

Article

Assessing the Effect of Community Preparedness on Property Damage Costs during Wildfires: A Case Study of Greece

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Abstract: The current study attempts to assess the effect of community preparedness on property damage costs during wildfires. The focus is primarily on how various aspects of community preparedness, such as early warning systems, early risk assessment, emergency response plans, and fire-resistant landscaping, influence the extent of property damage costs during wildfires. For this purpose, data were collected from 384 Greek residents from different regions of the country using an online questionnaire. In this case, analysis was performed utilizing SPSS version 22.0. According to the findings, survey respondents replied that fire suppression was the most common property cost associated with wildfire. The study contributes to existing knowledge by providing insights into the specific factors that affect property damage expenditure during wildfires, specifically the intricate relationship between the expenses of property loss caused by wildfires and community preparation. The study's findings can be utilized by policymakers and communities to improve preparedness plans and consequently decrease the impact of wildfires on property and people.

Keywords: community preparedness; wildfire suppression costs; early warning systems; property damage costs; fire-resistant landscaping; risk assessment; Greece



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1. Introduction

1.1. Background to the Study

Massive destructive wildfires have been recorded globally, with the number of high-loss catastrophes increasing [1]. Global climate change may contribute to frequent catastrophic weather events, causing significant damage to high-value assets in wildfire-prone areas. These events have major consequences on national governments, the global insurance sector, and society [2,3]. For example, the 7 February 2009 “Black Saturday” incident in Victoria, Australia, which resulted in the death of 173 people, has been acknowledged as a transformational event that triggered long-term public, media, and political attention [4,5]. Moreover, California in the United States and Greece have the same Mediterranean climate, making them extremely vulnerable to wildfires. From 2002 to 2011, insured losses in the US caused by wildfires amounted to USD 7.9 billion, USD 6.2 billion more than the last 10 years [6].

Wildfires, also known as “unplanned fires”, have caused enormous property damage and deaths in the majority of the world’s fire-prone regions [6–8]. In 2007, wildfires destroyed approximately 850 structures in Greece and more than 2200 houses in California, USA [7]. Also, in 2009, approximately 2000 residences were destroyed in Victoria, Australia, during the Black Saturday fires [9]. More than 2000 homes were destroyed by wildfires in Russia in 2010. Fire management agencies use resources for fire suppression to save lives

and property. Nonetheless, there is inadequate funding or resources to prevent deadly wildfires from destroying every home [10]. Moreover, when towns and residences are threatened, an active suppression response exposes wildland firefighters to the dangers of the fire line [11–13]. Likewise, wildfires are inevitable, but lives are precious, and residences and ecosystems are difficult to reconstruct. When confronted with complexity and ambiguity, organizations in both public and commercial sectors utilize decision science and risk management concepts [14–16]. According to Kleindorfer et al., decision science is defined as an interdisciplinary approach that employs quantitative and analytical methods to support the decision-making processes in complex situations [17]. In this context, mathematics, statistics, economics, and behavioral science are combined to assist in the making of informed decisions. In response to ISO 31000 [18], risk management is the process of identifying, assessing, and ranking risks, followed by coordinating efforts to reduce, monitor, and control the probability or impact of unexpected events. In wildfire situations, decision science and risk management assist communities in analyzing the different ways to reduce fire risks and prepare for potential fire events [17,18].

Managing wildfire risks, like other types of risk management, involves determining the likelihood of a wildfire and the vulnerability of valuable resources and assets to wildfire [19,20]. Furthermore, the management of strategic risk in the context of wildfires is complicated by many factors. Specifically, strategic risk encompasses the possible threats that can harm the organization's long-term goals and general direction. It includes the risks that are connected with business strategies, policy changes, and environmental factors that could hinder the accomplishment of strategic goals. Also, strategic risk in wildfire management is the assessment of the probability and impact of fire events on community assets, the planning of resource allocation, and the implementation of long-term mitigation strategies to reduce the vulnerabilities [21]. Historically, wildlands have been more prone to periodic fires. It is crucial to emphasize that wildfires are dynamic ecological processes that have contributed to the evolution of most North American ecosystems. Approaching wildfires through spatial processes, it is noteworthy that burnt areas frequently occur at considerable distances from the ignition point. Also, it is a fact that many communities are situated within or adjacent to fire-prone ecosystems, with various degrees of exposure and susceptibility to wildfires. Nevertheless, sociopolitical expectations regarding wildland fire management and community fire protection may not be realistic in the present or predicted in the future [22].

Research has shown that only a small percentage of inhabitants sufficiently prepares for wildfires [23–26]. Specifically, homeowners' absence of preparedness for wildfires can be attributed to the high cost and time commitment. In simple terms, to decide whether to prepare, a resident needs to evaluate whether the time and money invested provide a sufficient return [27–29]. As a result, some residents decide against getting ready because they do not believe the danger is great enough to justify the time and financial investment [30,31]. In addition, some locals do not make direct preparatory investments because they believe their property will be sufficiently protected from fires or can be replaced with insurance or funds for disaster recovery [32,33]. However, the small percentage of individuals who decide to make any preparations usually selects the least expensive plan of action, which does not always increase the property's chances of survival. Despite the careful use of decision science techniques that could be helpful in the selection of effective mitigation strategies, these factors considered together provide challenges to the reduction of wildfire risk [34–36]. Notably, the assessment of risk mitigation choices starts with addressing the appropriate goals for managing wildfires and how different risk mitigation strategies are in terms of price, likelihood of success, and assigning blame [6,16,26,37]. Finally, this study examines the consequences of community preparedness on property damage costs during wildfires.

1.2. Purpose of the Study

This study aims to provide insights into how communities can better protect themselves from the financial consequences of wildfires by understanding the role of preparedness measures such as fire-resistant landscaping, early warning systems, emergency response plans, and early risk assessments. Specifically, the study focuses on the following objectives:

1. To evaluate the influence of fire-resistant landscaping on the management of property damage costs during wildfires.
2. To examine the relationship between early warning systems and reduced property damage costs during wildfires.
3. To assess the effect of emergency response plans on the level of property damage costs during wildfires.
4. To examine the influence of early risk assessment on the level of property damage costs during wildfires.

1.3. Research Hypotheses

Hypothesis 1. (H1). Fire-resistant landscaping is negatively associated with property damage costs during wildfires.

Hypothesis 2. (H2). There exists a strong and significant relationship between early warning systems and reduced property damage costs during wildfires.

Hypothesis 3. (H3). Emergency response plans are negatively associated with property damage costs during wildfires.

Hypothesis 4. (H4). Early risk assessment is negatively correlated with property damage costs during wildfires.

2. Literature Review

2.1. Fire-Resistant Landscaping

It is worthy of note that there is a distinction between a well-kept garden and a fire-safe landscape [13]. The plants used in fire-safe landscaping are specifically chosen to withstand fire and prevent it from spreading to residences. For example, fire-resistant plants are excellent in California because they are often drought-tolerant. Nonetheless, all plants, regardless of classification, burn under specific circumstances, even though some may be promoted and sold as “fire-safe” or “fire-resistant” [30,38]. Otherwise, plant flammability is mostly determined by the conditions in which they develop and how they are maintained, rather than by the characteristics of the plant itself. When a plant is stressed or experiencing drought, it may exhibit stunted development and collect dead materials [39–41]. Conversely, a plant with a sufficient quantity of water may have a larger growth form and retain leaves longer. Consequently, a combustible species in one habitat may be fire-resistant in a different one [42,43].

Furthermore, plant species may not always determine whether a plant ignites: landscaping techniques, such as trimming, upkeep, and cleaning, may have a bigger influence [44]. When choosing plants with a fire-resistant architecture, if a plant has more moisture in its leaves than others, this will make its leaves less likely to catch fire. Reducing fuel accumulation at the base of a plant that loses branches or bark may require more frequent maintenance-related cleaning [22,45–47]. However, rapid growth might surpass expectations and undermine the objectives of defensible space [14]. Defensible space is also the area outside a house that is intended to act as a buffer to contain or delay a wildfire. While drought-tolerant, pollinator-friendly, and native plants may be excellent options for the attributes listed, it is possible they will not withstand fire more effectively than other plants [26,44,48]. When selecting fire-resistant plants, placement is the most crucial factor

to consider. It is essential to keep in mind that vegetation near or under a deck, under eaves and vents, touching the exterior of a house, and in front of windows can all be the cause of the property being burnt in a wildfire [46,49]. To create “defensible space”, or to reduce the likelihood of wildfires causing damage or loss to one’s house, fire-resistant landscaping entails choosing, arranging, and maintaining plants and other landscape elements surrounding one’s property [26,39]. Therefore, to establish a fire-resistant landscape, build at least 100 feet of defensible space in all directions away from the house and any related buildings, such as decks or fences [13,50].

