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# Community perceptions regarding prescribed fires, wildfires, and ecosystem disservices in southern California's Wildland-Urban Interface

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ABSTRACT

Wildfires adjacent to highly populated Wildland-Urban Interface (WUI) areas are increasingly impacting urban communities in terms of post-fire costs and displacement of populations. But community perception of these socioeconomic and ecological costs, or ecosystem disservices (EDs), before catastrophic events like the 2025 Los Angeles Fires is little understood. Thus, understanding how experts and the urban public perceive fire-related EDs, relative to the risk reduction benefits of prescribed fire, is key. We used a 2023 survey ($n$ = 869) from communities within Greater Los Angeles as well as spatial data and econometrics to understand how urban and WUI public and experts perceived prescribed fires, wildfires, and fire-related EDs. We found no significant difference between experts and the public in reported smoke exposure over the past five years. Experts were significantly less likely to agree that threat of property damage outweighed the ecological benefits of prescribed fire. Younger (18–29) and non-white respondents were significantly less likely to support prescribed fire, whereas higher-income individuals were more likely to view property damage from fire as exceeding the ecological benefits of fire. Overall, living in a designated WUI area and recent smoke exposure did not significantly influence EDs perceptions. Findings have implications for understanding risk perceptions, WUI fire governance, and audiences before the occurrence of catastrophic urban fires such as the 2025 Los Angeles urban fires. Policy makers can use these insights to craft context-specific outreach and social-media communication for urban communities, diverse populations, and young adults in or near high fire risk WUI areas.

## 1. Introduction

Wildfire-driven urban fire events such as the ones that occurred in the Greater Los Angeles Metropolitan Area in early 2025 have been growing in scale, severity, socioeconomic costs, and long-term impacts to communities across the globe (Thomas et al., 2022; Chen et al., 2024). The two urban fire events affecting Los Angeles resulted in over 16,000 homes being lost, 30 fatalities and property and capital losses could range between $USD 50–275 billion dollars (Vincent, 2025). Post-fire, such communities are severely affected and long-term impacts (e.g., population displacement, gentrification, building density, tree cover) can completely, or minimally, change their socio-ecological composition (Kramer et al., 2021; Thomas et al., 2022; Escobedo et al., 2024). Similarly, the long-term and indirect costs due to wildfire smoke, water-soil contamination, social displacement and long-term human morbidity impacts are unknown (D'Evelyn et al., 2023; Schollaert et al., 2024; Rogers et al., 2025).

Such negative costs and impacts to human wellbeing resulting from ecological processes and disturbance events, such as urban/wildfires, are often collectively referred to as ecosystem disservices (Escobedo et al., 2011; Sil et al., 2019). Although extreme climate events are often responsible for such fires and impacts (Dunn et al., 2010; Wallace et al., 2025), land use decisions and urbanization in the Wildland-Urban-Interface (WUI) have combined to create these new destructive fire regimes affecting human settlements (Abatzoglu and William, 2016; Davies et al., 2018; Kramer et al., 2021). More recently, urban fires have also affected highly urbanized communities that are distant from contiguous areas of wildland vegetation and fuels (Calkin et al., 2023; Leone et al., 2025). However, how the public and experts perceive these urban/wildfires and their related-EDs before their occurrence is poorly understood.

To mitigate these potential impacts from wildfire to communities, environmental and land management experts are increasing fire and land management activities such as “fuel treatments” using prescribed

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fire and other vegetation management activities (North et al., 2021) in the WUI (Halofsky et al., 2020). Prescribed fire in particular is an activity that can be used to treat vegetation in the WUI and in doing so mitigate wildfire severity, protect communities from wildfire, and increase the resilience of ecosystems (Chen et al., 2024; Depietri and Orenstein, 2020). However, prescribed fire by altering ecosystem structure (i.e., fuel loads, biomass decrease, soil quality, habitat alterations) can also alter ecosystem function (scenic quality, wildlife viewing opportunities, water quality, air quality from smoke, etc). It also comes with the risk that the burn could escape and become a wildfire and damage or destroy nearby homes (Wallace et al., 2025). Recently, others report that fuel treatments in the WUI are often not always effective in mitigating urban fire events such as the ones that occurred in Los Angeles in 2025 (Escobedo et al., 2024; Leone et al., 2025). Therefore, the negative impacts of prescribed fire on ecological functions and associated risk can also negatively affect human wellbeing and therefore are considered EDs (Dipietri and Orenstein, 2020; Escobedo et al., 2018). In doing so, accounting for the concept of EDs can help inform fire and environmental management decisions since it is increasingly being used to communicate the adverse impacts of natural processes (i.e., wildfire or prescribed fire) and related anthropogenic activities (e.g., forest and fire management) on human wellbeing (Dunn, 2010). Other more recent literature is also focused on ecosystem service (ES)/ED tradeoffs, governance and the related benefits – and costs- from forests (Cheng et al., 2024 and 2025b).

Specifically, ecosystem disservices are the social, economic and environmental costs of nature that adversely influence human wellbeing (Escobedo et al., 2011). Fire-related EDs can include smoke emissions and subsequent human health impacts; threat, damage to, and loss of property and infrastructure, utilities, and homes as well as human lives; loss of utilities, and impending risk and threat to communities (Sil et al., 2019). Severe wildfires can also lead to ecosystem alteration, erosion and sedimentation, altered scenery, wildlife habitat alteration, biodiversity decreases, soil-water quality impacts and downstream debris flows and landslide that threaten property and human lives (De'Evelyn et al. 2023; Chen et al., 2024). Similarly, prescribed fire can reduce fire severity but will also lead to short term EDs (e.g., air quality impacts) and fuel mitigation treatments are often considered "logging" and such polemic treatments do not address all risks to all communities equally (Davis et al., 2024; Thomas, 2024). Mechanical forestry-related activities will also lead to similar short-term impacts to scenery, soil-water quality, biodiversity habitat alteration, and recreation displacement (Burns and Cheng, 2007; Cheng et al., 2025b). Thus, such decisions between short-term forestry and prescribed fire impacts to mitigate the hazard and risk of severe long-term impacts are a trade-off for society (Cheng et al. 2023).

Indeed, to implement such fire and ecosystem management decisions and policies, public awareness and participation is a key process for planning-related activities (Kneeshaw et al., 2004). The process has been well documented in more rural forests (Cheng and Mattor, 2006) as well as in WUI areas (e.g., Kneeshaw et al., 2004), but there is less literature on whether the perceptions of nearby urban communities are taken into consideration (Cheng et al., 2024). This is particularly relevant since decisions and activities related to the trade-offs associated with fire and fuels in the WUI also have the potential to affect nearby and distant communities (Schollart et al., 2024). Previous research has demonstrated that the perceptions of forest managers and those of the general public around prescribed fire are not always aligned, possibly leading to misperceptions (Burns and Cheng, 2007; McGrath et al., 2023). For example, Wu et al. (2022) found that while recreationists were most worried about wildlife mortality, managers' top concern was the possible EDs associated with prescribed fire.

