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Received: 22 December 2023 | Accepted: 24 August 2024

DOI: 10.1002/pan3.10729

PEOPLE AND NATURE | BRITISH ECOLOGICAL SOCIETY

RESEARCH ARTICLE

Understanding stakeholders' perspectives behind wildfires in Sicily: A Q-methodology approach

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Funding information
EPSRC Centre for Doctoral Training in Technology Enhanced Chemical Synthesis; Leverhulme Centre for Wildfires, Environment and Society through the Leverhulme Trust, Grant/Award Number: PSH567_LFEPR; Arts and Humanities Research Council, Grant/Award Number: AH/Z00005X/1

Handling Editor: Rachel Carmenta

Abstract

1. Mediterranean wildfires persistently challenge regions due to climatic factors, changing land use, and abandonment of rural areas, posing threats to both ecosystems and human well-being.
2. Current fire management emphasizes fire exclusion, neglecting traditional methods and socio- ecological processes, thereby elevating the risk of catastrophic events and negatively impacting ecosystems.
3. Collaborative efforts among stakeholders and decision makers are essential for effective wildfire mitigation; lack of engagement perpetuates conflicts, underscoring the need to integrate diverse perspectives to enhance environmental management policies.
4. Focusing on Monreale, Sicily, as a representative of fire-prone Mediterranean landscapes, this study uses Q-Methodology to investigate stakeholder attitudes toward the causes and drivers of wildfires.
5. Using Q-Methodology, the research identifies shared values and discrepancies among stakeholders, revealing information on acceptable wildfire policies by discerning areas of consensus.
6. The paper delves into various perspectives on socioeconomic and political dimensions in Sicily, unravelling conflicts and consensus areas for advancing fire management objectives. It concludes with policy insights and recommendations for future research.

KEYWORDS
conflicts, fire management, interests, Q-methodology, wildfire

1 | INTRODUCTION

Wildfires present persistent challenges in Mediterranean countries due to a combination of climatic conditions and land use change increasing fuel availability (Doerr & Santín, 2016). While fires play crucial ecological roles (Bowman et al., 2019, 2020), human-induced climate change is expected to increase the frequency of catastrophic fire events with severe consequences for human lives and environmental quality. To meet this forthcoming challenge, human societies must learn to co-exist with fire, especially in areas where fires pose significant threats to both the environment and the economy (San-Miguel-Ayanz et al., 2022).

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While certain management solutions aim to shift the occurrence of fires in space and time, facilitating local community adaptation rather than eliminating wildfires entirely, and reducing their impact on humans, infrastructure, and ecosystem services (Pyne, 1990; Yibarbuk et al., 2001, 2018), policies in the Mediterranean tend to prioritize active fire exclusion. Strategies favouring suppression neglects traditional methods rooted in pastoralism and ranching, as well as prescribed burns that historically played a crucial role in preventing catastrophic fires (Castellnou et al., 2010). In addition, this approach is unsustainable and unrealistic (Olson et al., 2015), and often overlooks the intricate socio-ecological processes that underlie fire use (Moreira et al., 2020). Aggressive fire exclusion coupled with socioeconomic changes has increased the risk of catastrophic wildfires with negative ecological impacts (Duane et al., 2021). This underscores the need for a comprehensive approach that considers all socioeconomic and policy factors, allowing a better understanding of the complex interplay among landscapes, communities, and fire dynamics (Ford et al., 2021).

Designing well-supported and effective fire policy necessitates first a thorough understanding of local use, related drivers, and effects of fire. However, breakdowns in communication and the absence of consensus, where a multitude of perceptions, beliefs, and conflicting opinions on the causes and drivers of wildfires prevail, hinder the effective implementation of fire management policies (Wunder et al., 2021). The lack of stakeholder engagement with fire policy allows conflicts around fire management to persist (Bonsu et al., 2019). Evidence suggests that bureaucratic and institutional inefficiencies hinder meaningful dialogue and adjustments to fire management (Beggs & Dalley, 2023; Priyo et al., 2016), introducing sluggishness in the adoption of proactive prevention measures, compounded by the political appeal of fire exclusion (Silva et al., 2010). Ineffective policy perpetuates a siloed approach, where different institutions may inadvertently reinforce conflicting narratives (Swedeen, 2006). Coordinating interests across stakeholders with diverse mandates contributes to stronger and more suitable fire management approaches (Kapetas et al., 2019), and encouraging collaborative ways of resolving stakeholder disputes can improve decision quality (Blatner et al., 2001). Integrating public, stakeholder, and expert views can improve environmental management, policy credibility, and legitimacy (Mease et al., 2018).

Previous research on wildfire prevention and management have predominantly focused on stakeholders' perspectives, particularly those in forestry. Researchers have examined how the attitudes, values, and beliefs of forest owners influence their adoption of forest management strategies (Blennow et al., 2012; Eriksson, 2012; Nordlund & Westin, 2010). In Indonesia, stakeholders have prioritized the benefits and burdens of peatland fires and the perceived effectiveness of fire management interventions (Carmenta et al., 2017). In Europe, studies have highlighted differing and often conflicting perceptions among stakeholders regarding fire management policies and preventive practices (Karanikola et al., 2011; Palaiologou et al., 2021; Rocha, 2021). Similarly, in the United States, individuals' understanding and communication about wildfire-risk mitigation vary according to their roles (Champ et al., 2012). However, the current literature often overlooks involving a diverse range of stakeholders to understand the full impact of socioeconomic and policy factors on wildfires, including outdated management practices.

By engaging a diverse range of stakeholders, here, we systematically investigate their perceptions concerning fire use, wildfire drivers and management in an area characterized by misinformation and mystification surrounding fire causes. By gathering insights from in-depth discussions with stakeholders in Monreale, Sicily—a region emblematic of the fire-prone Mediterranean landscape with a history of catastrophic wildfires—we seek to discern commonalities and deviations across stakeholder opinions on wildfire drivers. We utilize a Q-Methodology approach (Aguilar & Montiel, 2011; Swedeen, 2006), to also explore whether stakeholder mandates and roles elucidate these perspectives.