2.2. Early Warning Systems in Wildfires

A multi-hazard early warning system (MHEWS) responds to many dangers of the same or different types in situations where things could occur all at once, in sequence, in cascades, or all at once across time. Communities, assets, public infrastructure, vital services, and in some situations the whole nation are all at risk from these cascading effects [51,52]. As a result, they may have correlated impacts that fall under the umbrella of a multi-hazard strategy. Inefficiencies, maintenance costs, and duplication are reduced and expenditure on awareness, education, and readiness are maximized when risk communication, warning distribution, and preparation are coordinated [30,53]. If warning signals are delivered in the same way and originate from the same source, they may also be more universally accepted, acknowledged, and comprehended [54]. Receiving alerts for various threats more often will increase familiarity with the structure and message. Moreover, it will be simpler to guarantee that warning signals for connected dangers are complementary and consistent if there is a shared framework [55,56]. Under these circumstances, users will not get confused. Additionally, it will make it possible to take steps to reduce cascading hazardous occurrences and address compounding repercussions [57].

Radostitz et al. [6] noted that of all the adaptation strategies and early warning systems are predicted to provide a return on investment that is more than 10-fold. A 24 h notice of impending storms or heat waves might minimize subsequent damage by thirty percent. By investing USD 800 million in these systems in poor nations, losses ranging from USD 3 billion to USD 16 billion annually may be prevented [58]. Furthermore, according to World Bank estimates, giving everyone access to better weather forecasting and early warning systems may generate an extra USD 22 billion in benefits annually on a worldwide basis. Nevertheless, one in three people worldwide are still not receiving early warning services, even despite these established advantages [56]. Furthermore, more susceptible individuals, such as those who reside in isolated locations, are disproportionately impacted [58].

Specifically, the use of local temperature arrays, satellite imagery, local monitoring, public education (for instance, on climate change, citizen science, and behavior modifications to reduce fire risk), and patrols by local forest rangers are some of the current techniques to identify these fires [14]. Improved techniques are required to proactively respond to fire threats, since satellites may be hidden by weather and lack the geographic or temporal resolution or sensitivity necessary to swiftly detect tiny starting fires [25]. A network like this might allow for quick action and early fire control in certain situations [46]. The elements of an effective MHEWS are presented summarily in Figure 1.

Early warning systems yield a return on investment that is more than 10-fold. When a dangerous occurrence is anticipated, as little as 24 h’s’ notification might reduce the resulting harm by 30% [59]. According to the Global Commission on Adaptation, poor nations might save losses of USD 3 to 16 billion a year by investing only United States Dollar (USD) 800 million in these kinds of systems [60]. Early discovery, prompt action, and the containment of even a single significant fire may prevent long-term exposure to contaminated air, save lives, and save billions of dollars in property damage [30]. Also, large wildfires scatter their pollutants across vast distances, exposing hundreds to millions of people to harmful concentrations of these pollutants for varied lengths of time [61–63]. Standards govern the safety of firefighters in general and wildland situations, and multi-gas monitors and respirators are among the tools of protection that are readily accessible [46].

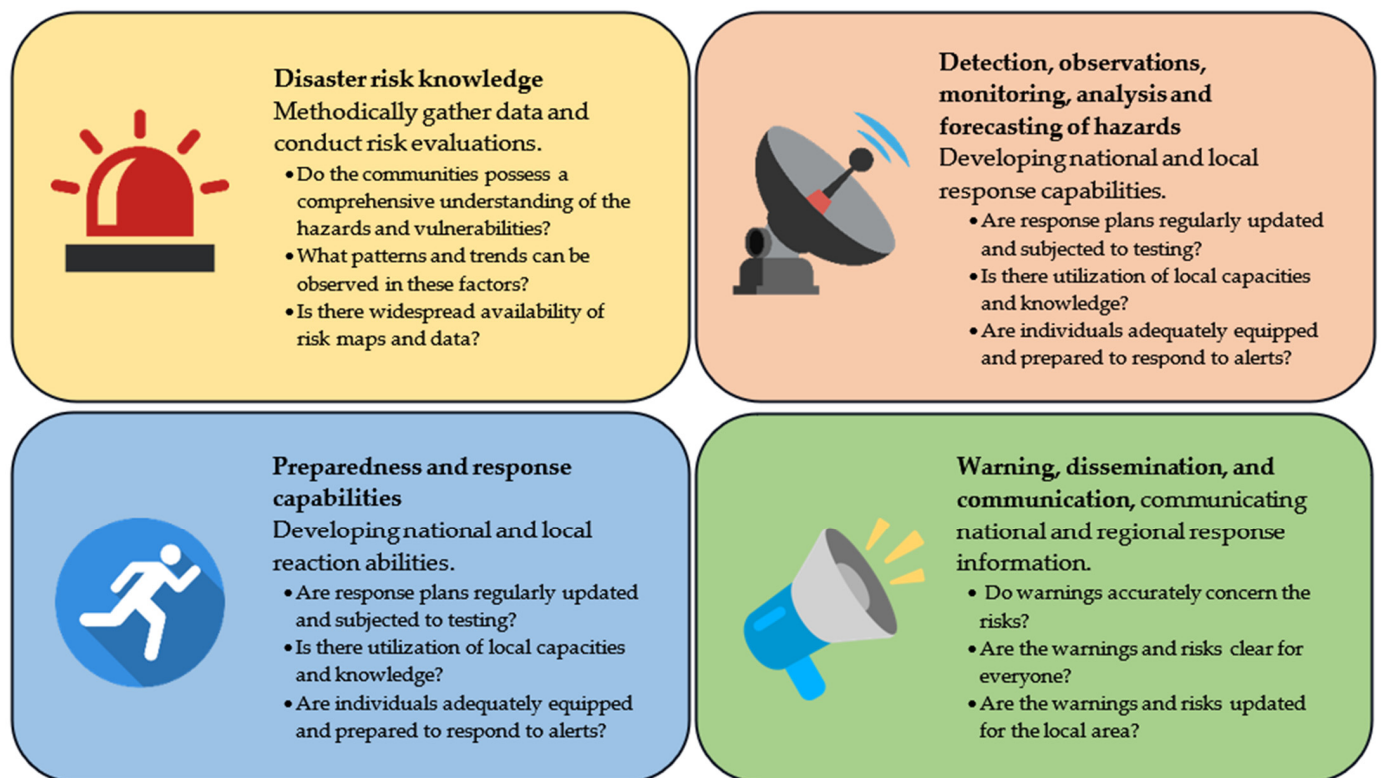


Figure 1. Elements of an effective MHEWS.

Global accords for disaster risk reduction and beyond may be used to trace the growth in EWSs (early warning systems) in international DRR (disaster risk reduction) policy and practice. Specifically, the Yokohama Strategy and Plan of Action for a Safer World (IDNDR 1994) was adopted by the State Members of the United Nations at the World Conference on Natural Disaster Reduction, which took place in Yokohama, Japan in 1994 [25]. Early warnings of impending disasters and their effective dissemination using telecommunications, including broadcast services, are key factors to successful disaster prevention and preparedness, as agreed upon by governments, was one of the 10 guiding principles [30]. The Yokohama Strategy asked for support in creating EWSs for nations most susceptible to natural disasters and highlighted the need to establish and/or enhance EWSs [27]. On the other hand, there has not been much progress made in terms of providing integrated EWSs at scale. Only after the terrible effects of the 2004 Indian Ocean Tsunami did EWSs receive more attention on a global scale [46].

This was acknowledged as a significant movement away from reaction and recovery and toward prevention and preparation in the Hyogo Framework for Action 2005–2015, a worldwide blueprint for disaster risk reduction. The Hyogo Framework lists improving early warning systems and identifying, evaluating, and monitoring catastrophe risks as one of its five action objectives [58]. Crucially, the Hyogo Framework emphasized the need for people-centered EWSs, which would take into consideration differentiable risks, provide instructions on how to respond to warning information, and assist decision-makers in taking appropriate action [22].

