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Promoting Stakeholder Interaction to Facilitate Wildfire Management: Insights From a Case Study in Monreale, Sicily

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ABSTRACT

Wildfires in Southern European Mediterranean regions, exacerbated by climatic conditions and human activity, pose significant threats to ecosystems and human well-being. Current fire management policies tend to prioritize fire exclusion, neglecting traditional land use practices and socio-ecological interactions underlying the human–fire relationship. Diverging from exclusion-dominated management paradigms is challenging due to entrenched beliefs and conflicting interests across local stakeholders. Developing effective fire management and characterizing the mechanisms driving wildfire frequency and severity requires understanding the interests of stakeholder groups, the historical and institutional context these emerged in, and their interactions with land use management practices. We examine the diverse narratives shaping fire management attitudes and policy in fire-prone regions at the urban–wildland interface with a long history of land use management conflict. We focus on Monreale, Sicily, a region characterized by frequent catastrophic wildfires. Employing a participatory approach with representatives of local authorities, government agencies, and civil society, we formalize diverse stakeholder perspectives on land use and fire management, revealing the socio-economic and political dimensions that contribute to deep-rooted conflicts. We provide insights into the role of local governance, social, and institutional complexities and highlight the need for cross-stakeholder collaboration to foster resilient and sustainable fire management.

1 | Introduction

Contemporary Mediterranean landscapes are adapted to periodic burning. Fire in the region serves a crucial ecological role and has contributed to the development of important cultural landscapes (Moritz et al. 2014). Nevertheless, climate change, shifting population patterns, and land use change disrupt long-established fire regimes, increasing the

occurrence of large-scale wildfire events threatening lives and leading to environmental and economic damages (Doerr and Santín 2016; Elia et al. 2022; Moreira et al. 2001). Wildfire is a broad term that encompasses uncontained fires that spread across rural or natural landscapes. This includes forest fires, bushfires, brushfires, and fires that occur at the intersection between wildlands and urban areas (Tedim and Leone 2020). Adapting to emerging wildfire challenges and mitigating their

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adverse effects requires developing effective, sustainable fire management strategies, enabling harmonious coexistence between human societies and fire (Moreira et al. 2020; Shuman et al. 2022).

Wildfire drivers in the region can be traced back to natural environmental conditions, but also to rural abandonment, deeply rooted cultural and governance systems, and perverse incentives generated by agricultural subsidies (Uyttewaal et al. 2023). The way local communities, organizations, and interest groups think and act on fire influences the choice of fire management policy priorities and their implementation. These decisions ultimately affect fire occurrence, severity, and the community's adaptive capacity to wildfires (Costanza and Moody 2011). The decision-making process is shaped by complex interactions between community identities, communication networks, local knowledge, and socio-economic factors (Elia et al. 2022). Local stakeholder groups are frequently characterized by diverse and often competing mandates and interests, operating in institutional or epistemological silos limiting opportunities for coordination and integration across fire management objectives and strategies (Kirschner et al. 2024; Marques et al. 2020). Wildfire research has often overlooked the views, experiences, spatial relationships, political contexts, and historical memories of those who have long been closely connected with fire practices (Sousa et al. 2022).

Limited communication and the absence of consensus have hindered the effective implementation of fire management policies (Wunder et al. 2021), perpetuating a fragmented approach within different institutions and conflicting fire narratives (Swedeen 2006). Understanding stakeholder perspectives and interests at the various levels of governance and management is crucial for promoting inter-institutional and cross-stakeholder cooperation (Kapetas et al. 2019) and for effective decision-making amidst environmental change (Finucane 2009).

Diverse methodologies, such as interviews, surveys, workshops, and advisory board meetings, enable agencies and researchers to assess stakeholders' perspectives on environmental and socio-economic issues. Multistakeholder networks play a key role in coordinating diverse conservation and development interests (Keough and Blahna 2006). By bridging gaps among stakeholders, these networks integrate diverse perspectives and expertise and can achieve mutually beneficial outcomes (Compton et al. 2007), in line with the principles of collaborative governance (Ostrom 2015). Previous research highlights the effectiveness of collaborative or participatory planning approaches in conservation management (Keough and Blahna 2006; Liu et al. 2010). In the realm of fire management, these approaches strengthen connections and understanding between communities and agents, enhancing effective management strategies (Achyar et al. 2015; Brannan et al. 2006; Jackman and Miller 2003; Mistry et al. 2019; Strzelecka et al. 2021; Suiseeya and Kimberly 2020).

A small but growing literature uses participatory approaches to study stakeholder opinion and facilitate coordination in fire management. Tebbutt et al. (2021) and Copes-Gerbitz et al. (2021) apply participatory mapping to identify wildfire

drivers in the Colombian Amazon and in British Columbia, emphasizing the importance of involving diverse stakeholders in decision-making, while Smith et al. (2007) use participatory systems analysis to assess obstacles to fire management in Australia. In South America, Bilbao et al. (2019) applied a workshop to address tensions in fire management, resulting in an intercultural network to promote collaboration. In the Mediterranean, participatory workshops and focus groups are used in forest management to tailor future scenarios to stakeholder needs (Palacios-Agundez et al. 2015). In Monchique, Portugal, a research project uses participatory mapping to highlight local knowledge and community agency in fire management, fostering a community-based disaster risk reduction approach (Partidário et al. 2022). Active stakeholder participation has led to a shared understanding of vulnerabilities and the development of risk reduction strategies.

In the Italian context, existing research has examined the spatial and temporal variability of wildfire disturbances (Elia et al. 2022), as well as the coherence and effectiveness of governance structures at the regional level (Kirschner et al. 2024). While the value of local knowledge in wildfire management is increasingly recognized, particularly in aligning fire and land use practices with specific local conditions (Uyttewaal et al. 2023), there remains a pressing need to foreground community perspectives and cultural diversity in decision-making processes, and participatory action research in this area remains largely underexplored.

This study addresses the challenges in wildfire management stemming from conflicting stakeholder priorities, fragmented governance, and divergent understandings of fire's role in Mediterranean landscapes. Using a participatory research approach (Chambers 2012), we employ a stakeholder workshop as a forum for dialog, allowing local actors actively involved in fire management to exchange perspectives and build mutual understanding (West et al. 2008). This, to our knowledge, is the first attempt to explore a participatory approach in Sicily to identify major fire management issues. The research focuses on Monreale, Sicily—a region with a long history of land-use changes and fire regime shifts, underpinned by complex institutional arrangements and contested interpretations of wildfire causes and impacts. The central aim of the workshop was to uncover how varying priorities, interests, and attitudes shape fire use and management, and to identify the social and institutional factors influencing wildfire frequency and severity. In doing so, we also sought to explore the potential for developing collaborative networks for more integrated fire governance at the local level.

The following Section 2 provides critical contextual background, outlining fire governance across multiple territorial levels, from national to local, alongside the historical and institutional landscape specific to Monreale. Section 3 describes the methodological approach, including workshop design, participant selection, and data collection. Section 4 presents the main findings, highlighting key areas of consensus and disagreement among stakeholders and identifying perceived drivers of wildfire risk. Section 5 discusses the implications of these findings for local fire governance and participatory approaches, while Section 6 draws the main conclusions of the study.

2 | Background: The National, Regional and Municipal Context

Italy's Mediterranean climate, marked by hot, dry summers, leads to high wildfire incidence, particularly impacting forested areas (San-Miguel-Ayanz et al. 2022). Much of Italy's present-day forest landscape, particularly in the south, is the result of afforestation and reforestation policies carried out throughout the 20th century. Forests are vital to the country's landscape, biodiversity, environmental balance, and economy. As of 2013, Italy's forested area reached 11,054,458 hectares, covering 36.7% of its national territory, yet over the past 30 years, fires have devastated more than 1,100,000 hectares (Gasparini et al. 2022).

In Sicily, reforestation efforts were heavily supported by the Cassa per il Mezzogiorno, a public fund established by law in 1950 to promote the socio-economic development of Southern Italy. These interventions focused on soil conservation and erosion control, mainly through large-scale plantations on public land. After the Fund was abolished, the Sicilian Region maintained these efforts, albeit with varying intensity and focus (Cantiani et al. 2018; Romano and Zullo 2014). These reforestation programmes, often using non-native or fast-growing species, have since come under scrutiny for their ecological suitability, fire susceptibility, and long-term sustainability (Avolio et al. 2012).

