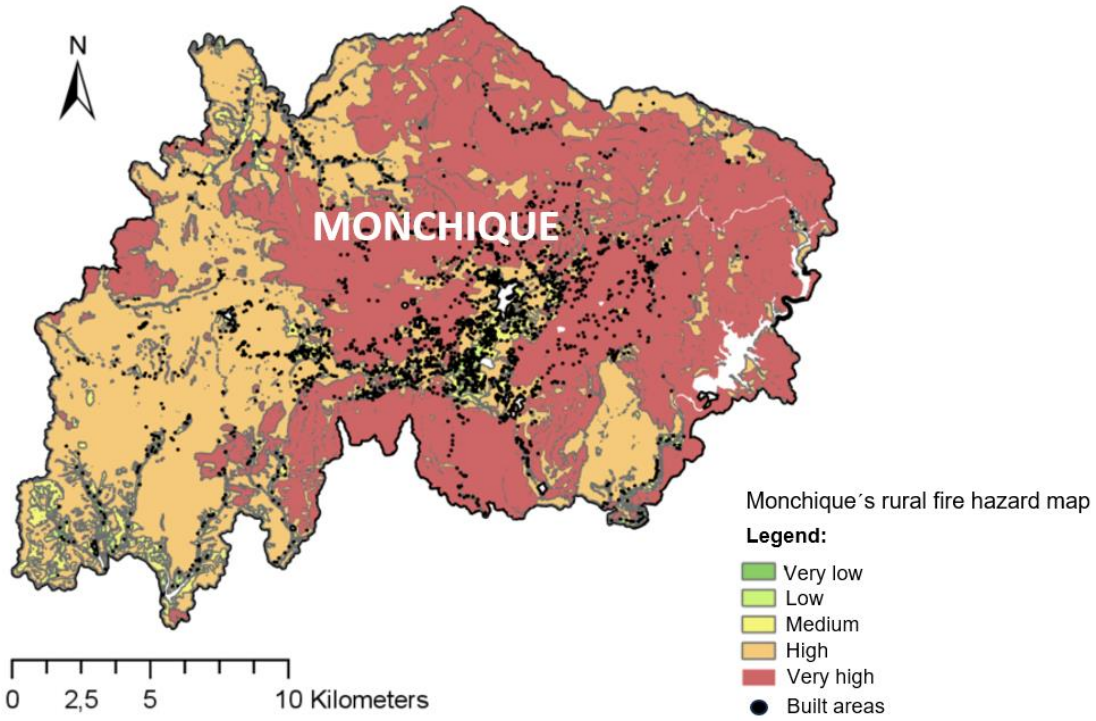

Figure 8 - Rural fire structural hazard map with built areas. Source: Adapted from ICNF.

Monchique is historically an area of large forest fires, the most recent event being in 2018, which tore through the municipalities of Monchique, Odemira, Portimão and Silves. The occurrence of this major fire largely coincides with the area of the fire that occurred in 2003, an event that consumed around 80 per cent of the municipality (Rodrigues et al., 2021). The event that occurred in 2003 was the largest forest fire in the Algarve since 1980, devastating an area of 32,843.37ha and affecting all three parishes in the municipality. The 2018 event mainly affected the parishes of Alferce and Monchique, with 40.95ha and 33.61ha burnt respectively (BRIDGE Project, 2022). In both events it was observed that the land use predominantly affected by the fire was Forests, followed by Bushes.

Thus, the territory's high vulnerability to fires seems to require a great deal of land management and planning. Regarding the regulatory tools, the policies adopted on European Territories over the last century on forest fire generally have been based on firefighting and suppression. In this sense, the wildland fire legislation and respective policies seem to have been the result of fast and ad hoc reactions to catastrophic situations instead of proactive mitigation measures (Montiel-Molina, 2013).

The European Union (EU) does not have an explicit mandatory policy for forest management; however, Europe officially endorsed the UN's Forest Principles in 1990, which aims to promote a sustainable forest management in the European context. The resolutions under this scope are implemented through the National Forest Programmes, resting the responsibilities for forest management solely with each nation state.

Despite the lack of a common legally binding forest policy on European context, there have been several voluntary initiatives attempting to address this issue, such as Ministerial Conference on the Protection of Forests in Europe, Forest Europe and the EU's Forest Strategy and Forest Action Plan (Edwards & Kleinschmit, 2013). Additionally, forest management is also affected by other policy areas that have been developed throughout Europe, particularly those relating to environmental issues, such as the Natura 2000 network. In Monchique, the specific characteristics and natural values of the mountainous area have led to the inclusion of a large part of the municipality on the National List of Natura 2000 Sites (Figure 9) (do Carmo et al., 2020), with 87% of its area classified as Rede Natura2000 (Antunes & Águas, 2017), thus reinforcing the clear forestry vocation of this territory (Rodrigues et al., 2021).

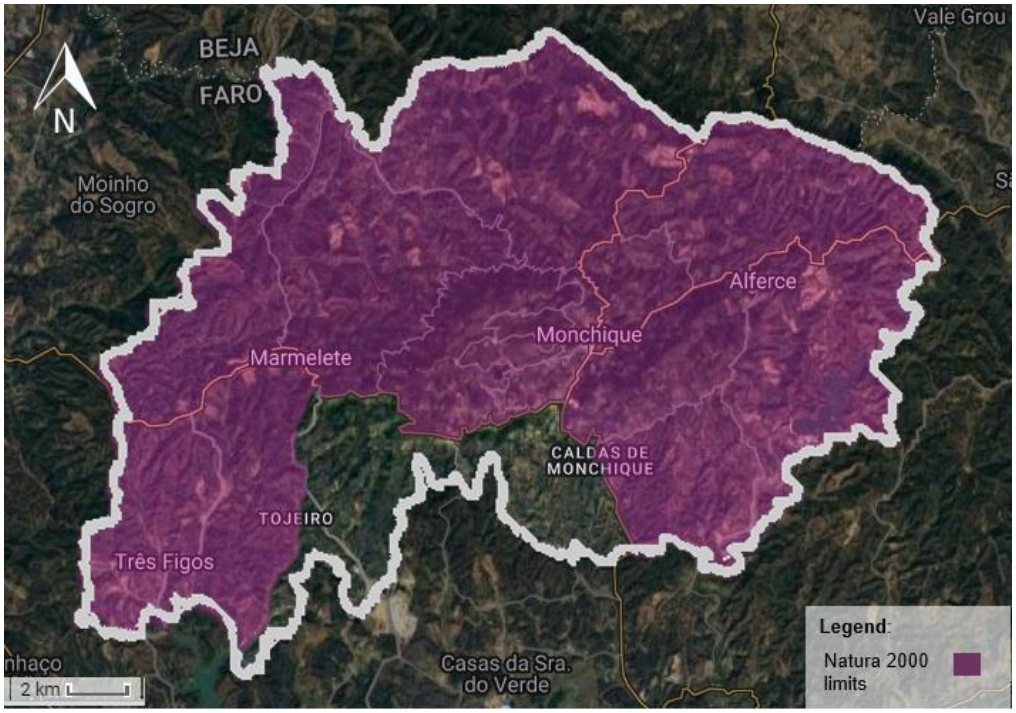

Figure 9 - Natura 2000 occupancy in Monchique. Source: Adapted from CMM (2022).

The intersectoral perspective on forestry and forest fires also encompasses risk reduction frameworks. The UN's Sendai Framework for Disaster Risk Reduction (SFDRR), with a time horizon of 2015-2030, to which Portugal is a signatory, is noteworthy on the supranational spectrum. Forest management policies and instruments have undergone major changes throughout the world over the years. Mourato et al. (2020) research systematized this evolutionary process in Portugal, presenting the recommendations for reforestation in uncultivated areas, the state's contribution to eucalyptus plantations (mobilizing financial instruments to support private forestation only when there is an industry need for eucalyptus).

An analysis of the Portuguese regime on this subject draw attention to the intense reforestation that took place in the country, which seems to have been "encouraging and supporting the intervention of private forest owners in extensive forest areas directly linked to the pulp and paper industry, reinforcing and consolidating the central role of private initiative in the management of forest territories" (Saad Ximenes, 2022, pg. 5). In the specificity of the Portuguese model, public forest, communal forest, private forest

owned by industry and non-industrial private forest coexist (Coelho & Auxiliar, 2003), where private forest represents almost 85% of the total forest area, 76.6% of which is non-industrial private forest and 7.7% private forest owned by industry (Coelho & Auxiliar, 2003).

The BRIDGE project and Monchique

The municipality of Monchique is the pilot case for the BRIDGE (Bringing science and local communities together to reduce the risk of forest fires) project, within which scope this dissertation has been developed. BRIDGE is being developed in three phases, as can schematized in Figure 10. Phase 1 aimed to understand the territory and its populations, assessing socio-ecological vulnerabilities and local strategies for adapting to the risk of forest fires. Phase 2 brings together all the local capacity-building action in the form of an innovation laboratory (from now on called InnoLab) which fosters dialogue between local communities, science and organizations involved in forest fire risk management. Phase 3 aims to share knowledge and the BRIDGE approach to building local capacity to reduce forest fire risk in Monchique and to support its replication in other at-risk territories.

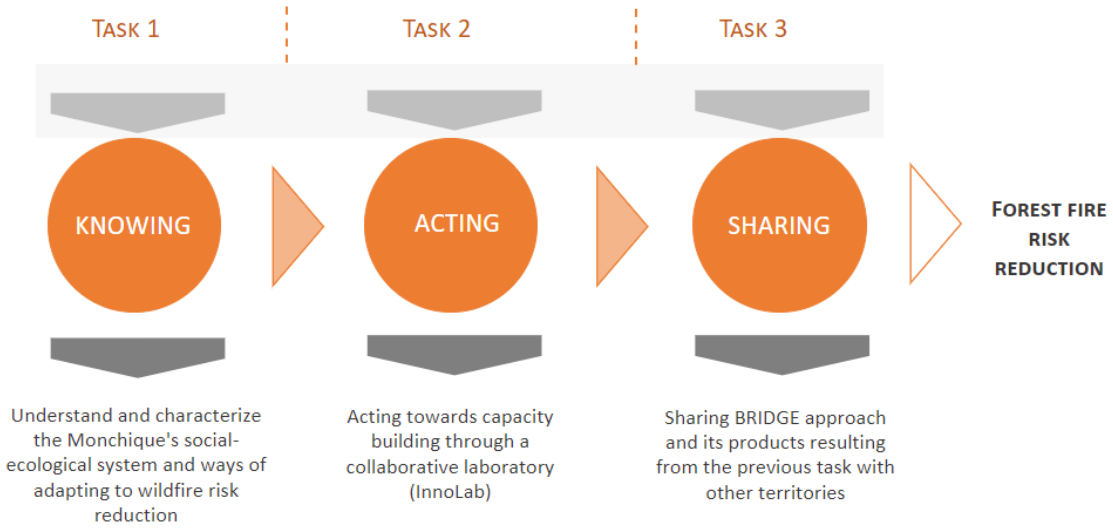

Figure 10 - Tasks of BRIDGE project. Source: Partidário et al. (2022).

As a product of the project, four master's theses were developed, dealing with different themes related to the object of study, Monchique. The issues surrounding the biophysical aspects of the study region, as well as the characterisation of the cadastral property of the parish of Alferce, were covered by the University of the Algarve, a partner in this project. The network of local actors, with a focus on forest owners, was previously addressed within the scope of the project by another dissertation, developed at the Instituto Superior Técnico. This research therefore seeks to add to the discussion proposed by the project while avoiding any overlap between themes.

The present dissertation has been conducted in parallel with BRIDGE phase 2 and used the knowledge gathered in the participatory moments (promoted by the project) as a source of information and a way to discuss its findings. Thus, the information that supported the discussion was mainly collected in the context of the BRIDGE Innolab which has aimed to provide a collective space to promote dialogue,

knowledge sharing and collective debate in the Monchique territory to (i) promote social learning on key aspects of local vulnerabilities and forest fire risks, (ii) strengthen collaborative networks, (iii) build and enhance both social and institutional adaptive capacities for forest fire risk reduction, and (iv) encourage a CBDRR participatory process approach in Monchique (Partidário et al., 2022).

The Innolab held several participatory sessions, being highlighted here, due to their connection with the scope of this study, the activities held in January and February of 2023 in Monchique, entitled "Priorities and Capacities". These insightful sessions were open to the whole community and aimed to identify, in a participatory and collective way, priorities for intervention in that forest territory and the local existing capacities to reduce the risk of forest fire in Monchique.

In January, were conducted three sessions focusing on the identification of priorities by the community, which took place between the 24th and 26th, each day in one of the municipality parishes. The parish of Monchique had, in these sessions, the highest turnout, with 26 participants, while the participation attendance on the other parishes were fairly low, with 4 attendees in Alferce and no one in Marmelete. Figure 11 illustrates some moments of the participatory sessions in Monchique and Alferce parishes). The turnout from these sessions was also consistent with previous attendance observed in other BRIDGE participatory events that took place in november, which prompted a change in the engagement strategy (trying to attract more people).

Figure 11 - BRIDGE Participatory **s**essions about Monchique´s priorities and capacities held in January.

Thus, in the following sessions, that took place on the 22nd and 23rd of February (Figure 12), one of the participatory moment was held in the parish of Monchique, in order to consolidate the work group (13 attendees). An attempt was also made to attract a specific set of stakeholders (local landowners), with a session being held in the local association Coopachique (Agricultural Cooperative of the Municipality of Monchique), where 10 rural producers and landowners attended the session.

Figure 12 - BRIDGE Participatory sessions about Monchique´s priorities and capacities held in February.

As already mentioned, in these two participatory moments conducted by the BRIDGE project, the community discussed what they considered to be the priority areas for intervention to reduce the risk of forest fire. Synergies were found between the issues presented by the participants and can be systematized in the following key three points as priorities that need action: (i) lack of public and private investment; (ii) human desertification and (iii) restrictive legislation.

The capacities sessions were built on these priorities, seeking to get the community to identify what capacities exist and what are needed to act in these priority areas. As existing capacities, the community pointed to a common vision, human resources (although scarce, with a lot of potential), know-how, local products and partnerships, and the attractiveness of the territory. As needed capacities, the community pointed out: better communication skills, leadership, human resources, trust between local actors, cooperation between neighbours, innovation-driven mentality and agricultural and forest interest.

3.2 Data collection

Several factors make Monchique a good territory for applying of collaborative forms of management, including the predominance of forest, land abandonment, and fragmentation, culminating in a high risk of forest fires (issues already highlighted in the previous section). Additionally, the literature review has shown that local communities are an underutilized resource for forest management (Colfer, 2005), which is why Monchique´s community and its capacity have a central hole in this analysis. However, a successful and sustainable implementation of community forest management requires more than (just) the local capacity to manage its territory; namely, it requires an institutional framework that can facilitate this management approach.

Thus, this section and the following one aim to understand and examine the local community capacities for managing Monchique´s forest territory, as well as to draw an analysis of the institutional arrangements and respective ability to enable and promote collaborative management. The institutional arrangements analysis aims to address objectives I (analyse existing regulatory tools and assess if and to what degree the capacities of local communities are acknowledged) and II (verify the extent to which

the instruments provide institutional support for collaborative management), while the capacity analysis aims to address objective III (comprehend the capacities of the local community and existing barriers to managing the forest territory). The investigation of the case study begins with an analysis of local capacities since understanding this sphere is also essential when reviewing institutional arrangements. The following paragraphs present the main assumptions of this research to achieve its goals.

Using Räsänen et al. (2020) conceptualization of the community concept, in the context of this research, community will be understood through a place-based lens (Räsänen et al., 2020), considering the totality of individuals who live in Monchique and/or are linked to its forest land. For the purposes of the analysis of capacities, institutional bodies will not be considered. What motivated this choice was the fact that Monchique´s forest land is mostly owned by private individuals, and it is, therefore the private landowners who are mainly responsible for the management of this territory.

The revision of the literature has shown that there is no defined framework to help navigate the analysis of capacities, especially with regard to DRR. This is because a framework designed for this purpose would need to encapsulate the resources of different scales, ensuring the required flexibility for dealing with events that are unique (considering that no disaster, in terms of nature, types/scale of damage and level of vulnerability, response and recovery is the same, as Ofei-Manu & Didham (2017) also emphasized). However, to attempt to overcome this challenge, the data collection techniques used, in this research, for the analysis of Monchique's community capacities followed the recommendations from ASDC (2007), who developed a guide to measure community capacities. These recommendations led to the selection of two methods: (i) questionnaire to gather information about attitudes, opinions and perceptions; and (ii) content analysis to obtain information on institutional arrangements. The analysis will be conducted considering two angles, that can be perceived as a bottom-up angle, encompassing the community capacity, and a top-down angle that seeks to perceive if the instruments enable such approach.

Considering the study area and drawing on some perspectives and insights of the local community gathered from the participatory process developed on BRIDGE project, the characterization of domains presented by Bopp et al. (2000) was the one that best suited the context. The literature review demonstrated the usefulness of applying the concept of domains for a deeper understanding of capacities of a given community (Goodman et al. (1998), Easterling et al. (1998), Chaskin (1999), Bopp et al. (2000), Laverack (2008)), which led to its adoption on this study. As previously mentioned, the rationale behind this approach is the possibility to identify, in this specific community, which domains perform well, and which ones have shortcomings. Thus, allows the analysis on what are the strengths that can be leveraged to address the policy and local needs and what domain is performing poorly, requiring more attention and development measures. This analysis will be carried out using a questionnaire, which is detailed in the next sub-section of this chapter.

As to the institutional arrangements, it is considered that they can create an environment conducive to the development of collaborative approaches, given that they either enable or disable real power and responsibility sharing (Armitage et al., 2009). Considering that the case study constitutes a complex

system that has an intrinsic characteristic of unpredictability, the centrality of learning as an element of effective management arises (Colfer, 2005). As already identified in the literature review, the adaptive co-management presents itself as a management approach capable of navigating such environment (Carlsson & Berkes, 2005), thus being chosen as the guiding thread of this analysis. The institutional arrangements will be analysed through a content analysis of the territorial management instruments (at different scales) that are relevant to the case study, from the perspective of ACM. For such purpose, the four prescriptions of ACM from Huitema et al. (2009) and the notion of capacity, will guide this analysis.