Results reveal substantial variation in stakeholder opinion on the primary culprits behind repeated fires, stemming from socioeconomic drivers, ranging from agricultural practices to construction activities. Stakeholders attributed fire occurrences to more than one group, emphasizing different motivations driving their behaviour and the local use of fire. Furthermore, our findings shed light on the diversity of perspectives regarding the role of politics in fire management. Stakeholders are divided between those who advocate for modernized silvicultural management, those who support private sector control, and those who emphasize robust government intervention to ensure public safety. Nevertheless, findings also identify areas of consensus that can facilitate solutions and progress toward common shared goals in fire management. Finally, the study advocates for a more integrated, multi-stakeholder approach to fire management that goes beyond sectorial silos, moving from reactive to proactive strategies in regions like the Mediterranean, where suppression efforts are heavily relied upon (Castellnou et al., 2010).

2 | BACKGROUND

The North–South economic divide in Italy emerged in the late 19th century, marked by industrial growth in the north and a lagging southern economy (Felice et al., 2019). Despite attempts to promote Southern industrialization, initiatives like the Southern Development Fund (*Cassa per il Mezzogiorno*), resulted in socioeconomic distortions and institutional fragility, hindering long-term economic growth (Cesaratto & Zezza, 2018; Charron & Lapuente, 2018). The South experienced population loss, an aging demographic, and a brain drain of young, educated individuals, resulting in a substantial loss of human capital. These factors collectively explain the ongoing economic disparities between northern and southern Italy (Svimez, 2017).

Efforts to foster socio-economic development in southern Italy, including the *Cassa per il Mezzogiorno*, led to a large-scale

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reforestation initiative. After the discontinuation of the fund, the Sicilian region continued reforestation to safeguard soil integrity, mitigating erosion on abandoned public properties (Cantiani et al., 2018). Today, forests cover almost 20% of Sicilian land (Sadori et al., 2015). Sicily's Mediterranean climate, characterized by mild, wet winters and hot, dry summers, is linked to uncontrollable wildfires. A crucial element contributing to the uncontrollable nature of wildfires in southern Italy is the sirocco wind, originating in Northern Africa. Although climate change is a significant factor in fire occurrence (Turco et al., 2014), human activities accounted for 77% of vegetation fires in Italy in 2021.[1] It is noteworthy that 87% of 2021 wildfires were concentrated in Sicily, Sardinia and Calabria, making them susceptible in large part due to uncontrolled fires (Legambiente, 2022). Throughout history, the tradition of burning fields and pastures has been widespread in Sicily. In the southern regions of Italy, fire is used routinely to remove vegetation along roads, surrounding houses, and across open fields (Ascoli & Bovio, 2013). However, the phenomenon of rural–urban migration has led to a loss of knowledge of cultural burning practices, and with the ban on ignitions during the summer months, fires left unattended can frequently spiral out of control and extend beyond their originally intended areas.

Furthermore, Sicily enjoys greater autonomy from the state compared to other regions. Sicily's special status grants it autonomy, allowing for retention of the Regional Forestry Corps of Sicily (CFRS) after Legislative Decree No. 177 of 2016 redistributed responsibilities across other institutional bodies (especially *Arma dei Carabinieri*). The CFRS in Sicily continues to coordinate prevention, surveillance, and firefighting efforts, ensuring the preservation of the region's natural heritage.

The Monreale Municipality, located in Sicily, with approximately 40,000 residents, spans a diverse geographic landscape. During the period 2010 to 2022, the municipality faced 337 documented fires that affected 8862 ha, 26% of which being forest areas. Annual averages of fire-affected land during this period were 682 ha, with an average fire-affected area measuring about 26 ha. Particularly devastating fires occurred in 2021 and 2022, with affected areas at peak 61 and 40 ha, respectively.[2]

3 | METHODS

The Q-methodology (Q) is a structured approach designed to characterize and quantify individuals' subjective perceptions, categorizing their opinions and beliefs (Brown, 1993). Its primary objective is to illustrate the diverse range of people's subjectivities regarding a particular issue, allowing to reveal systematic patterns of consensus or disagreement between members of a group. Q proves particularly valuable for navigating complex webs of interests and potential conflicts involving multiple stakeholders, promoting transparency and providing a controlled environment for participants to freely express their viewpoints (Cuppen, 2013; Stenner et al., 2008), and contributing to the identification of commonalities that serve as entry points for action when seeking acceptance for new policies (Steelman, 2016).

An expanding body of academic work has adopted Q as a systematic mean of mapping various viewpoints and narratives related to conflicts and policy assessments, to identify consensus among stakeholders, gain insight into public attitudes and behaviours, and shed light on barriers to policy adoption (Seghezzo et al., 2023; Zabala, 2014). This method has been applied in fields including renewable energy (Chang et al., 2019; Ellis et al., 2007), agriculture (Bumbudsanpharoke et al., 2009), and forest management (Steelman & Maguire, 1999). The unique qualities of the Q methodology are particularly valuable in addressing wildfire-related issues, which often have a significant social dimension. Researchers have used Q methodology to reveal conflicting perspectives on policy solutions between experts and resource users in contexts such as peatland fires in Indonesia (Carmenta et al., 2017; Phelps et al., 2021), and fire management in Australia (Ockwell, 2008). These studies highlight the importance of considering a diversity of values when dealing with the complexities of fire governance.