Sicily's strategic location at the heart of the Mediterranean, coupled with its rich ecological variety and long-standing exchanges with major agricultural civilisations, has given rise to an extraordinary diversity of agrarian and agroforestry landscapes (Barbera and Cullotta 2012). From the irrigated garden landscapes surrounding Palermo, shaped by Arab innovations in crop cultivation and water management, to the terraced vineyards and orchards that trace ancient lava flows on the slopes of Mount Etna, the island bears testament to centuries of adaptation between people and environment. Significant remnants of Mediterranean forest and maquis vegetation persist across the island, particularly within its protected sites. However, extensive land abandonment and agricultural decline—driven by rural depopulation and migration—have resulted in decreased land stewardship and increased fire-prone vegetation (Gasparini et al. 2022). While larger urban centers have retained more stable populations, smaller towns have experienced a marked decline (Statistical Service of the Sicilian Region 2024). Around 47.3% of the Sicilian population now resides in the provinces of Palermo and Catania, out of a total of nine provinces.

In recent decades, Sicily has seen a notable rise in wildfire activity. Over the past 15 years, there has been a marked increase in the frequency and extent of wildfires with especially severe events occurring during years marked by extreme weather conditions, now occurring at increasingly shorter intervals (La Mela Veca et al. 2024). In 2021, 87% of all wildfires in Italy occurred in just three southern regions: Sicily, Sardinia, and Calabria (Legambiente 2022). Sicily was the most affected due to its arid summers, widespread afforested terrain, and growing wildland–urban interface zones. In 2023, wildfires on the island accounted for 70% of the total burned area nationwide (La Mela Veca et al. 2024).

It is widely recognized that human activities influence fire regimes (Chas-Amil et al. 2015), although the dynamic interactions between landscapes, people, and fire continue to evolve (Ford et al. 2021). Institutional weaknesses further aggravate wildfire challenges. The regional Forestry Corps, increasingly understaffed, aging, and under-resourced, is often ill-equipped to meet the scale and complexity of contemporary fire management needs (Legambiente 2022). The transition initiated with the creation of the National Department of Civil Protection in 1992 introduced a more centralized system of disaster response. However, this shift also coincided with a gradual decline in public engagement and local involvement in fire suppression efforts, altering the previously community-driven approaches.

This broader context is exemplified in the case of Monreale, a municipality in the province of Palermo with approximately 40,000 residents. Located in a predominantly hilly area, at an average altitude of 310 m above sea level, Monreale includes various wildland–urban interface zones, agricultural land, and forested areas spread across seven protected sites: Bosco della Ficuzza, Bosco delle Cappelliere, Rocca Busambra, Gorgo del Drago, Valle del Fiume Oreto, Monte Pizzuta, and Moarda (see Figure 1).

Between 2010 and 2023, a total of 337 wildfires were recorded in Monreale that burnt 8862 hectares (Figures 2 and 3). Of this, approximately 26% was forest land. The average annual area affected by fire over this period was 682 hectares, with the average fire covering 26.3 hectares. The years 2021 and 2022 witnessed particularly destructive events, with peak burned areas of 61.51 and 40.52 hectares, respectively (data provided by the Regional Forest Corps of Sicily¹).

2.1 | Wildfire Regulations and Laws

Wildfire management legislation in Italy has evolved over time, shaped by both national and regional developments. In Sicily, a region with special autonomous status, pioneering legislation began with Regional Law No. 36/1974, which assigned the Sicilian Regional Forest Service responsibility for wildfire prevention, surveillance, detection, and reporting. The law also mandated firefighting interventions and stipulated that the regional government cover fire-related expenses. This was expanded by Regional Law No. 16/1996, which introduced planning mechanisms and personnel training provisions. Despite the limitations imposed by a prolonged hiring freeze, the Regional Forest Corps of Sicily (CFRS)—established in 1972—continues to oversee forest areas in the region and plays a crucial role in coordinating prevention, surveillance, and firefighting efforts.

At the national level, Legislative Decree No. 177 of 2016 marked a significant shift by dissolving the State Forestry Corps and integrating its functions into other national forces. However, Sicily, due to its special status, chose to retain the CFRS, recognizing its strategic importance in safeguarding the island's natural heritage. As such, the CFRS maintains comprehensive responsibilities, including wildfire prevention, surveillance, law enforcement, and active firefighting functions.

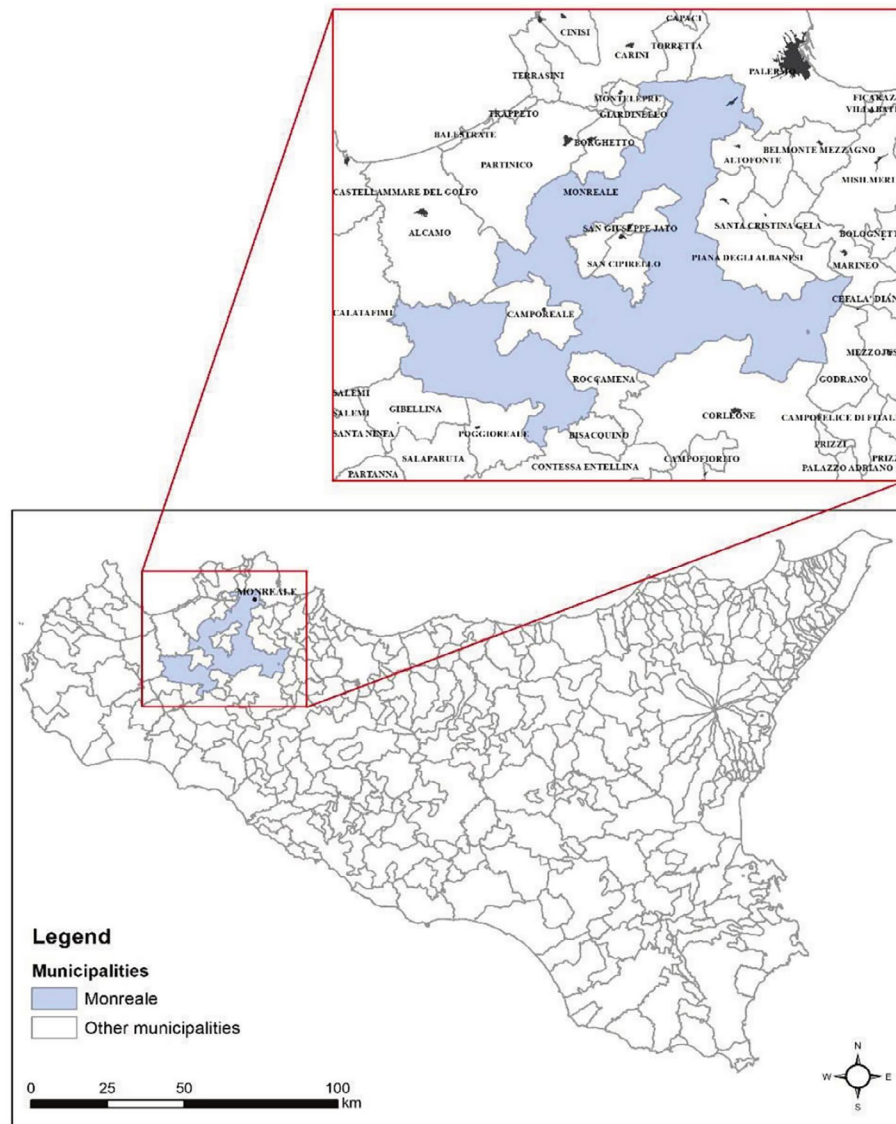


FIGURE 1 | Municipality of Monreale map. The bigger map shows the region of Sicily. In light blue, the Municipality of Monreale.

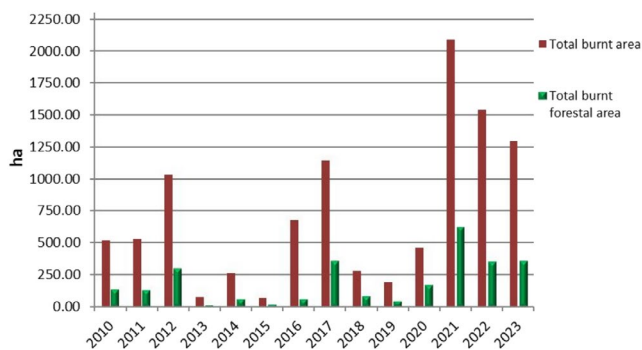


FIGURE 2 | Total burnt area and forested area in Monreale from 2010 to 2023. *Source:* Forest Corps of Sicily.