3.2.1 Local capacity questionnaire

As already mentioned, the local capacity questionnaire adopted the domains stablished by Bopp et al. (2000), which are summarized in Table 5. The developed questionnaire comprises an initial section, entitled “general information” aiming to characterize the respondents and their connection to the Monchique territory, followed by 14 questions. Questions 1 to 10 address the domains using close-end questions and statements to be rated with a Likert scale of 1-6 (1 being "Strongly disagree" and 6 being "Strongly agree"). Each domain was covered by an average of three questions/statements.

Table 5 - Capacity domains according to Bopp et al. (2000) and descriptions.

Domain	Brief description
Shared Vision	If the community share a relatively consistent idea on what the forest should look like and how it should be managed, there is a greater chance of achieving it (Thomson et al., 2003).
Sense of community	“Sense of community refers to the quality of human relationships that make it possible for people to live together in a healthy and sustainable way.” (Bopp et al., 2000, p.30).
Communication	“A comprehensive communication strategy should identify the preferred media for specific audiences within the community, so that key messages can be efficiently targeted to key people.”(Thomson et al., 2003, pg. 43). A clear and consistent communication channel helps on the development and enhancement trust and connections within the different stakeholders.
Participation	“Participation is the active engagement of the hearts and minds of people in improving their own living.” (Bopp et al., 2000, p.34).
Leadership	“Leadership is a process of engaging the community in learning and action. It is developed from within the community. Communities have both formal (i.e. elected officials and people in positions of power) and informal leaders (i.e. those who are not in formal positions of power, but whose voice is highly regarded).” (Bopp et al., 2000, p.119).
Resources, knowledge and skills	“Resources, skills, and knowledge are the human talents and material goods that a community uses to improve, such as volunteers, buildings and facilities, money, and time.” (Bopp et al., 2000, p.30).

Domain	Brief description
Ongoing learning	"Ongoing learning is a process of reflecting upon what is happening within a project, organization or a community and then systematically exploring what is discovered in order to learn how to be more effective. Ongoing learning also leads to greater self-awareness and community understanding (Bopp et al., 2000, p.40).

Questions 11 to 14 attempt to delineate the local knowledge of territorial management instruments and provide a better identification of the relationship between territorial policy and the local population. Both close-ended and open-ended questions were developed to cover this matter.

The questionnaire to analyse the local capacities of the community of Monchique was applied using both online and paper version. The online version was made available through Jotform website, between 08/06 and 31/08. It was disseminated through social media, by reaching out to local groups, and through the Project BRIDGE website and mailing list, which includes private individuals, associations, and local government bodies. The physical version (Annex III) was made available in the three parish councils of the municipality and during the BRIDGE session that took place in 22/06, in Monchique. The questionnaire was also publicized through the distribution of a flyer (Annex IV) in mailboxes and in the places where the local population most frequently visits, such as restaurants, supermarkets and gas stations. Given the presence of foreigners in the locality, questionnaire was made available in English and Portuguese languages.

The survey resulted in 77 responses, 19 of which were filled in on paper and the remaining online. The platform used to make the online questionnaire available makes it possible to view metrics relating to the form, for which it should be noted that the peak period for responses followed the dissemination through social media (Facebook and Instagram), and the dissemination through the BRIDGE project mailing list, comprising the end of June and the whole of July. The website also reports that the form was viewed 277 times, with an average response time of 4:20 minutes.

Concerning the analysis of the results, within the questionnaire the questions that employed the Likert scale will adopt a quantitative approach for the discussion of the results (chapter 4), in which the aim is to classify how a given domain of capacity is performing, serving as a basis for discussion. As a parameter, the classification used by ASDC (2007) will be adopted, applying the average value of the answers into the scores, as shown in Table 6. For both open and close ended questions, a qualitative approach will be used.

Table 6 - Scores for capacity measurement. Source: ASDC (2007).

Scores	
> 4.0	Demonstrate sufficient capacity, meaning that this domain do not need special attention.
3.0 to 3.9	Borderline – this domain needs further information in order to find if it deserves attention.
<2.9	Demonstrates a lack of capacity. This domain need attention and effort.

3.2.2 Policy content analysis

Institutional arrangements are a fundamental part of implementing community forest management, as they make this type of approach viable (Armitage et al., 2009). Given the importance of this aspect, an attempt was made to (i) identify if and how the orientations of territorial management instruments operating in the study offer the opportunity to establish a more collaborative approach to land management; (ii) check whether the instruments recognize the capacities of local communities or not.

This analysis begins with the selection of the territorial management instruments that are pertinent to the case study area. To select the instruments a multiscale approach was adopted, with the intention of identifying at which scale the key concepts are most present. Therefore, instruments were chosen that cover the national, regional and local scales, as presented in Table 7.

Table 7 - Documents included in the content analysis (n=9).

Scale	Title and publication date (in brackets)
National	Programa Nacional da Política de Ordenamento do Território – PNPOT (2019) National Spatial Planning Policy Program
National	Plano Nacional de Gestão Integrada de Fogos Rurais - PNGIFR (2022) National Plan for Integrated Rural Fire Management
National	Plano Nacional de Defesa da Floresta Contra Incêndios - PNDFCI (2006) National Forest Fire Defence Plan
Regional	Plano Regional de Ordenamento do Território do Algarve – PROT Algarve (2007) Algarve Regional Spatial Plan
Regional	Programa de Reordenamento e Gestão da Paisagem das Serras de Monchique e Silves – PRGPSMS (2020) Monchique and Silves Mountains Landscape Reordering and Management Program
Regional	Programa Regional de Ordenamento Florestal do Algarve – PROF Algarve (2019) Algarve Regional Forest Management Program
Local	Plano Municipal de Emergência de Proteção Civil de Monchique – PMEPC Monchique (2015) Monchique Municipal Civil Protection Emergency Plan
Local	Plano Diretor Municipal de Monchique – PDM (2008) Monchique Municipal Master Plan
Local	Plano Municipal de Defesa da Floresta Contra Incêndios de Monchique - PMDFCI (2016) Monchique Municipal Forest Fire Defence Plan

The first documents selected for analysis were the National Spatial Planning Policy Program (PNPOT), the Algarve Regional Spatial Plan (PROT Algarve), and the Monchique Municipal Master Plan (PDM). What motivated this choice was the interconnection and cascading effect between these documents,

since the guidelines on a national scale are defined by the PNPOT, developed on a regional scale by the PROT and used as a strategic reference framework for the local scale, in the form of the Municipal Master Plan (PDM). The fundamental importance of these three pillar instruments for the territorial management system motivated this initial choice, in addition to the fact that it made it possible to check whether and how the principles on which the ACM is based are presented and scaled down to the more local instrument.

After this choice and given the centrality of forest fires and management in the local context and in this research, it was decided to choose documents that dealt with these such issues. On a national scale, the list of documents analysed included the National Plan for Integrated Rural Fire Management (PNGIFR), whose strategy covers the 2020-2030 timeframe and is a subsidiary of the PNPOT. The strategy outlined in this document sets out four main guidelines: (i) valuing the territory; (ii) caring for rural areas; (iii) changing behaviour; (iv) managing risk efficiently. This document is also closely related to the Integrated Rural Fire Management System, which established an integrated management model focused on increasing and strengthening the collaborative networks of stakeholders to share information and to promote joint strategies to intervene in forest management and fire risk reduction. Still on a national scale, the National Forest Fire Defence Plan (PNDFCI) was also chosen, as one of its main lines of action addresses themes that can be related to collaborative management, namely adapting a functional and effective organic structure and increasing the territory's resilience to forest fires.

On a regional scale, in addition to the PROT Algarve, there are two documents for analysis: the Algarve Regional Forest Management Program (PROF Algarve) and the Monchique and Silves Mountains Landscape Reordering and Management Program (PRGPSMS). The PROF Algarve is related to the PROT Algarve, namely its regional structure for environmental protection and enhancement, the ecological corridors and their relationship with the use of forest areas. The PROFs are part of the operationalization of the themes of the National Forestry Strategy, which focus on the planning of forestry use in the territory. For its part, the PRGPSMS is not a formal territorial management instrument in the light of current legislation, but rather a program to guide public and private policies to create a biophysically fit and resilient landscape that is economically viable, applying the commitments expressed in the PNPOT.

As for the local scale, along with the PDM, the Monchique Municipal Forest Fire Defence Plan - PMDFCI (2016) and the Monchique Municipal Civil Protection Emergency Plan - PMEPC Monchique were chosen. It should be noted that the PDM is currently under revision, as is the PMDFCI. The PMDFCI contains the necessary measures to protect and prevent the forest against fires and, including the forecast and the integrated planning of the interventions of the different entities involved in the event of a fire. The PMEPCM, on the other hand, was drawn up to deal with all the emergency situations that may arise within the territorial and administrative scope of the municipality of Monchique.

The decision was made to analyse the PNDFCI, despite the instrument having been repealed by Decree-Law 82/2021, since it was mentioned during the community participation sessions and was even more widely known by the community than its successor. Also mentioned by the population, it was

decided to include the PMPEC in the analysis process, even though it does not deal with the territory itself, it is related to the fire events discussed here.

For the purpose of this research, three methods were chosen to perform the analysis on the selected documents, namely (i) word cloud, (ii) frequency count and (iii) word tree, being frequency count and word tree used in combination. First, word cloud is an intuitive visualization technique that can serve as a starting point for deeper text analysis, by indicating relevance or occurrence frequency of certain topics (Lohmann et al., 2015). In this technique, font size, density or colour's properties create hierarchy between words and highlight its importance (Yakar, 2018). Second, frequency count is used to reveal differences in emphasis between documents (Weber, 1976). Third, in the word tree technique, the word constitutes the root of visualization, diverging to branches that summarize the most frequent connection on the documents (Yakar, 2018). The relational decoding of word, presented in the word tree help to strengthen the validity of the inferences that are being made from the data (Stemler, 2000). NVIVO was the software chosen to perform content analysis on the selected territorial management instruments.

When running a text word query, the NVIVO software offers a tool that allows to count exact words, or group up similar words together, so that it is possible to find the most frequently terms used in the analysed document. For the purpose of this research, the degree of precision of the search was defined as "stemmed", meaning that when searching the software returns a group of exact matches and words with the same meaning (for example, the software will group "sport" and "sporting").

The display of the 30 most frequent words was selected to provide a better graphic visualization, limited to words with a minimum length of 5 letters, so that articles, nouns and pronouns were removed from the results. This generation of word clouds served as a starting point for further discussion on institutional arrangements. In addition to this cloud graphical representation, the software produces a cluster diagram, that helps the discovery of patterns and explore the data of the files.

3.3 Results

3.3.1 Local capacity questionnaire

The following paragraphs present the results obtained from the local capacity questionnaire application on the case study area. Result analysis is presented according to the questionnaire structure: general information, domains (questions 1-10) and knowledge of territorial management instruments (questions 11-14).

General information

This initial part of the questionnaire consisted of a block of general questions, aiming to characterize the respondents. Issues such as nationality, gender and place of residence were addressed within this section. The results revealed that the majority of respondents were men (58%), while women accounted for 38% and feminine/masculine and blank 3%, as shown in Figure 13. In relation to the respondents' nationality, 8 different countries were identified, with the vast majority (79%) being Portuguese, followed

by Germans, who represent 11% of the sample (Figure 14). United Kingdom and Austria counted for 3% each, whilst the other countries accounted for 1% each.

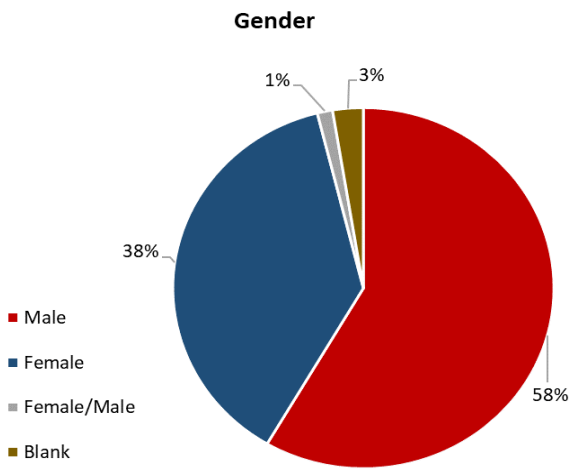

Figure 13 - Gender of the respondents.

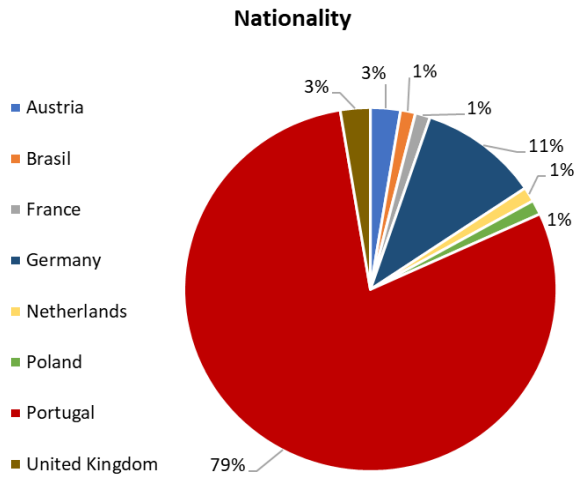

Figure 14 - Nationality of the respondents.

When the participants were asked about their place of residence, 8 municipalities were referred, with the vast majority claiming to live in the municipality of Monchique (82%) (Figure 15). The second most frequent municipality where respondents lived in was Portimão, with 11%. With regard to residents in Monchique, it was found that approximately 56% of respondents live in the parish of Monchique, previously characterized as the urban centre of the municipality, while the parishes of Alferce and Marmelete account for 15% and 8% of the responses, respectively.

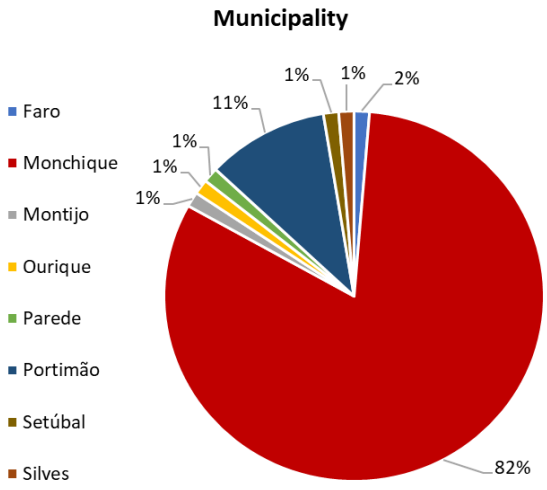

Figure 15 - Municipality of residency of the respondents.

Furthermore, the characterization section sought to determine whether the house/land where the respondents live is owned, rented or other. The result was that 61 of the 77 respondents live in a property of their own, which corresponds to 79% of the sample. Another ten respondents live in a rented situation and six are in another arrangement. Concluding the characterization section, attempts were made to ascertain whether the participants were involved in any local associations, thereby beginning to grasp

the realm of participation of the local population. For this question, 4 cooperatives and associations were listed which, through the BRIDGE participatory construction process, had already been involved in the project activities. Participants were also able to include other options that were not listed or indicate if they do not partake in any group.

In this sense, participants added: (i) ALIM - Associação dos Lesados do Incêndio de Monchique, which represents a group of people affected by the fires in Monchique; (ii) Altri Florestal; (iii) Monchique Volunteer Fire Brigade. The image below (Figure 16) reveals that 41 of the respondents state that they don't belong to any association, which correspond to 53% of the sample. Nossa Terra Associação Ambiental was the local association with the highest number of respondents (17), approximately 22% of respondents. It should also be noted here that Coopachique, one of the organizations suggested, was not represented by any of the participants.

Figure 16 - Respondents connections to local associations.

Domains

After the characterization, the first question addressed the domains of Sense of Community and Shared Vision. Participants were asked to respond to the extent to which they agreed with certain statements and a 6-point Likert Scale was used, as previously mentioned. The results are shown in Figure 17. The statements "There is a sense of community and togetherness in Monchique" and "I often discuss community issues in Monchique with my friends and neighbours" were the ones that had the most positive results. The statements "We have an action plan to achieve a better future for Monchique" and "There is a common sense of commitment and responsibility to improve the management of the forest territory" were the ones that, in the respondents' perception, generated the most disagreement.

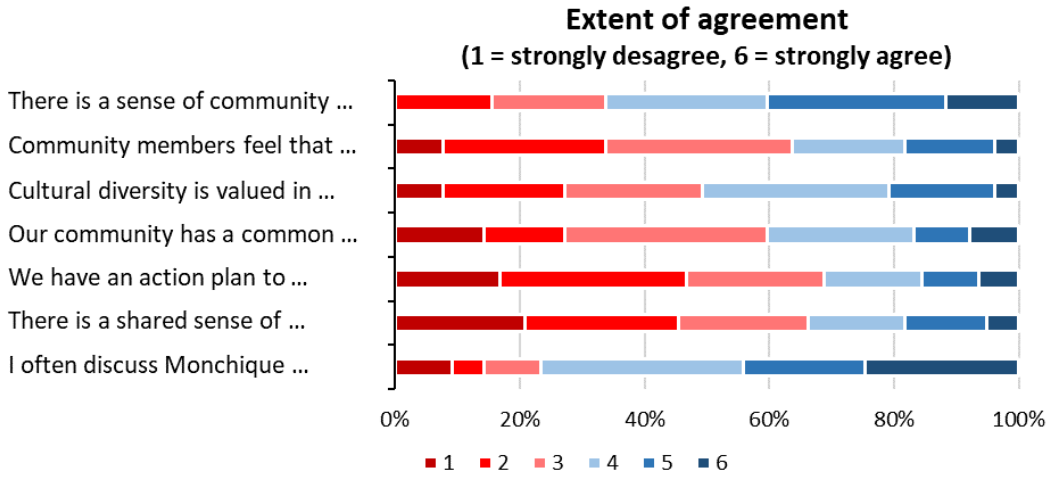

Figure 17 - Question 1: extent of agreement with the statements.

Questions 2 and 3 addressed the field of communication. When asked if there are communication channels for the community members to identify problems and actively participate in solving them, 61% of the participants responded negatively (Figure 18). For those who responded positively (35%), it was asked to specify what these channels might be, for which parish councils, the town hall, social and the local media were mentioned.

