



**Household adaptation to smoke
from wildfire and fires to achieve
forest management objectives in the
greater Parks, AZ area**

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Executive Summary

Smoke from wildfire and forest management increasingly impacts communities in fire-prone areas. Places like Parks, AZ are home to extremely diverse populations and properties, providing the opportunity to study how households respond to smoke and its impacts. We collected data via two approaches:

- A survey delivered to 816 households in the Parks census block (368 responses, 45% response rate)
- Interviews with 56 residents and professionals to better understand social dimensions of smoke at the household level

Questions focused on experience with smoke, acceptability and tolerance of different smoke sources, and household adaptations to address low air quality among other topics.

We found that more than half of survey respondents (or someone else in their home) have a pre-existing health condition that is exacerbated by smoke. Few households have taken actions to minimize impacts of air quality in their home, with many citing the cost of those actions as a barrier or indicating that smoke is too infrequent to warrant action. More passive solutions to low air quality that align with local culture are preferred. Establishment of an air purifier program for households received a lot of interest from both survey participants and interviewees, with preference for a donation-based structure organized by a locally-trusted group (e.g., fire station or Parks Area Connection).

A subset of Parks-area residents are growing increasingly concerned about smoke impacts, and are enthusiastic to participate in conversations about its management and impacts. Interest in increased communication and access to resources related to local smoke events was consistently high, as study participants anticipated modifying day-to-day activities to minimize their smoke exposure using that information. Continued posting of information to community hubs like the Parks in the Pines store and Texaco, in addition to electronic communication via email and/or text were highly sought after.

Although there is some level of tolerance for smoke in the Parks area, residents consistently support non-smoke producing alternatives for forest management (e.g., mastication, grazing) wherever possible. Notably, there is high interest in access to residual materials after forest management efforts (e.g., timber sales) are complete.

A full list of recommendations based on research findings are provide in Section 5 of this report on pages 20-21.

1. Overview

Smoke from both wildfires and forest management efforts is increasingly affecting households in the wildland-urban interface. Given that accelerated use of prescribed fire and managed fires are increasingly advocated for in efforts to support forest restoration and mitigate wildfire risk, there is a growing need to understand how communities are adapting to smoke and its associated impacts.

This study sought to understand:

1. Household impacts from recent smoke events;
2. Adaptation strategies households are using to mitigate health risks associated with smoke; and
3. Current public information or resource needs related to smoke, wildfire, and forest management efforts

Parks, AZ, and the surrounding area is a well-suited community for investigating these foci, primarily because of its close proximity to active public land management, and the diverse population living in that area based on social-economic considerations like household income, age, education, and pre-existing health conditions. Research presented here is part of a broader effort to understand community adaptation to wildfire smoke in Coconino County.

2. Approach

2.1 Survey

Surveys are a useful approach for rapidly establishing a basic understanding of attitudes and opinions across a population. The survey instrument was developed to align with and expand existing research around wildfire and forest management smoke. Survey questions asked about: (1) smoke impacts to the respondent's household, (2) opinions on different sources of smoke, (3) consequences of smoke for health of household members, (4) interest in adaptation strategies to minimize smoke impacts, and (5) basic socio-demographic information.

The survey was administered to 816 Parks-area addresses from May to July 2021 using two different delivery techniques depending on whether the property was a primary or secondary residence:

- **“Drop-off, pick-up” administration:** The research team visited primary residences in-person and delivered a paper copy of the survey. They organized a collection time 24 hours later with a member of each household. We visited 323 primary residences, 173 of which had someone home during one of our visits. Each property was visited at least two times over the course of two weeks in mid-May 2021. A total of 134 surveys were returned via this technique.
- **Mail administration:** For secondary home owners (n = 496) and primary addresses where no one was home during our in-person visits (n = 150), we delivered paper copies of the survey via mail. We sent a reminder to those who had not responded after two weeks. At the four-week mark we delivered a spare copy of the survey to non-

respondents to encourage additional responses. We received a total of 203 survey booklets were returned via mail, 157 of which were from secondary home owners.

In total, we received 368 completed survey responses for a 45% response rate. Approximately 259 were received before the 2021 Rafael Fire began, and 109 after.

A map and description of the study area is available in Appendix A.



2.2 Interviews

We followed up survey data collection with semi-structured interviews. Semi-structured interviewing involves a core set of questions that are asked of each participant, in addition to follow up questions that vary by interviewee based on the emergent information they share. Survey participants were invited to provide contact information if they were interested in participating which we used as a starting point for recruiting interviewees, but we also sought out people who had not participated in the survey to ensure that data collected was representative. Survey questions sought to develop understandings related to survey findings, and inform the development of recommendations that can support improved smoke adaptation at the household level within the greater Parks area. We conducted 46 interviews with 56 residents and professionals, each of which lasted between 30 minutes and two hours ten minutes. Interviews were transcribed verbatim for analysis and common themes across conversations were identified for this report.

3. Survey findings

3.1 Who responded to the survey?

Survey respondents were 54% male, 45.1% female, and 0.9% other, with an average age of 63 years old. The majority of respondents identify as white/Caucasian, with 8.4% of respondents identifying as other ethnicities or races. Approximately 55.3% of respondents had a four-year degree or a higher level of education. More than half (50.7%) of respondents reported a total annual household income of \$60,000 or more before taxes. Almost all respondents (99.1%) owned their Parks-area property. Tenure of respondents was wide ranging, spanning from less than one year to 71 years of residency in the greater Parks area.

Documenting health conditions that may cause some residents to be more vulnerable to smoke is a critical consideration for air quality research. More than half (53.9%) of survey respondents reported one or more members with a pre-existing health condition that is affected by low air quality lives in their household. The most common health conditions were asthma (25.5%), heart disease (14.9%), and diabetes (14.3%), followed closely by chronic obstructive pulmonary

disease or COPD (10.3%) and bronchitis (9.2%). Approximately 18.5% of respondents reported that someone in their household has a disability.