Wildfire governance is complex, involving competing incentives, numerous actors, various management strategies, and varying impacts on different segments of the population. This complexity often leads to assigning blame to different parties, influencing policy responses based on public perceptions of responsibility (Cammelli et al., 2019). Furthermore, creating a platform for competing stakeholders to engage in dialogue can promote collaboration, as seen in studies on vegetation recovery after wildfires and competing narratives of active fire management (Burns & Cheng, 2007; Edgeley et al., 2020). These studies emphasize the importance of uncovering hidden narratives of stakeholders to achieve effective governance and create opportunities for socioeconomically optimal solutions (Cuppen et al., 2016).

3.1 | Ethics statement

This research adheres to the established principles of research ethics, having received approval from Science, Engineering and Technology Research Ethics Committee (SETREC) of the Imperial College London (Reference Number: 6497365). Prior to commencing data collection, an informative document was distributed to all participants. This document outlined the study's objectives, participant roles, associated risks, voluntary participation, and withdrawal processes, as well as guarantees of free and informed prior consent, anonymity, confidentiality, and data access and protection. Additionally, a consent form, signed by all participants, was administered before the initiation of data collection.

[1]Data provided by Forestry Corps and elaborated by Legambiente.

[2]This data has been sourced from the Regional Forestry Corps of Sicily.

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3.2 | The Q-study steps

In a Q-study, researchers follow a systematic six-step process (Stenner et al., 2008). (1) They begin by defining the research question and collating all concepts related to the issue of interest at a specific place and time, known as the concourse. (2) From this, they extract a comprehensive set of statements, referred to as the Q-Set. This set undergoes scrutiny and refinement, often through theoretical frameworks or judgement, adopting an inductive approach (Webler et al., 2009). (3) The third step involves forming the 'P-Set', selecting participants with expertise and relevance to the problem. (4) During the Q-sort, participants rank each statement onto one space of a normal distribution grid according to their viewpoints, which contains the same number of spaces as there are statements. (5) The collected data undergoes factor analysis, typically using principal component analysis (PCA), to identify natural groupings of viewpoints. (6) The final step interprets the factors to create a clear summary of shared perspectives within the sample. The rest of Section 3 details the second through fifth steps, while Section 4 presents the factors.

3.3 | The themes and concourse

We collaboratively created the concourse with selected participants, rather than imposing a predefined structure (Billard, 1999). We extracted themes from a workshop with 17 different stakeholders that took place in Monreale in June 2023, followed by separate interviews with three of the participants (E. Piroli, D. S. La Mela Veca, J. Mistry, & Y. Kountouris, unpublished data). The workshop and interview participants differed from those conducting the Q-sort but both groups were identified through a prior stakeholder analysis of local actors (Reed et al., 2009), involved in decision-making, policy, management, tourism, and research activities. Participants of the workshop and the Q-sort included representatives from 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, forestry experts, workers and trade unions, academia, NGOs, and cultural and voluntary organizations. Using the methodology of McKeown and Thomas (2013), we applied an inductive approach to build the initial Q-set of 60 statements. This data-driven approach avoids pre-existing coding frameworks (Braun & Clarke, 2006). The Q-set was subsequently reduced to 40 statements through iterations and Q-sorting consultations to avoid redundancy. The workshop and the expert interviews highlighted five overarching themes: (i) triggering causes, (ii) indirect drivers, (iii) firefighting and suppression, (iv) prevention strategies, and (v) wildfire management culture and leadership. The study was conducted in Italian; Table 1 summarizes the final English- translated statements (see Table S1 for the statements in Italian).

3.3.1 | Theme 1: Triggering causes

Workshop participants and local experts attribute wildfire occurrences in the region to negligence and arson. Negligence covers various factors, including inadequate preventive measures and maintenance of the road network.

Deliberate ignitions are driven by revenge due to grazing disputes and irregular fire use in farming. For example, local farmers and pastoralists contribute to summer wildfires by ignoring bans, while in the interior of the island pastoralists use fire to illegally expand land holdings. Certain areas in Calabria and Sicily consistently face recurrent arson (Legambiente, 2022). Motivations range from revenge against administrations to hunting that uses fires for accessibility. Urban and tourist interests drive intentional fires for illegal construction, reflecting the 'ecomafia' concept coined by the NGO Legambiente, individuals seeking territorial control. Unregulated urban expansion in Sicily, like other regions, lacks planning, zoning or environmental consideration, resulting in historic informal construction and environmental damage (Fiorini et al., 2019).

3.3.2 | Theme 2: Indirect drivers

Indirect drivers include regional, national, and global economic transitions and policies. These included, for example, rural-to-urban migration trends like Italy's post-World War II rural exodus industrialization, and the Common Agricultural Policy, which affected fire patterns leaving marginal lands prone to fires (Ciliberti & Frascarelli, 2015). At the same time, political decisions impact human-ecological systems and wildfire patterns (Leverkus et al., 2020). Short-term gains drive politicians to favour fire suppression policies, ignoring forest management advice. Southern Italy's history of political patronage and Mafia influence exacerbates the north–south economic divide. Overcoming these issues requires comprehensive reforms and the dismantling patronage networks (Quaresima & Fiorillo, 2020).

Although some indirect drivers in the Q-set could be seen as solutions, they might be tied to actions and mismanagement. The line between cause and effect is often blurred in fire management. For example, shorter land concessions and summer bans might encourage illegal fire use, and debates over airplane management raise ethical concerns about private involvement. Conspiracy theories suggest that private interests may hinder proactive fire management, favouring suppression tactics instead.

3.3.3 | Theme 3: Prevention strategies

Stakeholders emphasized the need for a two-pronged strategy for wildfire management: first, focusing on ignition sources; second, focusing on forest and fuel management. The Sicilian Forestry Corps, which has the main responsibility for both monitoring ignition

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TABLE 1 Themes and statements used in the Q-study.