Also regarding the communication aspect (Figure 19), it was attempted to ascertain which channels of communication disseminating events taking place in Monchique are more frequently used by the respondents. There seems to exist a prevalence of use of the social media as the main way to communicate events, followed by contact through other residents and newspapers/magazines.

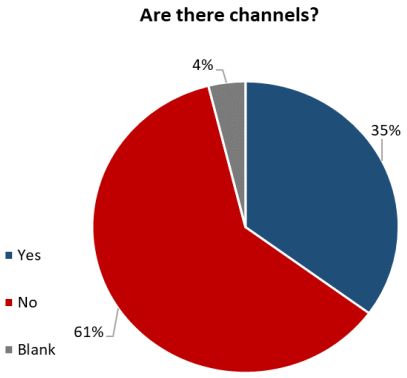

Figure 18 - Existence of communication channels.

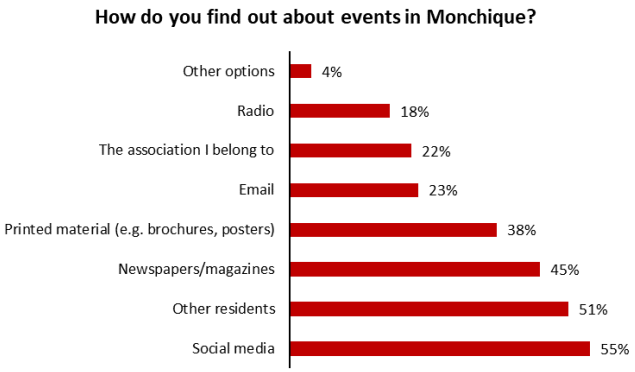

Figure 19 - Most used communication channels.

The dimension of local participation was addressed through questions 4 and 5. When asked about how often the participants take part in community events, monthly and weekly were identified by the majority of the respondents, with 18 and 16 votes respectively, as can be seen in Figure 20. The 10 participants who selected the “other” option had the opportunity to fill in the response in an open-ended way, for which some of the answers were "occasionally", "when the subject interests me", "whenever there is

one", among others. It is also important to notice that 16% of the participants claimed that they do not partake in any event of the community.

Figure 21 shows what was presented by the respondents as being the biggest limitations in participating in community activities, being time pointed out (by 47%) as the main obstacle to participation. The second most frequent reason given by participants was the lack of motivation. Health problems and disagreements with other members of the community were the two reasons given least often by participants.

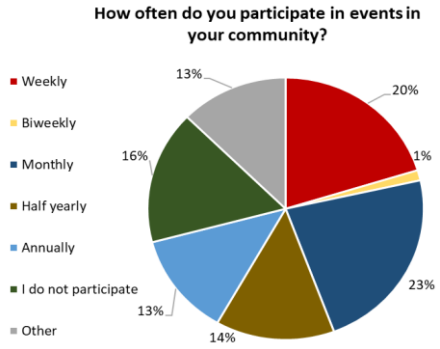

Figure 20 - Frequency of participation on community events.

Figure 21 - Limitations on participating in community activities.

Question 6 explored the domains of leadership, resources, knowledge and skills and ongoing learning, through the usage of 6-point Likert Scale. The graph below (Figure 22) represents the results obtained, where it can be seen that the statements "I have a good understanding of the strengths and needs of this community" and "I believe that engaging in collaborative partnerships with my neighbours can help in the management of the forest and the territory of Monchique" obtained the highest degree of agreement according to the sample. The statement “If I share my ideas and opinions with local leaders, I feel that I will be heard and represented” received the lowest score, thus being the sentence with which most of the participants disagree.

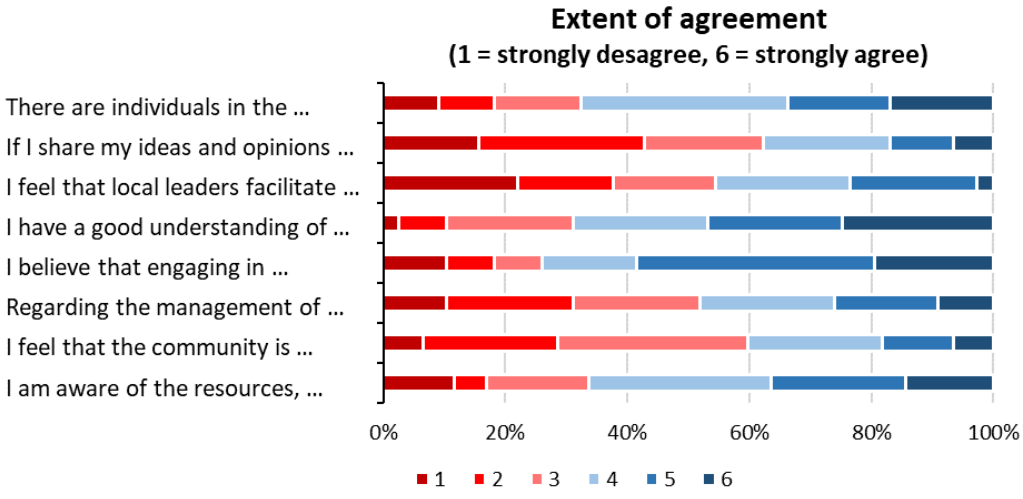

Figure 22 - Question 6: extent of agreement with the statements.

Question 7 sought to ascertain whether the most important issues affecting Monchique are being addressed according to the perception of the participants, to which 62% of respondents answered negatively (Figure 23). Those who responded positively (Figure 24), they were asked to indicate who are the main actors involved in resolving those problems, where the town council was the most cited, being mentioned by 26 people (89%) of the respondents, followed by the parish councils, present in 72% of the responses. The central government and private companies were the least frequently cited.

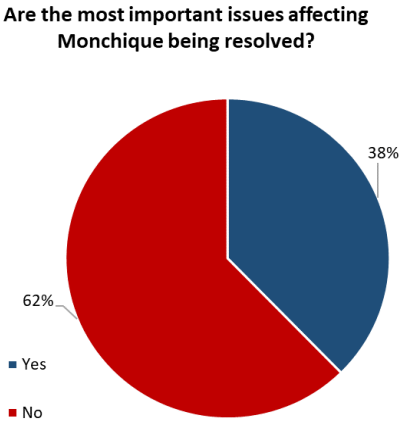

Figure 23 - Participants perception on the resolution of important issues in Monchique.

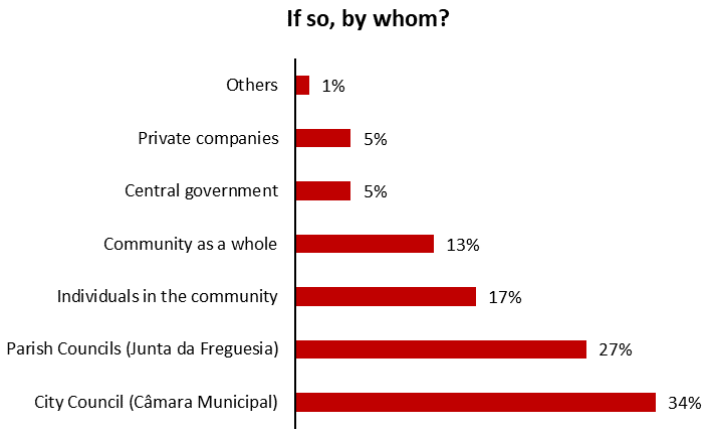

Figure 24 - Responsible for solving Monchique's main problems.

Questions 8, 9 and 10 deal with ongoing learning. When asked if there are opportunities for community members to develop new skills (question 8, Figure 25), the majority (65%) said that there were no programs of this nature available in the territory of Monchique. For the 27% who said there were opportunities, they were asked to cite examples, and the answers were mostly focused on local cooperatives and associations, such as Nossa Terra and Coopachique. Two respondents also mentioned the training courses offered by the institute of job and professional formation Portimão.

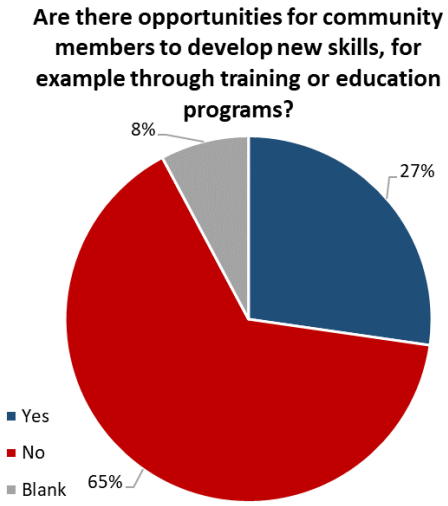

Figure 25 - Respondents' perception about the existence of opportunities to develop skills.

The next question (question 9, Figure 26) was whether the participants knew how to access resources, knowledge and skills when they need to manage forest land, to which 64% of the participants answered yes. In this context, the respondents were also asked (question 10, Figure 27) whether they would be willing to take part in training programs associated with forest land management, to which 71% said yes.

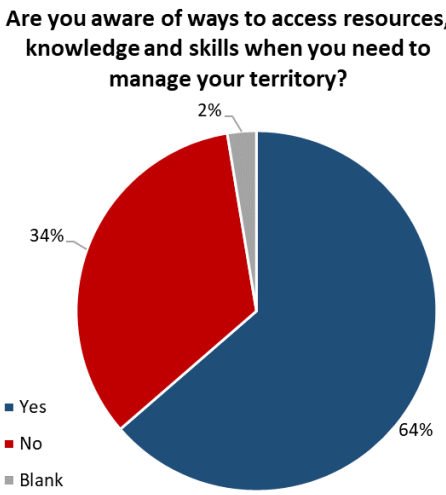

Figure 26 - Respondents' access to resources.

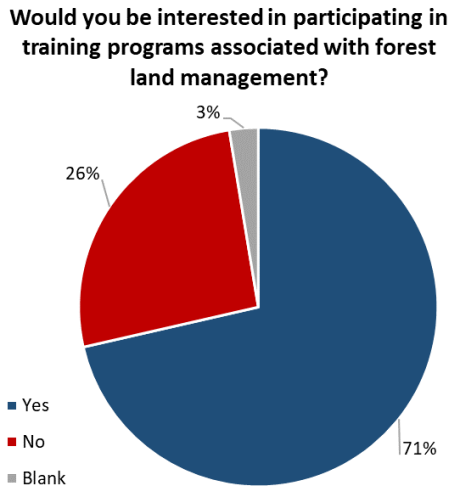

Figure 27 - Respondents' willingness to participate in forest-related training.

Knowledge of management instruments

An effort was made to determine the participants' familiarity with the territorial management instruments that affect the territory of Monchique, which was addressed in question 11. A list of 5 instruments was presented and the participants were given the opportunity to score those ones as well as “other” option. As it can be observed in Figure 28, Monchique's PDM was the instrument most frequently mentioned by respondents (75%). The PROF and the PMDFCI were mentioned in 42% answers each and the PROT and PRGPSMS in 36%. The participants also added the Safe Village Plan and the Management Plan for the Ribeiras do Algarve Hydrographic Region to their answers.

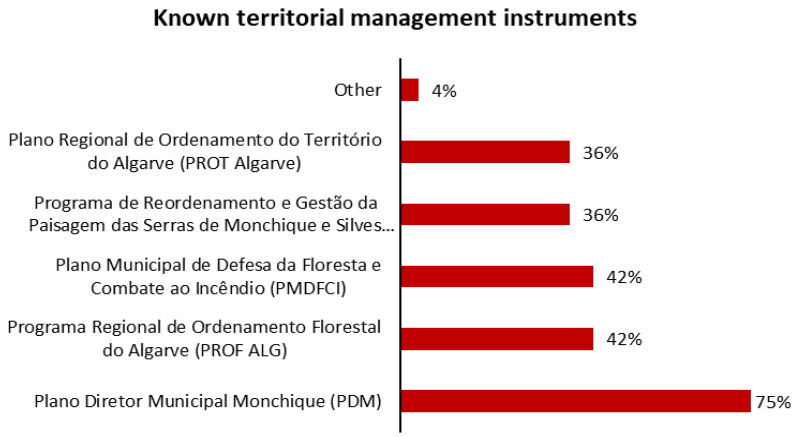

Figure 28 - Territorial management instruments known by the local community.

Question 12 aimed to understand whether the respondents who own forest land in Monchique have the skills to manage their land and what management related practices they carry out on their plot. The results indicated that 51 respondents (66%) claimed to own forest land in the study area whilst 33% answered in a negative way (Figure 29). Among those who own land, 80% stated to feel capable of managing their territory, while the remaining 20% indicated to feel incapable (Figure 30).

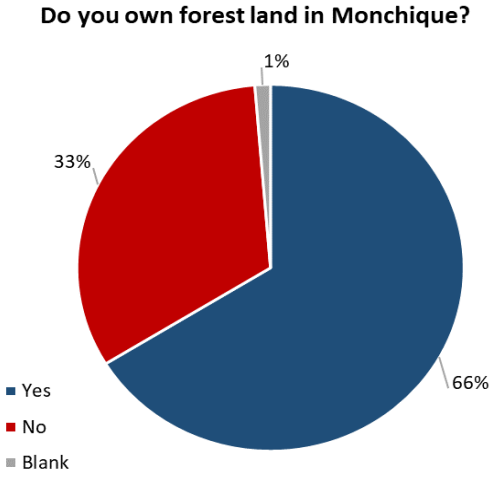

Figure 29 - Forest land ownership.

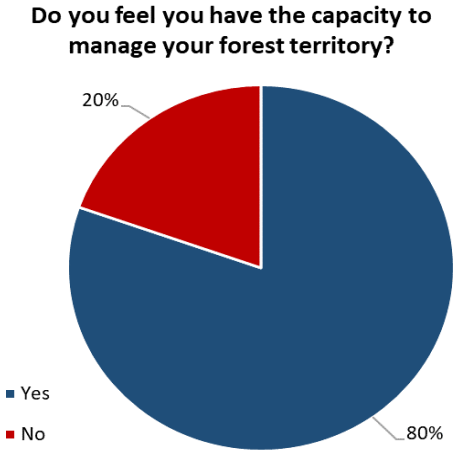

Figure 30 - Capacity for forest management.

When questioned which management-related activities they carry out on the land, the option most reported by the participants was fuel management, pointed out by 56% respondents, followed by protection of buildings, present in 44% responses. Campfires were the least frequent option, present in only 10% responses (Figure 31).

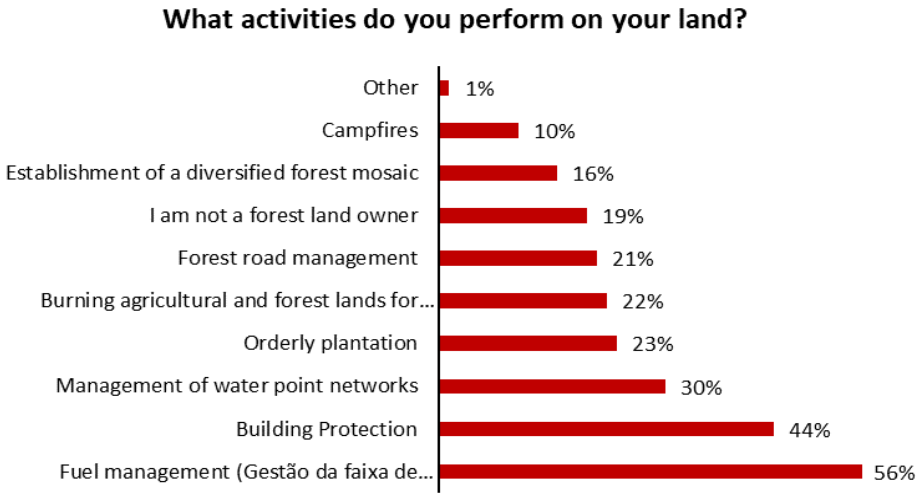

Figure 31 - Management activities performed.

Question 13 aspired to understand, from the respondents' point of view, the main difficulties in managing the forest territory. This question was open-ended, allowing each respondent to give the reasons they considered most relevant. Of the 77 respondents, only 44 gave their perceptions. Among the answers,

there was a greater frequency of those who put forward the lack of human resources, also related to the desertification and to the ageing population, and the lack of financial resources as being the main difficulties. Land abandonment, lack of profitability of the forest territory, restrictive legislation, lack of training and support for landowners, fragmentation of the territory, lack of personal motivation and the presence of monocultures were also cited. There were also disagreements with neighbours, when two respondents mentioned that although they maintain their land, they have neighbours who do not.

In the last question of the questionnaire, the purpose was to understand what the local community considered to be the most important issue in the management of their forest territory (Figure 32). There were a few options for answering this question, but space was also made available for additional inputs. “Financial resources” option was the answer most often given by the participants, present in 53 answers, followed by “people and people's motivations”, which was pointed out by 47 and 38 people respectively. From the other options presented, infrastructure was the least selected. The participants also identified some other important aspects for managing forest land, namely common sense, less bureaucracy, adapting legislation and knowledge to reality and paying for ecosystem services.

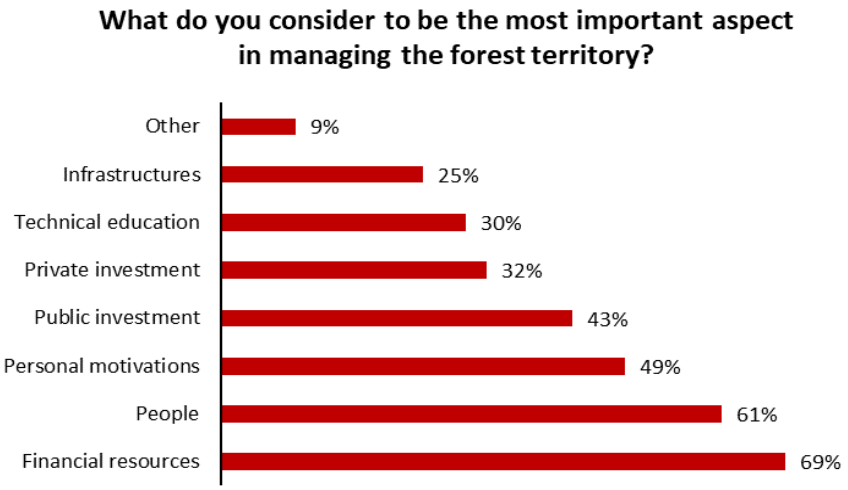

Figure 32 - Important aspects in forest management.