3.2 What do Parks-area residents know about wildfire and forest management?

Several survey questions assessed respondents' general knowledge of fire and its place on local landscapes. We found a high level of concern for wildfire risk, with less certainty regarding its benefits and presence in the Parks area:

- 92.6% of respondents agreed that they are concerned about wildfire risk in the Parks area. There was no difference in reported concern between full and part time residents
- 82.6% of respondents agreed that active forest management is needed in the Parks area
- 58.7% of respondents agreed that fire is a natural part of the landscape around Parks
- 72% of respondents agreed that fire has a beneficial impact on landscape health around Parks

Smoke was a concern for many respondents who participated in this survey. Awareness of smoke in the area was moderate, but when it was present respondents felt they were well informed about its source.

- 38.5% of respondents reported that they often see smoke in the Parks area. Full-time respondents are almost twice as likely to report seeing smoke in the Parks area compared to part-time respondents
- 30.8% of respondents agreed that smoke is a problem in the Parks area
- 51.4% of respondents indicated that residents are concerned about smoke in the area
- 35.1% of respondents agreed that smoke is well-managed in the Parks area
- 23.5% of respondents agreed that land managers make decisions about smoke that protect residents' health and safety in the Parks area
- 86% of respondents agreed that smoke from wildfire is unavoidable
- 73.5% of respondents agreed that smoke is acceptable if it results in healthier forests
- 89.5% of respondents disagreed that "residents have a say in decisions related to smoke in this area"
- 40.5% of respondents stated that they want to be more involved in local decision-making about smoke



3.3 How have households in the Parks area been impacted by smoke?

In order to understand how households respond to smoke, it is important to gather baseline data on impacts from smoke to date. Approximately 32.7% of respondents reported that their health had previously been affected by low air quality. The most common source of health-impacting smoke was wildfire (23.1% of respondents), followed by prescribed fire (19.6%) and managed fire (16.2%). Slash pile burning (12.8%) and other sources of low air quality (14.2%) such as urban smog were also reported as caused of previous health issues.

Respondents were invited to report whether they had experienced a broad range of impacts associated with low air quality from smoke that have affected their day-to-day activities. Responses were not limited to experiences documented while living in the Parks area – it could also include impacts experienced at a prior residence or job. Only 33.6% of respondents reported some kind of impact from previous smoke experiences; the most common were disruption to daily routines (31.6%), with all others rarely reported. Those included financial loss because of smoke (2%), missing work or losing income because of smoke (1.7%), and filing a health insurance claim after a smoke event (1.7%).

3.4 Access to smoke-related information

Access to information about potential smoke events like prescribed fire or slash pile burning, reporting on smoke sources, and smoke forecasting (e.g., duration and changes in air quality) are critical for households looking to take action to mitigate low air quality from smoke. Survey respondents generally felt that they were well informed about the source of smoke, with 63.3% of respondents agreeing that they know why there is smoke in the Parks area when it is present. However, 54.6% of respondents disagreed with the statement “It is easy to find information about air quality in the Parks area,” indicating that identifying the source of smoke may be challenging or require lengthy searches to find relevant information.

Respondents were asked to indicate where they access information about smoke in the Parks area, and the extent to which they found that source trustworthy or untrustworthy. Responses are summarized in Table 1. Local Fire Departments, Coconino County, and the US Forest Service were identified as the most trustworthy sources. Notably, fewer respondents used Environmental Protection Agency and Arizona Department of Environmental Quality as information sources, which would include AirNow and other related national and state-level air quality reporting tools.

Respondents were also asked about their interest in a range of resources that could improve access to information about air quality related to smoke. Findings are summarized in Table 2. The most sought-after resource was an email or text messaging alert system that rapidly communicated a predicted decline in air quality, followed closely by a website or app that could communicate whether air quality is unhealthy. Data gathered from this question highlight a low awareness of existing resources; for example, numerous apps and websites already exist that document air quality in real time, but only 16.2% of respondents state that they already had access to that resource.

Table 1: Respondent identification of trustworthy and untrustworthy information sources on air quality. Most frequent responses are indicated in bold.

Information source	Very untrustworthy	Somewhat untrustworthy	Neither trustworthy or untrustworthy	Somewhat trustworthy	Very trustworthy	I do not use this source
Local Fire department	1.2%	1.2%	15.0%	16.5%	52.0%	14.1%
Coconino County	1.8%	4.2%	13.6%	29.0%	40.2%	11.2%
U.S. Forest Service	3.3%	5.7%	13.2%	20.7%	46.2%	10.8%
Arizona Department of Environmental Quality	3.0%	4.8%	21.1%	19.6%	31.1%	20.2%
Arizona Department of Forestry and Fire Management	3.3%	3.6%	16.3%	22.8%	35.2%	18.9%
U.S Environmental Protection Agency	6.6%	7.8%	24.9%	17.1%	19.2%	24.6%
My healthcare provider	3.0%	4.8%	25.6	14.9%	23.2%	28.6%
My health insurance company	7.5%	6.9%	36.7%	11.0%	6.9%	31.0%
My neighbors, friends, or family	2.4%	6.6%	23.0%	32.8%	25.4%	9.9%

Table 2: Respondent interest in different resources providing information on local air quality

Resource	I would be interested	I would not be interested	I already have access to this resource
A website or app that indicates when air quality is unhealthy	68.5%	15.3%	16.2%
Educational materials about air quality	51.2%	34.0%	14.8%
A household assessment conducted by an expert with recommendations for improving air quality	25.5%	69.4%	5.1%
Open house or listening sessions with local fire professionals about smoke	45.7%	47.2%	7.0%
Opportunities to ask questions about forest and fire management to land managers	61.0%	31.7%	7.3%
An email or text messaging alert system to let me know when air quality is about to decline	79.8%	15.5%	4.7%

3.5 Does the source of smoke matter to Parks-area residents?

Respondents were asked several questions related to different sources of smoke in their area. The survey instrument included definitions for four terms: wildfire, prescribed fire, managed fire, and slash pile burning. This ensured that all participants were familiar with the language used in the survey before responding to questions that included these terms. To begin, respondents indicated how often they noted smoke coming from varying land ownerships across scales (Table 3).