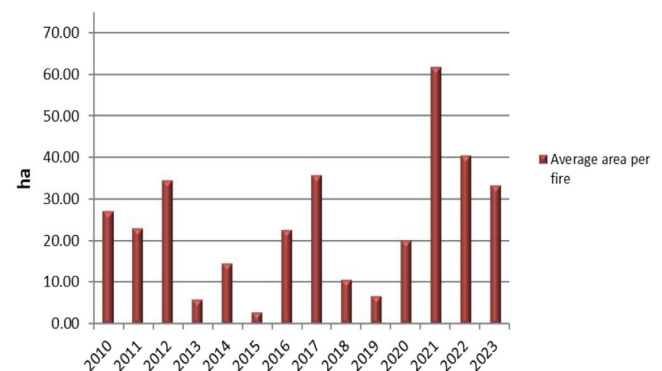


FIGURE 3 | Average burnt area per fire and in Monreale from 2010 to 2023. *Source:* Forest Corps of Sicily.

The broader national framework for wildfire management is primarily governed by Framework Law No. 353/2000, which established the foundation for wildfire prediction, prevention, and active firefighting across Italy. This law provided a formal definition of “forest fires” clarified responsibilities across national and regional agencies, and introduced planning tools both at the

regional level (Art. 3) and within national parks (Art. 149). Under this framework, regions are primarily responsible for planning, prevention, and active firefighting, utilizing their own resources in coordination with national entities such as the National Civil Protection Department and the National Fire Brigade (CNVVF).

TABLE 1 | Roles and responsibilities of the institutional bodies in Sicily.

Organization/department	Functions	Responsibilities
Regional Forest Corps of Sicily (CFRS)	Forest fire planning and natural heritage preservation.	Coordinates prevention, surveillance, and firefighting.
Department of Civil Protection (DRPC Sicilia)	Forecasting and preventive measures for diverse risks.	Safeguards assets and individuals during emergencies.
National Fire Brigade (CNVVF)	Technical safety interventions during emergencies.	Addresses fire incidents and diverse emergencies and focuses on wildfires in rural areas and the wildland–urban interface.
Regional Department of Rural and Territorial Development (DRSTR)	Management of Sicily's territory and public forest areas.	Manages economic development, vegetation restoration, and forest fire prevention strategies.
Regional Department of Environment	Oversight of Sicily's regional parks, nature reserves, and Natura 2000 network.	Protects regional parks, addresses pollution, monitors areas at environmental risk, and promotes strategic environmental assessments

However, challenges persist. One of the key issues lies in the varied interpretation of what constitutes a “forest fire” across regions, which complicates the collection of standardized data at the national level. Since 2021, wildfire perimeter mapping has been handled by the Carabinieri Forestali in regions with ordinary statutes, while autonomous regions like Sicily continue to manage this through their own forest corps. Although Law No. 155/2021 updated aspects of Law 353/2000-particularly to clarify responsibilities regarding mapping-issues related to data storage and standardization remain unresolved. The absence of a unified national database containing essential information such as ignition points, georeferenced fire perimeters, weather risk indices, and fire causes hampers the development of coherent and effective wildfire management strategies.

Additionally, regions often encounter difficulties in formulating preventive measures within their wildfire management plans. This is frequently due to restrictive legal frameworks, which can limit the adoption of more proactive and adaptive approaches to wildfire prevention.

3 | Methodology

Participatory workshops involving stakeholders provide a valuable opportunity to observe multiple actors, exchange ideas and perspectives, and gain a deeper understanding of their motivations (West et al. 2008). In determining the participants for our participatory study, it was important to encompass not only individuals directly engaged in fire management but also those who encounter direct or indirect repercussions stemming from wildfires due to their roles or exposures (Pivello et al. 2021). This inclusive approach provides a more comprehensive understanding of contextual factors, interconnections among participants, and identification of interests, behaviors, and ultimately, the desirable changes (Guerrero et al. 2013; Pierson et al. 2024).

3.1 | Stakeholder Identification

To characterize the actors involved in fire management we conducted a stakeholder analysis (Reed et al. 2009). Stakeholder analysis is a method for systematically identifying individuals, groups, and organizations involved in decision-making processes, and evaluating their influence (Enserink et al. 2022). To engage local actors, we identified relevant stakeholder groups and organizations involved in fire and land management activities. We consulted the Regional Plan for Forest Fire Management 2023–2025, issued by the regional forestry authority, for guidance. This plan provides a comprehensive framework for fire management, outlining the roles and responsibilities of various bodies involved in fire management, ranging from national to municipal and local levels.

Additionally, we incorporated information from key local organizations, including documents and projects managed by the Department of Agricultural, Food and Forestry Sciences (SAAF) at the University of Palermo, which oversees various forestry initiatives across different parks in Monreale. We also collaborated closely with the Office of the Mayor in Monreale, particularly during the stakeholder identification phase, to ensure the inclusion of relevant local actors. Table 1 outlines key organizations and their responsibilities for wildfire management operating at the regional level but with significant roles and implications in local municipal territories.

Stakeholders were selected based on their expertise in environmental policy, forestry, agriculture, or fire management, positioning them as valuable sources of information. Stakeholders were categorized into four macro-categories²: (i) government institutions, departments, and agencies, (ii) private organizations, individuals, agencies, and communities at risk, (iii) academia, and (iv) NGOs and voluntary organizations. The onion diagram in Figure 4 depicts the various interest groups organized by jurisdictional levels.

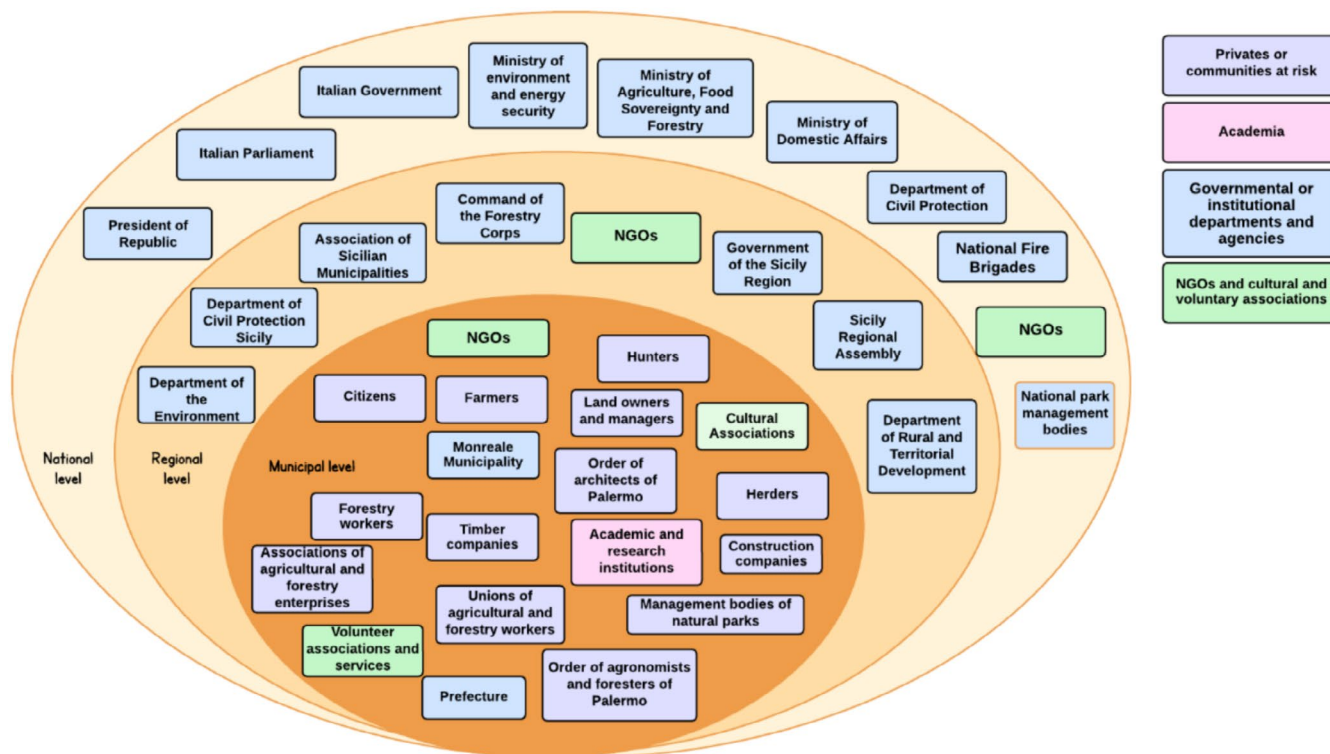


FIGURE 4 | Onion diagram of the stakeholders grouped by jurisdictional level.