3.3.2 Policy content analysis

The following paragraphs present the results obtained from policy content analysis applied on the case study area. Result analysis is presented in sections, according to the method of analysis applied.

Word cloud

In the context of the Portuguese territorial management system, as established by the Law on the General Basis of Public Policy on Land, Territorial Planning and Urbanism, the programs establish the strategic framework for territorial development and its programmatic guidelines or define the spatial incidence of national policies to be considered at each level of planning. Meanwhile, the plans comply with the guidelines defined in the programs, seeking to establish concrete options and actions in terms of territorial planning and organization. The different roles that plans and programmes hold in the system

can shed light on the presence of certain words within the clouds., given the nature of documents chosen for each scale.

Figures 33, 34 and 35 show the tree word clouds that resulted from the application of this method. The matrices containing the most frequent words and the search groups that resulted from the document analysis can be found in ANNEX V.

For analysis on a national scale, two plans (PNGIFR and PNDFCI) and one program (PNPOT) were analysed. Figure 33 presents the cloud word resulting from the analysis of the national selected instruments. "Nationality" and "Territories" were the most mentioned words in this visualization. Given the strategic nature of the PNPOT it can be argued that the territorial and management nature of the most frequent words can be attributed to this document. Despite the fact that the two plans chosen for the analysis on this scale centre on the theme of fire (and its proximity to the theme of forests), it can be observed that words on this issue only appear on the third degree of occurrence. It is worth noting that there are few words relating to the social sphere, while there are more words relating to the concept of management. Finally, it should be noted that the word risk is among the most mentioned, although it is not prominent in the cloud.

Figure 33 - NVIVO word cloud for the national scale.

The word cloud below (Figure 34) displays the result of applying the method to regional-scale territorial management instruments. For this scale, two programs (PRGPSMS and PROF Algarve) and one plan (PROT Algarve) were selected. The most frequently mentioned words in these documents were "Algarve" and "Forestry", which are compatible words with the themes covered by the instruments under analysis. The strategic and management nature of the documents is also present in the second-level words. In this cloud, it is possible to find some mentions to more biophysical issues, such as "mountains", "nature" and "species". The absence of words related to fire and risk is also observed for this Scale.

Figure 34 - NVIVO word cloud for the regional scale.

In contrast to the other scales already presented, the municipal scale (Figure 35) seems to show a selection of institutional arrangements made up only of plans, following the order of relations between programs and territorial plans established by law (Law on the general bases of public policy on land, territorial planning and urbanism). This is the first cloud composition to feature words of a social nature, such as population, however in a low frequency. For this scale, words such as fires, protection, forest and risk are more prominent, in comparison to the other scales.

Figure 35 - NVIVO word cloud for the local scale.

Frequency count and word tree

As described previously, given the complexity inherent to social-ecological systems and the degree of unpredictability to which the study area is subjected, particularly considering the risk of forest fires, the ACM approach appears to be a suitable perspective to guide this analysis. The literature review suggested that certain agreement exists around common components of ACM, thus for the for the purposes of this research, mainly for the word selection, the analytical framework proposed by Huitema et al. (2009) was selected. The aforementioned author suggested that there are four institutional prescriptions of adaptive co-management, which can be described as: (i) polycentric structure; (ii) public participation; (iii) bioregional approach; and (iv) experimentation (Huitema et al., 2009). The table below (Table 8) lists the keywords which were used to carry out the frequency query and word tree methods. The four prescriptions suggested by (Huitema et al., 2009) were used as the main descriptor, in addition a descriptor for community capacity was added. Three key words were selected for each descriptor, based on the conceptualization presented by the author.

Table 8 - Selected keyword per concept.

Concept	Keywords
Polycentric structure	Multilevel governance, Decentralization, Autonomy
Public participation	Public participation, Involvement, Civil society
Bioregional approach	Landscape management, Valuing the territory, Collaboration
Experimentation	Adaptative management, Pilot project, Reflection
Community capacity	Leadership, Local actors, Local capacity

Polycentric structure

The selected concepts for the analysis on this prescription are: (i) multilevel governance, (ii) decentralization, and (iii) autonomy. Multilevel governance recognizes that different issues must be addressed at different levels, thus being closely linked to the theme of this prescription. The concept of decentralization is at the core of the polycentric structure system, therefore being a chosen concept. Finally, autonomy relates to the ability of the entities and levels, within the polycentric structure, to have a degree of self-governance and independence.

The table below (Table 9) summarizes the frequency of the key concepts that were chosen to assess the polycentric structure of institutional arrangements are used in the instruments analysed. It can be seen that the PNPOT is the only document that mentions the three key concepts selected to address this prescription, while the PROT Algarve mentions two of the three concepts and the PNGIFR, PRGPSMS and PROF Algarve only mention one. In relation to the other instruments, the selected words were not found, highlighting here that on a local scale there was no mention of the words in this descriptor. Of the three words selected, decentralization was the one that found the most recurrence in the documents.

Table 9 - Polycentric structure key words occurrence.

Scale	Institutional arrangements	Key words occurrence		
		Multilevel governance	Decentralization	Autonomy
National	**PNPOT**	9	31	5
	PNGIFR	-	1	-
	PNDFCI	-	-	-
Regional	**PROT Algarve**	-	2	3
	PRGPSMS	-	1	-
	PROF Algarve	-	-	1
Local	**PMEPC Monchique**	-	-	-
	PDM	-	-	-
	PMDFCI	-	-	-

For a better understanding of the context in which the words and concepts being analysed were used, the word tree method was applied. This method creates a visual branching structure to show how the pre-selected word are connected to other words. The graphic images resulting from this process can be found in Annex VI. To make it clearer on how concepts were applied, the table below (Table 10) summarizes the results, pointing out the word and the context in which it appears most frequently, according to the output produced by NVIVO.

Table 10 - Polycentric structure word tree summarization.

Key words	Most frequently linked to
Multilevel governance	"Promote cooperation and **multilevel governance**" (PNPOT)
Decentralization	"Strengthening the **decentralization** of competences" (PNPOT) "...**decentralization** of competences in local authorities" (PNGIFR) "Regional framework for **decentralization** policies" (PROT Algarve) "**Decentralization** of public activity" (PROT Algarve) "governance and **decentralization** framework" (PRGPSMS)
Autonomy	"…neurodegenerative diseases leading to loss of **autonomy**" (PNPOT) ".. new activities with **autonomy** from touristic demand" (PROT Algarve) "Member states will have more **autonomy** in the use of resources" (PROF Algarve)

Regarding multilevel governance, which is featured only in the PNPOT, it was found that its most frequent link refers to the promotion of the concept. Decentralization, the word with the most returns in this descriptor, is mostly associated with the decentralization of public powers. In the PNPOT, the

concept of autonomy is more closely related to individual autonomy, while in the PROT, it is mostly related to tourism demand, with a link to "contractual public autonomy", and in the PROF, the concept of autonomy refers to autonomy in the use of resources from the European Union.

Public participation

The following keywords were chosen for content analysis: (i) public participation, (ii) involvement and (iii) civil society. Public participation was selected over public consultation, a term that is also frequently used, because the concept of participation presupposes the establishment of links between governmental and non-governmental stakeholders, following the by Huitema et al. (2009). Involvement, in this context, represents the active participation of stakeholders, which is an important pillar for the notion of public participation. Civil society was chosen primarily to see how this specific stakeholder is addressed in the documents being analysed.

In the field of public participation, the word frequency analysis (Table 11) showed that of the chosen concepts, involvement was the most present in the documents analysed. The concept was present in all the national selected documents, and in two of the regional (PROT Algarve and PRGPSMS). Involvement had its most striking presence in PNPOT. Public participation is present in 3 of the instruments analysed, mostly on a regional scale. Involvement was the most frequently mentioned concept in this descriptor, in terms of number of document appearances and presence in several of the items analysed. Finally, civil society, despite being present in only one of the documents (PNPOT), was the second most repeated word. It should be noted that of the concepts selected for this descriptor, only "involvement" is present on the local scale, being mentioned once in PDM.

Table 11 - Public participation key words occurrence.

Scale	Institutional arrangements	Key words occurrence		
		Public participation	Involvement	Civil society
National	PNPOT	1	31	18
	PNGIFR	-	13	-
	PNDFCI	-	8	-
Regional	PROT Algarve	3	2	-
	PRGPSMS	8	6	-
	PROF Algarve	-	-	-
Local	PMEPC Monchique	-	-	-
	PDM	-	1	-
	PMDFCI	-	-	-

The table (Table 12) below summarizes the information extracted from the word trees (ANNEX VI). Public participation was most commonly related to "access to information" and "forms"/"processes" of participation. The concept of involvement was associated, with the exception of the PDM, with local actors, different actors and sectors of the administration, where it is understood that all the instruments on a national scale and two of the three on a regional scale (PROT Algarve and PRGPSMS), chosen for this analysis, appear to promote and encourage the greater involvement of different actors. Among the documents analysed, the concept of civil society appears exclusively in the PNPOT, where it is mostly linked to concepts related to decision-making processes.

Table 12 - Public participation word tree summarization.

Key words	Most frequently linked to
Public participation	"Access to information and **public participation**" (PNPOT) "…forms of **public participation** at both regional and local level" (PROT Algarve) "**Public participation** processes" (PRGPSMS)
Involvement	"…greater citizen **involvement**" (PNPOT) "...the **involvement** of local actors and owners" (PNGIFR) "...to ensure the **involvement** of the various stakeholders" (PNDFCI) "Coordination and the **involvement** of various sectors of the administration" (PROT Algarve) "…encouraging citizen **involvement** and participation" (PROT Algarve) "…active **involvement** of stakeholders" (PRGPSMS) "**Involvement** by plant protection" (PDM)
Civil society	"Involvement of organizations and **civil society** in decision-making processes" (PNPOT)

Bioregional approach

In order to analyse this prescription, the following concepts were selected: (i) landscape management, (ii) valuing the territory, and (iii) co-management. The concepts were chosen after a preliminary analysis which indicated the absence of the term bioregional in the documents analysed. Landscape management was selected due to its relation to coordinated planning that focuses on issues within a specific geographical area, as proposed by the bioregional approach. Valuing the territory emphasizes the recognition of the unique characteristics of a given area, thus constituting an important aspect of the bioregional approach. Finally, co-management was chosen because it is a complementary concept to the prescription and could enhance the effectiveness of the approach.

The concepts selected for analysis in this descriptor only appear in the PNPOT and PRGPSMS, being absent from the other documents analysed (Table 13). Co-management was the least frequent concept in this descriptor, appearing only once in the national instrument and 3 times in the regional one. Valuing the territory was most frequently presented in the PNPOT and Landscape management in the

PRGPSMS. It can be inferred here, from the frequency with which the word appears, that the concept of Landscape management is addressed in greater depth in the PRGPSMS.

Table 13 - Bioregional approach key words occurrence.

Scale	Institutional arrangements	Key words occurrence		
		Landscape management	Valuing the Territory	Co-management
National	PNPOT	2	16	1
	PNGIFR	-	-	-
	PNDFCI	-	-	-
Regional	PROT Algarve	-	-	-
	PRGPSMS	38	4	3
	PROF Algarve	-	-	-
Local	PMEPC Monchique	-	-	-
	PDM	-	-	-
	PMDFCI	-	-	-

The table below (Table 14) displays the most frequent links presented by the word tree method. The concept of landscape management was found in the PNPOT in the sections dealing with monitoring. The first citation of this term is related to safeguarding and management measures, which is placed in the context of monitoring indicators for what is called the Natural Domain in the document. The second citation is related to the expected effects indicator towards the territorial governance domain, related to the potential for good practices. Both citations are included in the document in the monitoring section.

Meanwhile, the concept of landscape management is mentioned frequently in the PRGPGSMS, especially associated with the word "unit", as this is the terminology used for the management model adopted by this instrument, where landscape management units are established, based on the dynamic relationship between the biophysical system and the human system, rather than administrative boundaries.

Valuing the territory is associated, in both instruments in which it appears, with landscape. In the PRGPSMS, the concept is included in the methodological approach, while in the PNPOT the concept is often represented in the areas of intervention, representing the operationalization of the commitments for the national territory.

Finally, the concept of co-management appears in the PNPOT in the context of the 10 commitments defined for the territory, namely in commitment 7 "Encourage collaborative processes to strengthen a new culture for the territory" and in the PRGPSMS as part of the methodological approach, where it is linked to the provision of ecosystem services.

Table 14 - Bioregional approach word tree summarization.

Key words	Most frequently linked to
Landscape management	"…**landscape management**, safeguarding and management measures" (PNPOT) "**Landscape management** units" (PRGPSMS)
Valuing the Territory	***"*Valuing the territory** through the landscape" (PNPOT) and (PRGPSMS)
Co-management	"…**co-management** of protected areas" (PNPOT) "Providing ecosystem services through landscape **co-management**" (PRGPSMS)

Experimentation

Considering the conceptualization presented in the literature review, the following keywords were selected for content analysis: (i) adaptive management, (ii) pilot projects and (iii) reflection. Adaptive management was chosen because of its close connection to complex systems and because at its core it consists of flexible decision-making based on monitoring and evaluation of results. The notion of pilot project was chosen because it is linked to the concept of experimentation, where a concept or idea is tested on a small scale before being implemented on a large scale. Reflexive/reflection terminology was considered due to their relationship to the capacity to critically reflect on issues, actions and results. This constitutes an ongoing process of reflection and adaptation, fundamental to ACM.

Monitoring was one of the words initially chosen for the analysis of the experimentation descriptor, guided by the conceptualization presented by Huitema et al. (2009). However, a preliminary search for the concept showed that all the instruments selected for analysis dealt with this topic. In view of this, it was decided to attempt to verify whether the information acquired in monitoring processes is incorporated into plans and decision-making processes, thus highlighting the adaptive nature of management. To this end, the option was to search for the concept of "reflection", as previously mentioned.

Table 15 shows that pilot project was the concept found in the smallest number of instruments, being present only in the PRGPSMS, but more frequently than the other concepts in the descriptor. Adaptive management was briefly mentioned by PNPOT and PRGPSMS. The concepts in this descriptor appear more frequently at the regional scale and are absent at the local scale.

Table 15 - Experimentation key words occurrence.

Scale	Institutional arrangements	Key words occurrence		
		Adaptative management	Pilot projects	Reflection
National	PNPOT	1	-	6
	PNGIFR	-	-	1
	PNDFCI	-	-	-
Regional	PROT Algarve	-	-	-
	PRGPSMS	1	12	1
	PROF Algarve	-	-	1
Local	PMEPC Monchique	-	-	-
	PDM	-	-	-
	PMDFCI	-	-	-

Adaptive management was mentioned once in the PNPOT in the context of commitment for the territory no. 8, called "Integrating new approaches to sustainability into the territorial management instruments", specifically mentioning the adoption of adaptive management principles (Table 16). In the PRGPSMS, this term is mentioned in the context of the management structure proposed by the document, where it is mentioned that the operational manager is responsible for "proposing adjustments to the implementation of the Plan that allow it to adapt to changes in the socio-economic and environmental context, in a logic of adaptive management" (PRGPSMS, pg. 230). Pilot projects are only mentioned in the PRGPSMS, where they are most often related to the introduction of the pilot fuel management project using pasture ("cabras sapadoras"). As for the concept of reflection, it was found that its presence in the document is mostly used in a generic context, not directly inferring to the reflection on results and adaptation. In the documents, with the exception of the PNGIFR, which deals with reflection with stakeholders, the use of the word reflection occurs in a context unrelated to the one initially proposed.

Table 16 - Experimentation word tree summarization.

Key words	Most frequently linked to
Adaptative management	"…adopting the principles of **adaptive management**" (PNPOT) "…in an **adaptive management** logic" (PRGPSMS)
Pilot project	"Introduce fuel management **pilot project**" (PRGPSMS)
Reflection	"…**reflecting** on the planning system" (PNPOT) "…working and **reflection** sessions with stakeholders" (PNGIFR) "…important **reflection** on water lines management" (PRGPSMS) "…anticipate the **reflection** on the national forest strategy" (PROF Algarve)

Community capacity

The descriptor of capacity goes beyond the prescriptions for institutional arrangements proposed by Huitema et al. (2009). Nevertheless, it was included in the content analysis to help understand how and if the notion of capacity is presented in the instruments chosen, in order to meet one of the specific objectives of the investigation. The following keywords were selected for content analysis: (i) leadership, (ii) local actors and (iii) local capacity.

Initially, the hypothesis was to look for the concept of "capacity", but a preliminary analysis showed that this concept was widely mentioned in the documents, being present in all of them, but not used in the sense adopted in this research. It was therefore decided to look for the concept of local capacity. This concept was present on a national scale (PNPOT) and on a local scale (PMPEC Monchique), however it was not mentioned on a regional scale (Table 17). Additionally, leadership is one of the domains of capacity addressed by Bopp et al. (2000). The concept was found in all instruments selected for the national scale, and one instrument for the regional scale, and was absent from the local scale. The concept of local actors was present in the PNPOT and PRGPSMS.

Table 17 - Capacity key words occurrence.

Scale	Institutional arrangements	Key words occurrence		
		Leadership	Local actors	Local capacity
National	**PNPOT**	6	1	2
	PNGIFR	1	-	-
	PNDFCI	2	-	-
Regional	**PROT Algarve**	-	-	-
	PRGPSMS	5	9	-
	PROF Algarve	-	-	-
Local	**PMEPC Monchique**	-	-	1
	PDM	-	-	-
	PMDFCI	-	-	-

The table below (Table 18) shows the main links between these three concepts researched within the documents. The concept of leadership is mentioned in the PNOT in the so-called economic domain, in the context of identifying and strengthening organizations with a leadership role in rural development and boosting local and regional potential. In the PNGIFR, the concept is mentioned when the document addresses weaknesses identified in the field of governance. In turn, leadership is mentioned briefly in

the PNDFCI as a basic attribute for the document, while in the PRGPSMS it was mentioned in the strategic diagnosis as a key issue for change.