However, it can be challenging for managers to know community perceptions since there are few incentives for public participation in the planning process for such activities since participation time represents a cost (Reed et al., 2018). As a result, participants at forest planning meetings are more likely to be male, higher income, white, and with an education beyond high school (Davies et al., 2018); therefore not reflective of the community at large. This affects wildfire planning efforts within a community or project area, since perceptions about fuel treatments are often divergent according to socio-demographic factors potentially influencing opinions and attitudes (Cheng et al. 2023). For example, Lim et al. (2009) found significant differences between Whites, African Americans and Hispanics regarding concern over smoke emissions, harm to fish habitat, and decreased scenic beauty due to prescribed fire effects. The two latter groups were more concerned, as were females and those with a higher level of education. In contrast, Toman et al. (2014) found the acceptability of prescribed fire and mechanical thinning were not significantly influenced by age, gender or education. The authors also noted that there was no consensus regarding the presence of any significant links between sociodemographic variables (e.g., gender, education, income) and support for fuels treatments, with some studies showing a significant influence and other studies finding no significant differences. Notably, geographic location and context can influence support for fuels reduction projects (Kneeshaw et al., 2004), but previous work on this subject is not common in places such as California (Brenkert-Smith et al., 2023; Toman et al., 2014).

Buchy and Hoverman (2000), for example, emphasize the importance of ensuring that participants in public engagement efforts are representative of the broader population of the city and WUI area. As such, public awareness, and often support, for these activities is needed given that the implementation of these practices on wildlands, and subsequent EDs, often occur immediately next to highly populated communities; particularly those at high fire risk such as those in southern, California in the United States (US; Cheng et al., 2024). Although there is available literature on fire management issues in the WUI (D'Evelyn et al., 2023; Toman et al., 2014) and about EDs in both urban and rural ecosystems (Thomas et al., 2022; Chen et al., 2024), less is known about the perceptions of socio-demographically diverse, urbanized WUI communities regarding these fuel management activities and the resulting changes to ecosystem services and EDs. For example, Anton and Lawrence (2016) found that place attachment was a significant influence on wildfire mitigation efforts for people living in rural areas, but not for those living in WUI, non-urban areas.

The aim of this study was to identify pre-fire perceptions, between experts and the public living in urbanized WUI communities similar to the ones affected by the 2025 LA fires, regarding prescribed/wildfires and fire-related EDs. Specifically, there were three objectives. First, we analyze divergent perceptions regarding fire-land management issues, and EDs, of experts versus those of the general public living in urban and WUI communities. Second, we attempt to understand if, and how, the socio-demographic characteristics of urban and WUI communities influence perceptions regarding prescribed fire, and fire-related EDs. Finally, we test whether living in a WUI designated neighborhood and having been previously exposed to wildfire smoke events, affects these perceptions. Findings from this study can offer a glimpse into how urban population and experts, perceived wild/urban fires, their effects, and risk mitigation activities before the occurrence of the catastrophic 2025 Los Angeles Fires.

## 2. Methods

### 2.1. Study area

The study area is within the Greater Los Angeles (LA) metropolitan area in southern California, United Staes (US) and is geographically and socio-demographically similar to communities affected by the 2025 Eaton Fire that affected the cities of Altadena, Pasadena and Siera Madre ~65 km to the west. Specifically, the study area is in northeastern Greater LA area in urban portions of Los Angeles and San Bernardino Counties, and covers an area of approximately 12,561km$^2$. Elevations range from sea level along the Pacific coast to over 3000 m in the San

Bernardino and San Gabriel mountains and encompasses several ecosystem types including grasslands, chaparral shrublands, oak dominated woodlands, montane forests, and urban ecosystems (Cheng et al., 2024). The Mediterranean climate is characterized by cool and wet winters, when most precipitation occurs, and then dry and hot summers.

Ecosystems in the study area are in urban or WUI designated areas including mountain communities in, and adjacent to, wildlands in the San Bernardino and Angeles National Forests. These WUI ecosystems in particular are an important source of ecosystem services for Los Angeles' population, including water supply and recreation (Cheng et al. 2023). However, the forest and shrubland-dominated ecosystems are already degraded and increasingly threatened by an altered and abnormally severe wildfire regime, invasive species, increasing recreation visits and the highly populated communities nearby (Underwood et al., 2019). Combined, these disturbances are changing the structure and composition of ecosystems and altering the provision of ecosystem services and EDs.

This study area is part of the second largest metropolitan area in the US and is home to a large and diverse population of around 19 million people, of which approximately 49% are Hispanic, 24% Asian, and 15% are African American (U.S. Census Bureau 2020). The sampled population lives in the northeast Los Angeles-San Bernardino urban area, but suburban mountain communities in the Lake Arrowhead-Big Bear area alone have a population of about 44,000. Los Angeles' urban-WUI boundary extends approximately 130 kms from west (i.e., San Fernando Valley-Santa Monica Mountains) to east (i.e., San Bernardino-Highland area). As such, it is typical of many urbanized WUI communities throughout southern California US. We define the WUI using sources from the State of California (Appendix B). This WUI definition is based on Stewart et al. (2007) and Radeloff et al. (2018) which were basically developed using building density data, land cover polygon data and criteria, and established distances between these two.

### 2.2. Survey design and implementation

This survey was part of a larger research project that identified the benefits of montane forest ecosystem services to nearby urban communities in southern California (Cheng et al., 2024). As such, the survey included a series of germane questions to our study aim and fire in the WUI such as: exposure to wildfire risk and smoke and the use and socio-environmental impacts of prescribed fire and other fire risk mitigation activities. For specific details of the survey please refer to Cheng et al. (2024). Based on Kruter et al. (2019), Ragmi et al. (2024), and Leone et al. (2025), in this study we elicited a respondent's perception defined as when: "a person is confronted with a situation or stimuli… The person interprets the stimuli into something meaningful to him or her based on prior experiences. However, what an individual interprets or perceives may be substantially different from reality" (Pickens, 2005).

We specifically analyzed five main questions (Appendix A). First (Q1), "How often have you been exposed to smoke from wildfires or controlled fires in the last 5 years since living in southern California?". This question was you used test whether perceived smoke, a fire-related EDs (Rogers et al., 2025; Schollaert et al., 2024) influenced responses. Later, in Section 2.3 we spatially and explicitly identify whether that respondent experienced actual smoke exposure in 2020. For our second question (Q2), we asked "Would you support the use of controlled fires in the National Forest of southern California?". This assessed respondents' perceptions towards prescribed fire in adjacent WUI forests (Eriksson et al., 2023; Miller et al., 2020). Finally, we asked if they agreed or disagreed with the following three-part statement (Q3): a) Fires are important to the health of the forest, b) Prescribed fires are useful in preventing larger, more severe wildfires, c) The threat of damage to property outweighs the ecological benefits of prescribed fires. Using these three questions from Q3 and the question from Q1, we indirectly capture respondents' perceptions towards EDs from wildfire by using the terms "fires", "severe wildfires", "threat of damage to property", and "smoke", respectively (Sil et al., 2019; Schollaert et al., 2024).

Respondents were also asked additional questions regarding their employment, experience and awareness of land and environmental issues (Appendix A). Specifically, Q4) "What is your profession or the type of work that you do?" (i.e., Student, Ecology/Biology, Fire Management/Policy, Hydrology/Soils, Indigenous Stewardship, Forestry, Unemployed, Other), and Q5) "A controlled, or prescribed, fire is a planned burning of specific trees or areas of a forest to prevent larger, uncontrolled forest fire in the future. Is this correct?" (Yes/No). To improve comprehension among the general public, the term "controlled fire" was adopted in the survey based on feedback from pilot testing with community members. Nonetheless, the term "prescribed fire" is consistently employed in all subsequent analyses and discussions. We also did not directly ask respondents regarding specific EDs, but rather perceptions were captured as explained in the previous paragraph. Additionally, to assess respondent attentiveness, participants were instructed to select "none of the above" in response to an item unrelated to montane forests in southern California (Cheng et al., 2021).