Next, respondents were asked to indicate how acceptable or unacceptable they found smoke originating from different fire ignition sources (Figure 1). Prescribed fires were consistently reported to be the most acceptable source of smoke in and around Parks, followed by slash pile burning. Human-caused wildfires were the least accepted by a significant margin; more than 88% of respondents found this source of smoke unacceptable.

Table 3: Reported frequency with which respondents see smoke originating from different land ownerships. Most frequent response is indicated in bold.

Smoke origin	Never	Once every few years	Every year	Multiple times a year
Private property in the Parks area	12.0%	33.2%	23.1%	31.7%
National Forest lands adjacent to Parks	4.2%	29.3%	45.0%	21.5%
Lands within Coconino County	3.9%	15.9%	50.3%	30.0%
Lands outside Coconino County	9.7%	25.2%	43.8%	21.3%
Lands outside the state of Arizona	25.2%	37.4%	22.7%	14.6%

Survey respondents were also asked to estimate how many days of unhealthy air quality they could tolerate from different smoke sources before it became an issue for themselves or other members of their household. The average response in days is shown in Table 4.

Table 4: Average number of days survey respondents could tolerate unhealthy levels of smoke from different fire sources.

I could tolerate unhealthy levels of smoke from...	Mean # days	Standard deviation
A wildfire for	5.2 days	8.4
A prescribed fire for	5.2 days	13.7
A managed fire for	5.4 days	13.8
Slash pile burning for	4.6 days	9.8

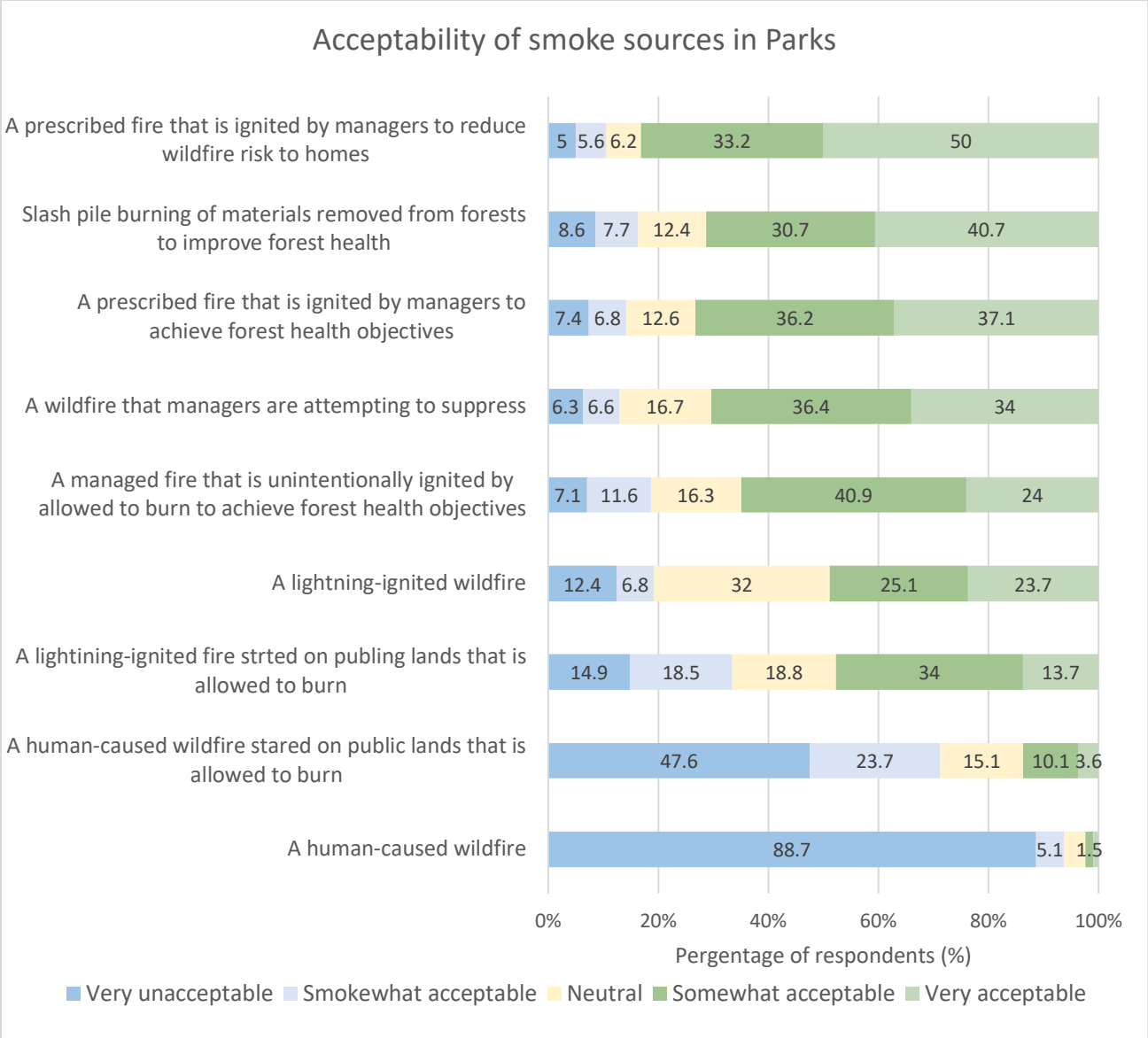
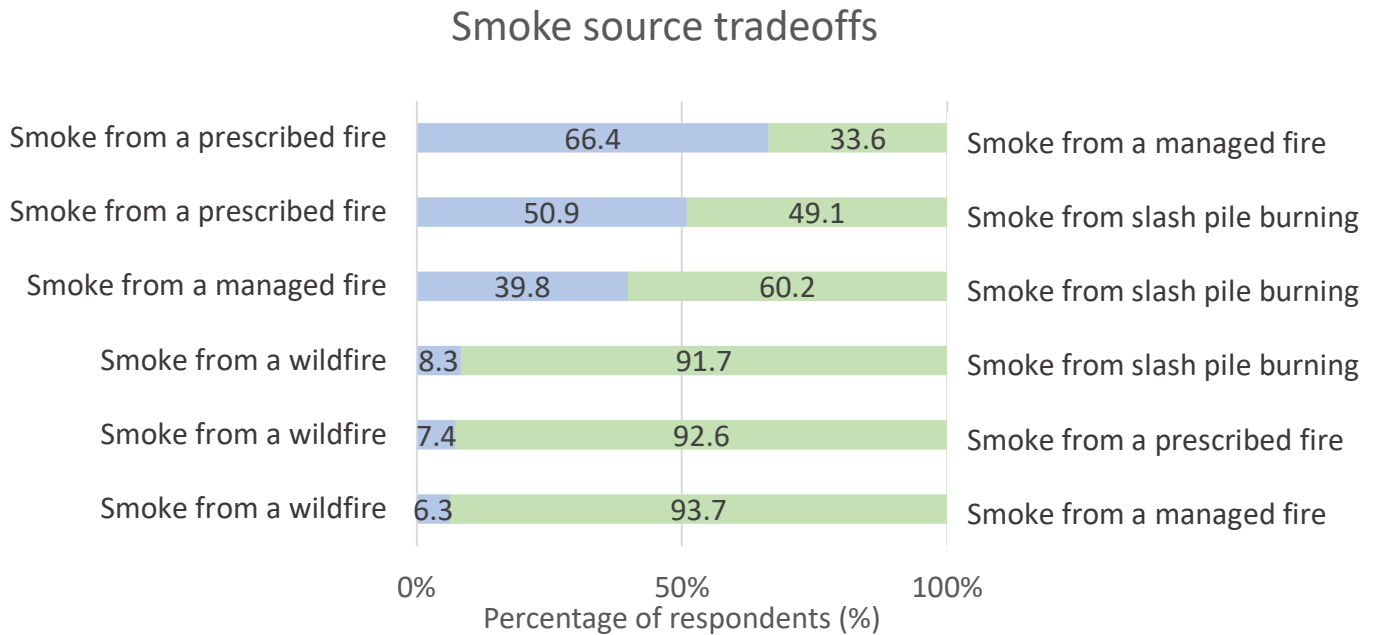