3.2 | Ethics Statement

This study adheres to recognized principles of research ethics and has received approval from the Science, Engineering and Technology Research Ethics Committee (SETREC) at Imperial College London (Reference Number: 6497365). Prior to data collection, participants received a comprehensive information sheet outlining the study's objectives, participant roles, potential risks, the process for voluntary withdrawal, and assurances of free and informed prior consent, anonymity, confidentiality, and data protection. A consent form, signed by all participants, was collected before the commencement of data collection.

3.3 | Workshop Structure

Government agencies and researchers often use a range of methods—such as interviews, surveys, workshops, and advisory board meetings—to assess stakeholder views on environmental and socio-economic issues. A participatory workshop, held in June 2023, offered a valuable opportunity to engage with multiple actors, exchange ideas, and better understand their motivations. Invitations were extended via email using non-probability snowball sampling (Reed et al. 2009), targeting networks and organizations identified through stakeholder analysis.

The workshop was attended by 18 participants representing all major stakeholder groups. These included representatives from key organizations such as the Regional Forest Corps of Sicily, the Department of Rural and Territorial Development of the Sicilian Region, Palermo Provincial Fire Brigade Command, the Regional Department of Civil Protection, as well as forestry

science experts, forestry workers, and trade unions, academia, NGOs, and cultural and voluntary organizations.

The majority of participants were male (89%), with the 40–64 age group most represented (64%). This demographic skew reflects the ongoing male-dominated nature of fire-related professions and a decades-long hiring freeze within the Regional Forest Corps of Sicily. It is also worth noting that in 2023, men accounted for 61% of the workforce in the province of Palermo. Two co-authors of this study facilitated the discussion in Italian, guiding participants through three carefully selected activities. These were designed to give all stakeholders an equal opportunity to share their views, moving from general concepts to more detailed insights through structured discussion, contributing to the research objectives. It is important to note that the facilitators encouraged open dialog, fostering an unstructured yet inclusive exploration of the complexities of fire management. They did not steer the conversation towards any theme; instead, all inputs were open and generally framed. Their role was to ensure that speaking time was evenly distributed and that space was created for differing viewpoints and rebuttals. However, it is crucial to recognize that certain methodologically driven complications may persist when interpreting the findings. For instance, facilitators' own unconscious biases could subtly shape the conversation, even when striving for neutrality. Similarly, despite efforts to balance speaking time, dominant personalities might inadvertently steer the discussion, potentially leading to groupthink or the overshadowing of less assertive participants.

Conversations were audio-recorded and transcribed post-workshop, forming the data for this study. The data were analyzed through inductive coding to identify perspectives, arguments, and emerging themes. This inductive approach

allowed themes to emerge organically from the data, rather than being guided by a pre-existing coding framework or researcher assumptions (Braun and Clarke 2006).

3.3.1 | Rich Pictures

In the first activity, participants were divided into two groups of nine, with each group including a mix of institutional and civil society representatives. A facilitator guided the discussion and took notes. The task was to collaboratively create a “rich picture” illustrating participants’ immediate thoughts and ideas about wildfires in the area (Bilbao et al. 2019).

Groups were free to determine the content and layout of their rich picture, incorporating drawings, symbols, and keywords (Berg and Pooley 2013; Walker et al. 2014). This activity served as an ice-breaker and encouraged the exchange of perspectives and themes. At the end of the session, each group presented their rich picture to the others.

3.3.2 | Stakeholder Matrix

Building on the stakeholder analysis in Section 3.2, we categorized stakeholders according to their level of interest in and power over fire-related activities (Varvasovszky and Brugha 2000). To distinguish between decision-makers and decision-takers (Grimble and Wellard 1997), we developed an interest–power matrix (Reed et al. 2009).

During a plenary session, participants were asked to rate each stakeholder group’s level of “interest” and “power” on a scale from 1 (low) to 10 (high), resulting in a four-quadrant matrix. While the terms “influence” and “power” are often used interchangeably in stakeholder studies, we adopt the definition used in previous literature, where power is derived from control over assets, asymmetric access to resources, or the ability to mobilize resources to achieve outcomes (Marques et al. 2020). See Appendix A for the definition of the concepts of interests and power as presented to the participants for compiling the Power–Interest Matrix.

To avoid confusion around the definitions of power and interest, we conducted follow-up individual sessions with each participant to finalize the matrix. These sessions allowed participants to elaborate on their reasoning. Beyond identifying key actors in wildfire management, the matrix also served to inform a strategy for potential future collaboration at the local level. Recognizing that each stakeholder group has distinct roles may facilitate a more comprehensive approach to management by tailoring engagement strategies to those with higher levels of interest and power (Eden and Ackermann 1998).

3.3.3 | Problem Tree

The third activity involved a plenary session during which participants developed a problem tree. Problem tree analysis is commonly used to guide interventions in complex fields such as poverty alleviation or agricultural development (Adesope and Ogueri 2018; Ammani et al. 2010), by deconstructing challenges

into component parts (European Commission 2004). This is typically done using a tree diagram to map out cause-and-effect relationships, akin to a mind map (Renger and Titcomb 2002).

The aim was to identify the factors contributing to wildfire ignition and frequency, and to understand stakeholder motivations and interests. The value of the exercise lay in the discussion, debate, and dialog that emerged as participants identified, refined, and reorganized the contributing factors (Renger and Titcomb 2002).

4 | Results

Figure 5 presents a hierarchical chart of themes that were explored during the workshop, with the area of polygons reflecting the duration of conversations (measured in minutes) devoted to each theme or subcategories of themes. The most prominently debated themes revolved around the coordination of firefighting, the insufficiency of prevention culture, and institutional authority. Causes and indirect drivers were the second most discussed topics.

4.1 | Rich Pictures

The rich pictures activity (Figure 6) revealed the strong emotional dimension of fire experience. All groups used words and phrases demonstrating emotional engagement and highlighting the psychologically scarring effects of wildfire experience. “Anger,” “frustration,” “preoccupation,” “a sense of helplessness,” “death,” and “devastation” were frequently used during the sessions and recorded in groups’ illustrations.

Participants commented on operational considerations, encompassing both prevention and firefighting. There is evidence of a strong memory of the transitions in the institutions involved in fire management over time. Participants recalled how, in its early stages, the responsibility lay with the military and citizens who directly participated in firefighting activities, even for smaller-scale fires. The establishment of the Department of Civil Protection was mentioned as a catalyst for the “institutionalisation and politicization of wildfires.” This shift has led to a decreased level of public engagement in active suppression efforts, contrasting with the more involved role that the public played in firefighting operations 50 years ago. Simultaneously, there has been a growing reliance on aerial means of fire suppression, especially as larger wildfires have become more prevalent. This transformation has contributed to a diminishing sense of responsibility among the public for actively participating in firefighting endeavors.