Theme	Number	Statement
Triggering Causes	S24	Wildfires are caused by power companies that do not properly maintain high voltage cables
	S26	Fire is often used as a tool to retaliate and settle scores regarding land concessions
	S28	Lands are set on fire for building purposes
	S32	Most of the wildfires occur due to agricultural practices
	S33	Most of the wildfires occur for the renewal of pastures
	S34	The fires are ignited by forest workers as a means of protesting against working conditions
	S35	Most fires occur due to arson
	S37	Protected areas are set on fire in hopes of removing environmental restrictions
	S39	Most of wildfires have unintentional origins, caused by people's imprudence
	S40	Wildfires in the Monreale area occur at the hands of organized crime
Indirect drivers	S8	Land abandonment has contributed to the spread of the fires
	S9	Current residue burning ban effectively discourages the use of fire in agriculture
	S13	Sanctions against those responsible for the fires should be increased
	S16	The management of Firefighting airplanes should not be transferred to the state
	S17	Government prioritizes spending on suppression over funding forward-looking prevention
	S21	Those responsible for the fires are not punished for lack of surveillance and control of the territory
	S29	Extending the periods of land concessions would make farmers and breeders loyal to the land and would improve the situation of fires
	S36	Privatizing the forestry sector would improve the situation of wildfires
Prevention strategies	S1	The Sicilian Forestry Corps ensures the performance of public security services and territorial control in Monreale
	S2	Prevention activities, such as silvicultural management and land cleaning, are modern and up to date
	S3	Forestry prevention activities should also be carried out during the winter months and not just at the beginning of the fire season to be effective
	S4	The use of technology in land surveillance and control would reduce the number of fires
	S5	The creation of a specialized investigative apparatus within the *Carabinieri* and / or Forestry Corps to identify the causes and those responsible would improve the situation of wildfires
	S6	Prescribed fires should not be adopted as a means of prevention
	S7	Investing in prevention rather than firefighting would improve the situation of wildfires
	S10	The planning, organization, and resources available to forest workers are sufficient to carry out prevention activities
	S12	A synergistic collaboration between the different stakeholders can favour the development of an integrated fire management policy
	S19	A complete and accurate register of burned areas can prevent fires
	S25	Road managers are diligent in cleaning the edges of the roads
	S31	There is no way to prevent forest fires
	S38	The forestry works are carried out according to the specific technical skills of the sector
Firefighting and suppression	S11	The current organizational structure and the level of coordination in extinguishing procedures is sufficient to control the expansion of fires
	S14	Ground operations during fire suppression are often sufficient to contain them
	S15	Fire suppression relies too much on the use of firefighting aircraft
	S27	Wildfires are difficult to extinguish in the field because the areas are often difficult to access
Culture and institutional leadership	S18	The obligation of the Municipalities to conduct an annual census of the areas affected by the fire is not fulfilled and is controlled for political interests
	S20	I trust that politics is in the service of the interests and the protection of the common good
	S22	The individuals responsible for the fires are not punished because of the negligence of the institutions
	S23	Illegality and the individuality at the expense of the common good are widely tolerated by society
	S30	Citizens are concerned only when fires reach residential areas

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sources and fuel, faces significant challenges driven by an aging workforce and personnel shortages. This hinders their ability to effectively manage forests, creating a capacity gap compared to other autonomous regions with similar institutional arrangements. Delays in identifying the causes of fires and responsible parties complicate fire management, suggesting the need for a specialized task force in law enforcement. Fragmented responsibility across administrative units further hinders forest management effectiveness.

Overall, forest planning remains relatively rare in the country, with only 18% of forested land currently managed through corporate-level management plans (RaFITALIA, 2017). Sicily comprises 391 municipalities, and 147 municipalities so far have failed to comply with the obligation to survey and report the registry of fire-affected areas.[3] This hinders timely mapping of fire-affected areas, which could be a crucial tool for fire prevention by limiting access and enabling the identification of lands consistently affected by wildfires.

3.3.4 | Theme 4: Firefighting and suppression

Fire suppression often takes centre stage in political discourse, as it provides a tangible demonstration of government action. However, this reactive approach can undermine long-term fire management goals, allowing fuel loads to increase, that in combination with local topography and changing climate can contribute to more severe fires (Doerr & Santín, 2016). In Italy, as in other western countries, this strategy has become deeply ingrained, leading to significant alterations in natural fire regimes (Williams, 2013). Stakeholders expressed concern about the current organizational structure and the level of coordination between various bodies and institutions in extinguishing procedures. Topography and local weather conditions in mountainous areas could exacerbate these firefighting challenges.

3.3.5 | Theme 5: Culture and institutional leadership

Workshop discussions revolved around how wildfire drivers and management are intricately linked to a deeper and more pressing concern: the urgent need to restore adherence to rules and regulations while embracing a comprehensive approach that extends beyond mere technical fire management. According to stakeholders, the prevalence of illegality and its profound impact on various aspects of society, particularly in rural areas and territorial control, manifests itself on two fronts. On one side, it reflects self- interest and individualism within the public, while on the other, it exposes institutional leniency concerning environmental matters. The participants emphasized the need for institutions to assert their authority, addressing illegal activities that pose threats to the environment and societal order. This involves reaffirming the importance of rules and the principle of legality to effectively counteract these issues and mobilize available resources. While fostering active citizenship is crucial for land maintenance and encouraging cleaner streets, achieving community participation and awareness can be a multifaceted challenge. Thus, effective coordination remains essential to ensure that local communities actively participate in wildfire prevention efforts.

[3]From Dept. Decree 'D.A. 357/3/2023'.

3.4 | Selection of participants and Q-sorting

To ensure participant diversity (Webler et al., 2009), we conducted a stakeholder analysis to leverage the network of the Department of Agricultural, Food and Forest Sciences at the University of Palermo and employed email invitations, systematic and snowball sampling (Reed et al., 2009). The 16-member P-set included representatives from academia, NGOs, public bodies, tourism, agronomists, forest experts and trade unions. It is important to emphasize that a substantial number of participants is not a prerequisite for conducting high-quality research in Q studies (Brown, 1993). As long as there are enough participants to establish a factor comparable to another, a meaningful Q analysis can be achieved. In total, our study included 16 participants from various affiliations and professions.