The general public living in urban and WUI communities in the greater Los Angeles area are socio-demographically diverse, and income and education levels are highly variable (Cheng et al. 2023). Accordingly, we used survey responses to better characterize our study sample into two broad groups, the General Public and Experts. We define the General Public as respondents or people from urban neighborhoods and communities living in, or adjacent to, the WUI. However, given the demographic diversity in the study area and the frequent use of education as a socioeconomic variable in the WUI fire literature (Walker et al., 2007), we split the General Public sample into two subgroups "Professionals and "Non-Professionals". Thus "General Public - Professionals" were respondents with some environmental and natural resource education or training (i.e. 'Other' in Appendix A), as well as other university-educated public and stakeholders (i.e., Bachelor's, Graduate or advanced degree) with a vested interest in the management and conservation of forests in southern California as defined in (Cheng et al., 2024 and 2025b). Otherwise, all other respondents from the general public were designated as "General Public- non-Professionals". The General Public group were WUI and urban respondents that lived in communities adjacent to, within or up to approximately 40 km of the Angeles and San Bernardino National Forests. To determine appropriate communities for our survey, we used US Census data and a respondent's self-reported Zip Code, for the nearby cities of San Bernardino-Fontana-Highlands communities to define Qualtrics survey panel population quotas and their specific home neighborhood. The sample frame was then stratified by US Census income level, gender, and age (Cheng et al., 2024).

Our Expert group consisted of Q5 respondents who were working in the area of "Ecology/Biology, Fire Management/Policy, Hydrology/Soils, Indigenous Stewardship, and Forestry" as well as employees of the USDA Forest Service, California Department of Forestry and Fire Prevention (CAL FIRE), California State parks, and environmental conservation organizations from Southern California. For this respondent group we sent out two rounds of targeted e-mails to organizations dealing with forest conservation and management issues in southern California.

The online Qualtrics panel survey was launched in May 2023 for respondents 18 years or older and could be taken using a computer, cellphone, or tablet. The Qualtrics panel population was further refined using US Census data for the study area and a screening question: "Do you live, or have you lived, in or near the cities of San Bernardino, Fontana, or Highlands (San Bernardino County, California)?". To proceed, respondents had to answer 'yes' to this question. The same survey was sent to the Expert respondents via a link sent to their emails. Socio-demographic information was collected for both groups including age (i.e., 18–29, 30–44, 45–64, 65+ years), political affiliation (i.e.,

Conservative, Moderate, Liberal), as well as income, race, gender, educational attainment, and Zip Code. Zip Code was used to identify the actual neighborhood the respondent lived in. For specific details on survey methodology, the sample population and quota, sociodemographic classes, response variable ranges, and data quality please refer to Cheng et al., (2024 and 2025b).

### 2.3. Data and econometric analysis

The initial sample population was 869. However, after deleting respondents who had a response time below five minutes or who provided a zip code outside our study area, the final sample consisted of 813 respondents: 35 experts, 113 professionals, and 665 non-professionals. Using a respondent's Zip Code, we then determined whether: 1) they actually lived in a WUI designated area and 2) if they had actually been exposed to prolonged smoke frequency days in 2020; the last year prior to the survey that the Los Angeles area was affected by wildfire smoke episodes (Aguilera et al., 2021; Barbosa, 2020; Rogers et al., 2025). First, we identified and calculated the area of a respondent's Zip Code located in 4 of the State of California Designated WUI types: No WUI, Influence, Interface, and Intermix (Appendix B). To do so, we overlaid Zip Code with WUI polygon boundaries and calculated the percent of the 4 WUI types in all respondent's Zip Codes (%ZPWUI) using the equation: *% ZPWUI = coverage_fraction / sum(coverage_fraction)*, grouped by zip code and WUI type. Fractions were then summed to obtain the total percentages for each WUI type within each Zip Code. Respondents in a Zip Code with more than 50% of its area in any, or all, of the 3 WUI types (i.e., influence, interface and intermix) were classified as "Lives in WUI" in subsequent analyses.

Second, we used the NOAA Hazard Mapping System (NOAA-HMS, 2025; Appendix B) data to spatially estimate wildfire-related smoke density in the respondent's Zip Code as measured using three particulate matter (PM2.5) levels: low (0–10 μg/m$^3$), medium (10–21 μg/m$^3$), and high (Greater than 21 μg/m$^3$). According to NOAA-HMS (2025), although this data, "represents smoke in the entire atmospheric column, it is a reliable predictor of ground-level PM2.5 concentrations and is used in studies and air quality predictions". Accordingly, Zip Codes with any NOAA-HMS (2025) 0.05° grid smoke density data were identified and designated as "Yes" (i.e., the Zip Code experienced a measurable smoke event). If the Zip code did not have any smoke data, it was designated as having "No" measured smoke events. Respondents in a Zip Code that were exposed to these smoke events in 2020 were classified as a "Actual smoke exposure" in subsequent analyses. We used zonal statistics in the R *exactextracter* package to calculate *%ZPWUI* (Baston, 2024) and the R *terra* and *sf* packages to identify, designate, intersect, and extract Zip codes with NOAA-HMS (2025) data (Pebesma, 2018). Respondents who lived in the WUI area was remarked as 1, otherwise 0.

We developed two regression models for all questions in Appendix A. Specifically, for Question 1 (exposure to smoke), an ordered logit (OL) was used where the dependent variable is ordinal, specifically 1 indicated 'never', 2 indicated 'once in the last three years', 3 indicated 'once a year', 4 indicated 'every six months', and 5 indicated 'every month'. The probability function of the OL is as follows:

$$P_{ab} = \frac{1}{1+\exp(-k_a + x_b\beta)} - \frac{1}{1+\exp(-k_{a-1} + x_b\beta)} \quad (1)$$

where category $\alpha = 1$ is defined as the minimum value of the variable, $\alpha = 2$ as the next ordered value for the empirically determined $b$ categories.

For Questions 2, 3, and 4, we used a binary model where the dependent variable is 1 if the respondent selected yes/agree and 0 otherwise, specifically the probability (selecting Yes = 1) $= \frac{e^{a+bX}}{1+e^{a+bX}}$

where a is intercept b and the estimated coefficients, and X is an independent variable. The utility is linear in arguments with systematic and random components:

$$U_{it} = \beta_1{}' x_i + \varepsilon_i \quad (2)$$

We note that $\beta$ is a vector of estimated parameters, $x_i$ is the factors of the choice matrix, and $\varepsilon_i$ is an unobserved random disturbance term from the extreme value distribution with an expected value of zero and variance $\sigma_\varepsilon^2$. The probability function of this binary model is as follows:

$$\mathrm{P}(Y_i = 1) = \frac{\exp(U_i)}{1+\exp(U_i)} \quad (3)$$

where $Y_i$ is the outcome variable and takes on a value of 1 if the respondent selects yes/agree to the question. Three comparisons were then made, first between the general public and expert groups, second between the non-professional and professional subgroups, and third the non-professionals subgroup and expert group

For objective 2, we tested for the effect of six socio-demographic characteristics: age, gender, race, income, educational attainment, and political affiliation. Our base categories were set as: Female, older than 65 years old, less than high school, white, income less than 50 k; moderate political ideology. Finally, our third objective was tested by including "Lives in WUI" and "Actual smoke exposure" as predictor variables in addition to the six previously mentioned socio-demographic variables. The OL and binary models were all estimated using Stata's *ologit* and *logistic* commands, respectively (StataCorp, 2023).