Historically, reflecting on firefighting efforts when they were unified under a single umbrella reveals a shift from social to political-administrative concerns. The establishment of civil protection services further emphasized economic over social aspects. In the past, firefighting was seen as an adventure, with everyone, from children to women, boarding fire trucks to extinguish relatively small fires. However, the transition to aerial firefighting activities transformed it into a paramilitary

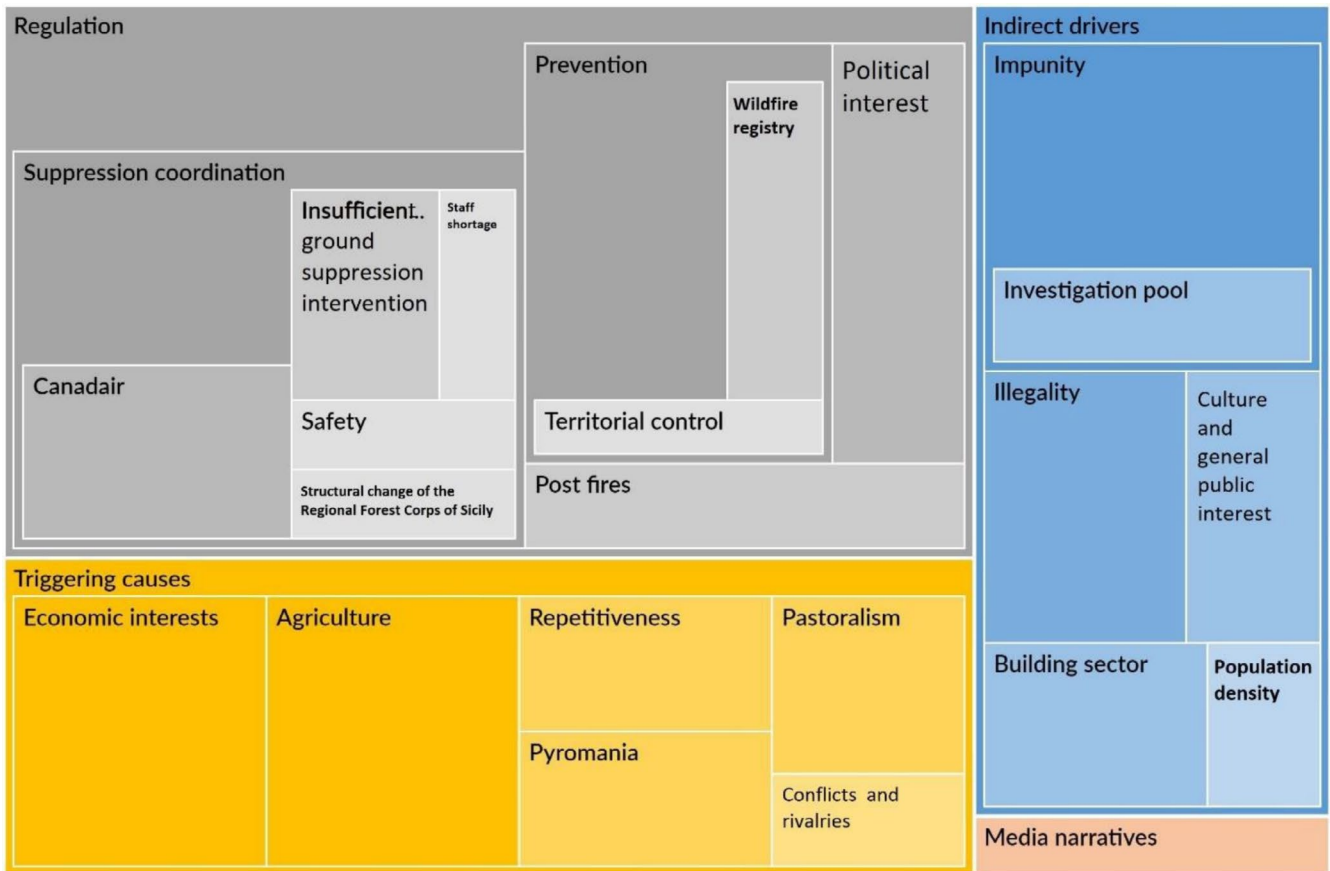


FIGURE 5 | Hierarchical chart of themes explored during the workshop. The chart organizes the qualitative data into major thematic areas and nested subcategories, showing how ideas cluster and relate. Each colored area represents a main theme, while the blocks inside show subthemes or more specific codes. The size of the blocks reflects the time spent on each theme. Grey represents Governance and Institutional Gaps, yellow represents Triggering Causes, blue represents Indirect Drivers, and orange represents Media Narratives.

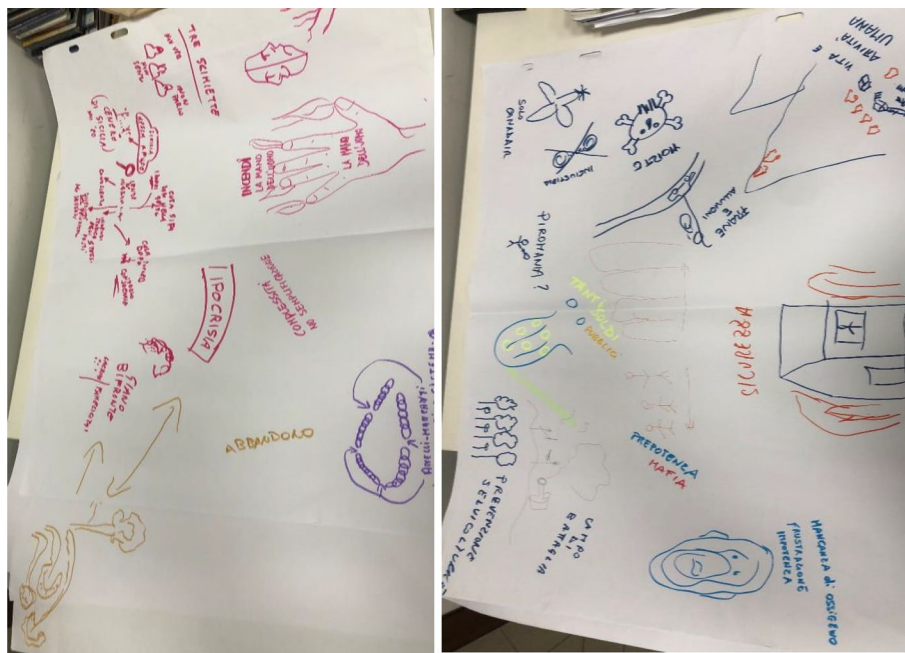


FIGURE 6 | Rich pictures from the two working groups. The figure is a photograph of the two rich pictures drawn by the participants.

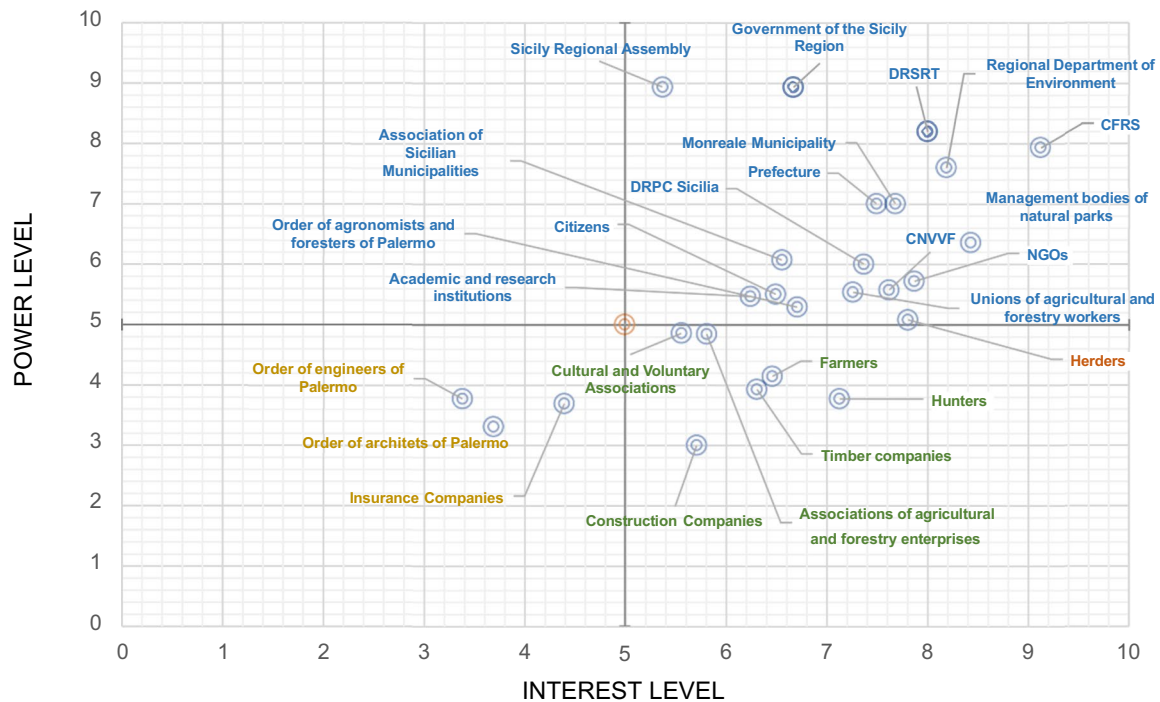


FIGURE 7 | Interest–power matrix mapping various stakeholders. The matrix uses a Cartesian grid where the x-axis represents the level of interest, increasing from left (low interest) to right (high interest), and the y-axis represents the level of power, increasing from bottom (low power) to top (high power). Stakeholders are color-coded as follows: Those in blue have high levels of both power and interest; those in yellow have low levels of both; those in green have high interest but low power; and those in orange have higher levels of power and interest than the green group, but not as high as those in blue.

operation. Nowadays, firefighters rely on planes, and training occurs during active firefighting periods rather than in winter. This shift has turned firefighting into a spectacle, and there's a need to return to its roots.