2.3. Emergency Response in Wildfires

Wildfires are sources of significant property loss and loss of life globally every year, hence the importance of early detection and monitoring systems [64]. Of all the technologies available, satellites are the biggest and most common means of identifying wildfires. Satellite-based systems offer wide coverage and the possibility of monitoring huge and difficult-to-access regions, which are essential in the case of wildfire [65]. Some of the most

useful instruments in this respect are the Moderate Resolution Imaging Spectroradiometer (MODIS) and the Visible Infrared Imaging Radiometer Suite (VIIRS). The MODIS on the Terra and Aqua NASA satellites offers data at moderate resolution essential in detection of thermal anomalies related to fire. Likewise, the VIIRS onboard the Suomi National Polar-orbiting Partnership (Suomi NPP) satellite is characterized by higher spatial resolution and better radiometric sensitivity, which leads to an improvement in the efficiency of fire detection and monitoring [64,65]. Besides MODIS and VIIRS, the Spinning Enhanced Visible and Infrared Imager (SEVIRI) sensor of the Meteosat Second Generation (MSG) geostationary satellite also supports near-real-time monitoring. The SEVIRI provides high temporal resolution with 15 min intervals for taking images, which helps in monitoring the growth and expansion of wildfires. This real-time information is essential to support emergency response teams in making decisions and distributing resources immediately [66,67]. It is also used in monitoring fire weather at various meteorological stations. These stations give information on temperature, humidity, and wind speed and direction, all of which are crucial factors in the spread of wildfires. The combination of satellite information with in situ meteorological data provides information on fire weather and leads to improved wildfire prediction [68].

In Greece, the application of these technologies has been vital in enhancing the effectiveness of early detection and combating of wildfires. Wildfire monitoring and early detection in the country are dependent on the MODIS, VIIRS, and SEVIRI sensors in the management of wildfires. These tools have helped the Greek authorities to tackle wildfire incidents more efficiently, thereby reducing loss of lives and properties. Satellite technology and meteorological stations are crucial, but there are other tools, such as unmanned aerial vehicles (UAVs), for observing fires [39,69,70]. Sensor-carrying UAVs can be used to fly over the affected areas and obtain better and more detailed images and data compared to satellites. Furthermore, fire detection cameras located at high vantage points and lookout towers provide localized surveillance and early warning in the remotest zones [71,72]. These advanced technologies have improved the means of handling wildfires and protecting the populace and properties in Greece [73,74].

According to Tagarev et al. [13], a low-rate wireless personal area network is proposed in other research as a means of early forest fire detection and monitoring. The architecture of the system enables it to measure different parameters on trees at varying heights, according to the unique topography of the forest [12]. The evaluation of the effects of fire on various forest ecosystem components, such as the soil, tree trunks, treetops, and even the identification of subsurface fires, is made possible by this capacity. Measurements of power usage confirm that putting this sensor network into practice is feasible [25]. With a duty cycle of just 0.33% and sensors that meet low-voltage, low-power requirements, the network has an operating lifetime longer than a year [59]. According to Radostitz et al. [6], there is potential for this novel method to increase early forest fire detection and monitoring, which might lead to better forest fire management and mitigation initiatives.

2.4. Risk Assessment Regarding Wildfires

Risk analysis is a critical aspect of wildfire management because it entails the identification of the likelihood of occurrence, extent, and consequences of wildfires. One of the important resources in this process is forest fire danger rating, which is helpful in sharing information with the public and allocating resources. Van Wagner developed one of the most famous systems, the Canadian Forest Fire Weather Index (FWI) system, in 1967 [56]. The FWI system is an integrated tool that makes use of temperature, relative humidity, wind speed, and precipitation data to come up with a fire weather index for each day, which shows the level of fire danger.

In Europe, the European Forest Fire Information System (EFFIS) uses the FWI system to forecast and report on fire risk throughout the continent. The EFFIS gives information on fire danger in near real time and helps national and regional authorities in their decisions. This system plays an important role in informing the public about the current fire risks and

how communities can prepare for worst-case scenarios. Furthermore, through risk ranking, the EFFIS assists in identifying the appropriate distribution of firefighting resources where attention and support are required most [75].

Specifically in Greece, the FWI system plays a crucial role in assessing and managing wildfire risk. Another work highlighting the adaptation and efficacy of the FWI system is Dimitrakopoulos et al. (2011) [76]. The FWI system, which they use in their research, is crucial to identify the fire danger and come up with appropriate preventive measures or immediate actions in cases of wildfire occurrence. Combining the FWI system with local meteorological data has proved helpful in increasing the reliability of fire danger ratings in Greece, which has in turn made the general management of wildfires more effective [76]. Forest fire danger rating systems such as the FWI and information systems such as the EFFIS have a dual purpose in combating wildfire. Firstly, they play a crucial role in communication with the public to convey information on fire hazards and preventive measures. Communication of the levels of fire danger enables the mitigation of human contributions to fires and encourages measures necessary to prevent destruction from wildfires. Secondly, these systems are crucial for the tactical and organizational management of firefighting organizations. These systems help in proper evacuation of resources in times of fire danger, coordinate response efforts, and help communities prepare better against the risks of wildfire [56].

Following the general nomenclature of natural hazards, a wildfire risk assessment should take into account all relevant factors that impact not only the probability of the fire occurring but also its potential to cause harm (such as exposure and vulnerability) to not only people and property but also ecosystem services and ecological values [59,77]. A specific set of ideas and terminology have historically been established by the wildfire risk literature, sometimes separately from the broader literature on natural or technology dangers [56,78,79]. These are often expressed as an index of both constant and variable factors affecting the inception, spread, and difficulty of control of fires and the damage they cause, whereas fire hazard and fire risk are related to fuel conditions and causative agents, respectively [46,80–82]. Though there are some remnants of the former risk assessment methods, the fire community's growing acceptance of the UN's natural hazards nomenclature suggests that the words are mostly no longer used [20,25].

Assessing the risk of wildfires involves determining which regions are potentially vulnerable, when, where, why, and how they are most likely to start and spread, and the possible damages that flames may cause [27,83]. Due to this, a thorough risk characterization needs to include all three of these risk factors: danger, exposure, and vulnerability [46]. The risk assessment system should ideally also be coherent (internally logical), versatile (applying to a broad variety of geographic and temporal contexts), comprehensive, and repeatable (based on transparent methodologies) [33]. The absence of an appropriate approach to risk communication and management would render risk assessment essentially meaningless [25,30,39].

In order to guarantee the safety of people engaged in controlling wildfires as well as those who may be harmed by them, good communication between fire management professionals, emergency services, and the public is a crucial component of wildfire management [84]. Risk circumstances should be communicated by appropriate media at appropriate times and to appropriate receivers, and should include a broad variety of stakeholders, from residents to public authorities and operational services [25,44]. Involving the public, communicating risks effectively, and providing appropriate training should take into account how people see the real risk and encourage them to take responsibility for managing it, all the while lowering exposure and enhancing readiness [46,85]. Important methods for communicating wildfire danger include the following.

- **Informing the General Public:** It is crucial to inform the general public about the dangers of wildfires and their potential consequences. Providing clear, concise, and timely information is essential, as is responding to any questions or concerns they might have [30]. Community outreach should also be part of this effort. Participatory

techniques have proven to be very useful, allowing the local population to express their views on the danger [27]. Public messaging involves disseminating important information through various means, such as social media, press releases, and public meetings [13,37]. This is especially crucial during the fire season. Communication in the public sphere should be succinct, precise, and consistent [12].

- **Public Relations:** Wildfire control organizations should collaborate with the media to ensure the public is informed in a timely and accurate manner. This includes providing frequent updates, arranging official and expert interviews, and granting access to fire sites as necessary [13].

Assessing the risk of wildfires is essential to minimizing the effects of fires, but for an integrated strategy to be effective, it must also be connected to other methods that both lessen the effects of fires and improve resilience to future risk situations [36]. The process of managing wildfire risk includes estimating the probability and severity of wildfires and creating suitable countermeasures to lower ignitions, minimize exposure, and boost resistance [26]. Policies for adaptation are also necessary to mitigate the harmful effects of shifting fire regimes due to societal and climatic change [37,56,59]. Several studies have highlighted how climate change affects the frequency of heat waves and droughts, which in turn causes severe occurrences, especially in the case of drought periods [6,59]. Climate change interacts with patterns of agricultural abandonment, especially in Southern Europe, where there is rural migration in many locations [37]. As a result, as landscapes change from controlled, mosaic kinds with plenty of variety in fuel density and distribution to more pyrologically uniform land cover of even-aged stands with thick, continuous understories, these regions will confront new and increased dangers [86].