## 3. Results

We found that experts were predominantly male, white, 45–64 years of age, had graduate degrees, earned more than $100,000 and had liberal political ideologies (Table 1). Conversely, non-professionals were female, white, 45–64 years old, had some college education, and had a moderate political ideology. Hispanics represented 31% and 34% of experts and non-professionals, respectively, and 31% of professionals, while there were 0% experts, 13% professional African Americans and approximately 8% Asian Americans in both groups. Non-professional subgroup respondents' age and gender were generally proportional to US Census bureau population estimates for the study area, while their income and education proportions were varied (Table 1). Overall, 57% of the General Public actually lived in the WUI and 37% were exposed to smoke. Only 10% of the General Public did not live in the WUI or were actually exposed to smoke.

We found no significant difference between experts and the general public in terms of perceived smoke exposure in the last five years (Table 2, column 1). However, there was a significant difference between the professional and non-professional subgroup ($p < .01$) respondents. General Public professionals were significantly more likely (123%) to perceive as having been exposed to smoke than experts during the last 5 years, but there was no significant difference between experts and non-professionals. With regard to the perceptions towards prescribed fire and its benefits, both experts and professionals displayed more positive perceptions (Table 2, column 2). There was no significant difference between the general public and experts (Table 2, column 2), but when comparing the three groups of respondents, there was a significant difference. General Public professionals were significantly ($p < .001$) more likely to support the use of prescribed fire, and were 72% more likely to select yes, compared to non-professionals.

Regarding whether fire is important to the health of the forest, when compared with the general public, experts were significantly more likely (267%) to agree (Table 3, column 1). When breaking down the general public into professionals and non-professional subgroups, there were significant differences. Specifically, professionals were 68% more likely to agree ($p < .001$) and experts were 276% more likely to agree ($p < .001$) than non-professionals. We also found that when compared with the general public, experts were significantly (123%) more likely to agree that prescribed fires are useful in preventing larger, more severe wildfires ($p < .001$; Table 3, column 2). Finally, when compared with the

**Table 1**
Sample population and sociodemographic characteristics for Wildland-Urban Interface (WUI) Communities in the eastern portion of greater Los Angeles, California US. Non-professionals and professionals when combined refer to the "general public" in the text.

| Characteristic | Experts (n = 35) | General Public-Professionals (*n* = 113) | General Public-Non-professionals (*n* = 665) | General Public-living in WUI (*n* = 464) | General Public-smoke exposed (*n* = 303) | General Public-non WUI and non-smoke exposed (*n* = 86) | Study area |
|---|---|---|---|---|---|---|---|
| *Age* | | | | | | | |
| 18 to 29 | 0.00% | 26.55% | 23.61% | 24.61% | 22.44% | 23.61% | 18.8% |
| 30 to 44 | 40.00% | 49.56% | 26.17% | 31.54% | 28.45% | 26.17% | 28.9% |
| 45 to 64 | 54.29% | 23.01% | 33.83% | 32.41% | 33.93% | 33.83% | 32.7% |
| 65 and over | 5.71% | 0.88% | 15.79% | 11.27% | 14.64% | 15.79% | 19.6% |
| *Gender* | | | | | | | |
| Female | 34.29% | 36.28% | 51.73% | 47.31% | 49.66% | 51.73% | 49.8% |
| Male | 65.71% | 61.95% | 46.77% | 51.82% | 48.84% | 46.77% | 50.2% |
| Other | 0.00% | 1.77% | 1.50% | 0.87% | 1.09% | 1.05% | N/A |
| *Educational Attainment* | | | | | | | |
| Some High School | 0.00% | 0.00% | 3.76% | 2.95% | 3.42% | 3.76% | 18.8% |
| High School | 0.00% | 18.58% | 30.98% | 28.94% | 29.00% | 30.98% | 22.6% |
| Some College | 14.29% | 27.43% | 34.89% | 32.06% | 33.65% | 34.89% | 26.5% |
| Bachelor's Degree | 22.86% | 26.55% | 19.25% | 19.24% | 20.52% | 19.25% | 20.4% |
| Graduate Degree | 62.86% | 27.43% | 10.68% | 16.81% | 13.00% | 10.68% | 11.7% |
| *Ethnicity* | | | | | | | |
| Hispanic/Latino (of any race) | 31.43% | 30.97% | 34.44% | 36.05% | 32.97% | 34.44% | 49.1% |
| *Race* | | | | | | | |
| Asian (non-Hispanic) | 8.57% | 3.54% | 7.37% | 6.59% | 6.84% | 7.37% | 24.4% |
| Black/African American (non-Hispanic) | 0.00% | 13.27% | 11.13% | 11.61% | 10.67% | 11.13% | 14.5% |
| White (non-Hispanic) | 71.43% | 67.26% | 60.90% | 62.05% | 62.38% | 60.90% | 52.7% |
| Other(non-Hispanic) | 20.00% | 15.93% | 20.06% | 19.76% | 20.11% | 20.60% | 8.4% |
| *Annual Household Income* | | | | | | | |
| < $35,000 | 8.57% | 6.19% | 27.07% | 22.01% | 24.76% | 27.07% | 21.7% |
| $35,000 to $49,999 | 0.00% | 14.16% | 14.59% | 15.60% | 13.82% | 14.59% | 9.3% |
| $50,000 to $74,999 | 14.29% | 16.81% | 22.11% | 21.14% | 21.07% | 22.11% | 14.9% |
| $75,000 to and $99,000 | 8.57% | 29.20% | 15.04% | 16.46% | 16.55% | 15.04% | 12.8% |
| $100,000 or more | 68.57% | 33.63% | 20.75% | 24.78% | 23.39% | 20.75% | 41.5% |
| *Political Ideology* | | | | | | | |
| Conservative | 11.43% | 33.63% | 26.92% | 25.65% | 26.81% | 26.92% | N/A |
| Moderate | 34.29% | 29.20% | 42.71% | 41.59% | 40.77% | 42.71% | N/A |
| Liberal | 54.29% | 37.17% | 29.92% | 32.76% | 32.01% | 29.92% | N/A |

**Table 2**
Results for the non-professionals and professionals (i.e., the general public) as well as experts' responses to perceived smoke exposure, using an ordered logit model, and support for prescribed fire, using a logit regression, in southern California's (US) Wildland-Urban Interface (*n* = 813). Non-professionals and professionals when combined refer to the "general public" in the text.

| | Perceived Smoke Exposure | | Support for Prescribed Fires | |
|---|---|---|---|---|
| Explanatory variables | *ß* | 95% CI | *ß* | 95% CI |
| *Reference = General public* | | | | |
| *Intercept* | 1.72 | (1.52, 1.91) | 1.59 | (1.40, 1.78) |
| Expert | −0.39 | (−0.99, 0.22) | 0.78 | (−0.42, 1.98) |
| *Reference = non-professional* | | | | |
| *Intercept* | 1.60 | (1.40, 1.79) | 1.50*** | (1.31, 1.70) |
| Expert | −0.24 | (−0.85, 0.37) | 0.86 | (−0.34, 2.06) |
| Professional | 1.23*** | (0.85, 1.61) | 0.72* | (0.07, 1.38) |

ß = coefficient; CI = Confidence Interval; * $p < .05$, ** $p < .01$, *** $p < .001$;

general public, experts were significantly ($p < .001$) less likely (157%) to agree that the threat of damage to property outweighs the ecological benefits of prescribed fires (Table 3, column 3)

For our second objective we tested whether the socio-demographic characteristics of urban and WUI communities influenced perceptions regarding prescribed fireand smoke-related EDs (Table 4). When asked, "how often have you been exposed to smoke from wildfires or controlled fires in the last 5 years since living in southern California?", 45–64 and 30–44 ($p < .01$) year olds were significant and 39% and 73% more likely to perceive as having been exposed to smoke when compared to respondents who were 65 years or older. Also, when compared with respondents having an income below $50,000; those reporting an income of $75,000 to $99,000 and over $100,000 were 53% ($p < .01$) and 43% ($p < .01$) were more likely to perceive as having been exposed to smoke (Table 4). We also tested whether respondents' sociodemographic characteristics influenced support for the use of prescribed fires in the national forests of southern California (Table 4). Overall, younger respondents were significantly less likely to support the use of prescribed fires (Table 4, column 2). Specifically, compared with respondents aged 65+, those 18 to 29 were 191% ($p < .001$) less likely to support prescribed fire. Similarly, ages 30–44 were 166% ($p < .001$) less likely to support prescribed fire. Gender was also significant. Males were 61% more likely ($p < .01$) to support prescribed fires when compared with female respondents (Table 4). Notably, we found that living in a WUI designated area and actually having been exposed to smoke events in 2020 were not significantly related to perceived smoke exposure or support for prescribed fires.