—Participant 8, during the rich pictures session

4.2 | Stakeholder Matrix

After the workshop, we conducted individual sessions to compile the stakeholder matrix. Figure 7 shows the placement of each stakeholder group in the power–interest space.

Agents in the top right quadrant are the “leaders,” stakeholders with high interest and high power, bearing the main responsibility for wildfire management under contemporary institutions. These included primarily institutional bodies such as the Regional Forest Corps of Sicily (CFRS), the Department of Civil Protection (DRPC Sicilia), the National Fire Brigade (CNVVF), the Regional Department of Rural and Territorial Development (DRSTR), and the Regional Department of Environment, but also NGOs, academia, citizens, and the municipality. Stakeholders in the bottom right quadrant have high interest but low power. This group of “players,” including private entities and cultural associations, lacks authority but has an acute understanding of interactions and behaviors driving wildfire occurrence. In the bottom left are the “crowds,” stakeholders with low interest and low power. Notably, participants did not identify any stakeholder as belonging to the low interest–high power group.

This depiction suggests stakeholders' potential roles in inter-institutional and cross-stakeholder collaborative fire management. A network strategy, with potential future collaboration at the local level among stakeholders with significant interests and power, can foster an integrated approach to fire management (Eden and Ackermann 1998). In this example, regional institutions would need to strengthen the collaboration and coordination within the different departments and municipalities and initiate a network strategy with academia, NGOs, citizens, forestry workers, and unions for a more comprehensive fire management framework.

4.3 | Problem Tree

Figure 8 illustrates the problem tree developed during the third activity. The tree suggests that participants agreed that Monreale's vulnerability to wildfire impacts and the frequency of fires were the main areas of concern. They then explored the direct causes and consequences of the problem, distinguishing between immediate factors—such as triggers, both voluntary and involuntary—and indirect drivers. These elements were used to construct a visual representation that captures the complexity of these interrelated factors.

4.3.1 | Effects

We recorded unanimous recognition of the broad and impactful negative effects of wildfire in the area. Participants acknowledged that wildfires not only lead to human casualties and injuries,

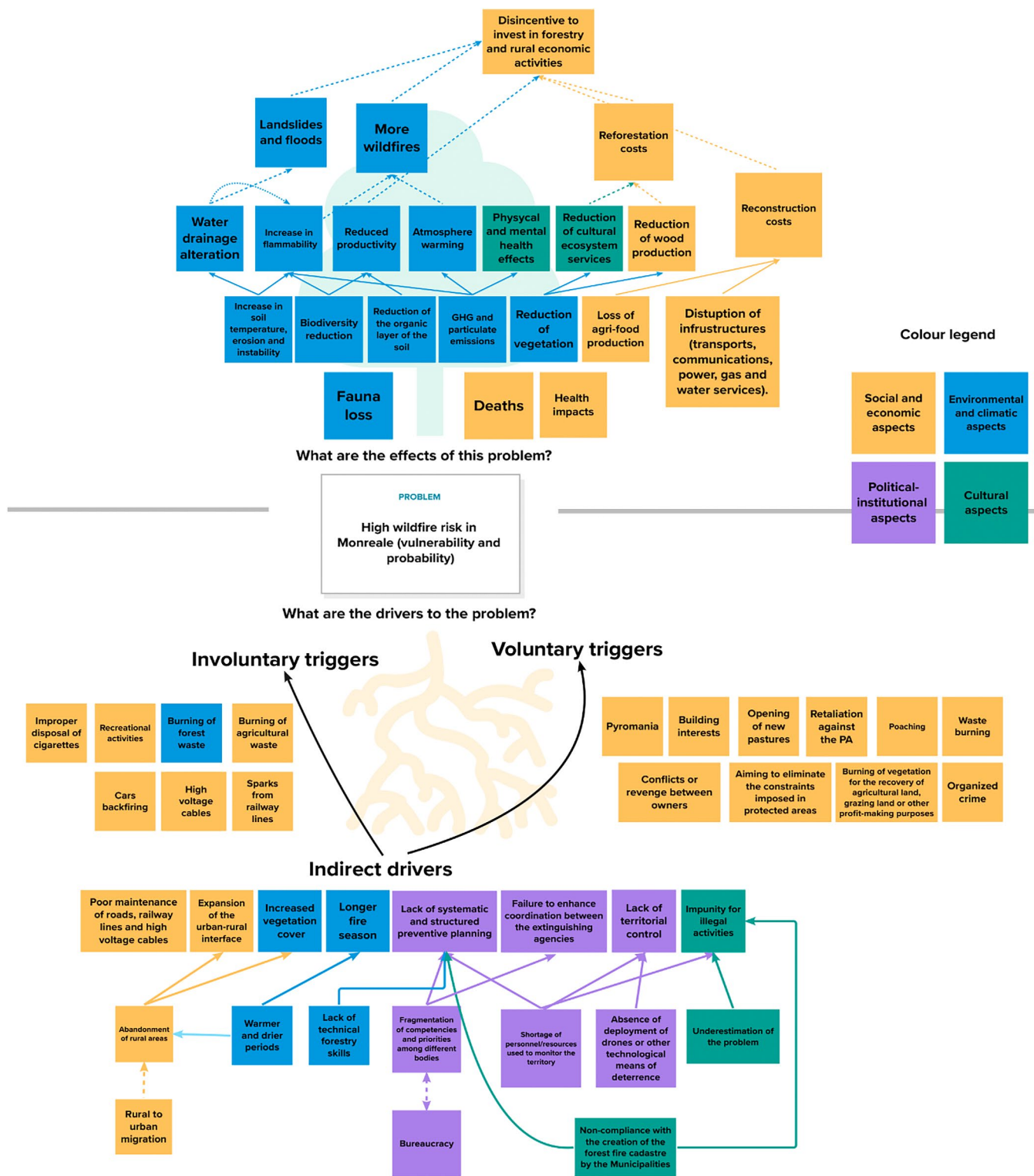


FIGURE 8 | Problem tree developed during the workshop.

threatening communities, but also negatively influence biodiversity and ecosystem health. They further highlighted the economic impact implied by the disruption to infrastructure. Finally, they highlighted how greenhouse gas emissions and particulate matter released during wildfires contribute to air pollution, which can have long-lasting effects on air quality and human health.

According to most participants, wildfires contribute to soil erosion and alter water drainage patterns, increasing the risk of landslides and floods in affected regions. They all agreed that the disturbance to the natural hydrological cycle can further exacerbate environmental degradation and endanger human settlements.

Fires create a point of discontinuity in territorial management. Consequently, the aftermath of fires includes floods and landslides, especially in the Monreale area, as the protective vegetation is compromised. Previously, the Oreto valley was with no vegetation. After the flood of 1931, significant efforts were made to reforest the entire Oreto valley, including Monte Pellegrino.

—Participant 18 (during the problem tree session)

While respondents generally agreed on restoring landscapes to their pre-wildfire state, they acknowledged that reforestation and ecosystem restoration imply significant costs for local and national governments and communities. Soil productivity is significantly reduced following wildfire, affecting agricultural and forestry activities. The loss of agri-food production and wood resources further impacts local economies and livelihoods. In light of this, concerns were raised regarding the future role of the forestry sector. There were apprehensions that the consequences of wildfires might deter investments in economic activities connected to forestry and rural regions.