The concept of local actors in the PNPOT is mentioned in the section dealing with territorial governance, associated with the articulation between local actors and other agents in the territory, in order to strengthen rural-urban articulations. In the context of the PRGPSMS, the concept is mentioned in various parts of the document, most prominently in the sections discussing public participation.

Finally, the concept of local capacity appears in the PNPOT in the section entitled "territorial governance domain" in the context of boosting inter-urban links and territorial subsystems and in the PMEPC the concept appears to be mentioned in the section dealing with medical services and the transportation of victims.

Table 18 - Capacity word tree summarization.

Key words	Most frequently linked to
Leadership	"Increased **leadership** and stakeholder involvement" (PNPOT) "…weaknesses in the **leadership** of the national forestry authority" (PNGIFR) "…knowledge, competence, motivation and **leadership** of the territory's infrastructure" (PNDFCI) "…culture of participation and **leadership** for the landscape" (PRGPSMS)
Local actors	"…in close coordination with **local actors** and other players in the area" (PNPOT) "…the **local actors**, the owners/managers of the territory" (PRGPSMS)
Local capacity	"…that strengthen **local capacities**, interurban connections…" (PNPOT) "In general, **local capacities** are limited." (PMEPC Monchique)

4. Discussion

In order to reflect on different approaches towards the current regulatory structure to enable a community forest management (research objective IV) it is fundamental to become acquainted with what might be an appropriate strategy for this type of territory. Research focusing on approaches that may help navigate through the dynamics of social-ecological systems are a growing, apparently becoming an area of study that typically emphasize collaboration, learning, and building adaptive capacity as core concepts (Plummer et al., 2013). Adaptive co-management presents itself as a management model capable of operating within the complexity inherent to those systems (Carlsson & Berkes, 2005). As already explored in the previous chapters, capacity and institutional arrangements are key pillars to establish vertical and horizontal collaborations (Shah et al., 2020).

Based on the work developed and described in previous chapters, this section will discuss and elaborate on the two-stream approach adopted in this research: (i) the attempt to better understand the capacities of Monchique community by examining the local capacity domains that perform well and those that need to be developed; and (ii) the review and analysis of the institutional arrangements that can serve as catalysts for a shift towards more collaborative and adaptive management of the case study forest territory.

Findings show that the engagement of female population of Monchique in participatory moments related to forest management activities seems to be lower than expected when considering the male and female proportion of Monchique's resident population. However, there is a lack of information on why this seems to be happening, not being able to infer more deeply on that subject.

The high percentage of questionnaire respondents that own their land property may indicate, in some way, a greater willingness of landowners to engage in activities more related to land management, for example, when compared to residents that do not own a land in that territory. Most of the questionnaire respondents are from the urban parish (Monchique), which could suggest that these people would not have a strong connection with the forest territory and therefore could compromise the analysis developed in this research. However, when looking into the proportion of Monchique's territory that is artificialized versus the one that has forest use, it does not seem to constitute an issue of concern, once there is (only) approximately 1% of the municipality that is artificialized (corresponding to the urban centre). Moreover, findings seem to allow to infer that, even though these people live in the urban centre, the inhabitants have strong contact with the forest territory, given the context and surroundings in which they are inserted.

Additionally, it is important to highlight that the presence of the foreign community in the sample is higher (where they represent 21% of the total respondents) compared to the total population, where foreigners comprise 13.13% of the population in 2021. Although the data is not substantial enough to support the hypothesis that foreigners are more willing to engage in participation activities, it can be argued that the foreign community in the study area is willing to engage in this type of activity. Thus, this could be an opportunity to create more diverse networks that link several types of actors that can contribute with

different perspectives on forest fire risk reduction and land management towards a more sustainable territory.

A common vision is fundamental for setting goals and action plans towards community development, as well as it can be a way of integrating different groups of agents, such as for example a foreign population. In the case of Monchique's community shared vision, the domain was addressed in questionnaire through three statements (which were rated using the Likert scale). This domain average total score of 3.0 shows, according to the ASDC (2007) classification adopted in this research, that it needs further information to stablish a more accurate state of play so that the appropriate measures can be taken to improve or stablish this aspect.

However, when disaggregating these results by the respondents nationality (nationals and foreigners), it is possible to observe that nationals have an average of 3.16 and foreigners 2.49, which means that for the group of foreigners there is an apparent lack of capacity to establish a common vision. This difference seems to be the result of a contrasting perception (between these two groups) about the existence of a shared sense of commitment and responsibility to improve forest land management", where the average for foreigners was 1.5 and for nationals 3.27. In this sense, it can be argued that for this sample universe, the main point of imbalance towards the existence of a common vision is the notion of commitment and responsibility. This weakness can be attributed to the apparent lack of dialog and of a "common language" between these two groups, an effort to create spaces for dialog is crucial so that a consistent idea of what their forest territory should look like and how it should be managed can be discussed. Exercises such as the visioning building developed by BRIDGE project InnoLab can serve as a good tool for building consensus.

Like the shared vision, the sense of community was assessed using three statements (average score of 3.54. The statement "There is a sense of community and unity in Monchique" was the one that performed best, with an average of 4.02, demonstrating a satisfactory level opinion cohesion with regard this topic. Unlike the previous domain, in this case, it was not observed a significative variation in the perception between the national and the foreign groups. In general, the sense of community appears to be present in the study area, which is something that have also been witnessed during the BRIDGE participatory sessions. It is important to emphasize that although there are disagreements about the common vision for the future of the Serra of Monchique, it can be said that the local sense of community is an element of capacity that can be harnessed to build closer ties between members of the different community groups.

An efficient communication strategy is key a component of capacity, especially in terms of community, given it comprises the exchange of information, knowledge and attitudes between local actors. According to most of the questionnaire participants, there are no channels of communication to identify and discuss local problems. Some respondents, however, did identify local government bodies (such as parish council and town hall) as official channels to this end. Thus, it can be argued that the main channels pointed out are external to the community, mainly constituting what seems to be the establishment of vertical communication with the local government.

As to the means of communication within the community itself, they were barely mentioned, with only 4 out of 77 respondents identifying the social media as a way to communicate, which can be seen as a more horizontal communication tool between the community members. Despite the lack of expression in the question about the existence of communication channels, the social media have been pointed out as the main source of information about community events, followed by the other residents (word of mouth) option. It can be said here that social media are more used for disseminating information and community events, but not so much as a place where community members get together to discuss problems/ideas. The fact that social media has been identified as the main channel of communication can be paralleled with the way in which the questionnaires were publicized, where a greater number of responses were obtained in the days following the posts on these communication forms. The fact that the exchange of information between residents is so prevalent as a communication channel for events dissemination reinforces the sense of community present in the study area. For this domain to perform better, it could be suggested that within the community's internal communication, groups should be set up to discuss specific topics, creating spaces for dialogue. In turn, the community's communication with local institutional bodies could be strengthened through the use of social media so that key messages can be efficiently delivered to targeted key people. Given the strong presence of foreigners, it could be also suggested that an effort should be made to communicate in a common language (English), in order to reach a wider audience.

The low participation of individuals in local community activities is a significant challenge that can be attributed to a number of factors. In the case of the questionnaire respondents, incompatibility of schedules with activities was identified as the main limitation for people’s absence from community activities. Aware of this, which is also a common challenge for participation in other communities, the BRIDGE Project used different strategies as an attempt to hold the participatory sessions at different times and places in order to engage the widest audience possible. It turned out, for example, that after-work hours were the most popular with local residents. However, the project's experience has also showed that two other factors are also important when it comes to community participation: the location of the event and the consistency of the meetings, especially in cases where there is a common and continuous construction of an idea or dialog. The importance of the venue is due to the possible incompatibilities or discomfort that may exist with some community members, so it is essential to choose a place considered safe where people can feel comfortable and motivated to attend. Consistency, on the other hand, is particularly related to the creation of closer ties and communication channels with the community, which can improve the chances of community-based activities to continue.

The second item most pointed out by the local community as a limitation to participate in community activities was the apparent lack of motivation. This was also an issue addressed during the BRIDGE participatory sessions, during which it was found that this can be attributed to (i) a lack of trust with the government and public bodies and (ii) a lack of hope that their opinion will be heard and take into consideration at in the decision-making process. The lack of clear communication affects the creation of intra-community ties, as well as the community's ties with other actors, which in turn also has an impact on community participation levels. It was, therefore, found that communication seems to be an

aspect of the community that is in need of improvement, requiring efforts from both civil society and public authorities. Improved communication can create a positive impact on public participation. Moreover, effective community participation forms the basis of collaborative management processes and is therefore of fundamental development.

Leadership is also a pivotal element for the community to feel represented. The analysis of this aspect in the questionnaire used a Likert Scale. It was found that there is consistency between the groups of foreigners and nationals, namely about recognising the existence of individuals who are known as leaders in the community (average score of approximately 3.96). Participants also agreed to a certain degree that local leaders facilitate consensus building and collaboration among the community (average score of 3.2). Of the three questions proposed for the analysis of this domain, the statement with the lowest mean was the one regarding whether if people shared their ideas and opinions with local leaders they felt heard and represented. The experience with the BRIDGE participatory sessions has allowed to confirm the existence of individuals in the community who excel in this leadership role, but there is a need to strengthen community ties with the leadership so that the community can feel heard and better represented by these people.

In the resources, knowledge and skills domain, the analysis seems to indicate that Monchique's community have a good understanding of their strengths, existing consistency (average of 4.27) between the different group of actors. Findings also seem to show that there is a common awareness between the questionnaire respondents about the resources available in the community.

In order to gauge the willingness of local actors to engage in co-management approaches, a number of statements were included in the questionnaire to better understand this issue. The results seem to point out to the existence of, at least in the sample universe, a certain willingness of that community for acting together, through for example the creation of partnerships between neighbours, towards the management of their forest territory. As highlighted in the literature reviewed, processes related to complex social-ecological systems require the development of adaptive strategies. In this sense, ongoing learning is a key issue to consider when dealing with this type of complex systems. Regarding that, it appears to exist a common agreement that the Monchique's community has learned from the successes and challenges they faced in the past about forest territory management (average score of 3.4). In addition, findings seem to show an agreement on the community openness to new ways and ideas on how to manage that territory (average score of 3.29). Thus, it can be argued that the community of Monchique appears to have the needed willingness to collaboratively deal with disturbances they may face however their adaptability capacity could be improved.

The analysed community, for the most part, seems to point to the inexistence of programs to develop new skills and capabilities. However, it is important to highlight that the community members that considered that Monchique's offers them such opportunities pointed out the providers as the local cooperatives and associations. Still, this apparent lack of skills and capabilities programs contrast with the community awareness about the resources available for their use. Such dichotomy could lead to a discussion about whether there are in fact no opportunities for capacity building or whether there is a

lack of communication about the existence of such opportunities. While improving communication could help in this regard, in terms of capacitation the results seem to show that the participants would be willing to take part in training programs related to forest land management if accessible to them.

There has been a lot of discussion in the literature about lowering the scale of management and strengthening a more local perspective. When the questionnaire sought to find out whether the local community thought that Monchique's main issues were being resolved, the majority believed that they were not. However, for the 38% who believe that the problems are being solved, local government, namely the parish councils and the town hall, were the most cited actors. The information gathered seem point to two different interpretations: (i) the community may a tendency to outsource responsibility to others (in that case to local government) for resolving local issues, placing the community as a passive agent in this situation, which may converge with the low local participation observed; or (ii) the presence of a strengthened relationship with the local government, which in this case can be a driving agent for change. Either way, the management of this territory can be improved by strengthening and consolidating the community ties, not only among the members to create a greater sense of confidence that they are able to solve some of local problems, but between the community and the local government, so that a greater percentage of people can feel that the issues that are important to Monchique are being addressed. This may also require an effort to ensure that the community does not look to exogenous entities to provide answers to its current problems, but instead find the potential to solve them using their endogenous resources.

The majority of owners of forest land in the study area seem to believe being capable to manage their own territory, but it is worth noting that the literature showed that individuals can sometimes overestimate their capabilities in relation to risk. The reflection proposed here, and which could have been addressed in the questionnaire, is the understanding of capacity on the part of this community, since the perception adopted here may be different from that of the respondents; this constitutes a topic that may be addressed in future research. The discussion proposed here focuses on the fact that if the land were properly managed, the risks of forest fires would be reduced. Of the activities associated with the land, it was found that the fuel management is the activity most frequently carried out by the respondents. It is worth noting that although this is a mandatory activity, it was not taken up by all the owners of forest land. This shows that, on the one hand the community feels able to manage its territory, but, on the other hand there are activities required by law that are not carried out. In this sense, it could be suggested that initiatives being taken to adjust not only the community's perceptions of capacity, but also their perceptions towards risk related issues. Findings show that in terms of the main difficulties faced in managing that forest territory, the community identifies questions related to the lack of human and financial resources. This discussion of the main problems in managing the forest was also conducted during the BRIDGE sessions, and similar results were obtained.

According to the procedure used in the analysis, the discussion of the content analysis begins with the first prescription, the polycentric structure. It is to be expected that concepts related to the polycentric structure will be more strongly present in larger-scale instruments, given that the decentralization process starts with them. For this descriptor, the absence of key words on the local scale was observed.

In this context, it was also observed that the concept of decentralization was more present on a national scale, and more expressively in the PNPOT, which was also the only instrument to mention the concept of multi-level governance. The concept of autonomy, which is also fundamental to polycentrism, was present in some instruments, but in a context unrelated to the capacity of different levels of government or jurisdictions to make independent and autonomous decisions within their areas of responsibility. It is discussed here that the instruments chosen for this analysis, despite citing fundamental elements for polycentrism, need to improve its application and operationalize the concept, so that it is reflected at other scales. In addition, the concept of autonomy, understood here as the capacity of each level of government to act autonomously and implement policies according to local needs, could be better more present. Polycentric governance is the key to more collaborative management methods, as it allows for these different arrangements.

With regard to public participation in the context of institutional arrangements, it was observed that of the key words selected, involvement, was the most present in the documents. Therefore, when analysing the context in which the words were used, it is possible to see that this is mostly linked to the involvement of different actors, which is something compatible with the collaborative management methods. However, it should be noted that the concept of involvement was mentioned several times on the national scale while its presence was reduced as moving to the analysis of lower scales instruments, having only been mentioned once on the local scale. Furthermore, an attempt was made to understand how the concept of public participation itself is presented in the instruments, where it was observed that it is mentioned only once on the national scale by the PNPOT, and is more present on the regional scale.

Civil society was another key concept within the scope of public participation researched and was only mentioned by the PNPOT in a perspective that related in most of the mentions to the involvement of this public. The key words chosen to analyse this pillar of the arrangement were observed to be very few at the local level. The concept of involvement already appears well worked out at national and regional level, but it was noted here that the PROF Algarve, which is a strategic document for the region's forests, has no mention of any of the chosen keywords, showing a limitation of this instrument. The difference in the frequency in which the concepts of public involvement and participation appear may indicate a gap between the discourse and the actual operationalization of public participation, where it can be observed that there is an intention for these consultations, but little presence in the other instruments, especially those on a local scale. The ambition therefore of a collaborative forest management process, specifically in this pillar of public participation, needs to be reinforced in the institutional arrangements.

The bioregional perspective, as one of the pillars of institutional arrangements for ACM, is based on the notion of fit between institutions and social-ecological systems. In the case of the documents chosen for analysis, only the PNPOT and the PRGPSMS had words related to this descriptor. The fact that the PNPOT and PRGPSMS have a strong connection as instruments helps to understand the link in some of the themes. Landscape management is dealt with in greater depth by the PRGPSMS, since the concept permeates the management model proposed by the instrument. The valorisation of the territory is presented more on a national scale. Co-management, which is essential to the theme addressed in

this research, is mentioned briefly, being this absence of incorporation of related concepts into the instruments' development identified as a barrier to the ACM. This approach can present certain implementation challenges, such as defining boundaries, designing decision-making arrangements, funding and issues of tasks and responsibility sharing. It could be argued that given the difficulties imposed on the operationalization of this type of approach, this could justify the absence of such concepts in the institutional arrangements analysed. However, despite the existence of such barriers, it was observed in this research that it is important to not limit management processes to administrative boundaries, especially when there is a biophysical element as striking as the Serra of Monchique.

It was observed through the analysis of the scope of experimentation that, as with other descriptors, there was an absence of key words on the local scale. This highlights the role of the PRGPSMS as an instrument that promotes a more experimental and adaptive perspective. The absence of key words does not imply that the subjects are absent from the instruments, so a more in-depth analysis would be necessary for a better understanding, since the subject can be approached without necessarily using certain words.

Lastly, capacity is once again addressed, this time in terms of its representativeness in the context of institutional arrangements. As observed in the other prescriptions, there is a lack of tools and subsidies at local level to enable the application of more collaborative management methods. As supported by the literature review and the discussion developed here, the concept of capacity is complex and encompasses a number of factors, which in this research are approached using the conceptualization of domains. This complexity means that the content analysis is limited in terms of gauging whether the concept is covered in the instruments, but the results do allow for the following observations.

Leadership was presented by the local community during a participation session as part of the BRIDGE project as an aspect of capacity that needs to be improved in Monchique. It could be argued here that the absence of the concept of leadership, as far as local leadership is concerned, in the instruments could be presented as a lack of recognition of these actors. The absence of recognition for leaders can result in a perception of a lack of representation and generate a certain amount of distancing on the part of the community, especially on a more local scale. The same can be said of the way local actors are presented in the instruments, where we observe a lack of protagonism on the part of this group. The asymmetry of power and importance given to the actors can make it difficult to create bonds of trust, especially in the relationship between the population and the government; bonds which are fundamental for collaborative management. The insufficient recognition of local capacity may also be part of the reason for the ineffectiveness of some instruments, especially with regard to the management of forest territory.