We also analyzed the socio-demographic characteristics of respondents regarding their perception of three EDS-related issues, the first being whether "fires are important to the health of the forest" (Table 5). Overall race and income were not significant and we found that when compared with the oldest group of respondents (age 65+), younger respondents were significantly less likely to agree. Respondents aged 18–29 were 111% less likely ($p < .001$) to agree, as were those aged 30–44 (109% less likely, $p < .001$), and aged 45–64 (76% less likely, $p < .01$). Gender was also significant; when compared with females, males

**Table 3**
Logit regression results for non-professionals and professionals (i.e., the general public) as well as experts' responses regarding A) the importance of fire to forest health, B) the prevention of larger, more severe wildfire via the use of prescribed fire, and C) whether the threat of damage to property outweighs the ecological benefits of prescribed fires in southern California's (US) Wildland-Urban Interface ($n = 813$).

| | Important to Forest Health | | Prevent Larger, Severe Wildfire | | Property Damage Threat vs. Ecological Benefits | |
|---|---|---|---|---|---|---|
| Explanatory variables | *ß* | 95% CI | *ß* | 95% CI | *ß* | 95% CI |
| *Reference = General public* | | | | | | |
| *Intercept* | 0.13 | (−0.00, 0.27) | 1.14* | (0.97, 1.30) | −0.80*** | (−0.95, −0.65) |
| Expert | 2.67*** | (1.23, 4.10) | 1.23*** | (0.04, 2.43) | −1.57*** | (−2.76, −0.37) |
| *Reference = non-professional* | | | | | | |
| *Intercept* | 0.04 | (−0.11, 0.19) | 1.21*** | (1.03,1.39) | −0.90*** | (−1.07, −0.74) |
| Professional | 0.68*** | (0.26, 1.10) | −0.45** | (−0.04,2.36) | 0.63*** | (0.23, 1.04) |
| Expert | 2.76*** | (1.33, 4.20) | 1.16* | (1.03,1.39) | −1.47** | (−2.66, −0.27) |

ß = coefficient; CI = Confidence Interval; * $p < .05$, ** $p < .01$, *** $p < .001$

were 58% more likely to agree ($p < .001$). Respondents with both conservative and liberal political affiliations were significantly more likely to agree than moderates ($p < .001$).

Regarding whether "prescribed fires are useful in preventing larger, more severe wildfires"; age was the only significant socio-demographic characteristic (Table 5). In contrast to the previous question, younger respondents were more likely to agree than older respondents (Table 5, column 1). For example, those aged 18–29 were 116% more likely to agree than those aged 65+ ($p < .001$). Respondents aged 30–44 were 102% more likely to agree ($p <. 001$) and respondents aged 45–64 were 79% more likely to agree ($p < .01$).

Regarding perceptions on whether the threat of damage to property (i.e., ED) outweighs the ecological benefits (i.e., ES) of prescribed fire, we found that age, gender, and political affiliation all significantly influenced the likelihood of agreeing with this statement (Table 5). Specifically, when compared with respondents aged 65+, those aged 18–29 ($p < .001$), and 30–44 ($p < .001$) were 204% and 180%, respectively, less likely to agree. Gender was once again significant, with males 44% more likely to agree ($p < .01$). Conservative respondents were 50% more likely to agree compared with moderate respondents ($p < .01$; Table 5). Interestingly, respondents earning more than $100,000 were 54% ($p < .05$) more likely to agree with this statement than low-income respondents. Again, we found that living in a WUI designated area and actually having been exposed to smoke events in 2020 were not significantly related to responses regarding any of the three issues in Table (5).

## 4. Discussion

The aim of this study was to understand pre-fire perceptions regarding prescribed/wildfires and fire-related EDs between experts and the public living in urbanized WUI communities; similar to nearby communities affected by the 2025 LA fires. The study also elucidates how experts and the general public perceive prescribed fires and related EDs in urban and WUI communities in Greater Los Angeles' WUI; a complex mix of highly populated communities, land tenures, cultures, administrative areas, and governance structures (Cheng et al., 2024 and 2025b). Past litigation and resource conflicts, extreme wind events, and recent wildfire-driven urban events like the 2025 LA Fires have resulted in substantial socio-environmental costs and the loss of trust in public land and fire management organizations (Olsen and Sharp, 2013; Brenkert-Smith et al., 2023). Accordingly, this study offers insights on how highly populated WUI communities perceive: potential decision-making issues around prescribed fires and urban fires, the role of EDs from WUI fires, and the looming social, environmental, and economic costs and EDs potentially impacting their communities.

Although we tested for different fire-related EDs in Q1 and Q3 (Schmerbeck and Fiener, 2015), smoke is of particular concern because of its ability to reach beyond an affected community and even reach neighboring states or countries (Schwarz et al., 2023). Accordingly, our study explored differences in perceived and actual smoke exposure over the last five years between the general public and experts . Overall, experts were less likely than the General Public group and General Public-non-professionals to perceive smoke exposure within the last five years, though neither result was significant (Table 2). One possible reason for experts reporting less smoke exposure is that they might be taking smoke mitigation steps, such as staying indoors or wearing masks, during fire-related events, although our study does not reveal the causes behind these responses (D'Evelyn et al., 2023; Rogers et al., 2025). Notably, we found that being exposed to perceived or actual smoke events in 2020, irrespective of source, had no significant influence on perceptions around support by the General Public for prescribed fire (Tables 4 and 5).

Mylek and Schirmer (2020) found that the length of time since a wildfire did not significantly influence support for prescribed fire. Conversely, Rogers et al. (2025) found that exposure to wildfire smoke in the past three years and perceived future risks led to higher levels of support for prescribed fire in a study area that experienced damaging wildfires over the previous three years. However, 37% of the General Public was actually exposed to prolonged smoke events and all respondents in our study area directly or indirectly experienced wildfires in 2017, 2018 and 2020 on the nearby Angeles and San Bernardino National Forests. Thus, respondents were more likely concerned with other causal factors or EDs not captured in this survey. Some of those factors, which will be discussed later, could include: risks for adverse health outcomes from smoke/poor air quality, other unknown EDs impacts (post-fire flooding, insurance costs), sense of a safe distance from fire/treatment area, awareness of other risks and forest conditions (Bright et al., 2007; McGrath et al., 2022; Kiely et al., 2024). Also, the lack of accessible context-specific messaging could also be a factor, particularly in a highly urbanized multi-cultural area such Los Angles in southern California, where more than half of residents speak a language other than English at home (Cheng et al., 2024).