Figure 1: Acceptability of smoke caused by different sources of fire ignition

Finally, respondents were asked to make decisions about management tradeoffs between different smoke sources (Figure 2). Prescribed fire was most consistently indicated as a preferable source of smoke, while smoke from a wildfire was consistently identified as least desirable.

Survey respondents were also asked about desirability of tradeoffs that compared prescribed fire against management techniques that did not produce smoke, including mastication, hand thinning, grazing, and commercial timber sales. In each of these tradeoffs, prescribed fire was the preferred management strategy for no more than 28.4% of respondents. This indicates that although there is some level of tolerance for smoke in the Parks area, survey respondents consistently support non-smoke producing alternatives wherever possible.

Figure 2: Smoke source tradeoffs presented to survey respondents. Percentages indicate how many respondents preferred each option within a given tradeoff pairing.



3.6 How are Parks-area residents currently adapting to smoke impacts?

One core goal of this study was to understand what adaptive actions residents are already taking to address smoke consequences at the household level. We provided respondents with two lists of potential smoke risk mitigation actions: one list focused on proactive actions respondents may have already taken ahead of future low air quality events (Figure 3), and a second list focused on actions they might take in response to low air quality (Figure 4).

The majority of respondents reporting that they had somewhere they could stay outside the Parks area were part-time residents. Few had medical-grade masks for all household members, although this number is likely higher than it would have been prior to 2020 due to masking associated with COVID-19.

The survey also asked respondents a series of questions related to their capacity to improve air quality during smoke events for their household. Only 33.9% of respondents felt they had the information they needed to make decisions related to air quality. However, 54.1% knew how they could improve air quality in their home if they wanted to. Affordability of these actions was a substantial barrier; only 23.2% of respondents agreed that actions to improve air quality in their home were affordable, and 43.7% of respondents agreed that smoke was infrequent enough in the Parks area that investment in actions to improve air quality were not necessary.