Upgrading climate change adaptation strategies is essential to lowering the probability, behavior, and effects of wildfires *ex ante* in the context of rising severe wildfire risk [42]. Any action that lessens the risk of wildfires occurring as well as the exposure and susceptibility of buildings and communities to them *ex ante* is considered wildfire prevention [87]. Preventive strategies include buffer zones, controlled and cultural fires, fuel breaks, and other structural or “physical” methods of managing fuel loads and continuity. They also include adaptive management, ecosystem restoration, and protection [88]. Organizational measures are essential for lowering the *ex ante* danger of wildfires in addition to physical ones [89]. These include rules on construction norms and standards, land-use planning, and infrastructure management that is fire-resistant [87]. Moreover, post-fire rehabilitation, which is crucial to enhancing long-term resilience to wildfires, may combine wildfire preventive strategies [84,86]. To reduce the effects of extreme wildfires on society and government alike, wildfire prevention also requires adjusting wildfire risk assessment to account for projected climate change impacts on wildfire activity and increasing awareness-raising efforts (Figure 2).

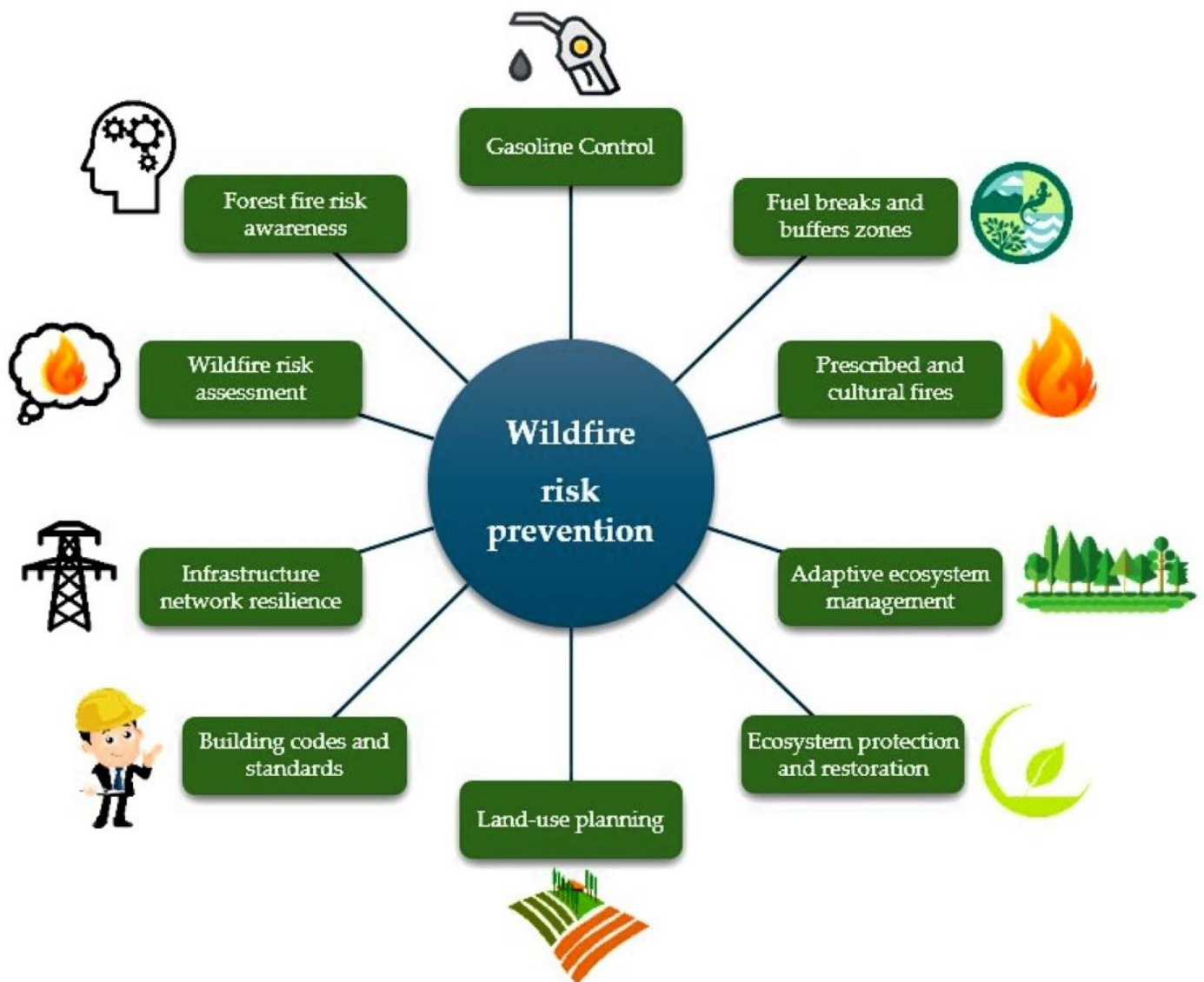


Figure 2. Reducing the risk of extreme wildfires through prevention measures.

2.5. Property Damage Costs during Wildfires

Like many other Mediterranean nations, Greece has long encountered meteorological conditions that might facilitate the beginning, development, and maintenance of flames [84,90,91]. The Fire Weather Index (FWI) is one measure of the pertinent meteorological conditions. It takes into account several factors that influence fire behavior [56]. Furthermore, Greece is among the few areas in the EU with some of the highest FWI ratings. The country's yearly scorched area, which totaled 50,735 hectares between 2006 and 2023, is a reflection of the significant fire danger [20] (Figure 3).

The wildfire season in 2023 was exceptionally severe in comparison to previous years, with wildfire breakouts in Rhodes, Evros, and the area around Athens. More than 173,000 hectares were burnt by the beginning of September [93]. There is a projection of yearly average wildfire damage to be €484 million for the years 2006–2023, based on the wildfire damage for 2023 and assuming that wildfire damage is proportionate to the burnt area [30]. The danger of wildfires and the damage they cause are expected to rise under all climate scenarios taken into account. Therefore, it is essential to comprehend how societies and asset values are affected by wildfires and how this may evolve in the future [36]. Although wildfires may have positive effects on certain biological resources, they can also have disastrous effects, particularly on the populations where they occur [77]. Data

illustrating the extent of devastation a wildfire generated might provide helpful measures to assess the fire's impact. These figures might include acres burnt or affected, firefighter and civilian fatalities, and destroyed residential, commercial, and other properties. For instance, wildfires in 2022 destroyed almost 2700 buildings, with California suffering the most damage [25,33].

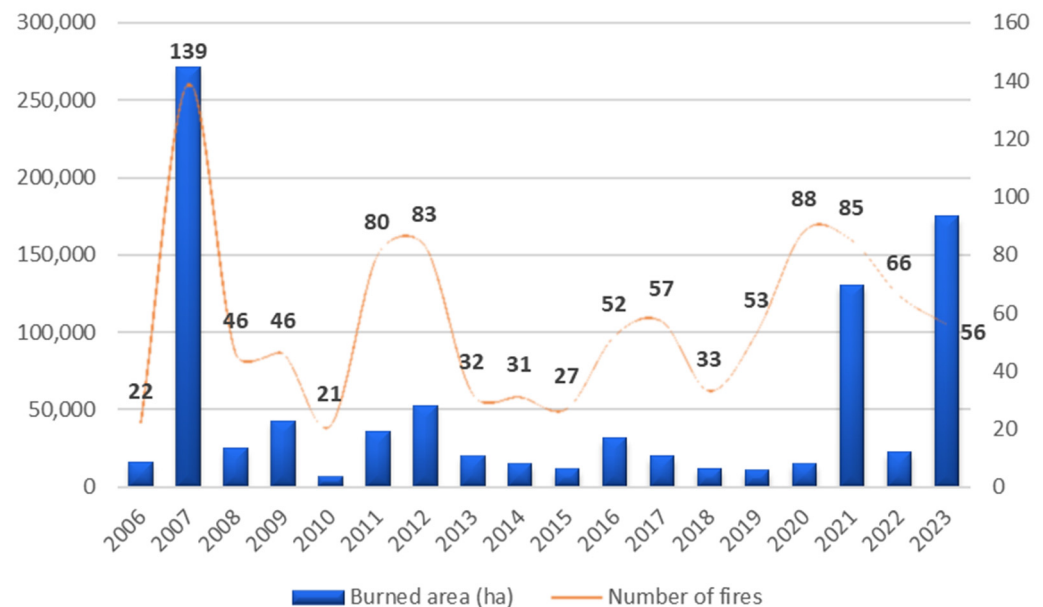


Figure 3. Yearly burnt area in Greece in ha (LHS); number of fires (RHS). Source: [92].

3. Materials and Methods

3.1. Research Design

A cross-sectional survey research design was utilized to conduct this study, following quantitative research methodology. Also, cross-sectional research is observational, employing methods that evaluate both outcomes and exposures simultaneously. Given that cross-sectional studies examine data at only one moment, the researcher is able to collect data on the effect of community preparedness on property damage costs during wildfires as quickly as possible. This study utilized a sample of 384 Greek residents. In addition, the sample size was determined using the Krejcie and Morgan sample size determination table [94]. The sample was representative of the different regions of Greece, especially in the areas commonly affected by fire [95,96].