Miller et al. (2020) found that experts - as defined in this study-supported all fire mitigation practices and felt an urgent need in their implementation. However, those results also suggested that although experts had more favorable perceptions of prescribed burns than the general public, they understood potential public fears such as smoke and potential fire escapes (Miller et al., 2020). Wildfire risk mitigation can present other complex challenges. Although mechanical thinning and prescribed fire are the most common methods for mitigating wildfire risk (Harris et al., 2021; Davis et al., 2024), prescribed fire faces several distinct barriers in implementation (Miller et al., 2020; Schultz et al., 2019). Miller et al. (2020) and Schultz et al. (2019) describe common barriers to prescribed fire in California such as social factors, resource shortfalls, and restrictive regulations (i.e., weather conditions and environmental protection policies).

Our survey results echo Miller et al.'s (2020) since we found that

**Table 4**
Results regarding perceived smoke exposure, using an ordered logit model, and support for prescribed fire, using a logit regression model, in southern California's (US) Wildland-Urban Interface (WUI) according to respondent's socio-demographic characteristics ($n = 813$).

| | Perceived Smoke Exposure | | Support use of Prescribed Fires | |
|---|---|---|---|---|
| Explanatory variables | *ß* | 95% CI | *ß* | 95% CI |
| *Intercept* | −0.61 | (−1.49,0.26) | 2.81*** | (1.39, 4.22) |
| *Age range (reference = 65+)* | | | | |
| 18–29 | 0.32 | (−0.15, 0.80) | −1.91*** | (−2.91, −0.92) |
| 30–44 | 0.73*** | (0.30, 1.17) | −1.66*** | (−2.64, −0.67) |
| 45–64 | 0.39* | (−0.02, 0.81) | −0.92* | (−1.92, 0.09) |
| *Gender (reference = female)* | | | | |
| Male | 0.07 | (−0.20, 0.35) | 0.61*** | (0.18, 1.03) |
| *Race (reference = white)* | | | | |
| Non-White | −0.27* | (−0.56, 0.03) | −0.37* | (−0.79, 0.05) |
| *Income (reference = under $50,000)* | | | | |
| $50,000–$74,000 | 0.16 | (−0.20, 0.52) | 0.09 | (−0.42, 0.60) |
| $75,000–$99,000 | 0.53** | (0.13, 0.93) | 0.32 | (−0.32, 0.95) |
| $100,000+ | 0.43** | (0.03, 0.83) | 0.20 | (−0.46, 0.84) |
| *Highest educational degree (reference = less than high school diploma)* | | | | |
| High School Diploma | −0.01 | (−0.80, 0.78) | −0.36 | (−1.38, 0.65) |
| Some College | −0.17 | (−0.61, 0.96) | −0.35 | (−1.38, 0.67) |
| College Degree | 0.53 | (−0.31, 1.36) | −0.29 | (−1.41, 0.84) |
| Graduate Degree | 0.86* | (−0.04, 1.76) | 0.45 | (−0.91, 1.82) |
| *Political affiliation (reference = moderate)* | | | | |
| Conservative | 0.24 | (−0.11, 0.58) | 0.27 | (−0.26, 0.80) |
| Liberal | 0.32* | (−0.01, 0.66) | 0.50 | (−0.02, 1.01) |
| *Lives in WUI and actual smoke exposure* | | | | |
| Actual smoke exposure | 0.20 | (−0.07, 0.46) | 0.09 | (−0.31, 0.50) |
| Lives in WUI | 0.07 | (−0.22, 0.36) | −0.13 | (−0.58, 0.32) |

ß = coefficient; CI = Confidence Interval; * $p < .05$, ** $p < .01$, *** $p < .001$

experts were significantly more likely than the General Public living to agree that fire was important to forest health, and that prescribed fire is useful in preventing large, high-severity wildfires (Table 3). However, our experts were not significantly more likely to agree with prescribed fire use than the general public (Table 2). They were also significantly less likely to agree than the general public that the threat of property damage outweighs the ecological benefits of prescribed fire in southern California (Table 3). The dichotomy between understanding the benefits of prescribed fire but not being more likely to agree with its use suggests that experts are wrestling with additional barriers (e.g., litigation, politics, EDs) regarding prescribed fire use. In 2022, the U.S. Forest Service temporarily halted prescribed fires nationwide as the result of prescribed fires in New Mexico escaping prescribed burn boundaries (Hay, 2022), destroying homes and structures, and led to congressional inquiries into prescribed fire policy (U.S. Government Accountability Office, 2024). Although rare, escaped prescribed fires can lead to increased EDs and might help explain the differences in perceptions between experts and the general public (Toledo et al., 2013; Miller et al., 2020).

Findings also suggest that both experts and the general public were making tradeoffs between benefits and EDs as they pertain to using prescribed fire as a fire risk reduction practice. For example, experts were significantly less likely (157%) to agree that the threat of property damage outweighed the ecological benefits of prescribed fire (Table 3) and there was no significant difference between experts and the general public in terms of smoke exposure (Table 2). This is despite destructive WUI-urban fires that led to regional smoke emissions and dozens of human fatalities and 1000s of homes lost in northern and southern California in 2017–2018 and 2020 including in the far northeastern portion of the study area (Escobedo et al., 2024; Barbosa, 2020). Thus, the two different study groups might have different perceptions of fire-related risks and EDs (Cheng et al., 2024; Tables 2 and 3). Also, further education and messaging might be needed that shifts fire risk reduction decision-making from wildland to more urban contexts (Calkin et al., 2023).

The above results might also indicate that the general public interprets technical fire terminology such as severity, damage, WUI, and smoke (i.e., EDs) differently than experts. Weisshaupt et al. (2006) found that focus groups did not distinguish between various fire related terminology such as slash pile burning versus prescribed burning. They also found that urban participants were the least familiar with prescribed fire and WUI related terminology and practices. The concept and benefits of practices such as prescribed fire, and its potential to lead to less emissions and less harmful smoke, might not be evident to respondents living in cities or more urbanized WUI areas (Rogers et al., 2025; Weisshaupt et al., 2006). This despite studies reporting that smoke related EDs having greater negative health outcomes in more populated areas (Aguilera et al., 2021).

Greater Los Angeles and southern California's urban and WUI communities are highly diverse (Cheng et al., 2024) and other studies have been conducted on how wildfire perceptions, vulnerabilities, and experiences vary according to socio-demographics (Thomas et al., 2022; Cheng et al., 2025a). We found that Non-Whites were less likely than the White demographic group to perceive smoke exposure and support prescribed fires (Table 4). Additionally, 18–29-year-olds were also significantly less likely than those aged 65+ to support the use of prescribed fire (Table 4). All respondent groups under the age of 65 were significantly less likely to agree that fire was important for forest health, but were significantly more likely to agree that fire helped prevent larger more severe wildfires (Table 5). However, respondents 18–29 years in age were significantly less likely, than any other age variable, to agree that the threat of property damage outweighed the ecological benefits of fire. Conversely, respondents earning more than $100,000 were 54% more likely to agree with this statement than other income groups (Table 5). One possible explanation is that these younger respondents are less likely to own a home in greater Los Angeles, an area with a very high cost of living. So, for many of our respondents (Tables 4 and 5), the threat of property damage would not likely have a large influence on their perceptions of fire-related EDs.