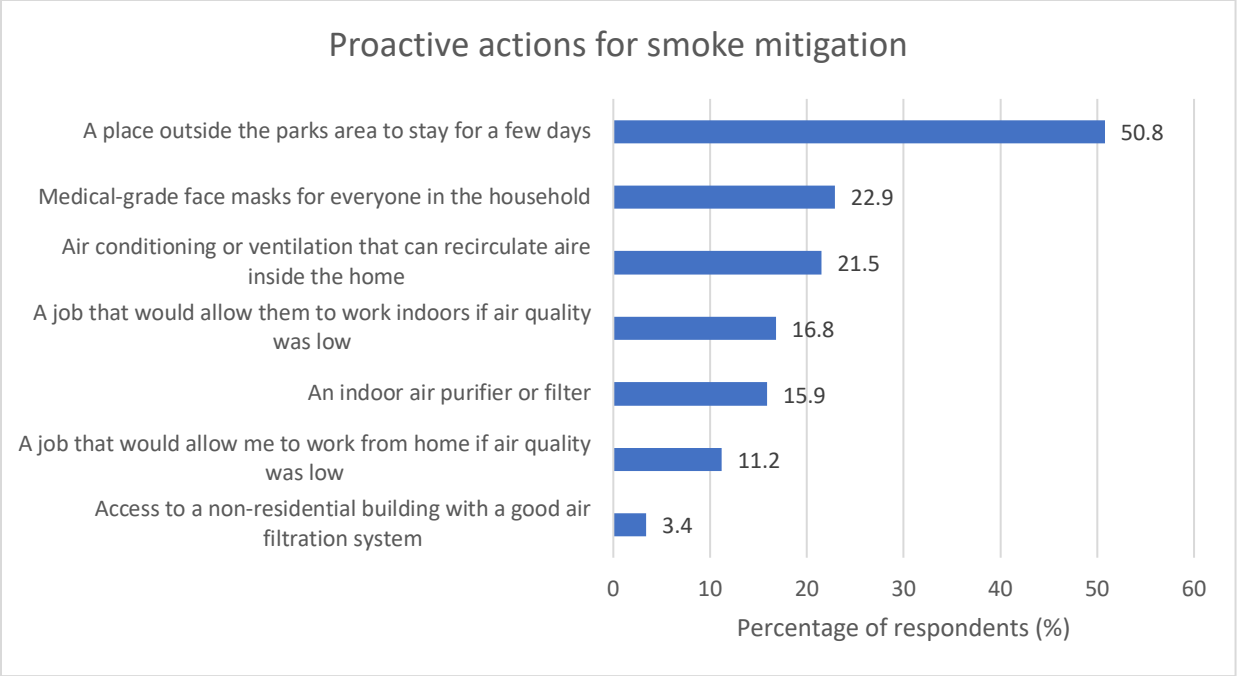


Figure 3: Number of respondents who reported having access to pro-active smoke mitigation actions.

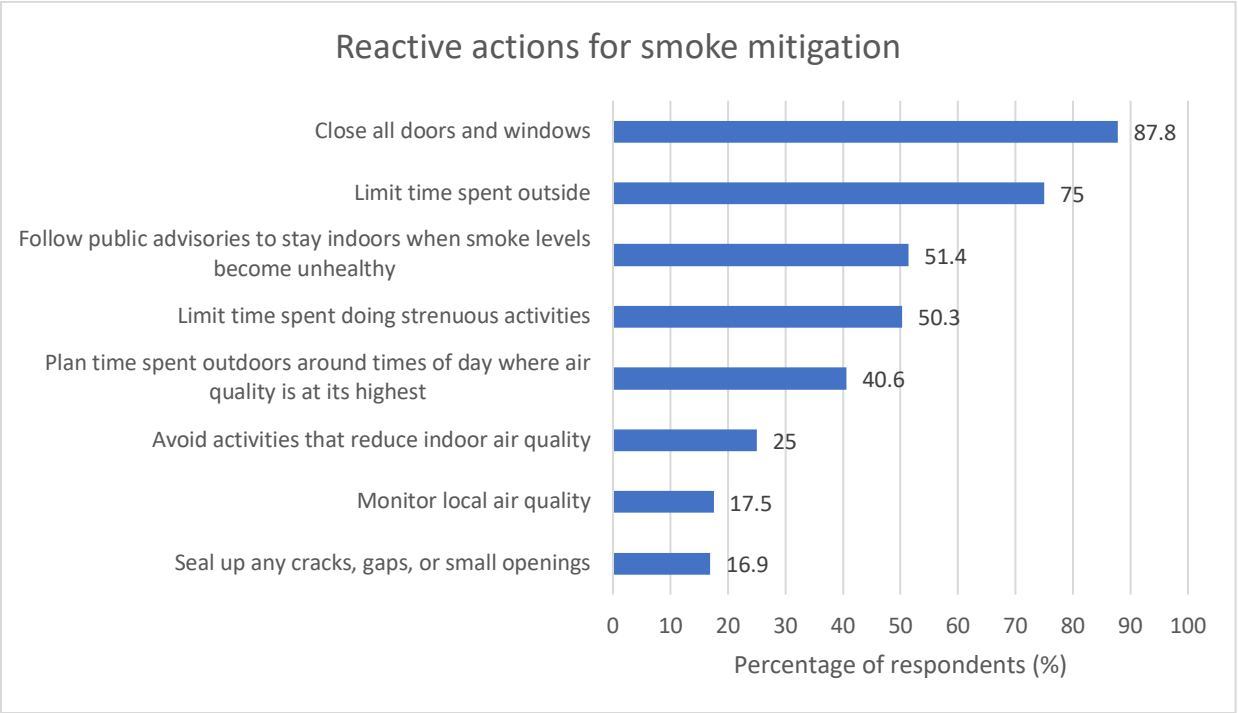


Figure 4: Number of respondents who reported planning to undertake reactive mitigation activities to address smoke events.

Visibility is a useful indicator of air quality for residents living in fire-prone areas. We asked survey respondents to identify how low visibility in the Parks area would need to be in order for them to become concerned about their health during a fire (Table 5). Distances were transferred from Arizona Department of Environmental Quality educational materials to ensure consistency.

Table 5: Distance at which visibility would cause survey respondents to become concerned about their health. Percentages indicate percentage of respondents who chose each distance band.

Over 10 miles	5 – 10 miles	3 – 5 miles	1.5 – 3 miles	1.5 – 1 mile	1 mile or less
3.8%	13.3%	26.9%	24.6%	15.4%	16.0%

3.7 What would influence Parks-area residents’ decisions to evacuate due to low air quality?

Approximately 9.3% of respondents reported evacuating from their home – whether in and around Parks or elsewhere – due to low air quality associated with smoke. We asked respondents whether different pieces of information or environmental changes would cause them to consider evacuating from the Parks area. Responses are summarized in Table 6. We found that presence of a wildfire, visible decreases in indoor air quality, or household members beginning to feel unwell were the most influential considerations in decision about whether to evacuate due to low air quality.

3.8 What programs are Parks-area residents interested in to access healthy air quality during fires?

Survey respondents were provided with descriptions of three programs that are being used elsewhere in the US to improve access to clean air during smoke events:

- **Clean air spaces**, designated public buildings with high-quality air filtering systems that residents can use when air quality is low
- **Air purifier programs**, which focus on the provision of high-quality indoor air filtration devices for households to use during periods of low air quality
- **Insurance policies or reimbursement programs** that cover the cost of short-term relocation to an area with healthier air quality

Approximately 39.8% of respondents were interested in participating in an air purifier distribution program. Air purifier programs can operate under several structures, ranging from permanent donations of units to cost-shares for households purchasing units. Parks-area respondents were most interested in the former (67.8% of interested respondents), which would allow permanent ownership of a donated air purifier. As indicated about in Figure 3, 15.9% of survey respondents already own an air purifier for their Parks-area property.