Both the analysis and the discussion made in this work, allowed to observe the close links between the concepts discussed, highlighting the interdependence between some of them. In the case of Monchique, the communication domain is observed to be central to improving local capacities for action, not only in terms of horizontal communication between community members, but also vertical communication between the community and government representatives. What leads to this assumption of centrality is

the fact that this domain is closely related to the development or consolidation of other domains. A better communication strategy can create and strengthen bonds of trust between the government and the community, which can, for example, improve the field of participation. The sense of community is already present in the case study, but more open communication channels that create space for dialogue can help to reinforce this, as well as helping to build a common vision. Communication can also be seen as an important part of the transmission of knowledge, the allocation of resources and adaptive issues. In addition, communication can also be referred to in the broader sense of how Monchique "communicates" with the rest of the nation, how it "sells" itself to the outside world, which can also have an impact on the territory's attractiveness for investment and human capital. It is therefore suggested that in order to improve local capacities, it is necessary to improve not only communication channels but also the type of dialog that is established with the community.

For most of the descriptors analysed in the content analysis of the policies, it is observed that the local scales are the most lacking in a structure that is compatible with more collaborative forms of management, although it is noted that this intention exists in the documents of higher scales, which may indicate a difficulty for local plans in operationalizing this demand. What stands out here is the lack of replication of the concepts to a more local scale, which can be understood as a lack of articulation between the scales or even a lack of synergy between the programs and plans, where part of the territorial strategy that would be important for the implementation and operationalization of the ideas can be lost.

The main point of connection between the two analyses and discussions conducted here is the operationalisation of spatial planning and the realisation of territorial ambitions. It could be argued that the main gap between the local scale and the other scales can be attributed to the recognition by institutions at this level of their resource limitations (financial, human and operational). From this point of view, it could also be argued that a deeper understanding of local capacities could help to reduce the existing limitations at this scale, by utilising the social capital that exists in the community. It is not expected that the community and its inherent capacities will be the solution to all the problems of operationalising land management instruments, but that this recognition of human capital can reduce these gaps.

5. Final remarks and conclusions

In recent years, collaborative efforts and adaptive approaches have become increasingly popular within the management of ecosystems, especially among those who are prone to high levels of uncertainty and complexity, such as the one that constitutes this dissertation case study. Thus, the present research aimed to analyse the articulation between the regulatory tools for forest management and the local community capacities, seeking to understand if the institutional arrangements provide an enabling environment for collaborative approaches in forest management. For this purpose, a literature review was conducted on four key concepts (disaster risk reduction and management, community-based disaster risk management, adaptive co-management and capacity), which allowed the understanding that ecosystems such as forest are dynamic entities that require flexible approaches. Adaptive co-management (ACM) falls under this heading, presenting itself as a flexible community-based approach that combines adaptive management and co-management, emphasizing power sharing, learning, and collaboration.

The literature review presents that ACM is often studied at regional and local scales, with a common focus on forestry. Consequently, a reduction in the risk of forest fires steams from this management improvement is expected, depending in collaboration among multiple actors as anis essential factor for effective landscape-level fuel management. However, but ACM relies on the willingness and capacity of local communities to act collaboratively, building on social capital as a critical prerequisite for collective action. In situations where non-industrial private forest owners are predominant, individual and uncoordinated management efforts may prove inadequate for achieving successful forest management, as pointed out by Martins et al. (2022).

The municipality of Monchique, the study area defined for this research, fits into this context, where a large percentage of the territory is forested and there is a strong presence of non-industrial private landowners, which, combined with the low population density and great fragmentation of property ownership, hinders the management of this territory. In addition to the existing difficulties, the biophysical component often limits effective land management, which makes the region prone to events such as forest fires. These characteristics make Monchique a fertile ground for practicing more collaborative management methods, aimed at building social-ecological resilience and fostering adaptive capacity, which is critical to embrace change and the uncertainty brought on by natural disasters. In this sense, ACM appears to be a dynamic process that can support ecosystem management more broadly and help social-ecological systems become more resilient.

Thus, this research aimed to verify if the existing regulatory tools recognize the capacities of local communities to manage its territory, while also trying to perceive if those instruments enable collaborative management approaches. The integration of the diverse stakeholders up- and downstream is extremely important for the success of ACM. For that reason, not only are the local capacities to act fundamental to its implementation, but so is the institutional arrangements that allow this to happen. For that reason, the two-stream approach was adopted in the context of this research; on one hand the questionnaire was applied as an attempt to better understand the capacities of Monchique community

and on the other, the review of the institutional arrangements to perceive if they could serve as catalysts for a shift towards more collaborative and adaptive management of the forest territory.

Adapting the regulatory tools to the capacities of local communities can enable community to recognize the vulnerabilities and create capacities to manage events of risks, ensuring that these new arrangements are sufficiently adaptive to anticipate and respond to uncertain future wildfire risks requires critical assessment and reflection. This reflection formed the basis for this research.

The case study of Monchique brings to light two main points of discussion along with questions for future research. A first interesting observation can be made about the recognition of community capacity as a key asset for achieving not only a more efficient forest management but the wildfire risk reduction within those territories. The results show that Monchique´s community is open to collaborative management actions, which should be encouraged and validated by territorial management instruments. Still in this sense, there are some barriers that need to be overcome to improve the relationship between the civil community and public bodies, by focusing on better communication channels, both endogenous and exogenous to the community, which can create relationships of trust. The centrality of communication as a catalyst for strengthening local capacities was highlighted. The local community also showed a certain degree of social capital, cooperation and trust among actors that are fundamental to make adaptive co-management operational, which can be improved and strengthened by better communication channels. In particular, conditions and mechanisms to increase opportunities for interaction of stakeholders could increase trust are issues to further the adaptive co-management approach.

Secondly, it can be discussed to which extend are the institutional arrangements prepared to fit more collaborative approaches. The analysis suggested that the system exhibits a limited degree of experimentation, a key aspect in which ACM relies on to deal with complexity and uncertainty. The lack of feedback mechanisms that allow the policy to incorporate some of the demands or specificities of the local context is also noticed, and as a result, the opportunity to learn from the failures of the past is overlooked; thus, perpetuating management practices that are not beneficial, nor effective, both for the territory and for the community that lives there. The polycentrism aspect also performed poorly within the analysed document. Notably, decentralization is more prevalent at the national level, however, autonomy, a fundamental aspect of polycentrism, appears disjointed from the capacity for independent decision-making among government levels. The selected instruments need to better operationalize polycentric concepts for broader applicability, with newer instruments playing a pivotal role in promoting polycentrism. Emphasizing polycentric governance is crucial for fostering more collaborative management methods that accommodate diverse arrangements. A final remark on the topic can be made highlighting the lack of recognition of local capacity within the documents, which can be attributed mostly due to a centralized, hierarchical government tradition lacking a participation culture. A higher community capacity can ensure the sustainability of the gains brought by the plans, facilitating the structural changes needed to reduce the risk of forests, this must be systematically integrated into policies, plans and programmes.

The investigation of institutional arrangements can be criticized for being limited by the choice of words and concepts searched, especially considering that the subject can be addressed even if specific words are not mentioned. In this sense, it is suggested that future research look more closely at the instruments in order to verify possible improvements that may lead to the enabling of more collaborative management. Also, since the number of respondents in this study is relatively limited, for increased validity, future research should encompass a wider set of respondents.

In conclusion, this research argues that there is an important capital within the community of Monchique that can be strengthened to create better synergies for forest management and forest fire risk reduction, despite the fact that, at the present time, there is little implementation of the ACM prescriptions in the institutional arrangements. Building community capacity is an important part of the strategy for forest management and risk reduction, enabling communities to respond to forest fire events. More flexible regulations can facilitate different management arrangements and are in line with what the participants pointed out during the participation sessions as being one of the priority areas for risk reduction. It is suggested that future instruments can tackle this asymmetry of power and responsibility, since the imbalance causes ruptures in the relationship between community and government, which can hinder the implementation of important proposals for efficient territorial management.

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7. ANNEXES

ANNEX I – Declivity map of Monchique

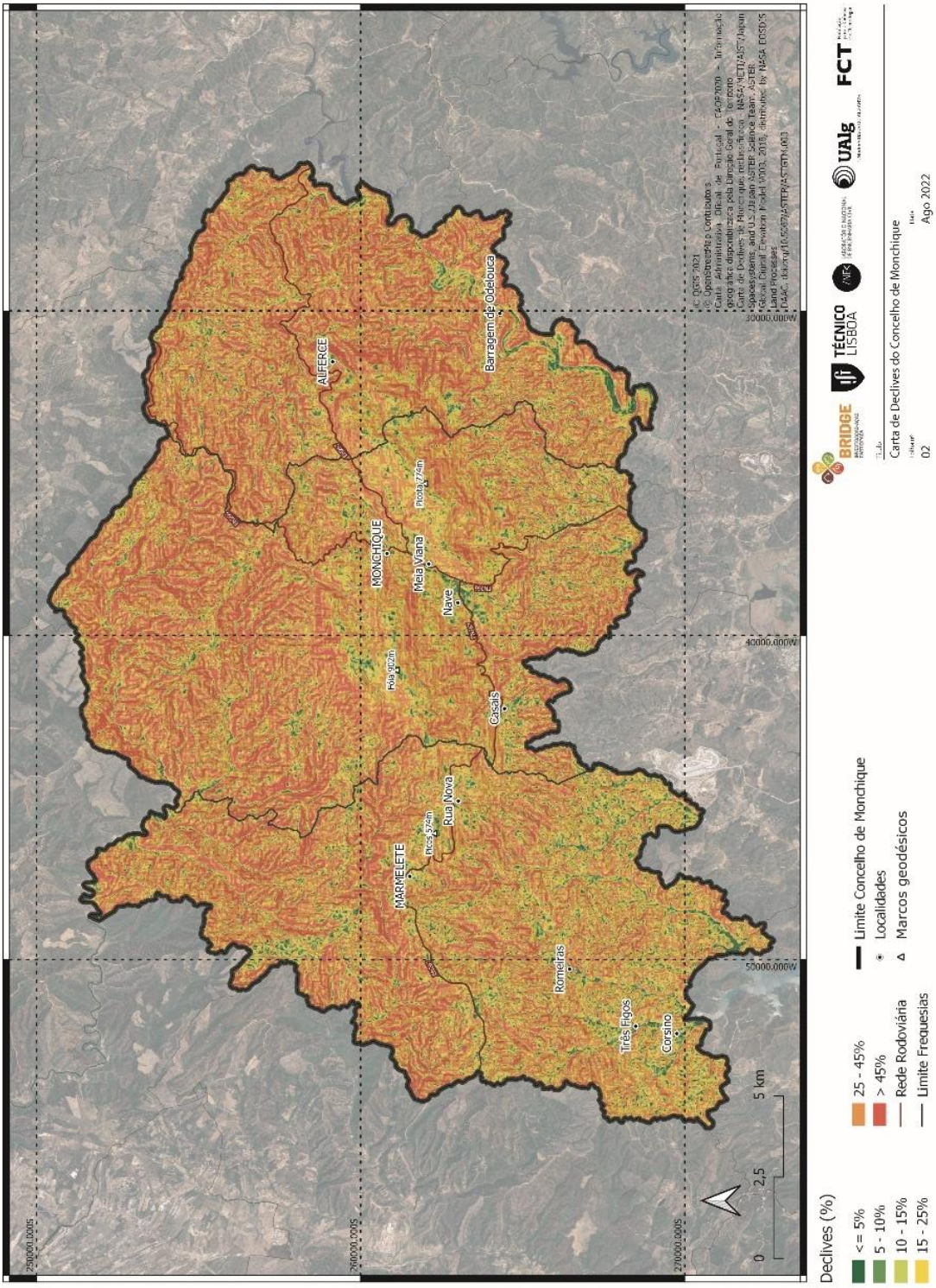

Figure 36 - Monchique´s declivity map. Source: BRIDGE

ANNEX II – Land uses of Monchique

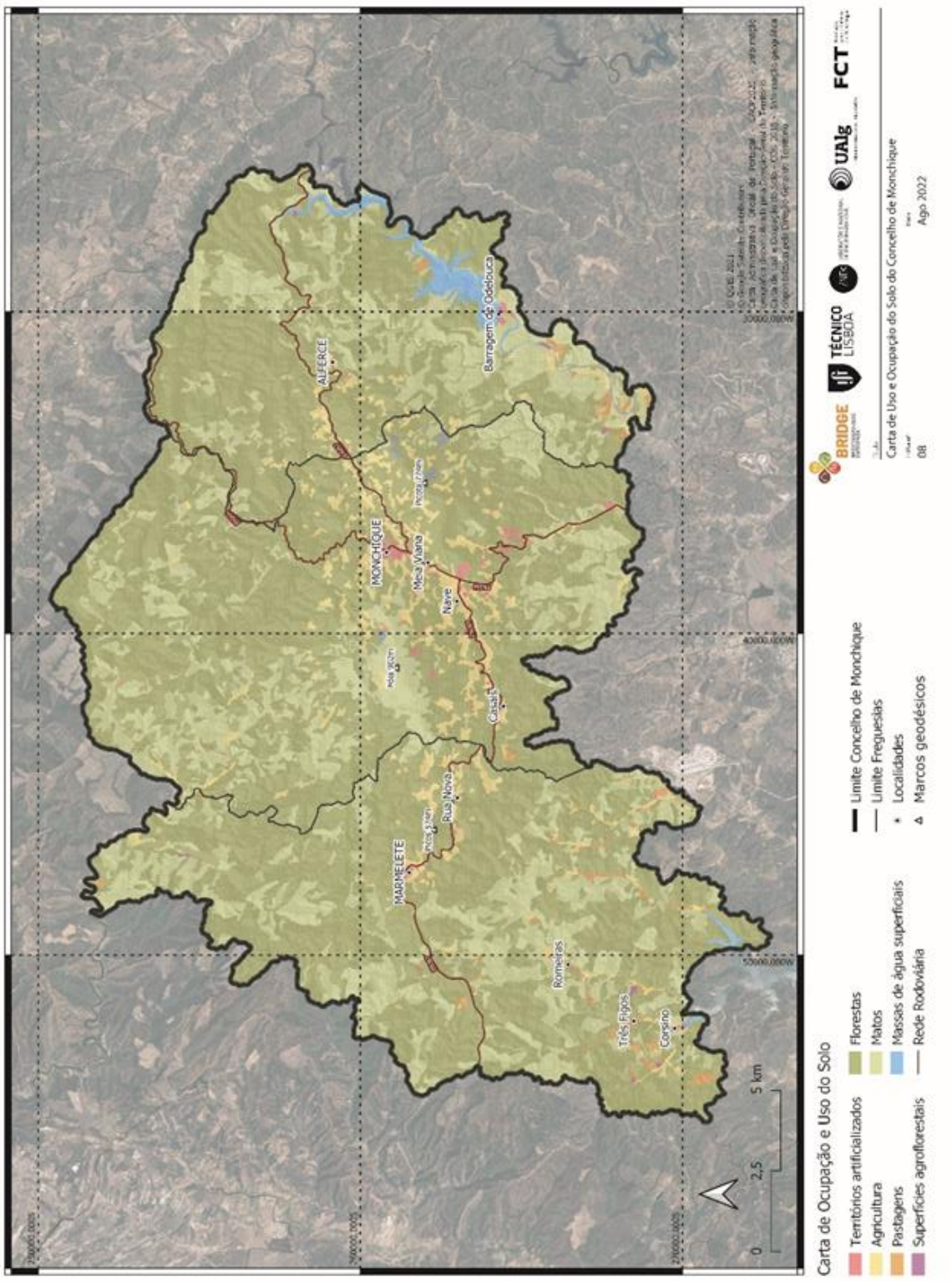

Figure 37 - Monchique´s land use chart. Source: BRIDGE.

ANNEX III – Models of the questionnaires applied in the case study

English version

Capacity Analysis – Forest Fires in Monchique

This questionnaire is part of the research project "Analysis of capacities for forest management: a case study of the Serra de Monchique" and focus on the local community of Monchique. This research is being developed by Ana Soares as part of the Master's in Spatial Planning and Urbanism (MOTU) and the BRIDGE Project - Bridging science and local communities for wildfire risk reduction (PCIF/AGT/0072/2019), a project funded by the Foundation for Science and Technology (FCT).

This investigation intends to analyze the individual and community capacity to manage the forest territory of Monchique. The concept of capacity adopted in this study is composed by several elements, such as a sense of community, communication, participation, and leadership. It thus aim to contribute to strengthen local capacity to manage this territory, reducing the difficulties faced by the community of Monchique.

When answering this questionnaire, please consider the following information carefully:

1. Your participation in this study is voluntary and you have the right to withdraw from the study at anytime. You also have the right to not answer any questions during the study without having to explain your decision to the researcher.

2. This study is NOT designed to collect information about specific individuals, so your responses will be combined with those of other individuals for the purpose of statistical analysis. If results are published or presented, the publication will protect the identity of all participants.

3. If you have any doubts, concerns or complaints about this study you can contact the researcher Ana Soares, by email: ana.s.soares@tecnico.ulisboa.pt

Completing the entire questionnaire takes approximately 10 minutes.

Please, before you begin your participation in this research, your consent is required.

I declare that I have read and understood the purpose of the research and I agree to participate in the study. Accordingly, I allow the use of my data for the purposes of this research, with the guarantee of confidentiality and anonymity indicated by the researcher.