Another notable finding were the significant differences between age groups, particularly between our reference group (65+) and younger age demographics. A similar study found that prescribed fire support increased with age (Rogers et al., 2025), however the interesting dichotomy here is that younger respondents (i.e., 18–44 years old) seemingly agree that fire is useful for preventing larger high severity fires (Table 5), yet still lack support for prescribed fire (Table 4) and do not agree with its usefulness for maintaining forest health (Table 5). The

**Table 5**
Logit regression model results for responses regarding A) the importance of fire to forest health, B) the prevention of larger, more severe wildfire via the use of prescribed fire, and C) whether threat of damage to property outweighs the ecological benefits of prescribed fires in southern California's (US) Wildland-Urban Interface (WUI) according to socio-demographic characteristics ($n = 813$).

| | Important for Forest Health | | Prevent Larger, Severe Wildfire | | Property Damage Threat vs. Ecological Benefits | |
|---|---|---|---|---|---|---|
| Explanatory variables | ß | 95% CI | ß | 95% CI | *β* | 95% CI |
| Intercept | −0.22 | (−1.52, 0.71) | −1.37*** | (−2.37, −0.52) | 1.56** | (0.31, 2.81) |
| *Age range (reference = 65+)* | | | | | | |
| 18–29 | -1.11*** | (−1.70, −0.52) | 1.16*** | (0.58, 1.74) | −2.04*** | (−2.96, −1.13) |
| 30–44 | -1.09*** | (−1.65, −0.53) | 1.02*** | (0.47, 1.57) | −1.80*** | (−2.70, −0.90) |
| 45–64 | -0.76*** | (−1.30, −0.22) | 0.79*** | (0.26, 1.34) | −0.94** | (−1.85, −0.02) |
| *Gender (reference = female)* | | | | | | |
| Male | 0.58*** | (0.26, 0.90) | 0.04 | (−0.27, 0.35) | 0.44** | (0.06, 0.81) |
| *Race (reference = white)* | | | | | | |
| Non-White | -0.24 | (−0.59, 0.10) | 0.25 | (−0.08, 0.58) | −0.30 | (−0.69, 0.09) |
| *Income (reference = under $50,000)* | | | | | | |
| $50,000–$74,000 | 0.001 | (−0.42, 0.42) | −0.07 | (−0.47, 0.34) | 0.23 | (−0.24, 0.70 |
| $75,000–$99,000 | 0.32 | (−0.16, 0.80) | 0.03 | (−0.43, 0.49) | 0.46 | (−0.10, 1.01) |
| $100,000+ | 0.42 | (−0.06, 0.90) | 0.25 | (−0.21, 0.70) | 0.54* | (−0.05, 1.13) |
| *Highest educational degree (reference = less than high school diploma)* | | | | | | |
| High School Diploma | 0.36 | (−0.63, 1.35) | 0.17 | (−0.82, 0.89) | 0.35 | (−0.54, 1.23) |
| Some College | 0.79 | (−0.20, 1.78) | −0.30 | (−0.89, 0.84) | 0.45 | (−0.44, 1.35) |
| College Degree | 1.12** | (−0.08, 2.17) | −0.30 | (−1.31, 0.53) | 0.70 | (−0.29, 1.69) |
| Graduate Degree | 0.89 | (−0.23, 2.00) | 0.35 | (−0.77, 1.20) | 0.48 | (−0.61, 1.58) |
| *Political affiliation (reference = moderate)* | | | | | | |
| Conservative | 0.55*** | (0.14, 0.95) | −0.11 | (−0.42, 0.37) | 0.50** | (0.01, 1.00) |
| Liberal | 0.64*** | (0.24, 1.03) | 0.04 | (−0.38, 0.39) | 0.39* | (−0.07, 0. 85) |
| *Lives in WUI and actual smoke exposure* | | | | | | |
| Actual smoke exposure | 0.12 | (−0.20, 0.43) | −0.16 | (−0.46, 0.14) | 0.27 | (−0.09, 0. 64) |
| Lives in WUI | −0.16 | (−0.51, 0.20) | 0.28 | (−006, 0.62) | −0.02 | (−0.43, 0. 40) |

ß = coefficient; CI = Confidence Interval; * $p < .05$, ** $p < .01$, *** $p < .001$

30–64-year-old respondents were also more significantly likely to perceive that they have been exposed to smoke in the last five years than those 65+. However, of the General Public that actually were exposed to smoke in 2020 (Table 1), 46% of these respondents perceived that they had indeed experienced a smoke event in the last 5 years.

In terms of gender differences, we found that males were significantly more likely to support prescribed fire use (Table 4), agree that fire was important for forest health, and agree that the threat of property damage outweighed the ecological benefits of prescribed fire (Table 5). Berget et al. (2024) did find that male family forest land managers in Georgia were more likely to self-report higher levels of confidence surrounding forest management skills, prescribed fire knowledge, and intentions of conducting a prescribed fire. Gender has also been shown to significantly influence wildfire preparation, response and recovery (Cadeddu et al., 2013; Tyler and Fairbrother, 2018). For example, men are more likely to stay and defend their property; while women are more worried about the safety of household members and more likely to evacuate in the event of a fire (Strahan and Gilbert, 2021). Thus, traditional gender norms and societal expectations of men might also help explaining these responses (Christopher, 2024). Although the risks and barriers for prescribed fire are well documented (Schultz et al., 2019; Miller et al., 2020), we found few specific studies about the socio-demographic differences in environmental manager perceptions regarding EDs as it pertains to prescribed fire (Bright et al., 2007; Table 4).

We also found that living in a WUI designated neighborhood, had no influence on perceptions regarding Q1-Q5 (Appendix A, Tables 4 and 5). Also, despite our study population being largely urban and 63% not being exposed to wildfire smoke events (Table 1); unknown concerns over EDs could still be factoring into their perception of the risks of prescribed fire (Paveglio and Shriner-Beaton, 2024). Walker et al. (2007) found that urban residents were more supportive of a prescribed fire program than WUI residents. However, Vining and Merrick (2008) found that a respondent's distance from a Michigan national forest had no significant effect on preferences for fire risk reduction practices; suggesting that other variables (e.g. smoke exposure, previous experience with wildfires) could be more important. Toman et al.'s (2014) study of WUI communities in the western U.S. found that the general public's perceptions towards land-fire management were influenced by trust in experts and the positive outcomes of fire risk reduction activities. Similarly, Mockrin et al. (2018) found that after a fire event, fire planning documents within the affected area tend to change, even though actual land use and regulations do not.

Our findings regarding age discrepancies and the role of smoke exposure merit further discussion. Ribeiro (2022) reports that younger generations might have increased perceived exposure to wildfire related EDs and stories through social media. Although we have no evidence, we posit that younger respondents, who regularly use social media, experienced COVID restrictions that required them to be indoors and thus were less exposed to outdoor conditions and experiences. These factors might shape the lack of support for fire without differentiating between prescribed and wildfire since “forest fires” are often considered negative in these news or social media (Stoof et al., 2024). García et al. (2024) examined social media usage around the 2017 Tubbs Fire in California and found that Twitter (now known as X) posts revealed a greater number of negative emotions than positive. Also, over a third of analyzed posts expressed stress concerns, including topics such as air quality and government disaster response (García et al., 2024). Bond

et al. (2024) also found that the word "smoke" was the most commonly used term in social media posts surrounding prescribed fire burns and terms like "controlled" and "prescribed" appeared only a half and a quarter as frequently, respectively, indicating that posts may be a means to further understand such topics (Bond et al., 2024).

Regarding perceived versus actual smoke exposure among the respondents, Aguilera et al. (2023) found that that wildfire-specific $PM_{2.5}$ was more harmful to children's respiratory health than $P.M_{2.5}$ from other non-wildfire related sources. Additionally, wildfires burning in WUI and urban areas may present additional air quality risks from the introduction of additional particulate matter from metals, structures, plastics, and other toxics into the smoke (Holder et al., 2023). While smoke emissions can vary according to fire events, in general, smoke from wildfire is more hazardous to human health than smoke from prescribed fire (Kiely et al., 2024). However, there is little information on whether people can discern smoke exposure due to prescribed or wildfire events or for that matter smog or overall poor air quality (Barbosa, 2020). A focus group by Weisshaupt et al. (2006) suggests that people do not discern between wildfire smoke and prescribed burn smoke without prior knowledge of management activities in the area, which suggest that smoke regardless of source is viewed as an overall ED.