Table 6: Role of different cues in decision making about whether to evacuate from the Parks area. Most common responses are indicated in bold.

I would consider evacuating once...	Strongly disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Strongly agree
I learn about a wildfire in my area	8.6%	10.3%	16.2%	30.1%	34.8%
I learn about a managed fire in my area	18.6%	19.5%	27.8%	25.4%	8.6%
I learn about a prescribed fire in my area	21.9%	24.5%	28.6%	17.8%	7.3%
I learn about slash pile burning in my area	25.4%	21.9%	30.3%	16.6%	5.8%
Air quality inside my house has visibly decreased	7.3%	8.1%	17.4%	32.3%	34.9%
Visibility has noticeably declined in my area	8.7%	11.3%	23.8%	35.9%	20.3%
I or others in my household begin to feel unwell	4.0%	3.5%	10.4%	22.8%	59.2%
Road closures are introduced in my area due to low visibility	5.8%	5.8%	17.4%	29.9%	41.0%
Someone else covers travel costs	17.0%	3.9%	57.3%	9.1%	12.7%

Approximately 28.2% of respondents were interested in access to a clean air space. All respondents interested in this option indicated that they had their own transportation to and from a designated clean air space. The average respondent was willing to travel 22.8 miles to a clean air space location.

Finally, 24.4% of respondents were interested in receiving some form of financial assistance to temporarily relocate to an area with healthier air quality. Several factors played into willingness to participate in this form of program: first, respondents were only interested in short term relocation, and some (6.4%) were concerned about loss of income associated with this option. If this kind of program were a component of health insurance, participants would be hesitant to use it unless they knew how it would affect the cost of their coverage (23.1%). Those who weren't interested indicated that they already had another place to stay at outside the Parks area.

4. Interview findings

The following section summarizes key findings from interviews with residents and local professionals working within the Parks area. Interviewees included both full- and part-time residents. Conversations typically gravitated towards: (1) the recent Saddle Timber Sale on the Kaibab National Forest adjacent to Spring Valley Road, highlighting concerns related to timing and extent of slash pile burning, and (2) smoke from the Rafael Fire which occurred in June 2021.

4.1. Resident experiences with smoke events

Most interviewees described smoke as part of living in Parks and the surrounding area, describing it as common and unsurprising given their forest location. While talking about different sources of smoke, numerous interviewees stated “smoke is smoke,” highlighting a lack of differentiation regarding smoke sources once air quality was reduced. The only source of smoke that received some level of critique was managed fire; many interviewees believed that managed fire was not necessary and some pointed to the 2014 Sitgreaves Complex as a negative experience with managed fire purely because of the extended duration of low air quality. These interviewees tended to live further from the fire itself, meaning that smoke was the only impact they experienced.

“Wildfire happens. There’s nothing you can do about that. If it’s a controlled burn, is it being managed properly? I think some people are going to be, “Okay, I’m good with that too because it’s helping our forest in the long run from us having a catastrophic fire.” So I think it kind of balances out that way.”

-- Full-time Parks resident

Experiences with smoke varied based on where in the greater Parks area the interviewee lived; some pockets had consistently worse air quality due to air quality and wind direction in comparison to others. Those in areas of consistently lower air quality due to smoke described adjusting the timing of trips to Flagstaff or Williams to run errands, adjusting work schedules, and timing of outdoor activities to work around unhealthy conditions. Most of the time, air quality was not low enough that residents considered taking adaptive action beyond closing windows or staying inside, indicating that the inconvenience of smoke was generally short term so they were willing to tolerate those conditions rather than invest in mitigative action.

Residents who participated in interviews consistently described a pronounced need for proactive communication about smoke from forest management activities. There was great uncertainty about forthcoming forest management activities that might produce smoke, and interviewees relied heavily on word of mouth and communication in Facebook groups to access current information.

4.2 Identifying smoke risk reduction activities that align with local culture

Interviews also served as an opportunity to begin designing and tailoring smoke adaptation approaches that align with Parks’ independent

“I’ve woken up at two o’clock in the morning [because of smoke], and just sit straight up in bed because I have super sensitive sinuses and really bad allergies. And I’ll just take off running and close the windows and batten down the hatches.”

-- Full-time Parks resident

culture. We asked interviewees about the three programs outlined above in section 3.8, and identified two additional approaches to reduce household impacts from smoke. Below, we describe each approach and the conditions under which interviewed Parks-area residents would support them.

4.2.1 Pre-burn notifications

Interviewees described advanced notification as a critical resource for proactive household smoke mitigation. Many explained how their homes did not have air conditioning, necessitating strategic opening of windows at night to keep indoor temperatures cool during the summer. However, this often resulted in unintentional inhalation of smoke as inversions drove smoke into the area during the night. Numerous interviewees described waking up because of smoke coming in through open windows at night, leading some to experience trouble breathing, headaches, or other health consequences. Notifications regarding incoming smoke even just a few hours in advance would allow residents to close windows and prevent accidental smoke inhalation. Many Parks-area interviewees saw this as the simplest action to improve access to healthy indoor air quality during smoke events.

Almost every interviewee described their ideal short-term communication as an email or text messaging system like the Coconino County emergency alert system that allowed for immediate notification, aligning with survey findings. In some areas in and around Parks, residents do not have internet or cell signal and rely on postings on boards at the Texaco gas station and Mercantile or the Parks in the Pines Store; individuals in these positions expected to learn of smoke events at these locations or through word of mouth from neighbors.

Interviewees who were part-time residents, business owners, or had young children were typically interested in advanced notification spanning several days to weeks. They described advance notification as a planning tool, allowing decision making about when to stay or leave the area, align timing of trips away from the local area to coincide with planned low air quality events, and/or focusing business endeavors on times where air quality would be high.