The *QMethodSoftware* (Lutfallah & Buchanan, 2019) facilitated data collection. Participants conducted Q-sorts using the following condition of instruction: 'Please sort these 40 statements based on how well they align with your views related to wildfire events in Monreale. You are asked to use a forced-choice quasi-normal distribution on a −5 to +5 grid, where −5 represents "least representative of my view" and +5 represents "most representative of my view." Select 0 to indicate "neutrality or unsureness."' This arrangement is an effective strategy for ascertaining which statements resonate most with the participants' perspectives, as it compels them to differentiate between statements while being selective with the assignment of the highest levels. Figure 1 shows the quasi-bell-shaped grid. To mitigate order and fatigue effects (Atmanspacher & Römer, 2012), participants pre-sorted statements, ranking them using a 3-point scale (agree with, disagree with, and feel neutral/unsure about the statement). Subsequent to completion of this exercise, a post-sorting interview was conducted with each participant to gain deeper insight into their rankings, facilitating a qualitative interpretation of the perspectives (Watts & Stenner, 2005).

3.5 | Data analysis

We used PCA factor analysis to simplify the multidimensional data and identify common themes in Q types. Factor loadings provide insight into the correlations between each Q-sort, and the generated factors can be interpreted as representing distinct points of view (Zabala & Pascual, 2016). It is worth noting that there is not a universally accepted method for defining the number of factors in the peer-reviewed literature (Sneegas et al., 2021). In this paper, we

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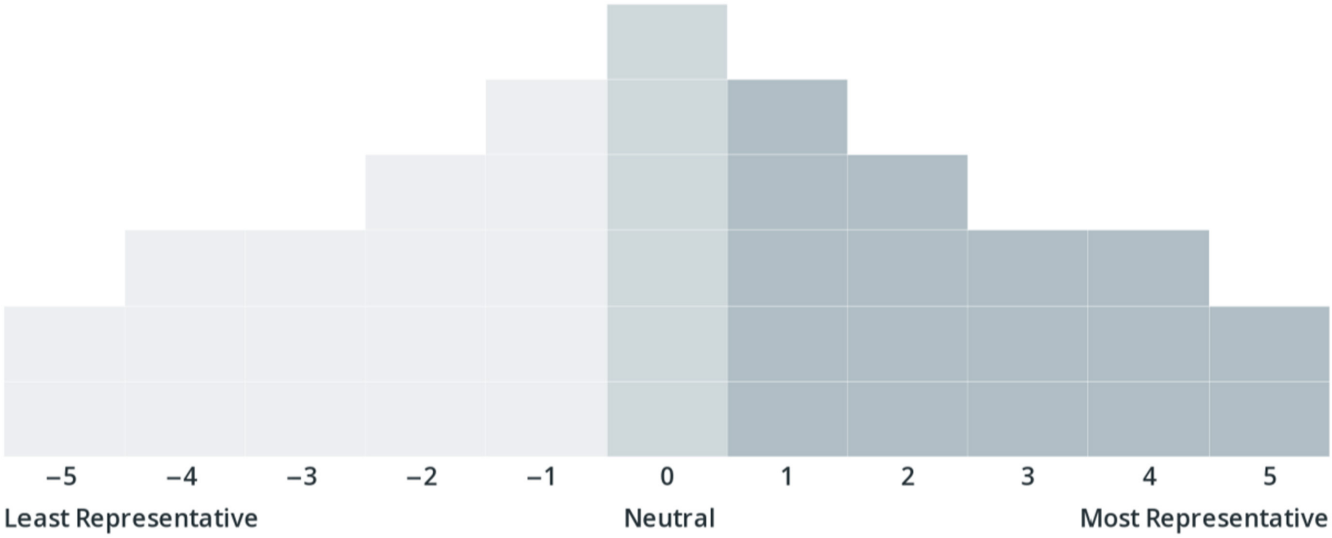


FIGURE 1 The Q-sort distribution.

employed a combination of criteria to arrive at a three-factor solution. These include the eigenvalue and scree test criteria, and avoidance of cross-loading (Brannstrom et al., 2022; Holmes et al., 2022). We compared the results from 2 to 4 factors solutions, rotated using Varimax orthogonal rotation. When analysing the Q-sorts, three distinct factors emerged (Table 2). Both three-and four-factor solutions were statistically viable, with $p < 0.05$, and had loadings from at least two participants. However, the four-factor solution would result in a confounding participant, with loadings on multiple factors, situated below the 'elbow' in the scree plot, and having eigenvalues less than 1. In addition, on the absence of cross-loading, we opted to extract three factors in adherence to the general principle of one factor per six to seven participants (Watts & Stenner, 2005). All analyses were conducted using the *qmethod* package on R (Zabala, 2014).

4 | RESULTS

The analysis resulted in three factors collectively accounting for ~60% of the variance (Table 3). These factors represent clusters of agents with distinct points of view, which are provided with a concise title and are described in more detail below.

The three factors achieved varying degrees of consensus in 10 of 40 statements, as shown in Figure 2, showcasing their positions along the value scale. Among the themes, there was consensus on 25% of the points for indirect drivers' theme, 40% for culture and institutional leadership, 50% for theme 4 (firefighting and suppression), and 35% prevention strategies. No consensus points were found for theme 1 (triggering causes).

The three factors exhibited the most contrasting views on strengthening prevention practices, the role of privatization in efficient fire management, and the role of institutions. Factor 1 is labelled '*prevention advocates*', factor 2 as '*pro-government*' and factor 3 as '*privatization supporters*', aligning with the predominant themes observed in their responses. Table 4 presents the *Z*-scores of the three factors associated with each statement, along with the corresponding positions of agreement or disagreement.