3.2. Target Population

The study targeted Greek residents to gain insights into the effect of community preparedness on property damage costs during wildfires. This population was selected to represent the various experiences and readiness levels of the different regions that are affected by wildfires [97]. The respondents are primarily located in rural areas and villages across Greece. The following is a summary of where they are located in general.

Rural Areas (Region A): The majority of the respondents are from various rural regions in Greece. These areas are typically characterized by smaller populations and are often agricultural or undeveloped compared to urban centers and represent approximately 30%.

Villages (Region B): Many respondents are from Greek villages, which are smaller than towns and cities and often have close-knit communities. These villages are likely situated near forests or agricultural lands and represent approximately 30%.

Regions Frequently Impacted by Fire (Region C): The respondents are from regions that are particularly prone to forest fires. This implies a geographic distribution that includes areas with significant forest coverage or dry landscapes that are more susceptible to fires and represents approximately 40%.

All three regions were polled together or combined in the study to understand the combined impact of community preparedness on property damages incurred during wildfires. However, the use of these regions enables comparison of the contribution of various areas to the results, and these areas may differ in terms of exposure and preparedness. The regions of the sample were not equal: the population of each region determined the proportion of the sample. This approach makes the results more realistic to the current distribution and experiences of the population in the various regions of Greece.

3.3. Sampling Technique

The study adopted both the stratified and simple random sampling methods to obtain the best sample. Applying stratified random sampling was useful in dividing the population into subgroups or strata according to their geographic location (Region A, Region B, Region C). The respondents were spread across these strata to increase the variability originating from rural areas, villages, and areas prone to fire outbreaks. Simple random sampling was then used within these strata to select respondents. To avoid a skewed sample, the number of participants from each region was adjusted according to the population of the region. This reduced the likelihood of bias in the study by ensuring that the number of respondents from each region was proportional to the population in the communities investigated in terms of impacts of community preparedness and property damage cost during wildfires.

3.4. Data Collection

An online survey questionnaire was utilized for data collection in 2023 (Appendix A). A questionnaire is a research tool that asks respondents questions. A research questionnaire usually includes close-ended and open-ended questions. A questionnaire collects data about respondents' views, experiences, and opinions. For this study, the questionnaire was comprised of Likert scale-rated questions about community preparedness and its influence on property damage costs during wildfires. The respondents were given three weeks to fully respond to the questionnaire. This time was sufficient for the respondents to review all questions and to evaluate their responses. A high level of confidentiality and privacy was observed, both during and after the process of data collection [98–100]. Respondents were contacted through a combination of methods, as follows.

In-Person Surveys: Field researchers visited rural areas and villages to administer the survey in person in 2023. This approach was particularly important for reaching participants without internet access.

Postal Surveys: Surveys were mailed to selected households in targeted regions. Addresses were obtained from local municipal records, ensuring a broad coverage of the population.

Community Centers and Local Events: Surveys were distributed at community centers and during local events in rural areas, allowing us to engage directly with residents.

The mailing list for the postal surveys was compiled using municipal records, which provided comprehensive and updated contact information for households in the regions of interest. This approach helped ensure that our sample was representative of the target population. Finally, based on our respondents' varied locations and agreed-upon sample size methodologies, we believe our sample is highly representative of Greece.

3.4.1. Measurement of Variables

The survey employed Likert scale-rated questions to assess the influence of each factor on property damage costs. The information presented in Figure 4 was obtained from the answers to a question included in the online survey: "Which categories of property damage costs have you incurred in wildfires?" The answers available to the respondents comprised firefighting costs, reconstruction and recovery expenses, personal property losses, destruction of landscaping and gardens, crop losses, infrastructure losses, and other expenses like higher insurance premiums and health costs. The question posed enabled

respondents to tick all categories that they considered relevant to their experiences. The percentages depicted in Figure 4 reflect the portion of the respondents who mentioned different types of costs as part of their experiences with wildfire property damages and are based on the survey responses, which means that the values presented do not distort the experiences of the respondents.

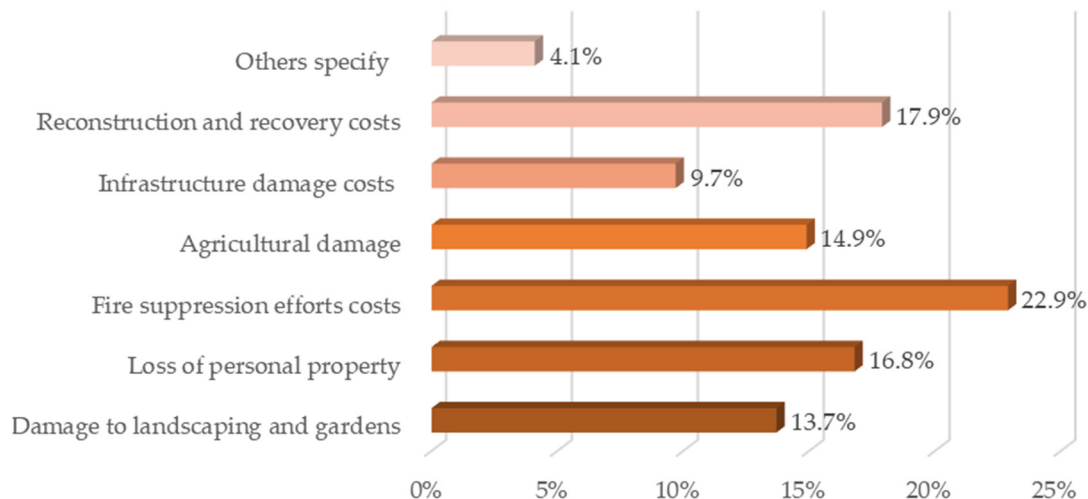


Figure 4. Common property damage costs during wildfires. Source: Authors.

3.4.2. Reliability and Validity

In order to guarantee the reliability and validity of the questionnaire some analyses were done. Regarding internal reliability, Cronbach's Alpha was calculated for all the sections and it yielded average value of 0.82. Content validity was also established by consulting with experts, thus ascertaining that all important topics were covered. Construct validity was assessed using Exploratory Factor Analysis (EFA), and all the items were found to be loaded well into their respective constructs with factor loadings varying between 0.68 and 0.90. Criterion validity was assessed using an objective index of community preparedness and was found to be significantly positively correlated to the scores obtained from the questionnaire ($r = 0.65$, $p < 0.01$). These results confirm the questionnaire's robustness in measuring community preparedness and its impact on property damage costs during wildfires.

3.5. Data Analysis

The data were thoroughly sorted and examined in SPSS ver. 22. Specifically, tables and figures represented the data after analysis using frequencies and percentages. Moreover, Pearson's correlation coefficient was used to examine correlations with 95% confidence. Regression analysis and the multiple regression model estimated predictive values and determined the study's dependent variable's general predictive power of the many independent variables (Equation (1)) [101].

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \quad (1)$$

where

Y = Property damage costs during wildfires

β_0 = constant (coefficient of intercept)

X_1 = Fire-resistant landscaping

X_2 = Early warning systems in wildfires

X_3 = Emergency response in wildfires

X_4 = Risk assessment regarding wildfires

ε = Shows the model's error term

$\beta_1 \dots \beta_3$ = demonstrates how the regression coefficient for the independent factors may be used to forecast the extent of property damage costs caused by wildfires.

The study's hypotheses were evaluated and interpreted at the 5% level of significance (0.05), with the *p*-value determining whether the null hypothesis was accepted or rejected.

4. Results

4.1. Demographics

Characteristics of the study participants are presented in Table 1.

Table 1. Background characteristics of the study participants.

Categories	Frequency	Percentage (%)
Gender		
Male	220	57.3
Female	164	42.7
Age of respondent		
Below 30 years	96	25.0
31–45 years	128	33.0
46–60 years	96	25.0
Above 60 years	64	17.0
Education level		
High School	92	19.3
College Diploma	80	24.0
Bachelor's	116	30.2
Master's	74	20.8
PhD	22	5.7
Geographic region in Greece		
Northern Region	113	29.4
Central Region	161	41.9
Southern Region	89	23.2
Islands	21	5.5
Total	384	100

Source: Authors' own work.