We note that our findings were not always corroborated by the relevant literature and highlight the importance of uncaptured decision-making factors that drive perceptions of those who have recently actually been exposed to fire-related EDs, to support – or not- prescribed fire (Smith et al., 2016; Donovan and Brown, 2007). Although our study does not determine causal reasoning behind survey responses, it does spatially and explicitly identify respondents that actually live in the WUI and were actually exposed to smoke in the last 5 years; although these factors were not significantly related to any of our response items (Tables 4 and 5). As social media usage has become ubiquitous, our findings, along with the current literature, suggest that there is a need to reframe how the public, particularly urban, non-rural communities, interpret and relate to fire-related messaging (McGrath et al., 2022). Ongoing campaigns have extensively promoted the benefits of wildfire, yet as we found our younger age demographics are less likely to support prescribed fires; yet they were the age group to least perceive smoke (Table 4); despite 22% of them actually being exposed to smoke (Table 1). So, messaging and social media campaigns related to fire education, evacuation, and risk mitigation could be designed for new types of audiences living in non-WUI, high fire hazard urban areas so they understand both the benefits - and EDs – of fire (Escobedo et al., 2024; Thomas et al., 2024).

That said, we do note some study limitations. First, our survey was carried out approximately 3 years after the 2020 southern California fire season and 1.5 years before the 2025 LA Fires; years in which fire substantially impacted the study area and its population. However, the ecosystems, urban morphology, extreme wind events and ignition probabilities are constant realities throughout urban and WUI communities in the greater LA area and southern California. Second, although the ages, gender, and income of our respondents were fairly similar to those of the study area, the pre-college education levels, and ethnicities, with exception of African Americans, were not. Third, despite sending multiple requests to experts, the sample size was still somewhat low ($n = 35$). That said, our study provides a glimpse into how experts and the community at-large, viewed fires in 2023; 1.5 years before the catastrophic 2025 LA Fires, and has implications for understanding fire-related EDs and decision-making in highly populated WUI and urban-proximate contexts elsewhere.

## 5. Conclusion

Understanding urban community perceptions towards the EDs related to fire in the WUI – before the occurrence of wildfires or catastrophic urban fires - can provide policy makers with the information needed to increase awareness and community adaptation on how to respond and recover from these now frequently occurring fire events. Although the benefits of prescribed fire to rural and WUI communities are well documented, less is known about the perceived EDs related to prescribed and wildfires occurring in more urbanized WUI areas. Accordingly, this study's findings provide a guide for future public messaging by identifying key terminology and population groups to target for increasing the acceptance for land managers' actions in highly populated WUI and urban communities. As future work examines these Urban-WUI communities pre- and post-fire, a complete picture will allow land managers to better understand public values and increase public buy-in for future fuels reduction work to protect public interests in decreasing the EDs such as smoke emission, loss of life and property, recovery costs, and long-term fire-related pollutants that urbanizing societies are increasingly experiencing.

In the wake of the 2025 LA Fires, additional support from the general public for fire risk reduction practices might be warranted because of the general public's perception of *wildfire*-related ED impacts. Paradoxically, given the nature of the Los Angeles *urban fire* event, it is unknown whether wildland vegetation management practices, such as prescribed fires, would have made a difference in the severity and types of impacts to Los Angeles' highly urbanized communities. Indeed, land use decisions coupled with climatic changes as well as shifting social and demographic trends is leading to increases in the frequency of high severity wildfire events and the number impacted communities in urban areas. The 2025 LA Fires resulted in the loss of lives and homes and present both a setback in public trust and a future opportunity for change. Post-fire, there is now an opportunity to improve alignment between expert and public perceptions on risk and fire management practices in urban and highly populated WUI areas, which in turn could lead to more positive fire outcomes and thus increase public trust in governance. Going forward, decision making and public messaging could aim to adapt traditional fire mitigation efforts that are relevant in wildlands (i.e., prescribed fire) and shift them to practices more in-line with urban communities (i.e., evacuation messaging and "home hardening" building practices). This paradigm shift is paramount for reducing the risks of high severity fire in highly urbanized communities.

## CRediT authorship contribution statement

**Francisco J. Escobedo:** Writing – review & editing, Writing – original draft, Investigation, Funding acquisition, Conceptualization. **Haotian Cheng:** Writing – review & editing, Methodology, Funding acquisition, Formal analysis, Data curation. **Alyssa S. Thomas:** Writing – review & editing, Writing – original draft. **Arthur Moses:** Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Description of the five main analysis questions regarding prescribed fire, wildfires, ecosystem disservices, and profession in southern California USA

| Question | Response type | Response options |
|---|---|---|
| 1) How often have you been exposed to smoke from wildfires or controlled fires in the last 5 years since living in southern California?" | Likert | -Every month<br>-Every 6 months<br>-Once a year<br>-Once in the last 3 years<br>-Never |
| 2) Would you support the use of controlled fires in the National Forest of southern California? | Binary | Yes/No |
| 3) Do you agree or disagree with the following three statements: a) Fires are important to the health of the forest, b) Prescribed fires are useful in preventing larger, more severe wildfires, c) The threat of damage to property outweighs the ecological benefits of prescribed fires | Binary | -Agree<br>-Disagree |
| 4. What is your profession or the type of work that you do? | Multiple choice | -Student<br>-Ecology/Biology<br>-Fire Management /Policy<br>-Hydrology/Soils<br>-Indigenous Stewardship<br>-Forestry<br>-Unemployed<br>-Other (please specify) |
| 5. A controlled, or prescribed, fire is a planned burning of specific trees or areas of a forest to prevent larger, uncontrolled forest fire in the future. Is this correct? | Binary | Yes/No |

## Appendix B. Source data and descriptions for Wildland-Urban Interface, Smoke events and administrative boundaries

| Data Description | Units | Source Link |
|---|---|---|
| 2020 Air quality monitor data for smoke events | 4 Smoke density Particulate Matter (PM) levels:<br>No smoke;<br>Light: 0–10 μg/$m^3$ of PM2.5;<br>Medium: 10–21 μg/$m^3$ of PM2.5;<br>Heavy: Greater than 21 μg/$m^3$ of PM2.5 | https://www.ospo.noaa.gov/products/land/hms.html |
| 2024 California Zip codes | Character strings for Zip Codes | https://gis.data.ca.gov/datasets/ca-zip-code-boundaries/about |
| 2020 and 2023 Boundaries for Los Angeles, Orange, Riverside and San Bernardino Counties | NA | https://redistricting.lacounty.gov/mapping-files-data-download/<br><br>https://catalog.data.gov/dataset/ca-geographic-boundaries |
| 2025 Wildland Urban Interface (WUI) raster data for California | 4 WUI types:<br>No WUI; Influence Zone; Interface; Intermix | https://www.fire.ca.gov/what-we-do/fire-resource-assessment-program/gis-mapping-and-data-analytics<br><br>https://34c031f8-c9fd-4018-8c5a-4159cdff6b0d-cdn-endpoint.azureedge.net/-/media/calfire-website/what-we-do/fire-resource-assessment-program---frap/gis-data/2025/wui251gdb.zip |

## Data availability

Data will be made available on request.

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