4.3.2 | Causes

Participants perceived depopulation, rural and agricultural abandonment, and land cover change as prominent features among indirect drivers of wildfire occurrence. They also agreed regarding the insufficient culture of prevention, pastoral and farm practices, the shortage of forestry-trained personnel for forest management, and the overall impunity of those responsible for the ignitions. Yet, the debates centered largely on the role and effectiveness of suppression coordination among the responsible authorities.

Some participants disagreed with including suppression coordination as one of the drivers of wildfire risk in the area, while others responded by providing examples of fire events that occurred in Monreale, where suppression efforts were unsuccessful. At the same time, doubts were raised regarding whether the forestry corps' aging workforce could cope with the increasing demands of forest fire management.

(...) I would say that there weren't any problems related to coordination. We operate according to well-established procedures, have a unified operations room, and coordinate aircraft recalls collaboratively. In other words, we have a system that has worked very well, especially in recent years. (...) Since last year, firefighters have also trained DOS personnel, who are the directors of firefighting operations. Therefore, considering that the airplanes are under the fire brigade management, if in that area, at that moment, there is no forestry DOS, there is also a firefighter's DOS for forest fires.

—Participant 4 (during the problem tree session)

(...) Regarding the fires in Monreale, I can share two dramatic cases. In 2021, a fire passed through the grove, entered Strasatto, consumed Carpineto, and reached Piana, practically traveling across Sicily. On that bad day, at least three teams from different bodies—AIB, firefighters, and civil protection—were present. Drawing from my firefighting experience, I know that when there's a sensitive spot, a line of fire, you must concentrate as many men as possible to stop it, and then move to another spot. Instead, these potentially coordinated teams scattered for various reasons. Only one team from the forestry corps remained, consisting of four people, highlighting the issue of decreasing personnel. The fire jumped the fender, passing through Strasatto, Piana degli Albanesi, and more. Now, let's discuss the terrible summer of 2022 in Valle Presti. On the night of August 15, 2022, things worked well; teams from the forestry corps, civil protection, and firefighters successfully controlled the situation. However, on August 18, a terrible day, around 12:30 pm, there was no longer a full team available. Some were sent to Contrada Barone. Despite efforts over three days, the fire reignited, leading to the devastation of Valle Presti—a tragic consequence of insufficient teams and resource allocation. That's what frustrates me.

—Participant 16 (during the problem tree session)

In the end, they agreed that they are facing unprecedented challenges in managing the new trends of large wildfires seen in the last decades, primarily due to climate change, as well as a lack of personnel and the fragmentation of priorities and competencies within the various bodies.

What is changing is the nature of the phenomenon. There are too many fires of aggressive nature, which tend to strain the existing structures. (...) Today, the scale of the phenomenon, not only here but in other regions as well, has become so extensive and intense that it is placing a significant burden on institutional systems. I believe this can be stated. You are forced to confront situations in certain contexts with complexities that put the systems, which include not only personnel but also resources and technical expertise, under stress. There should be more resources and additional structures in place. So, the phenomenon's widespread nature is creating challenges.

—Participant 5 (during the problem tree session)

This fragmentation is caused by bureaucracy and has led to a failure to enhance coordination among firefighting organizations in response to the new climate conditions.

When the flames are high, I'm sorry to say it, but without aerial support, we simply can't operate.

—Participant 4 (during the problem tree session)

Some of the stakeholders stressed how wildfire becomes a public interest only when it hits cities and houses. Additionally, participants do not perceive the media discourse around wildfires as representative of their own experiences. According to participants, media narratives often sensationalize wildfire reporting, attributing their occurrence to the involvement of the mafia or organized crime, capitalizing on public interest in the topic to generate engagement, even though they lack concrete evidence to support such claims. By focusing on sensationalized stories, the media fails to highlight the underlying causes and management issues related to wildfires, instead creating confusion and uncertainty among the public. Meanwhile, the complexities behind wildfires, which are often interconnected with other socio-economic drives, remain overlooked or understated in these narratives. For instance, participants emphasized the use of fire as a means of settling disputes among landowners and the actions of local farmers and herders who persistently engage in land clearing activities during the summer, often disregarding established national bans. This disregard of the ban is linked with a broader argument that stresses the necessity of reestablishing respect for rules and regulations, advocating for a comprehensive approach beyond technical fire management.

The environmental group expressed concern about the recurrent use of fire in protected areas, with the eventual aim of lifting agricultural or development restrictions in those areas. The issue of development speculation has drawn attention to a significant loophole in national law regarding the issuance of building permits in wooded areas, which was previously strictly regulated. The removal of constraints on absolute non-buildability has created potential for misuse, as historical cases have demonstrated instances where fires were intentionally set to manipulate land use regulations for personal gain. The following quote sheds light on the intricate challenges surrounding land development and fire management, calling for a re-evaluation of existing legal frameworks and their implications on environmental and social concerns.

We are in one of the realms of illegal construction. (...) We are not talking about hidden criminological phenomena it is not like drugs, murder. We are talking about illegal construction, what is illegal construction if not violating laws in broad daylight? Fires are becoming much more of a thing of this nature.

—Participant 5 (during the problem tree session)

The widespread illegality and its impact on various aspects of society, particularly in rural areas and the control of territory, is twofold: on one side there is the self-interest and individualism of the public; on the other, a certain institutional laxity for environmental issues.

Illegality that is not necessarily linked to the mafia, illegality that is in Sicilian culture, the culture of

mine, of the private good and not of the public good, I do not take care of that of others, I take care of my own property, I do my interests. I do not care if I create problems for others.

—Participant 6 (during the problem tree session)

Participants called for institutions to assert their authority and address illegal activities that threaten the environment and social order, reaffirming rules and respect for legality to counteract these issues and mobilize resources effectively.

5 | Discussion

The participatory workshop brought together representatives from diverse sectors involved in fire management policy, fostering a comprehensive understanding of the roles, behaviors, interests, and priorities of key stakeholders in Monreale's jurisdictional area. The discussions provided important insights into wildfire and land management in the municipality of Monreale and unveiled diverse perspectives on socio-economic and political dimensions. The results confirmed and expanded upon findings from other studies conducted in Italy and elsewhere. As in Kirschner et al. 2024, and Uyttewaal et al. 2023, work in Italy, we find significant value in recognizing local knowledge in wildfire management, particularly in aligning fire and land-use practices with specific local conditions. Continued efforts are necessary to ensure that the contributions and roles of all parties are fully acknowledged in the development of participatory local management strategies. The outcomes of the workshops and subsequent thematic analysis were instrumental in further engaging stakeholders, assessing the potential for common ground to advance more sustainable local policies (Piroli et al. 2024).

During the discussions, especially the rich picture exercise, we observed a clear emotional response to fire, particularly when discussing negligent and malicious triggers. Sentiments of anger and despair reported by participants are consistent with previous research on the negative impacts of wildfires on human well-being (Kountouris and Remoundou 2011). While some cases of natural disasters can result in positive changes and post-traumatic growth (Hefferon et al. 2009), other studies indicate an increase in depression, feelings of hopelessness and anxiety, as well as post-traumatic stress disorder (Knez et al. 2018). Additionally, individuals may experience emotions such as loss of solace from the landscape and grief (Eisenman et al. 2015).

There was unanimous recognition of the negative effects of wildfires, including threats to human safety, biodiversity, and ecosystem resilience, economic disruption, and air pollution. Participants also noted soil erosion, altered water patterns, and increased risks of landslides and floods, further endangering settlements. Findings confirm that stakeholders acknowledge and experience the impact of fire impacts hypothesized and reported in the wider wildfire literature (Doerr and Santín 2016; Frankenberg et al. 2005; Robinne 2021; Stephenson et al. 2013). For instance, Shakesby (2011) highlights the long-term implications of post-wildfire soil erosion for soil health in Mediterranean regions, while Caltabellotta et al. (2022) in a recent study of the Moarda forest in Palermo show that wildfires can destroy

naturally occurring soil water repellence that may increase overland flow and erosion risk.

We found significant diversity of opinion, particularly between institutional bodies and civil society groups. Environmental groups expressed a general distrust of governing institutions, highlighting their perceived structural incapacity to address the evolving wildfire challenges amid changing climatic conditions. Aside from this aspect, climate change received limited attention, with participants focusing more on the socio-economic and demographic dynamics specific to Sicily. This emphasis on human activities may be attributed to their significant contribution to vegetation fires in Italy (Legambiente 2022).