4.1 | Factor 1—Prevention advocates

Factor 1 accounts for approximately 34% of the total variance. Nine sorts significantly loaded to this factor. These represent stakeholders from NGOs, regional government officers, local environmental and cultural nonprofits, civil protection, local grass-roots organizations, and academia. Their focus is on the prevention of wildfires. They support a comprehensive overhaul of fire management at the local and regional levels. They believe that the government allocates more resources to suppression than proactive prevention (S17), and they propose redirecting funds toward prevention strategies (S7). To meet prevention objectives, they suggest modernizing silvicultural practices (S2, S31), extending silvicultural management into winter months (S3), and investing in the skills of forest workers (S38). They advocate for the use of technology in land use monitoring (S4) and argue that insufficient control and surveillance contribute to wildfires, supporting the establishment of a specialized investigative unit within the *Carabinieri* or the Forestry Corps (S5). Prevention advocates attribute wildfires to socioeconomic factors such as abandonment of land (S8), and identify retaliation related to land concessions (S26), agricultural practices (S32), and pasture renewal (S33) as the primary causes of fires.

4.2 | Factor 2—Pro-government

Factor 2 accounts for 17% of the total variance and includes five distinct Q-sorts that are linked to regional government departments, trade union representatives of forest workers, and agronomy and forest experts. Unlike factor 1, which expresses mistrust in the

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political system, factor 2 advocates for government and institutional bodies, asserting that politicians and institutions serve the common good (S20) and rejecting the notion that political interests caused the failure to conduct an annual census of fire-affected areas by municipalities (S18). They firmly advocate for maintaining fire management within the public sector, opposing privatization, and emphasizing that public safety should never be compromised for private profit. They argue against the belief that privatizing the forest sector would improve the wildfire situation (S36) and, more assertively than the prevention advocates' group, call for government involvement in managing firefighting aircraft (S16). While supporting strengthened prevention practices (S17), their overall position is slightly more moderate. They acknowledge the challenges of extinguishing wildfires in the field due to difficult access (S27), but disagree that lands are intentionally set on fire for construction purposes (S28) or that extending land concessions would improve fire situations (S29).

TABLE 2 General characteristics of the three factors.

Factors	No. load	Eigenvalues	Explained variance
1	9	5.39	33.72
2	5	2.72	17.01
3	2	1.46	9.15

4.3 | Factor 3—Privatization supporters

Factor 3, which constitutes around 9% of the total variance, is represented by two distinct Q-sorts linked to local grass-roots organizations for tourism and regional park management. This factor does not support the idea that collaborative efforts between stakeholders would necessarily lead to an integrated fire management policy (S12). Instead, they favour the privatization of the forest sector, believing that it could improve the situation of wildfires (S36). They express no objections to private ownership of firefighting airplanes (S37) and are not overly concerned about excessive reliance on them for fire suppression (S15). Unlike factors 1 and 2, they have a more positive view of the Forestry Corps of Sicily's ability to ensure public security and territorial control (S1) and believe that the government does not prioritize spending on suppression over prevention to the same extent (S17).

4.4 | Area of consensus among the factors

The key points of consensus among the respondents include the need for intensified sanctions against those responsible (S13) and a modest inclination toward the adoption of prescribed fires in fire management strategies (S6). The unfavourable opinions

TABLE 3 Participants and their factor loadings, which capture the participants' association to every one of the identified points of view.

Participant	Affiliation	Factor 1 loading	Factor 2 loading	Factor 3 loading
P1	Trade union for forestry labourers	0.43	0.70[a]	0.24
P2	Eco-cultural organization	0.80[a]	0.02	0.26
P3	Regional government department	0.77[a]	0.27	−0.12
P4	Academia	0.84[a]	0.09	−0.10
P5	Regional Forestry Corps	0.21	0.36[a]	0.15
P6	Regional Park management	0.33	0.21	0.73[a]
P7	Order of agronomists and forestry experts	0.18	0.60[a]	−0.16
P8	Eco-cultural organization	0.83[a]	0.24	−0.05
P9	Local grass-roots organization	0.73[a]	0.14	0.20
P10	NGO	0.68[a]	0.25	0.28
P11	Eco-cultural organization	0.82[a]	0.00	−0.11
P12	NGO	0.64[a]	0.40	0.16
P13	Local grass-roots organization	0.11	0.14	0.64[a]
P14	Regional government department	−0.05	0.82[a]	0.09
P15	Regional Department of Civil Protection	0.53[a]	0.31	0.04
P16	Province Fire brigade Command	0.11	0.73[a]	−0.40

[a]Highest loading.