In terms of gender distribution, the majority of participants were male, constituting 57.3% of the sample, while females represented 42.7%. This gender imbalance suggests that there might be variations in responses and perspectives based on gender, potentially influencing the overall findings of the research. The age distribution of the respondents reveals a diverse sample, with participants falling into different age brackets. Those below 30 years constituted 25.0%, participants aged between 31 and 45 years made up 33.0%, individuals aged 46 to 60 years accounted for 25.0%, and respondents above 60 years comprised 17.0%. The majority held a bachelor's degree (30.2%), followed by 20.8% with a college diploma, a master's degree (20.8%), and a smaller percentage with a PhD (5.7%). This educational diversity in the sample suggests that the study incorporates perspectives from individuals with varying levels of academic qualifications, potentially contributing to a comprehensive analysis of the relationship between community preparedness and property damage costs during wildfires. Geographically, the study covered four main regions in Greece: Northern Region, Central Region, Southern Region, and Islands. The highest proportion of participants were from the Central Region (41.9%), followed by the Northern Region (29.4%), the Southern Region (23.2%), and the Islands (5.5%). The geographic distribution is essential for understanding regional variations in community preparedness and their subsequent effects on property damage costs. Moreover, regional differences in climate, landscape, and infrastructure could impact the level of preparedness and the resulting impact of wildfires on property.

4.2. Descriptive Results

The study evaluated the influence of fire-resistant landscaping on management of property damage costs during wildfires. The results are presented in Table 2.

Table 2. Results on the influence of fire-resistant landscaping towards management of property damage costs during wildfires.

Statement	%	SD	D	NS	A	SA
My property has fire-resistant landscaping features.	%	1.3	4.2	2.6	34.5	57.4
Fire-resistant landscaping significantly reduces the risk of property damage in my area.	%	0.0	6.9	2.6	52.6	37.9
I am aware of the benefits of fire-resistant landscaping in wildfire scenarios.	%	0.0	8.9	4.7	58.7	27.7
The cost of maintaining fire-resistant landscaping is reasonable compared to potential wildfire damage.	%	7.7	3.4	7.2	54.5	27.2
Fire-resistant landscaping should be a mandatory requirement for all properties in wildfire-prone areas.	%	3.8	17.5	4.2	44.3	30.2

Key: SD = strongly disagree, D = disagree, NS = not sure, A = agree, SA = strongly agree. Source: Authors' own work.

The majority of the respondents strongly agree (57.4%) that their properties have fire-resistant landscaping features. This finding suggests a significant uptake of fire-resistant landscaping practices among the surveyed individuals, indicating a proactive approach to mitigating wildfire risks. A noteworthy 50.9% of respondents agree that fire-resistant landscaping significantly reduces the risk of property damage in their area. This positive perception underscores the belief that such landscaping measures contribute substantially to protecting properties from the destructive impacts of wildfires. Furthermore, the majority of respondents (58.7%) acknowledge the benefits of fire-resistant landscaping in wildfire scenarios. This high level of awareness indicates an informed community that understands the positive outcomes associated with implementing fire-resistant landscaping practices. A significant proportion of respondents (54.5%) agree that the cost of maintaining fire-resistant landscaping is reasonable compared to potential wildfire damage. This finding suggests that many individuals recognize the economic viability of investing in fire-resistant landscaping as a preventive measure, viewing it as a cost-effective strategy. Hence, the results reveal a balanced response to the notion of making fire-resistant landscaping mandatory. While 44.3% agree, a sizable 30.2% strongly agree with the idea. On the other hand, 17.5% disagree, indicating a degree of hesitancy or differing opinions regarding the enforcement of such measures. This suggests that while a considerable percentage of the community supports the mandatory adoption of fire-resistant landscaping, a notable segment may prefer it as a voluntary rather than a compulsory practice.

The study also examined the relationship between early warning systems and reduced property damage costs during wildfires, and the results are presented in Table 3.

The results in Table 3 show that the majority (89.2%) of the respondents either agree or strongly agree that they are satisfied with the effectiveness of their community's early warning system for wildfires. This high level of satisfaction suggests a positive perception of the EWS within the community, indicating that residents generally view it as a valuable tool in wildfire preparedness. Also, a notable 95.5% of the respondents agree or strongly agree that the early warning system provides timely information to take protective measures. The majority of the respondents (79.4%) agree or strongly agree that they regularly receive updates and alerts from the early warning system. This high level of engagement suggests an active use of the system by the community, which is crucial for its effectiveness in conveying real-time information and ensuring residents stay informed about potential threats. A combined 81.7% of respondents agree or strongly agree that the information is clear and easy to understand, indicating that the EWS is successful in delivering information in a manner that is accessible to the community. The majority (78.3%) of the respondents

either agree or strongly agree that they trust the system's accuracy in predicting wildfire threats. This high level of trust is crucial for the community's reliance on the EWS for making informed decisions during wildfire events. The majority of respondents (81.3%) agree or strongly agree that the EWS has played a crucial role in this regard, underscoring its perceived effectiveness in mitigating property damage and emphasizing its positive impact on community resilience.

Table 3. Results concerning the relationship between early warning systems and reduced property damage costs during wildfires.

Statement	%	SD	D	NS	A	SA
I am satisfied with the effectiveness of our community's early warning system for wildfires.	%	0.0	6.2	4.6	63.8	25.4
The early warning system provides timely information to take protective measures.	%	0.0	4.5	0.0	77.9	17.6
I regularly receive updates and alerts from the early warning system.	%	3.4	8.9	4.7	55.7	23.7
The information from the early warning system is clear and easy to understand.	%	7.7	3.4	7.2	64.5	17.2
I trust the accuracy of the early warning system in predicting wildfire threats.	%	0.0	17.5	4.2	44.3	34.0
The early warning system has played a crucial role in reducing property damage in past wildfires.	%	0.0	5.2	0.0	78.9	16.0

Key: SD = strongly disagree, D = disagree, NS = not sure, A = agree, SA = strongly agree. Source: Authors' own work.

The study assessed the effect of emergency response plans on the level of property damage costs during wildfires, and the results are presented in Table 4.

Table 4. Results on emergency response plans on level of property damage costs during wildfires.

Statement	%	SD	D	NS	A	SA
I am familiar with the emergency response plan for wildfires in my community.	%	0.9	15.9	1.7	46.7	34.8
The emergency response plan is well coordinated and effective.	%	19.5	10.9	0.0	42.6	27.0
I feel confident in the local authorities' ability to manage wildfires.	%	8.6	1.1	3.5	51.3	35.7
The emergency response plan includes clear evacuation routes and procedures.	%	5.5	9.1	11.8	56.6	17.0
I have participated in drills or training related to the emergency response plan.	%	1.5	8.1	1.8	60.2	28.4
The emergency response plan is regularly updated and communicated to residents.	%	1.8	7.4	11.5	51.2	18.1

Key: SD = strongly disagree, D = disagree, NS = not sure, A = agree, SA = strongly agree. Source: Authors' own work.

The results in Table 4 show that the majority of the respondents (46.7%) agreed that they are familiar with the plan, with an additional 34.8% strongly agreeing. This suggests that a majority of individuals surveyed are well acquainted with the emergency response plan, potentially indicating a level of community awareness and preparedness. While 42.6% agreed and 27.0% strongly agreed that the plan is well coordinated and effective, a noteworthy 19.5% strongly disagreed. This divergence in opinions suggests a degree of variability in how respondents perceive the efficiency of their community's emergency response plan. A substantial 51.3% agreed and 35.7% strongly agreed, indicating a prevailing confidence in the capabilities of local authorities. However, 8.6% disagreed, potentially highlighting some skepticism or lack of confidence among a minority of respondents. The majority (56.6%) agreed, but a notable 17.0% strongly disagreed. This suggests a potential gap in the

clarity and effectiveness of evacuation plans, which could impact community members' ability to respond appropriately during wildfires. An encouraging 60.2% agreed and 28.4% strongly agreed that they have participated, demonstrating a proactive engagement with preparedness activities among a significant portion of the community. While 51.2% agreed and 18.1% strongly agreed, a combined 9.2% disagreed, indicating that a portion of the community may feel that communication and updates are lacking.

Moreover, the study examined the influence of early risk assessment on the level of property damage costs during wildfires, and the results are presented in Table 5.

Table 5. Results on the influence of early risk assessment on the level of property damage costs during wildfires.

Statement	%	SD	D	NS	A	SA
Regular risk assessments are conducted in my community for wildfire threats.	%	0.0	20.9	0.9	48.4	30.7
I am aware of the risk level of wildfires in my area.	%	0.0	10.9	0.0	61.6	27.5
Risk assessment information is easily accessible to residents.	%	0.0	0.0	3.5	59.9	36.8
Early risk assessments help in better preparation and resource allocation.	%	5.5	9.1	0.0	57.6	27.8
Risk assessments have directly contributed to reducing property damage in my community.	%	0.0	0.0	1.6	68.5	29.9
There is active community involvement in the risk assessment process.	%	0.0	0.8	0.0	60.4	29.6

Key: SD = strongly disagree, D = disagree, NS = not sure, A = agree, SA = strongly agree. Source: Authors' own work.