Participants highlighted the use of fire to settle disputes among landowners and the persistent practices of local farmers and herders who engage in land clearing during the summer months, often in defiance of national fire bans. Intentional fires are suspected of being set to change land use, leading to conflicts between landowners, authorities, and communities and fueling property disputes (Ascoli et al. 2022). Stakeholders also stressed that media narratives often oversimplify the causes of wildfires by attributing them solely to organized crime or mafia activities. While such factors may play a role in certain instances, this perspective can obscure the complex socio-economic and political issues underlying wildfire incidents.

Although Italian law prohibits ignitions for land clearance during the summer months and restricts changes in land use in fire-affected areas for 10 years following an event, enforcement remains weak. Outdated and poorly maintained cadastral records create legal loopholes that hinder the verification of actual land use. Regarding the ignition ban, stakeholders note that the widespread disregard for fire-use regulations reflects a broader need to re-establish respect for rules and governance. It also raises concerns about the true effectiveness of seasonal fire bans. While such bans are intended to prevent catastrophic fires exacerbated by wind and climatic conditions, they may paradoxically discourage fire setters from monitoring the burns, resulting in uncontrolled wildfires.

The limited presence of specialized personnel and inadequate preventive control measures in Sicily pose additional challenges to mitigating catastrophic vegetation fires. The aging, demotivated, and understaffed regional Forestry Corps is ill-equipped to effectively respond (Legambiente 2022). Over the years, institutional bodies have been operating in isolated silos, with little effective communication. This has resulted in the emergence of conflict narratives, as reported in previous studies (Kirschner et al. 2024; Swedeen 2006). The limitations of this fragmented system become clear during this study, emphasizing the necessity for greater integration and collaboration among the different parties involved. By breaking down existing barriers and establishing robust channels of interaction, these entities can work together more effectively to address the challenges posed by wildfires and tackle the causes behind recurring fire events (Ascoli and Bovio 2013; Hasnaoui and Krott 2019; Palaiologou et al. 2021).

It is noteworthy that stakeholders did not appear to recognize the ecological benefits of fire in maintaining biodiversity, promoting vegetation renewal, and controlling pests (Moritz

et al. 2014). This perspective may stem from the disconnection between humans and natural fire regimes, a gap that has been exacerbated by urbanization and prolonged fire suppression policies, leading to a diminished understanding of fire's role in ecosystem health and human development (S. Pyne 2001, 2022, 2016). Extended periods of fire suppression and land abandonment have altered natural fire regimes, resulting in fuel accumulation and the loss of traditional land management practices, thereby elevating wildfire risks (Schoennagel et al. 2017; Ursino and Romano 2014). These factors may have significantly contributed to fostering negative perceptions of fire and its utilization in the region.

Building a collaborative framework that encourages shared decision-making and mutual understanding will lead to more comprehensive and sustainable fire management practices (Blatner et al. 2001; Kirschner et al. 2024). In addition, participants generally perceive a lack of a compelling long-term prevention plan suitable for the current wildfire situation in the area. This perspective may, on one side, underscore an overemphasis on reactive fire management, leading to the neglect of preventive measures (Ellison et al. 2015; Xanthopoulos et al. 2020). On the other hand, it signals fluctuating confidence in the government, influenced by wildfire events (Sharp et al. 2013) or linked to historical events and corruption (Rust et al. 2020). This has repercussions at the local level, where smaller municipalities in the Sicilian inland struggle to allocate funds for road cleaning every year before the summer season starts. Additionally, concerns have emerged regarding the freeze on hiring within the Forest Corps in Sicily, an institution responsible for tasks ranging from combating wildfires to environmental conservation across the region. This freeze is detrimental to the sustainability of the Forest Corps. In contrast, other similar special status regions like Valle d'Aosta, Friuli Venezia Giulia, Trentino-Alto Adige/South Tyrol, and Sardinia have successfully conducted legitimate hiring competitions, leading to the employment of young individuals who contribute to their respective regions.

Participants noted a decline in public engagement during the discussion, signaling a significant transformation in firefighting approaches over the past few decades. There has been a notable decrease in public involvement in active suppression efforts, particularly since the establishment of the Department of Civil Protection in 1992. This shift may have led to a detachment of the public from resource management responsibilities. Although firefighting was once associated with the close involvement of local communities, it has become less so with the adoption of aerial firefighting techniques and the professionalization of fire services. This trend reflects patterns seen in the United States since the 1960s, where there has been a decline in social capital according to Putnam (1995). Active citizen engagement in public affairs facilitates more effective policy responses and service delivery, particularly in emergency situations like wildfires (Andrews and Brewer 2010). Strengthening social capital can improve fire protection through increased funding and partnerships among local communities, voluntary associations, and the private sector (Purdue 2001). Prioritizing social capital development empowers policymakers to fortify community resilience, enhance wildfire prevention and response efforts, and prevent individual exploitation of shared resources, thus averting their depletion or degradation (Herzberg 2015; Ostrom 2015).

6 | Conclusions

This paper presents the results of a participatory workshop involving representatives from the civil service, firefighters, foresters, civil society, land managers, and academia aiming to enhance the understanding of the roles, behaviors, interests, and priorities of the actors involved in fire-related activities in the jurisdictional area of Monreale.

Our participatory workshop in Monreale shed light on critical fire management issues, offering valuable insights into the complexities at the intersection of environmental, social, and institutional dimensions. Advocating for a comprehensive wildfire management approach is essential, encompassing prevention, active management, and stakeholder collaboration. This entails allocating resources for prevention efforts, increasing community involvement, implementing legislative reforms for clearer governance, providing ongoing training for forestry personnel, and fostering sustained collaboration between Regions and the State. Despite challenges, redefining sector priorities and roles is necessary to effectively adapt to emerging wildfire patterns and mitigate their adverse effects.

These challenges extend beyond the local context, offering lessons applicable across the broader spectrum of fire management in the Mediterranean region. Recurring themes such as climate change impacts, evolving socio-economic conditions, and governance deficiencies underscore the need for enhanced collaboration and proactive, long-term prevention strategies. By collectively addressing these issues and implementing lessons learned from various regions, society can progress towards a more resilient and sustainable global approach to fire management amid an ever-changing climate.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Endnotes

¹ This data has been sourced from the Regional Forestry Corps of Sicily.

² An anonymous reviewer pointed out, during the peer-reviewing process, that the EU could potentially be considered as one of the stakeholders. The EU has developed strategies related to forested areas and the bioeconomy, which may have indirect relevance to fire management. For instance, the European Union's Rural Development Programme (RDP) provides funding for wildfire prevention measures as defined in regional fire management plans, and the Forest Strategy for 2030 includes actions to improve forest resilience and adapt to climate change. However, these do not directly influence national or regional frameworks through a mandatory directive on wildfire management. As Kirschner et al. (2024) note, the wider EU regulatory context plays a limited role in governing wildfires.

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Appendix A

Definition of the concepts of interest and power as presented to the participants for the Power–Interest Matrix.

"To assess the interest of the different actors, we ask you to consider the following:

- The extent to which they are vulnerable to wildfire activity in the area.
- The extent to which they are positively affected by wildfire activity in the area;
- Their direct and indirect economic dependence on wildfire;
- Their interests in the cultural services associated with wildfires (outdoor recreational activities, tourism, landscape aesthetics, etc.)
- Their interests in the ecosystem services associated with wildfires (pest and disease control, carbon sequestration, biodiversity, soil and water quality, etc.)."

"To assess the power resources of actors, we ask you to consider their ability to use the following mechanisms to influence behavior:

- Coercion, which involves altering behavior through the use of force, including laws and regulations, control of territory or access rights, as well as the threat of force.
- The power to establish incentives, which can be both economic and moral in nature, to influence behavior aimed at obtaining material and immaterial advantages or avoiding disadvantages.
- Finally, the power to disseminate dominant information, which involves altering behavior by using unverified but deemed reliable information by subordinates, ideologies, or specialized knowledge, through lobbying activities, public relations, contributions to research projects, technical documents, and participation in public events such as workshops, seminars, meetings, or working groups, as well as through the media."