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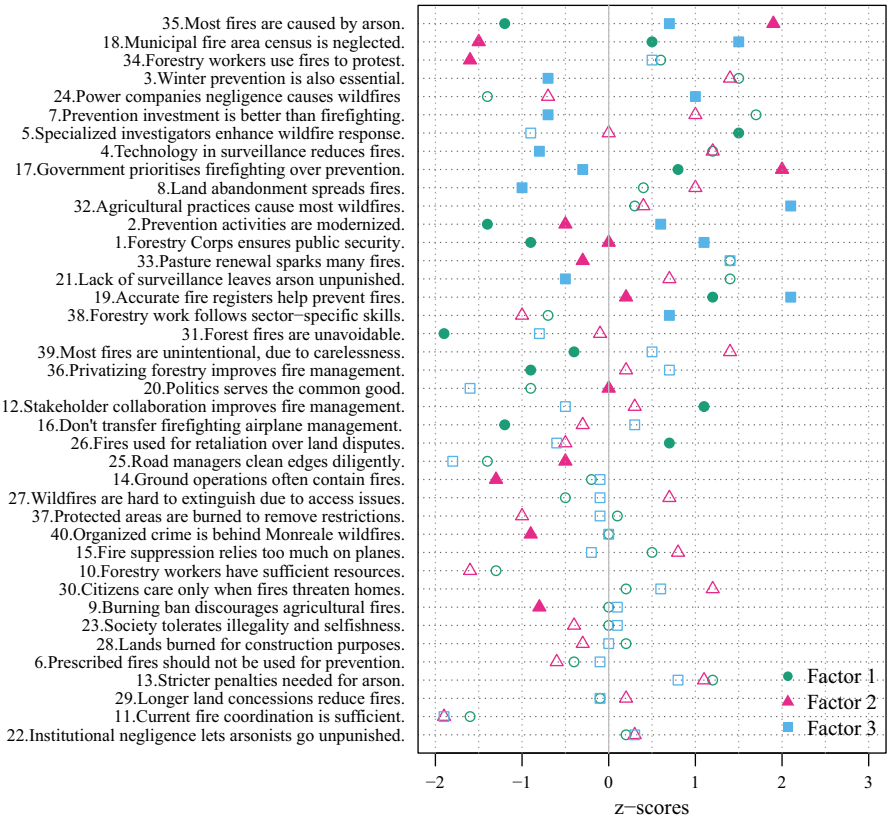


FIGURE 2 Three-factors *Z*-score plot of the 40 statements. Shortened versions of the statements are shown on the horizontal axis. These *Z*-scores reflect how strongly each factor aligns with a statement. The positions of the three factors show higher disagreements for the statements at the top of the graph, while toward the bottom, they converge toward consensus. The figure is scaled from −2 to 3; unfilled markers indicate scores beyond this range.

were unanimous on the suitability of the planning, organization, and resources available to forest workers for prevention activities (S10), the diligence of road managers in cleaning the edges of the road (S25) and the feasibility of preventing forest fires in the area (S31). Neutral positions were held on the effectiveness of the current residue burning ban during the summer months to discourage fire use in agriculture (S9) and the tolerance of society to illegality and individualism over the common good (S23). Despite unanimous agreement on the insufficiency of the current organizational structure and coordination in extinguishing procedures to control fire extension (S11), neutral views were expressed regarding whether ground operations suffice to contain wildfires (S14) and the lack of punishment for those responsible for institutional negligence (S22).

5 | DISCUSSION

Our Q study in Monreale adds to this knowledge by revealing diverse perspectives on factors influencing wildfires. Three distinct factors emerged: prevention advocates, pro-government, and privatization supporters. Despite these clear categories, participant affiliation's role in shaping views remains inconclusive, challenging oversimplified arguments.

The lack of consensus on triggering causes reflects the complexities of a sectorial approach to a socioecological problem. Similar to the views of Greek residents in Ilia (Karanikola et al., 2011), respondents expressed concerns about authorities' maintenance of streets and paths, linking it to fuel accumulation and fire risk. Factor 1 also identifies land abandonment as a key contributor to wildfire pressure, echoing previous studies highlighting socioeconomic changes, landscape alterations, and unintentional fires (Ascoli et al., 2022; Martínez et al., 2009; Williams, 2013).

Nonetheless, the study's findings suggest potential solutions and progress toward shared goals. Stakeholders slightly favour prescribed burning as a prevention strategy. In Sicily, effectively manage fragmented forests, especially in abandoned rural areas. (Ascoli & Bovio, 2013). However, practical implementation faces challenges such as sociocultural resistance, and regulatory constraints (Ascoli & Bovio, 2013; Fernandes et al., 2013; Miller et al., 2020).

Additionally, within the prevention theme, only Factor 1 advocates for updated silvicultural practices, enhanced forest worker skills, and collaborative efforts, aligning with trends observed in other Mediterranean countries (Alcasena et al., 2018; Troumbis

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TABLE 4 Three-factors *Z*-score and distinguishing or consensus statements for the 40 statements.

Statement	*Z*-score factor 1	*Z*-score factor 2	*Z*-score factor 3	C/D	Statement	*Z*-score factor 1	*Z*-score factor 2	*Z*-score factor 3	C/D
S1	−0.9	0.0	1.1	D	**S21**	1.4	0.7	−0.5	D
S2	−1.4	−0.5	0.6	D	**S22**	0.2	0.3	0.3	C
S3	1.5	1.4	−0.7	D	**S23**	0.0	−0.4	0.1	C
S4	1.2	1.2	−0.8	D	**S24**	−1.4	−0.7	1.0	D
S5	1.5	0.0	−0.9	D	**S25**	−1.4	−0.5	−1.8	C
S6	−0.4	−0.6	−0.1	C	**S26**	0.7	−0.5	−0.6	D
S7	1.7	1.0	−0.7	D	**S27**	−0.5	0.7	−0.1	D
S8	0.4	1.0	−1.0	D	**S28**	0.2	−0.3	0.0	C
S9	0.0	−0.8	0.1	C	**S29**	−0.1	0.2	−0.1	C
S10	−1.3	−1.6	−2.3	C	**S30**	0.2	1.2	0.6	D
S11	−1.6	−1.9	−1.9	C	**S31**	−1.9	−0.1	−0.8	C
S12	1.1	0.3	−0.5	D	**S32**	0.3	0.4	2.1	D
S13	1.2	1.1	0.8	C	**S33**	1.4	−0.3	1.4	D
S14	−0.2	−1.3	−0.1	C	**S34**	0.6	−1.6	0.5	D
S15	0.5	0.8	−0.2	D	**S35**	−1.2	1.9	0.7	D
S16	−1.2	−0.3	0.3	D	**S36**	−0.9	0.2	0.7	D
S17	0.8	2.0	−0.3	D	**S37**	0.1	−1.0	−0.1	D
S18	0.5	−1.5	1.5	D	**S38**	−0.7	−1.0	0.7	D
S19	1.2	0.2	2.1	D	**S39**	−0.4	1.4	0.5	D
S20	−0.9	0.0	−1.6	D	**S40**	0.0	−0.9	0.0	D