The results in Table 5 show that the majority of the respondents (48.4%) agree that these assessments occur, indicating a substantial level of awareness and proactive efforts. However, it is concerning that 20.9% disagree or are uncertain about the regularity of risk assessments, suggesting potential gaps in community preparedness for wildfire events. A significant 61.6% agree that they are aware, reflecting a generally high level of consciousness regarding the potential threat. However, the figure of 10.9% who disagree or are unsure may signal a need for increased communication and education on wildfire risks within the community. A positive finding is that 59.9% agree that such information is easily accessible, demonstrating a relatively open flow of crucial data. However, the figure of 3.5% who are unsure or disagree highlights a potential area for improvement in ensuring the widespread availability of risk-related information. Also, a substantial 57.6% agree that these assessments are beneficial, suggesting a recognition of their role in enhancing preparedness efforts. However, the figure of 5.5% who disagree indicates a need to explore and address potential concerns or challenges associated with the effectiveness of early risk assessments. A notable 68.5% agree with this notion, suggesting a positive correlation between risk assessment measures and a reduction in property damage. Finally, a substantial 60.4% agree that there is active community participation, indicating a collaborative approach to risk management.

The results in Table 6 show that a significant percentage of the respondents (76.3%) have experienced property damage due to wildfires. Among these, 22.1% reported minor damage, 19.5% faced moderate damage, and 13.1% suffered severe damage. This distribution indicates varying levels of impact, with a notable number of respondents experiencing substantial losses. The average cost of property damage was estimated at € 15,000, highlighting the financial burden that wildfires can impose on affected households. These findings emphasize the critical need for effective community preparedness measures to mitigate the impact of wildfires. Despite the implementation of such measures, the data suggest that a considerable proportion of the population remains vulnerable to significant property damage. Enhancing and promoting comprehensive wildfire preparedness strategies could be key to reducing these costs and improving community resilience in the face

of wildfire threats. The study also identified the different common property damage costs during wildfires, and the results are presented in Figure 4.

Table 6. Experiences of property damage among respondents.

Category	Frequency	Percentage (%)
Experienced property damage (Yes)	293	76.3
Extent of Damage		
- Minor	85	22.1
- Moderate	75	19.5
- Severe	50	13.1
Average Cost of Damage (€)	-	15,000

Source: Authors' own work.

The largest percentage of property damage costs, 22.9%, is attributed to fire suppression efforts. This indicates that a substantial portion of resources is dedicated to containing and extinguishing wildfires. Following closely behind, reconstruction and recovery costs constitute 17.9% of the overall property damage. This suggests that a considerable financial burden is placed on communities in the aftermath of wildfires, emphasizing the importance of preparedness measures not only during the fire but also in the post-fire phase. The loss of personal property represents 16.8% of the total damage, indicating that homeowners bear a substantial portion of the impact. Landscaping and garden damage contribute to 13.7% of property damage costs. While this may seem relatively low compared to other categories, it highlights the importance of safeguarding not just structures but also natural elements within communities. Community preparedness should incorporate landscaping practices that reduce fire risk, such as creating defensible space around properties. Agricultural damage accounts for 14.9% of property damage costs. This underscores the interconnectedness of rural and urban areas in the face of wildfires. At 9.7%, infrastructure damage costs represent a significant but comparatively smaller share of the total. Nevertheless, the impact on essential facilities and utilities highlights the need for infrastructure resilience planning as part of overall community preparedness. The lowest portion of respondents (4.1%) identified other losses such as increased insurance premiums and health-care costs, constituting 4.1% of property damage costs.

4.3. Results of Regression Analysis

Regression analysis helped to determine the level to which community preparedness affects property damage costs during wildfires, and the results are presented in Table 7.

Table 7. Model summary.

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
	0.613 ^a	0.689	0.692	2.603

^a Predictors (constant): property damage costs during wildfires.

The study's four independent variables showed a positive link between community preparedness and reduction in property damage costs during wildfires, as indicated by the positive multiple correlation coefficient (R). Additionally, the R-squared value attests to the fact that the study's independent variables account for 68.9% of the variation in property damage costs.

ANOVA was used to determine whether the regression model significantly explains some of the variance in property damage costs compared to the null model, which includes only the intercept term. The results, $F(3, 166) = 95.043$, $p < 0.05$, as shown in Table 8, indicate that the regression model is significantly better at explaining the data than the null model. This suggests that the independent variables in the model contribute significantly to predicting property damage costs during wildfires.

Table 8. ANOVA.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	23.210	3	17.182	95.043	0.015
Residual	3.258	166			
Total	26.073	169			

Dependent variable: property damage costs during wildfires. Predictors (constant): fire-resistant landscaping, early warning systems, emergency response plans, early risk assessment.

Regression analysis (Table 9) yielded unstandardized coefficients, which were used to determine the effect of community preparedness on property damage costs during wildfires.

Table 9. Regression analysis.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.318	0.136		2.408	0.003
Fire-resistant landscaping	−0.196	0.054	−0.147	−3.736	0.000
Early warning systems	−0.184	0.067	−0.313	−5.195	0.001
Emergency response plans	−0.241	0.013	−0.202	−12.501	0.000
Early risk assessment	−0.206	0.049	−0.182	−6.411	0.001

Dependent variable: property damage costs during wildfires.

The intercept term in the model (0.318) denotes the estimated property damage costs of wildfire while holding all other independent variables at zero. This intercept is statistically significant with $t = 2.408$ ($p = 0.003$), meaning that even in the absence of the assumed preparedness measures, the costs resulting from property damages are foreseen to have a minimum figure. Fire-resistant landscaping gives a negative unstandardized estimate of -0.196 and a 3.736 t -value ($p = 0.000$). The negative sign implies that higher levels of fire-resistant landscaping correspond to a decrease in property losses during wildfires. This result supports Hypothesis 1 that fire-resistant landscaping is positively associated with a reduction in property damage costs to communities. Thus, it can be suggested that Hypothesis 1 is supported by the regression analysis results obtained. Early warning systems also have a negative unstandardized coefficient (-0.184), with significant t value of -5.195 (p value 0.001). This negative coefficient fulfills Hypothesis 2, revealing a good relationship between early warning systems and decrease in property damage costs. Thus, Hypothesis 2 is approved, demonstrating that there is a negative correlation between early warning systems as an independent variable and property damage costs when it comes to wildfires. This raises significant concerns about the extent to which emergency response plans depress property damage cost in light of a negative coefficient of -0.241 with an immense t -value of -12.501 at $p = 0.000$. This finding supports Hypothesis 3, and confirms that contributing to the emergency response plans assists in decreasing costs related to property damage in wildfires. Early risk assessment has a significant negative influence on property damage costs (coefficient of -0.206 , t -value of -6.411 , $p = 0.001$), supporting Hypothesis 4. This indicates that communities with better early risk assessment practices experience lower property damage costs during wildfires.

5. Discussion

This study assessed the effect of community preparedness on property damage costs during wildfires. Effective risk management techniques for people, communities, and organizations include preparing oneself and one's property for a natural catastrophe. As per the data in Table 2, 57.4% of the respondents had fire-resistant landscaping features. Nevertheless, even though this measure was taken, many still encountered property damage, implying that while fire-resistant landscaping helps in the reduction of risk, it might

not be completely effective by itself. This discovery underlines the necessity of integrated preparedness strategies [93]. Bushfire preparedness has been shown to have many advantages, including less risk exposure, decreased losses and damage, and enhanced resilience that facilitates a quicker return to “normal” in terms of the surrounding environment, infrastructure, daily schedules, and psychological stability [25].

Research has shown that people who are prepared are more able to protect their houses from bushfires, although getting ready is no guarantee a property will survive [32,33]. For agencies, better-prepared households reduce pressure on responders when it comes to protecting both life and property. Nonetheless, the relationship between homeowners’ perceptions of the danger of natural hazards and their subsequent preparations or preventive measures has been the subject of conflicting discussions in the literature [25,87]. On the other hand, further research revealed that the relationship was shaky [87]. For example, Ryan et al. [36] showed that perceptions of danger did not predict protective action for chemical release, while Chuvieco et al. [46] found that there was either no association or conflicting findings for wildfire preparedness. More recently, the European Parliament verified the complexity identified in risk perception interpretations and their possible impact on preventive measures [50].