☐ Yes

☐ No

General Information

Gender: ☐ F ☐ M ☐ Other/ I'd rather not say Age: _____

Parish where you live:_____ Municipality: _____

Nationality: _____

How long have you lived in Monchique? ☐ 0-5 years ☐ 6-10 years ☐ Over 10 years

☐ I do not live in Monchique

The land or house where you live is: ☐ Owned ☐ Rented ☐ Other _____

Are you a member of any Local Association (select all that apply):

☐ Associação dos Produtores Florestais do Barlavento Algarvio (Aspaflobal)

☐ Cooperativa Agrícola do Concelho de Monchique (Coopachique)

☐ Nossa Terra Associação Ambiental

☐ Associação Monchique Alerta

☐ I am not a member of any local association

☐ Other: _____

1. **To what extent do you agree with the following statements:**

	Strongly Disagree					Strongly Agree
There is a sense of community and togetherness in Monchique.	1	2	3	4	5	6
Community members feel that they have a say and that they can contribute to the community.	1	2	3	4	5	6
Cultural diversity is valued in the community.	1	2	3	4	5	6
Our community has a common vision for the future of Monchique.	1	2	3	4	5	6
We have an action plan to achieve a better future for Monchique.	1	2	3	4	5	6
There is a shared sense of commitment and responsibility to improve forest land management.	1	2	3	4	5	6
I often discuss Monchique community issues with my family, friends and neighbours.	1	2	3	4	5	6

2. **Are there communication channels for community members to identify problems and actively engage in their resolution?** ☐ Yes ☐ No

   2.1. If so, which ones? _____

3. **How do you find out about events in Monchique?**
   ☐ Newspapers/magazines ☐ Radio ☐ Social media ☐ Other residents ☐ Email
   ☐ The association I belong to ☐ Printed material (e.g. brochures, posters)
   ☐ Other _____

4. **How often do you participate in events in your community?**

☐ Weekly ☐ Biweekly ☐ Monthly
☐ Half yearly ☐ Annually ☐ I do not participate ☐ Other _____

5. **What do you consider to be your biggest limitations in participating in activities in your community?**

☐ Time schedule ☐ Commute ☐ Language ☐ Lack of motivation
☐ Health issues ☐ Disagreement with other members ☐ Disbelief
☐ Other _____

6. **To what extent do you agree with the following statements**:

	Strongly Disagree					Strongly Agree
There are individuals in the community who are recognized as local leaders.	1	2	3	4	5	6
If I share my ideas and opinions with local leaders, I feel that I will be heard and represented.	1	2	3	4	5	6
I feel that local leaders facilitate building consensus and collaboration in the community.	1	2	3	4	5	6
I have a good understanding of the strengths and needs of this community.	1	2	3	4	5	6
I believe that engaging in collaborative partnerships with my neighbours and other community members contribute to the management of Monchique's forest and territory.	1	2	3	4	5	6
Regarding the management of forest territory, I feel that the community has learned from the successes and challenges of the past.	1	2	3	4	5	6
I feel that the community is open to new ways and ideas of how to manage the territory of Monchique.	1	2	3	4	5	6
I am aware of the resources, knowledge and skills that exist in our community (e.g., people, facilities, services, money, etc.).	1	2	3	4	5	6

7. **Are the most important issues affecting Monchique being resolved?**

☐ Yes ☐ No

7.1. If so, by whom?

☐ Individuals in the community ☐ Community as a whole ☐ City Council (Câmara Municipal)
☐ Parish Councils (Junta da Freguesia) ☐ Central government ☐ Private companies
☐ Other _____

8. **Are there opportunities for community members to develop new skills, for example through training or education programs?**

☐ Yes ☐ No

8.1. If so, which ones?_____

9. **Are you aware of ways to access resources, knowledge and skills when you need to manage your territory?**
   ☐ Yes ☐ No

10. **Would you be interested in participating in training programs associated with forest land management?**
    ☐ Yes ☐ No

11. **Check the territorial management instruments that you know:**
    ☐ Plano Diretor Municipal Monchique (PDM)
    ☐ Programa Regional de Ordenamento Florestal do Algarve (PROF ALG)
    ☐ Programa de Reordenamento e Gestão da Paisagem das Serras de Monchique e Silves (PRGPSMS)
    ☐ Plano Regional de Ordenamento do Território do Algarve (PROT Algarve)
    ☐ Plano Municipal de Defesa da Floresta e Combate ao Incêndio (PMDFCI)
    ☐ Other _____

12. **Do you own forest land in Monchique?**
    ☐ Yes ☐ No

    12.1. If so, do you feel you have the capacity to manage your forest territory?

    ☐ Yes ☐ No

    12.2. What activities do you perform on your land?
    ☐ Orderly plantation ☐ Fuel management (Gestão da faixa de combustível)
    ☐ Building Protection ☐ Management of water point networks
    ☐ Forest road management ☐ Establishment of a diversified forest mosaic
    ☐ Campfires ☐ Burning agricultural and forest lands for cleaning
    ☐ I am not a forest land owner

13. **What do you consider to be the main difficulties in the management of the forest territory?**

    _____

14. **What do you consider to be the most important aspect in managing the forest territory?**
    ☐ Financial resources ☐ People ☐ Infrastructures ☐ Public investment
    ☐ Private investment ☐ Technical education ☐ Personal motivations
    ☐ Other _____

Thank you for your participation.

Portuguese version

Análise de Capacidades – Incêndios Florestais em Monchique

Este questionário surge no contexto da investigação "Análise de capacidades para gestão do território florestal: um estudo de caso da Serra de Monchique" e é destinado à comunidade do município de Monchique. Esta investigação está a ser desenvolvida por Ana Soares no âmbito do Mestrado em Ordenamento do Território e Urbanismo (MOTU) e do Projeto BRIDGE - Unir a ciência e as comunidades locais para a redução do risco de incêndios florestais (PCIF/AGT/0072/2019), projeto financiado pela Fundação para a Ciência e a Tecnologia (FCT).

O objetivo deste estudo é analisar a capacidade, ao nível individual e de comunidade, para a gestão do território florestal de Monchique. O conceito de capacidade adotado nesta investigação é composto por diversos elementos, como por exemplo senso de comunidade, comunicação, participação e liderança. Assim, pretende-se contribuir para fortalecer a capacidade local de gestão deste território, reduzindo as dificuldades enfrentadas pela comunidade de Monchique.

Ao responder a este questionário, por favor considere a seguinte informação cuidadosamente:

1. A sua participação neste estudo é voluntária e tem o direito de desistir do estudo em qualquer altura. Tem também o direito de não responder a qualquer questão durante o estudo não necessitando de explicar a sua decisão ao investigador.

2. Este estudo NÃO pretende recolher informação acerca de indivíduos específicos, portanto as suas respostas serão combinadas com as de outros indivíduos com o objetivo de realizar uma análise estatística. Se os resultados forem publicados ou apresentados, a publicação protegerá a identidade de todos os participantes.

3. Caso tenha quaisquer questões, preocupações ou queixas acerca deste estudo poderá contactar a investigadora Ana Soares, através do email: ana.s.soares@tecnico.ulisboa.pt

O preenchimento total do questionário tem duração aproximada de 10 minutos.

Por favor, antes de iniciar sua participação nesta investigação é necessário o seu consentimento.

Declaro ter lido e compreendido o intuito da investigação e aceito participar no estudo. Desta forma, permito a utilização dos meus dados para efeitos da presente investigação, com a garantia de confidencialidade e anonimato indicadas pela investigadora.

☐ Sim

☐ Não

Dados Gerais

Sexo: ☐ F ☐ M ☐ Outro/Prefiro não dizer Idade: _____

Freguesia onde vive:_____ Concelho:_____

Nacionalidade: _____

Há quantos anos vive em Monchique? ☐ 0-5 anos ☐ 6-10 anos ☐ Acima de 10 anos

☐ Não vivo em Monchique

O terreno ou a casa onde vive é: ☐ Próprio(a) ☐ Arrendado(a) ☐ Outro(a) _____

É membro de alguma Associação Local (selecione todas as opções válidas):

☐ Associação dos Produtores Florestais do Barlavento Algarvio (Aspaflobal)

☐ Cooperativa Agrícola do Concelho de Monchique (Coopachique)

☐ Nossa Terra Associação Ambiental

☐ Associação Monchique Alerta

☐ Não sou membro de nenhuma associação local

☐ Outra: _____

1. **Em que medida concorda com as seguintes afirmações**:

	Discordo totalmente					Concordo totalmente
Existe um sentido de comunidade e união em Monchique.	1	2	3	4	5	6
Os membros da comunidade sentem que têm voz e que podem dar um contributo à comunidade.	1	2	3	4	5	6
A diversidade cultural é valorizada na comunidade.	1	2	3	4	5	6
A nossa comunidade tem uma visão comum para o futuro de Monchique.	1	2	3	4	5	6
Temos um plano de ação para alcançar um futuro melhor para Monchique.	1	2	3	4	5	6
Existe um sentido comum de compromisso e responsabilidade para melhorar a gestão do território florestal.	1	2	3	4	5	6
Discuto frequentemente questões comunitárias de Monchique com os meus familiares, amigos e vizinhos.	1	2	3	4	5	6

2. **Existem canais de comunicação para os membros da comunidade identificarem os problemas e participarem ativamente na sua resolução?** ☐ Sim ☐ Não

   2.1. Se sim, quais? _____

3. **Como fica a saber dos eventos que ocorrem em Monchique? Através de:**

   ☐ Jornais/revistas ☐ Rádio ☐ Redes sociais ☐ Outros moradores ☐ Email

   ☐ Associação a que pertenço ☐ Material impresso (ex: folhetos, posters)

   ☐ Outro _____

4. **Com que frequência participa de eventos em sua comunidade?**
   ☐ Semanalmente ☐ Quinzenalmente ☐ Mensalmente
   ☐ Semestralmente ☐ Anualmente ☐ Não participo ☐ Outro _____

5. **O que considera serem as suas maiores limitações para participar em atividades na sua comunidade?**
   ☐ Horários ☐ Deslocação ☐ Idioma ☐ Falta de motivação
   ☐ Questões de saúde ☐ Divergência de ideias com outros membros ☐ Descrença
   ☐ Outro _____

6. **Em que medida concorda com as seguintes afirmações**:

	Discordo totalmente					Concordo totalmente
Existem indivíduos na comunidade que são reconhecidos como líderes locais.	1	2	3	4	5	6
Se eu partilhar as minhas ideias e opiniões com os líderes locais sinto que serei ouvido(a) e representado(a).	1	2	3	4	5	6
Sinto que os líderes locais facilitam a construção de consenso e a colaboração entre a comunidade.	1	2	3	4	5	6
Tenho uma boa compreensão dos pontos fortes e das necessidades desta comunidade.	1	2	3	4	5	6
Acredito que o envolvimento em parcerias colaborativas com os meus vizinhos e outros membros da comunidade contribui na gestão da floresta e do território de Monchique.	1	2	3	4	5	6
Na gestão do território florestal, sinto que a comunidade aprendeu com os sucessos e os desafios do passado.	1	2	3	4	5	6
Sinto que a comunidade está aberta a novas maneiras e ideias de como gerir o território de Monchique.	1	2	3	4	5	6
Conheço os recursos, conhecimentos e competências que existem na nossa comunidade (ex.: pessoas, instalações, serviços, dinheiro, etc.).	1	2	3	4	5	6

7. **As questões mais importantes que afetam Monchique estão a ser resolvidas?**
   ☐ Sim ☐ Não

   7.1. Se sim, por quem?
   ☐ Indivíduos da comunidade ☐ Comunidade como um todo ☐ Câmara Municipal
   ☐ Juntas de Freguesia ☐ Governo Central ☐ Empresas privadas
   ☐ Outro _____

8. **Existem oportunidades para os membros da comunidade desenvolverem novas competências, por exemplo através de programas de formação ou educação?**
   ☐ Sim ☐ Não

   8.1. Se sim, quais?_____

9. **Sabe como aceder aos recursos, conhecimentos e competências quando precisa de gerir o seu território?**
   ☐ Sim ☐ Não

10. **Teria interesse em participar em programas de formação associados a gestão do território florestal?**
   ☐ Sim ☐ Não

11. **Assinale os instrumentos de gestão territorial que conhece:**
   ☐ Plano Diretor Municipal de Monchique (PDM)
   ☐ Programa Regional de Ordenamento Florestal do Algarve (PROF ALG)
   ☐ Programa de Reordenamento e Gestão da Paisagem das Serras de Monchique e Silves (PRGPSMS)
   ☐ Plano Regional de Ordenamento do Território do Algarve (PROT Algarve)
   ☐ Plano Municipal de Defesa da Floresta e Combate ao Incêndio (PMDFCI)
   ☐ Outro _____

12. **É proprietário de terreno florestal em Monchique?**
   ☐ Sim ☐ Não

   12.1.Se sim, sente que tem capacidade de gerir o seu território florestal?

   ☐ Sim ☐ Não

   12.2.Que atividades realiza no seu terreno?
   ☐ Plantação ordenada ☐ Gestão da faixa de combustível ☐ Proteção do edificado
   ☐ Gestão de redes de pontos de água ☐ Gestão da rede viária florestal
   ☐ Constituição de um mosaico florestal diversificado ☐ Fogueiras
   ☐ Queimadas para limpeza do solo agrícola e solo florestal

13. **Quais acredita serem as principais dificuldades na gestão do território florestal?**

   _____

14. **O que acredita ser o mais importante na gestão do território florestal?**
   ☐ Recursos financeiros ☐ Pessoas ☐ Infraestruturas ☐ Investimento público
   ☐ Investimento privado ☐ Formação técnica ☐ Motivação pessoal
   ☐ Outro _____

Muito obrigada pela sua participação.

ANNEX IV – Dissemination of the questionnaire: Flyer

ANNEX V – Word cloud: most frequent words

National Scale

Palavra	Contagem	Palavras similares
territórios	1007	território, territórios
nacionalidade	905	nacional, nacionalidade, nacionalmente
sistema	766	sistema, sistemas
territorialmente	742	territorial, territorialmente
desenvolvimento	724	desenvolvam, desenvolve, desenvolvem, desenvolvendo, desenvolver, desenvolveram, desenvolverão, desenvolverem, desenvolveu, desenvolvida, desenvolvidas, desenvolvido, desenvolvidos, desenvolvimento, desenvolvimentos
gestão	701	gestão
florestais	581	floresta, florestação, florestada, florestadas, florestados, florestais, florestas
serviços	575	service, serviço, serviços
planos	525	planeada, planeadas, planeado, planeados, planear, planeia, plano, planos
reforçou	512	reforça, reforçada, reforçadas, reforçado, reforçados, reforçam, reforçando, reforçar, reforçará, reforçaram, reforçarem, reforce, reforcem, reforço, reforçou
áreas	492	áreas
incêndios	489	incêndios
recursos	483	recurso, recursos
medidas	468	medeia, medeiam, media, mediar, medida, medidas
promovidas	467	promova, promovam, promove, promovem, promovendo, promover, promoverá, promoverão, promoverem, promovida, promovidas, promovido
económicos	462	económica, económicas, económico, económicos
políticos	442	política, políticas, político, políticos
processos	414	processamento, processo, processos
públicos	406	pública, públicas, público, públicos
riscos	390	risco, riscos
social	386	social, socialidade, socialmente
rurais	379	rurais, ruris
futuros	374	futura, futuras, futuro, futuros
estratégia	371	estratégia
programa	361	programa, programação, programadas, programados, programar, programas
melhoria	346	melhor, melhora, melhoradas, melhoramento, melhorando, melhorar, melhoraria, melhore, melhorem, melhores, melhoria, melhorias

estratégicos	342	estratégica, estratégicas, estratégico, estratégicos
sustentável	338	sustenta, sustentabilidade, sustentação, sustentada, sustentadamente, sustentadas, sustentado, sustentados, sustentam, sustentar, sustentáveis, sustentável, sustente, sustentem, sustentou
modelos	335	modeladores, modelo, modelos
valorização	333	valoriza, valorização, valorizada, valorizadas, valorizado, valorizador, valorizadora, valorizadoras, valorizam, valorizando, valorizar, valorize, valorizem

Regional Scale

Palavra	Contagem	Palavras similares
florestais	2482	floresta, florestação, florestada, florestadas, florestados, florestais, florestas
algarve	1687	algarve
áreas	1534	áreas
gestão	1341	gestão
florestal	1028	florestal
estratégico	988	estratégica, estratégicas, estratégico, estratégicos
espécies	905	espécies
espaços	893	espaços
região	792	região
monchique	785	monchique, monchique’
desenvolvimento	763	desenvolva, desenvolve, desenvolvê, desenvolveem, desenvolvem, desenvolvendo, desenvolver, desenvolveram, desenvolverem, desenvolveu, desenvolvida, desenvolvidas, desenvolvido, desenvolvidos, desenvolvimento
natureza	747	natura, naturais, nature, natureza
documentos	744	documentação, documento, documentos
produtos	723	produtiva, produtivas, produtividade, produtividades, produtivo, produtivos, produto, produtos
conservação	718	conservação, conservada, conservadoras, conservados, conservando, conservar, conservas
planos	686	plana, planas, planeada, planeadas, planeados, planear, plano, planos
sistema	681	sistema, sistemas

serras	677	serra, serra', serras
território	659	território, territórios
povoamentos	635	povoamento, povoamentos
objetivos	634	objetiva, objetivamente, objetivas, objetivo, objetivos
valor	618	valor, valoração, valorados, valorativo, valores, valori
tabela	617	tabela, tabelas
silves	612	silva, silvados, silvas, silves, silvo
devido	599	devam, devem, devemos, devendo, dever, deverá, deverão, deveres, deveria, deveriam, devida, devidas, devido
figura	574	figura, figuram, figurar, figuras, figurava
produção	569	produção
ordenamento	566	ordenamento
paisagem	550	paisagem, paisagista
recursos	540	recurso, recursos

Local Scale

Palavra	Contagem	Palavras similares
planos	632	planas, planeadas, planeado, planear, plano, planos
monchique	608	monchique
floresta	397	floresta, florestação, florestadas, florestais, florestas
municipal	386	municipal
proteção	354	proteção
incêndios	344	incêndios
civil	307	civil
emergência	281	emergência
entidades	261	entidades
operações	238	operação, operações, operadoras, operadores, operativas
concelho	226	concelho, concelhos
gestão	225	gestão
deverão	222	devam, devem, devendo, dever, deverá, deverão, devida, devido, devidos
apoio	219	apoio
defesa	215	defesa
meios	213	meios

risco	210	risco, riscos
ações	197	ações
populações	189	população, populações, popular
intervenção	181	intervenção
informações	179	informação, informações, informativo, informativos
pública	169	pública, públicas, público, públicos
estratégicos	164	estratégica, estratégicas, estratégico, estratégicos
figura	163	figura, figuras
áreas	161	áreas
serviços	159	service, serviço, serviços
florestal	152	florestal
artigo	142	artigo
âmbito	140	âmbito
coordenação	136	coordena, coordenação, coordenada, coordenadas, coordenado, coordenador, coordenadora, coordenadores, coordenando, coordenar, coordenará

ANNEX VI – Word Trees

Polycentric structure

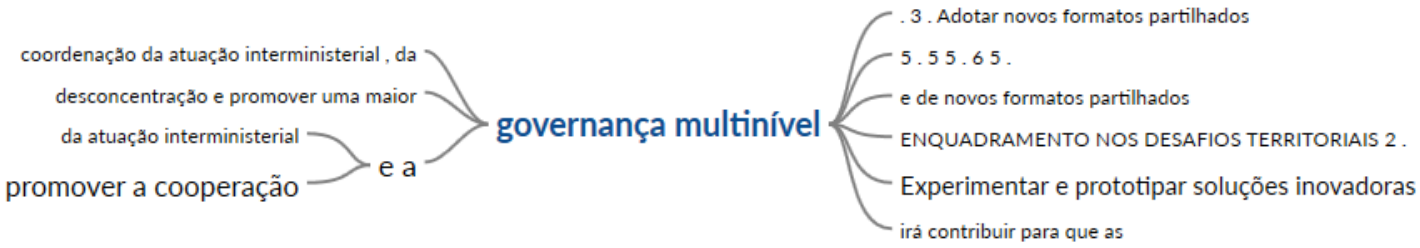

Figure 38 - Word Tree: Multilevel governance (PNPOT).