et al., 2022). Overemphasis on reactive fire management, particularly fire suppression, has neglected preventive measures, leading to more frequent catastrophic wildfires (Ellison et al., 2015; Ferrara et al., 2018; Xanthopoulos et al., 2019). This practice is evident in the growing average size of wildfires in the US despite increased annual wildfire expenditure (Rossi & Kuusela, 2019). Similar trends are observed in Europe, although limited data on fire management budgets make it challenging to fully assess the costs (Mattioli et al., 2022). All factors agree on the ineffectiveness of suppression in Sicily due to challenges such as limited personnel and inadequate preventive measures. The regional Forestry Corps faces hurdles with an aging workforce, insufficient coordination, and top-down approaches overlooking landscape peculiarities (Legambiente, 2022). Despite coordination frameworks, top-down approaches fail to fully acknowledge local fire culture, compounded by historical migration and summer ignition bans. Challenges are exacerbated by mountainous terrain and weather conditions. Protected areas often lack essential firefighting resources, hampering suppression efforts. Integrating agricultural incentives into forest programs is crucial, but Sicilian Forest management lacks context-aware interventions, operating independently across institutions.[4]

Factor 3 does not object to private ownership of firefighting airplanes and is less concerned about excessive reliance on them. The European Commission's plans to purchase new planes by 2027 could establish longer-term contracts with private providers as the new standard for Italy. Operators like Babcock have played significant roles in managing Italy's aerial firefighting service since 2011. While countries may want to strengthen their defences, long-term contracts between government agencies and private operators offer security and cost predictability (OECD, 2018).

Factor 1 and Factor 3 within the culture and institutional leadership theme both distrust the political system, reflecting fluctuating confidence following wildfire events (Sharp et al., 2013), other natural disasters (Rittelmeyer, 2020) or historical corruption (Micha et al., 2015; Rust et al., 2020). While Factor 3 supports privatization for wildfire management, Factor 2 advocates for public sector responsibility and opposes privatization, emphasizing the importance of public resources and retaining public forest workers for their expertise, consistent with previous research on public forest workers in Italy (Fagarazzi et al., 2021).

6 | CONCLUSIONS

Using the Q-methodology, this article aims to understand perspectives on wildfire causes and drivers among stakeholders in fire-prone Monreale, Sicily. Our results highlight socio-economic and political influences, revealing diverse perspectives (Lewicki et al., 2003). Balancing political interests, safety, and resource allocation is challenging, given varied stakeholder visions. Conflict is inherent in

[4]https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2018-04-03;34 (Retrieved on 05 June 2024).

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policymaking, but acknowledging diverse viewpoints enriches discussions, leading to widely accepted fire policies.

Stakeholders identify various wildfire actors and drivers, highlighting incomplete cause disclosure and perpetuated myths. However, the results offer valuable contributions to enhancing fire policies by focusing on consensus points. Instead of solely increasing firefighting funding, sustainable solutions like prescribed burning, higher fines against culprits, and forest sector strengthening. Innovations include specialized personnel hiring, training, and silvicultural practices. Using technology for territorial control and forming investigative units to identify culprits can enforce residue-burning bans. Additional measures include implementing Payment for Ecosystem Services to incentivize sustainable practices, promoting cultural and natural heritage through education and community involvement, and incorporating practices like burial of agricultural residues or strategic grazing in firebreak lines (Jack et al., 2022).

Despite the decentralization of responsibilities to regional institutions, government influence persists, hindering the transition from a government-centric to a governance-based approach in landscape management. This extends to fire management, where stakeholders, driven by individual interests and ideological backgrounds, hold diverse perspectives (Peterson St-Laurent et al., 2019; Pinillos et al., 2023). These perspectives impact government involvement and resource allocation for fire management.

Factor 1 promotes modernized practices and extended winter silvicultural management, highlighting drawbacks of reactive fire management. Factor 3 favours privatization, while Factor 2 advocates strong government involvement for public safety. Political actors drive policy changes, necessitating collaboration and conflict resolution. Our research reveals nuanced views, challenging professional role-based narratives. Future studies could compare public and private airlift services' effectiveness, considering cost, efficiency, and performance. A comprehensive evaluation of firefighting techniques' costs and environmental impact would aid sustainable fire management decision-making, protecting ecosystems and property.

AUTHOR CONTRIBUTIONS

Erika Piroli conceived the ideas, designed methodology, conducted the study, collected and analysed the data; Donato Salvatore La Mela Veca conducted the study and collected the data. Jay Mistry and Yiannis Kountouris developed the original idea and designed the methodology. Erika Piroli led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

ACKNOWLEDGEMENTS

The authors would like to thank the study participants and the Municipality of Monreale for their collaboration. Erika Piroli acknowledges support from the Leverhulme Centre for Wildfires, Environment and Society through the Leverhulme Trust (PSH567_LFEPR), and the Engineering and Physical Sciences Research Council. Yiannis Kountouris was partly supported by the Arts and Humanities Research Council under the FIRECULT project (AH/Z00005X/1). Special thanks to the Department of Agronomy, Food, and Forestry Science at the University of Palermo for their hospitality and valuable advice.

CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests.

DATA AVAILABILITY STATEMENT

Data available from Zenodo: https://doi.org/10.5281/zenodo.13684034 (Piroli, 2024).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Table S1: Statements used in the Q-study in Italian.

Table S2: Statement distribution continuum.

How to cite this article: Piroli, E., La Mela Veca, D. S., Mistry, J., & Kountouris, Y. (2024). Understanding stakeholders' perspectives behind wildfires in Sicily: A Q-methodology approach. *People and Nature*, *6*, 2514–2527. https://doi.org/10.1002/pan3.10729

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