Furthermore, the study revealed that only 57.6% of the respondents had undertaken early risk assessments. The ones who had were more prepared and suffered less damage, proving the hypothesis that early risk assessments are a prerequisite of preparedness and reduction in damage. Nevertheless, the lower adoption rate means that there is a need to improve community engagement and education on the benefits of risk assessments. The management and coordination of emergency occurrences, such as wildfires, is facilitated by current incident command systems (ICSs), which depend on risk communication for operation [87]. The population that is in danger and the fire risk circumstances may fluctuate quickly, mostly due to weather and fire potential. As a result, during a wildfire, risk communication should be initiated at all times [77].

Wildfire risk communication may be safeguarded against several tough elements, such as the topic’s complexity, since it often incorporates intricate scientific ideas that the general public may find problematic to comprehend [37,39,57,84]. To successfully ensure proper reactions, this might make explaining the dangers difficult [87]. Additionally, people’s attention spans are often short for things that are not directly related to their everyday lives or way of life [27,28]. During a wildfire, as well as before and after, false information and rumors may spread swiftly, complicating official risk communication efforts and confusing the public [30,53]. Furthermore, it is important to take into account linguistic and cultural obstacles when communicating risks. This may result in non-native speakers and people from other cultural backgrounds being less aware of the situation and less prepared [26,93]. There is a need to reevaluate the current approach to managing wildfires, especially when they pose a threat to populated areas, given the rising damages and management costs of wildfires and the incapacity of agencies tasked with managing them to articulate the return on investments from suppression and mitigation [14].

The Flame Act, which was adopted by Congress in 2009 in reaction to expensive wildfires, required the Secretaries of Agriculture and the Interior to collaborate with state and local partners to create a comprehensive plan for managing wildfires [102]. Wildfire response, resilient landscapes, and communities adapted to fire are the three main focuses of the plan [30,64]. A suitable wildfire risk framework functionally connects these factors, making it possible to determine the types and amounts of mitigation that result in the desired decrease in risk. However, the effectiveness of risk management depends on the clarity of the goals for reducing risk [56].

Furthermore, numerous restrictions apply to the estimation of wildfire damage in the future under climate-dependent scenarios [44,54]. Wildfire weather projections, like other climate forecasts, are subject to model uncertainty because a variety of variables, apart from global warming, may account for future wildfire paths [25]. Also, many wildfire-prone populations may adjust by implementing a variety of strategies, such as early warning

systems, fire suppression, and even the controlled burning of designated areas [6]. Even under the most favorable circumstances, it is predicted that fire hazards will rise over most of Europe and the US, even if burnt areas have been declining in certain places as a result of better adaptation [84,90,91]. In addition to other climate-related environmental initiatives, such as improved urban design, authorities in wildfire-prone areas will need to take damage management into account [27,29]. Living in more populated, fire-proof places is one way to lessen the possibility of wildfires, since more people living in formerly deserted or unvisited areas may raise the risk of wildfires because most fires are caused by humans, whether on purpose or accidentally [13,60].

Accordingly, the findings of the study can be of significant interest to policymakers and community leaders in areas affected by wildfires. This brings the need for improving community involvement and awareness of the importance of risk assessments. Better communication and making sure that all information is clear and easily understood would go a long way in increasing residents' awareness and preparedness. Such efforts are essential in building capacity within affected communities to respond to such disasters. Thus, the findings from this Greek case study are relevant not only for other Mediterranean areas but also for other parts of the world with similar climatic conditions and wildfire hazards. Strategies and challenges that have been observed in Greece can be used for countries such as Spain, Italy, and Portugal, and even California in the United States. Through applying systematic risk assessment approaches, these regions would be able to predict threats and accurately allocate adequate resources. In the same way, the research emphasizes the need for strong policies supporting community preparedness, risk evaluation, and information sharing. These findings can be used by decision-makers to design policies that strengthen communities against wildfire occurrences. Such policies should encourage contingency plans that include fire-resistant plantings, detectors, plans of action, and risk evaluations at initial stages.

One major limitation of this study is that the results were aggregated across respondents from low-wildfire-risk and high-wildfire-risk areas. This could have influenced the results of the regression analysis, since the areas surveyed for community preparedness levels may show varying wildfire risks, hence skewing the results in terms of community preparedness measures and property damage costs. Ideally, in the future, the sample should be divided according to the level of fire risk to consider the measures taken for preparedness in more detail.

6. Conclusions

The findings revealed important details of community wildfire preparedness with regard to property loss costs that help identify areas for policy enhancements and relevant community engagement. First, we identified that fire-resistant landscaping significantly affects property damage cost. While a substantial number of the respondents implemented fire-resistant landscaping, many of them still suffered losses, pointing to the fact that while it is helpful, it is not sufficient on its own. Secondly, early warning systems were found to be useful in preventing property damage. The majority of the respondents were aware of the efficiency of these systems in giving timely information for protection. Yet the volatility in satisfaction results suggests that there is potential for enhancing the dependability of these systems, as well as increasing the level of community trust. Thirdly, the credibility of emergency response plans was highlighted, where the respondents believe that their respective local authorities can effectively handle the occurrence of wildfires. In particular, early risk assessment was highlighted as one of the key factors in minimizing the cost of property damage. The research also showed that organizations that engage in frequent risk analyses withstand and incur fewer losses during wildfires. This finding points to the need for comprehensive risk assessment practices and shows that raising awareness and engagement in these assessments within communities can greatly improve levels of preparedness. Finally, the study discussed the social cost of wildfires, where respondents revealed high financial losses in terms of property.

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Appendix A

A survey questionnaire: Assessing the Effect of Community Preparedness on Property Damage Costs During Wildfires.

Appendix A.1. Demographic Information

1. Gender:
 - Male
 - Female
2. Age:
 - Below 30 years
 - 31–45 years
 - 46–60 years
 - Above 60 years
3. Education Level:
 - High School
 - College Diploma
 - Bachelor's Degree
 - Master's Degree
 - PhD
4. Geographic Region in Greece:
 - Northern Region
 - Central Region
 - Southern Region
 - Islands

Appendix A.2. Fire-Resistant Landscaping

Please indicate your level of agreement with the following statements about fire-resistant landscaping on your property.

Table A1. Fire-Resistant Landscaping.

Statement	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
My property has fire-resistant landscaping features.					
Fire-resistant landscaping significantly reduces the risk of property damage in my area.					
I am aware of the benefits of fire-resistant landscaping in wildfire scenarios.					
The cost of maintaining fire-resistant landscaping is reasonable compared to potential wildfire damage.					
Fire-resistant landscaping should be a mandatory requirement for all properties in wildfire-prone areas.					

Appendix A.3. Early Warning Systems

Please indicate your level of satisfaction with the early warning systems for wildfires in your community.

Table A2. Early Warning Systems.

Statement	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
I am satisfied with the effectiveness of our community's early warning system for wildfires.					
The early warning system provides timely information to take protective measures.					
I regularly receive updates and alerts from the early warning system.					
The information from the early warning system is clear and easy to understand.					
I trust the accuracy of the early warning system in predicting wildfire threats.					
The early warning system has played a crucial role in reducing property damage in past wildfires.					

Appendix A.4. Emergency Response Plans

Please indicate your level of satisfaction with the following statements about the emergency response plans for wildfires in your community.

Table A3. Emergency Response Plans.

Statement	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
I am familiar with the emergency response plan for wildfires in my community.					
The emergency response plan is well coordinated and effective.					
I feel confident in the local authorities' ability to manage wildfires.					
The emergency response plan includes clear evacuation routes and procedures.					
I have participated in drills or training related to the emergency response plan.					
The emergency response plan is regularly updated and communicated to residents.					

Appendix A.5. Early Risk Assessment

Please indicate your level of satisfaction with the following statements about early risk assessment for wildfires in your community.

Table A4. Early Risk Assessment.

Statement	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Regular risk assessments are conducted in my community for wildfire threats.					
I am aware of the risk level of wildfires in my area.					
Risk assessment information is easily accessible to residents.					
Early risk assessments help in better preparation and resource allocation.					
Risk assessments have directly contributed to reducing property damage in my community.					
There is active community involvement in the risk assessment process.					

Appendix A.6. Property Damage Costs

1. Have you experienced property damage due to wildfires?

- Yes
- No

2. If yes, what was the extent of the damage?
 - Minor
 - Moderate
 - Severe
3. What was the approximate cost of the damage (in EUR)?
4. What types of property damage costs have you experienced during wildfires? (Select all that apply)
 - Fire suppression efforts
 - Reconstruction and recovery costs
 - Loss of personal property
 - Landscaping and garden damage
 - Agricultural damage
 - Infrastructure damage
 - Other losses (specify)

Thank you for participating.

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