Figure 39 - Word Tree: Descentralization (PNPOT).

Figure 40 - Word Tree: Descentralization (PNGIFR).

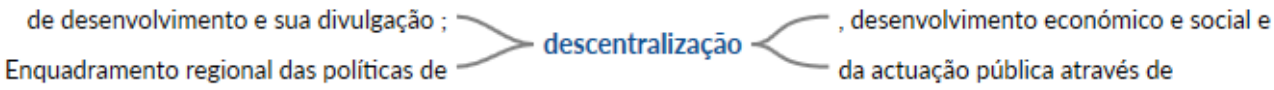

Figure 41 - Word Tree: Descentralization (PROT Algarve).

Figure 42 - Word Tree: Descentralization (PRGPSMS).

Figure 43 - Word Tree: Autonomy (PNPOT).

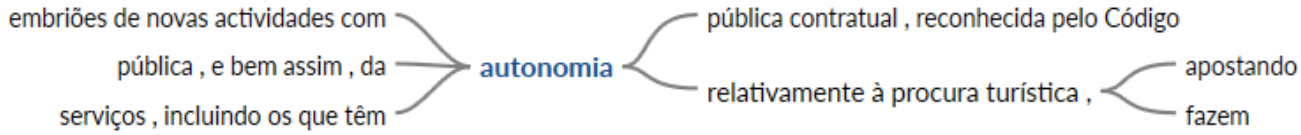

Figure 44 - Word Tree: Autonomy (PROT Algarve).

Figure 45 - Word Tree: Autonomy (PROF Algarve).

Figure 46 - Word Tree: Public participation (PNPOT).

Figure 47 - Word Tree: Public participation (PROT Algarve).

Figure 48 - Word Tree: Public participation (PRGPSMS).

Public participation

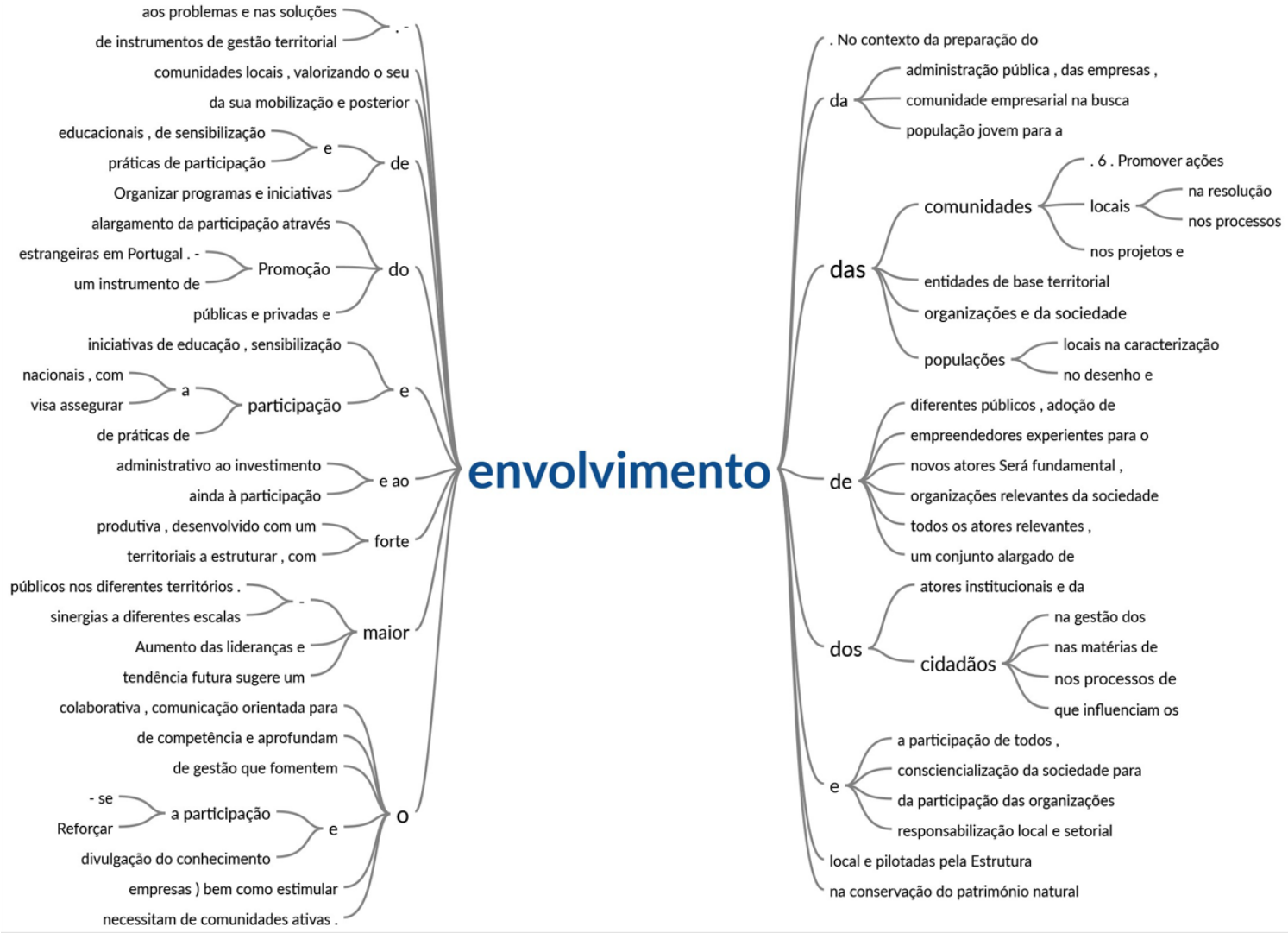

Figure 49 - Word Tree: Involvement (PNPOT).

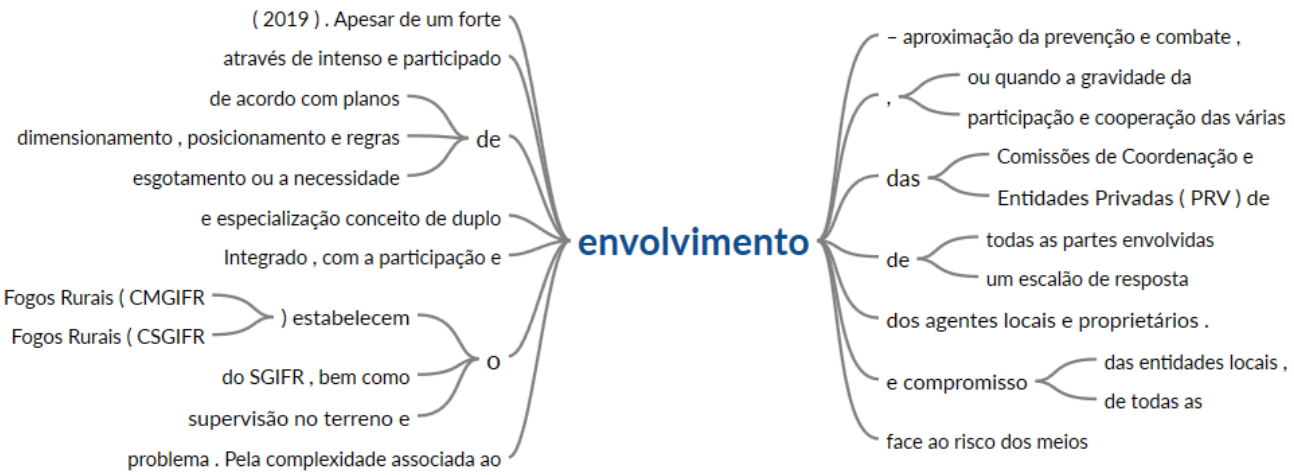

Figure 50 - Word Tree: Involvement (PNGIFR).

Figure 51 - Word Tree: Involvement (PNDFCI).

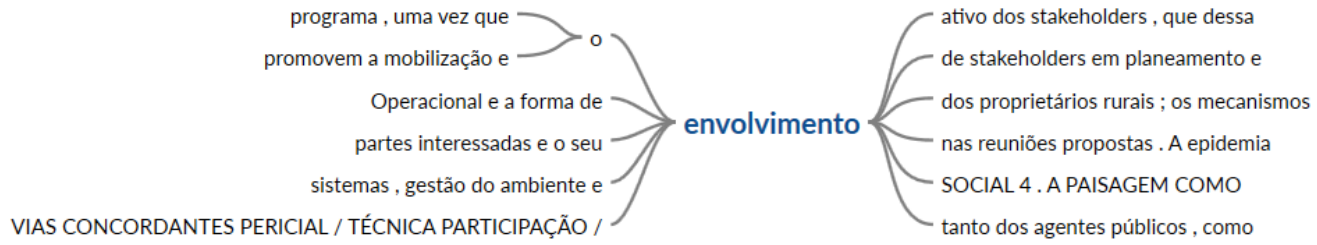

Figure 52 - Word Tree: Involvement (PRGPSMS).

Figure 53 - Word Tree: Involvement (PROT Algarve).

Figure 54 - Word Tree: Involvement (PDM).

Figure 55 - Word Tree: Civil society (PNPOT).

Bioregional approach

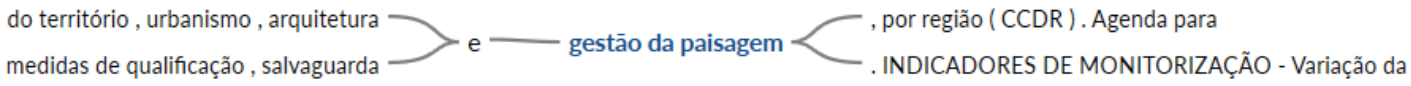

Figure 56 - Word Tree: Landscape management (PNPOT).

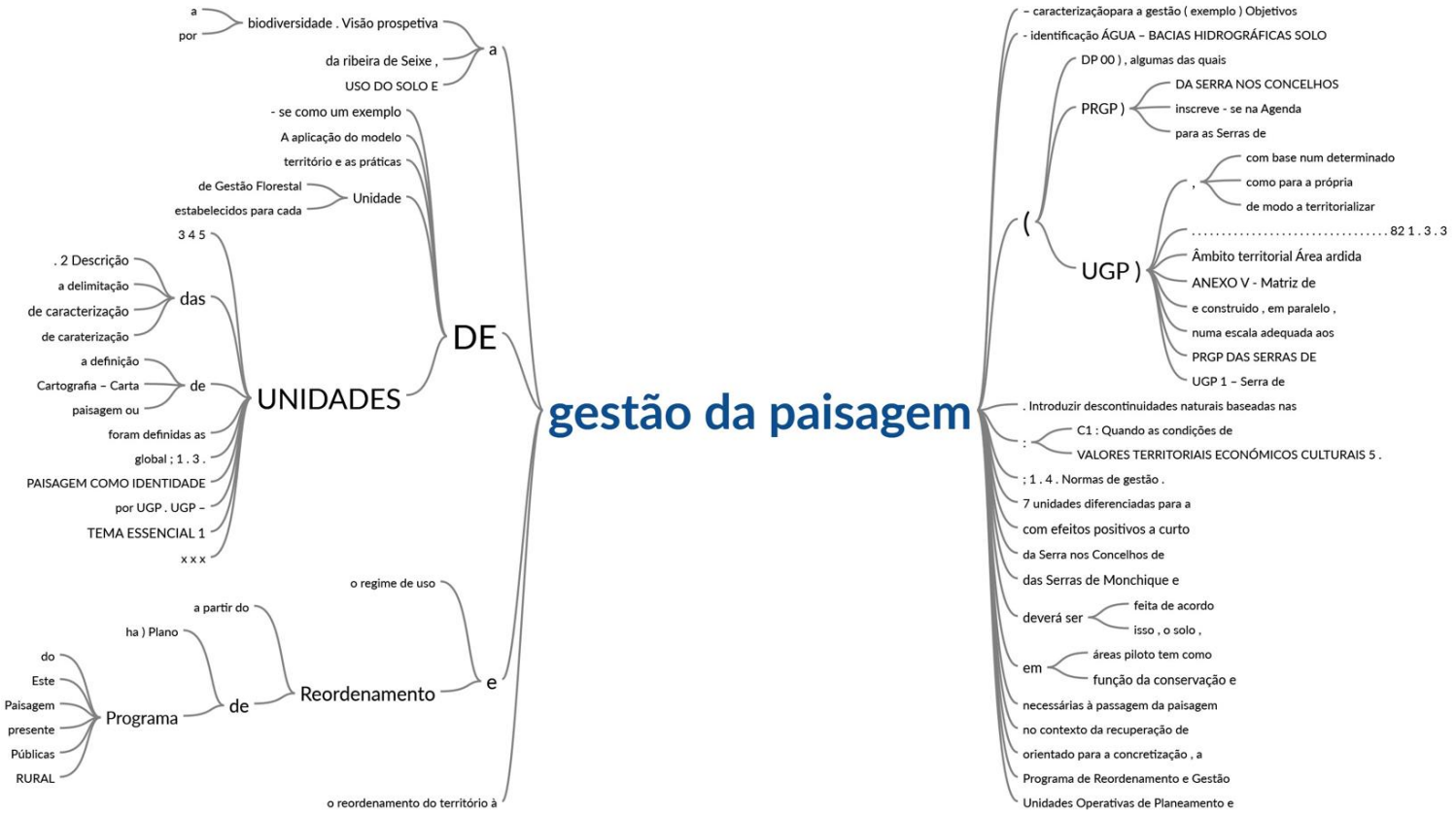

Figure 57 - Word Tree: Landscape management (PRGPSMS)

Figure 58 - Word Tree: Valuing the territory (PNPOT).

Figure 59 - Word Tree: Valuing the territory (PRGPSMS).

Figure 60 - Word Tree: Co-management (PNPOT).

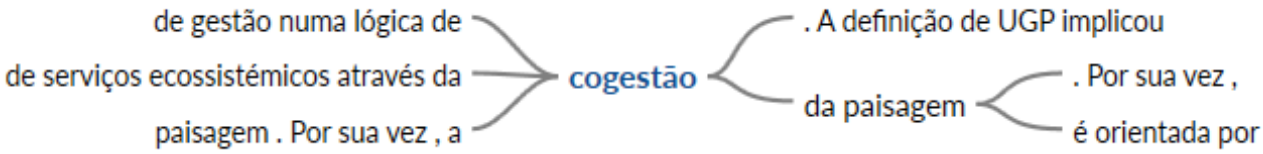

Figure 61 - Word Tree: Co-management (PRGPSMS).

Experimentation

Figure 62 - Word Tree: Adaptive management (PNPOT).

Figure 63 - Word Tree: Adaptive management (PRGPSMS).

Figure 64 - Word Tree: Pilot project (PRGPSMS).

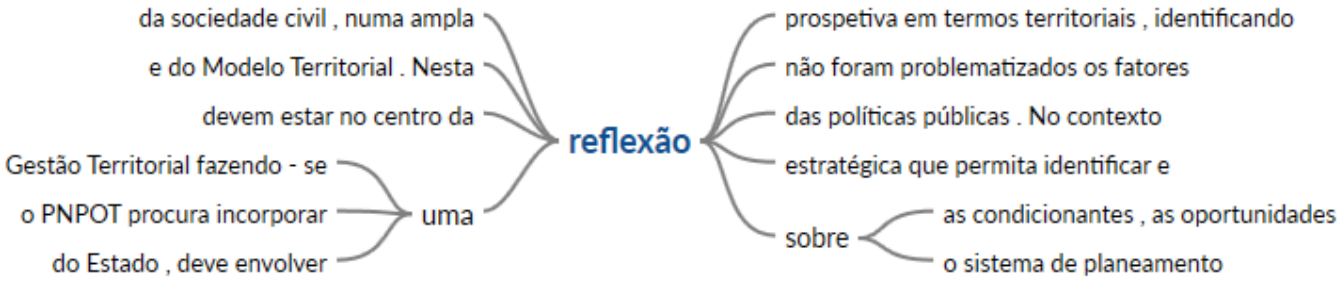

Figure 65 - Word Tree: Reflection (PNPOT).

Figure 66 - Word Tree: Reflection (PNGIFR).

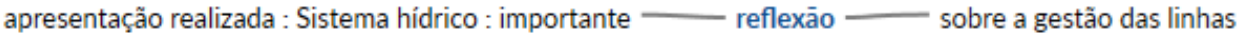

Figure 67 - Word Tree: Reflection (PRGPSMS).

Figure 68 - Word Tree: Reflection (PROF Algarve).

Community capacity

Figure 69 - Word Tree: Leadership (PNPOT).

Figure 70 - Word Tree: Leadership (PNGIFR).

Figure 71 - Word Tree: Leadership (PNDFCI).

Figure 72 - Word Tree: Leadership (PRGPSMS).

Figure 73 - Word Tree: Local actors (PNPOT).

Figure 74 - Word Tree: Local actors (PRGPSMS).

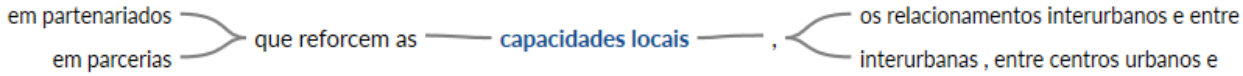

Figure 75 - Word Tree: Local capacity (PNPOT).

Figure 76 - Word Tree: Local capacity (PMPEC).