"It would be good if there was some way to get that out [as early as possible] so that people could make plans, maybe they can decide to go away. "Oh, you're going to be burning these days? Let's go take a vacation." Or "I shouldn't schedule the barbecue with the family."
-- Full-time Parks resident

One core challenge to addressing local interest in advanced notification is the uncertainty with which burning activities are conducted. Planning for a prescribed burn or slash pile burning may take months to years, and is extremely weather dependent. That may mean that advanced notification beyond 12-24 hours is not possible, or could lead to public distrust in agencies planning to conduct burns due to inability to commit prior to state approval for each burn.

4.2.2 Public clean air spaces

Although survey data showed initial support for a clean air space among respondents (section 3.8), interviews highlighted the complexity of this approach for Parks-area residents. Closer locations were better received; while some interviewees were willing to travel to Flagstaff or

Williams, most preferred the use of a community-based building and identified the Maine Consolidated School gymnasium as an ideal location in terms of accessibility. Concerns about this approach focused predominantly on the set-up of the clean air space for public use, including the resources available there. Some were concerned about sharing a confined space with others where air was being recirculated due to COVID-19 risk, while others asked whether internet would be available so that they could continue to work or if it would be pet friendly so that they didn't have to leave dogs or cats at home. Overall, few interviewees saw themselves using a clean air space even if it was in the Parks area, and indicated that the need to relocate to that space was inconvenient – particularly if a smoke event lasted more than a day or two.

“I know even for us, it would be an hour round-trip drive [to a clean air space]. So if it was smoky during the day, I work from home, I might take them up on the offer and take my laptop if they have good wi-fi and enjoy it.”

-- Full-time Parks resident

4.2.3 Short-term relocation

Full-time resident interviewees were interested in reimbursement or other forms of financial coverage associated with short-term relocation to hotels outside the Parks area, but it was still identified as a less desirable solution in comparison to other options. Interviewees expressed concerns similar to those associated with clean air spaces; leaving the area even temporarily was disruptive, and many respondents had horses or other livestock that could not be left alone for extended periods of time. Uncertainty about how long residents may need to relocate for also influenced a lack of interest in this action.

Many interviewees felt that if such a program became available for the Parks area, which ever land management agency was conducting management efforts that produced smoke had a responsibility to fund it or compensate residents for temporary relocation. However, a subset of the Parks-area population did not trust federal government and indicated that they would be hesitant to take advantage of such a program even if it would benefit their health.

4.2.4 Household air purifier program

Interviewees were consistently most supportive of a locally-organized air purifier program. Most identified this approach as least disruptive to day-to-day routines, meaning they were most likely to engage with and maintain use of resources through this program. In order for an air purifier program to be effective in the Parks area, interviewees indicated that they wanted to see it run by local entities, namely the local fire department and/or the Parks Area Connection group as they had earned high resident trust. Full-time resident interviewees were interested in receiving purifiers through a donation system, whereas part-time resident interviewees expressed less interest or preferred a cost-share mechanism.

Given that it is likely a limited number of air purifiers would be available through this program, interviewees stated that elderly residents, households with young children or members with pre-existing health conditions, or low-income residents should have priority. Full-time resident interviewees generally did not support donation of air purifiers to part-time residents, because

they felt part-time residents already had other homes outside the area to relocate to and would not use a purifier as consistently as a full-time resident might.

Communication about the hypothetical implementation of an air purifier program was a central point of discussion in interviews. Many suggested that pairing information about the availability of air purifiers with other outreach programs such as smoke detector checks and replacement by the local fire department or Red Cross would reach vulnerable populations who could benefit the most from a purifier. Others described how an air purifier might mitigate other air quality-related issues for their household, including allergies associated with pollen and dust from unpaved roads. A small number of interviewees were skeptical of air purifier units, questioning their effectiveness or indicating a lack of familiarity with that technology. Others raised concerns about whether use of air purifier units might cause some residents to delay evacuation, putting themselves at unnecessary risk.

4.2.5 Diversification in the use of residual products from forest management

One frequent topic of conversation that interviewees introduced was the Saddle Timber Sale, an effort by the Kaibab National Forest to support forest restoration under broader local land management initiatives. The sale is visibly prominent within the community, and many interviewees drove by it daily when travelling to and from their property. Numerous slash piles are visible from the road, prompting questions about whether and when they might be burned. Interviewees consistently stated their interest in accessing these residual materials for personal use before piles were burned, describing an added benefit of reduced smoke production.

Use of residual materials ranged from production of mulch and wood chips to use of larger materials for construction of outbuildings. Understandably, public access to these materials depends on agency approval and planning. However, many interviewees saw this as an olive branch, and felt that access to these residual materials would support forest restoration efforts. Professionals interviewed for this study indicated that public use of residual materials was challenging due to access restrictions in timber sale areas; in an ideal situation, residual materials would need to be moved to a publicly accessible area like the fire station parking lot to limit risk associated with entering a sale area. The Ponderosa Fire District (Station 81 in Parks) indicated a willingness to support such efforts should the opportunity arise.

Interest in repurposing of residual materials instead of burning them was not limited to personal use; some interviewees specifically mentioned their support of wood products for biomass utilization. Much of this support was based on the understanding that while those materials would be burned, they would first be moved off-site and therefore would not affect air quality in the Parks area.

“There's actually a fair number of pretty good-size logs just laying there... They could say, "You know what? We're going to do it [allow public access to residual materials], and we're going to do it on these four weekends," and they could have one of the Forest Service truck guys come out there... even if they could kind of put stuff to the side of the road for people to get, so they don't even have to go on [to the National Forest]

-- Part-time Parks resident

5. Recommendations and Conclusion

Combining survey data with interviews allowed us to develop a far richer understanding of how smoke management and mitigation can be advanced in the Parks area. Below we share key findings and recommendations for organizations, land management agencies, and governments planning to manage wildfires or conduct forest management activities that involve smoke production in the Parks area:

- Transparency about the complexity and depth of the federal and state planning process around prescribed burns and slash pile burning can improve public understandings about short notification times for smoke events. **Development of materials that describe the planning and approval process for burning for lay audiences** can reduce distrust in agencies.
- Organizations and agencies conducting forest management efforts that produce smoke should continue to **post information related to forest management events at central community locations**, including the Texaco gas station and mercantile as well as the Parks in the Pines store. **Development of a mailing list or posting burn information to local Facebook groups** would bolster support and adaptation among Parks-area households.
- Parks-area residents are interested in opportunities for face-to-face interactions with managers making forest management and fire decisions. **Open houses, public meetings, and listening sessions would likely be well attended** if they were held, based on responses to our survey.
- Many Parks-area residents are not able to adapt day-to-day activities to mitigate personal smoke risk because they have livestock, horses, or other animals that require them to both be present at their property and spend extended periods of time outside. **Communicating information on smoke risk to animals** may encourage temporary relocation or support purchase of personal masks with high quality air filters built in for use during extended periods of time outside.
- **Any action to mitigate smoke risk to households must align with local culture.** Interview participants identify as independent, and gravitate towards mitigation activities that support their lifestyle with little to no disruption.
- **Packaging information about smoke impacts and mitigation with other pre-existing community programs or outreach**, such as smoke alarm checks by the fire department, is most likely to reach audiences who are most vulnerable to smoke impacts.
- Some residents were skeptical of mitigative actions such as use of air purifiers. **Providing information about air purifier effectiveness and placing demonstration units in central community locations like the Texaco and Parks in the Pines store** may encourage conversations about their effectiveness and build support and interest in use of air purifiers at home.
- **Improving access to residual materials from forest management activities** is of great interest to Parks-area residents. This may reduce the amount of smoke produced from pile burning while also improving community-agency relationships.

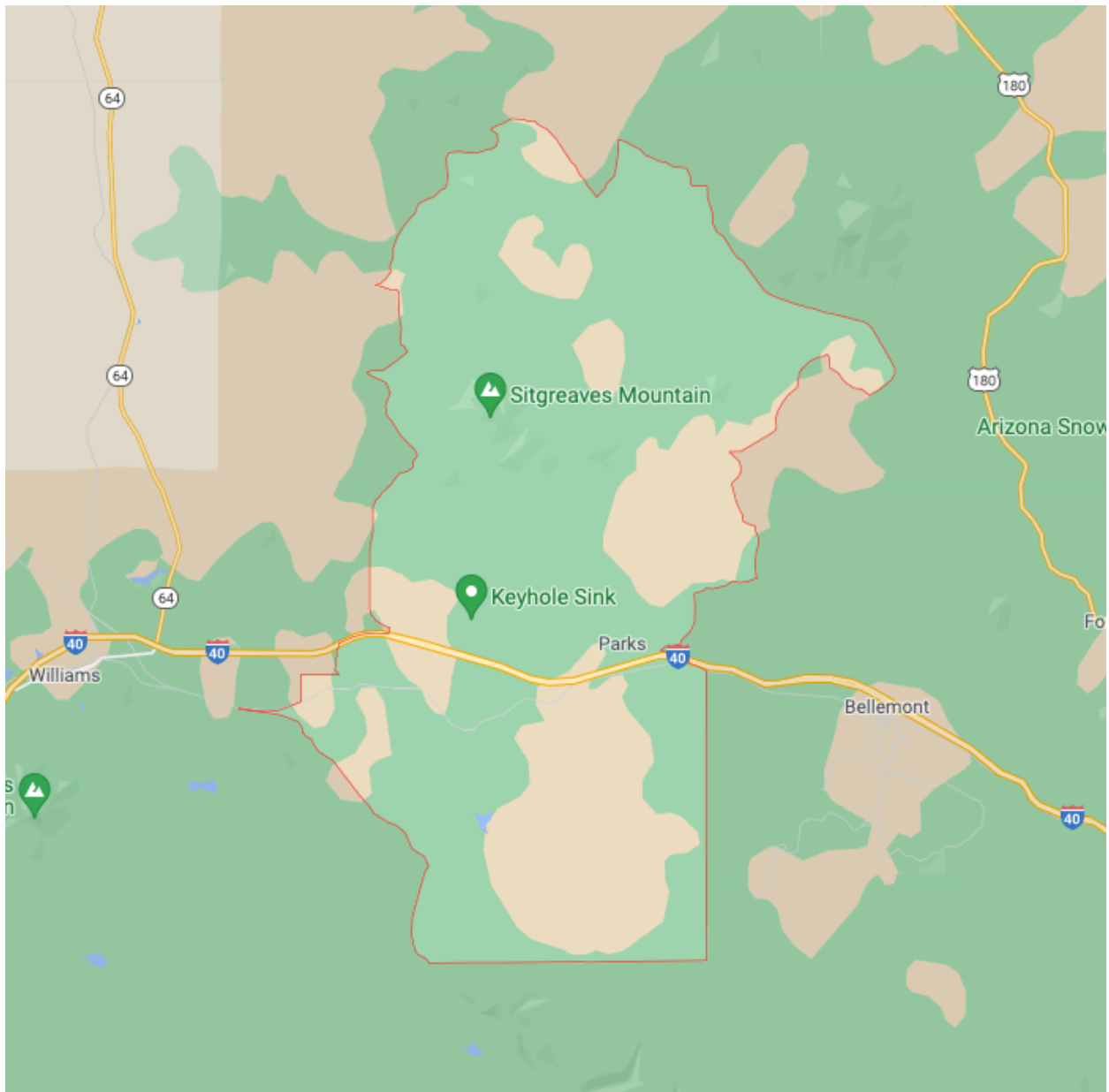
Residents in the Parks area are increasingly concerned about smoke impacts to their households. Locally-run, community-centric activities and programs that can support the improvement of indoor air quality on private property will receive the greatest support in this area. Opportunities for greater public interaction around forest management efforts like timber sales and prescribed fire can strengthen community-agency relationships while expanding the capacity of residents to live with fire.



Appendix A: Study area map

The study area followed the boundary of the Parks Census block developed by the US Census Bureau. This included Sherwood Forest Estates, Pitman Valley, Parks, properties in Garland and Government Prairies, and properties along Spring Valley Road.

Study interviewees defined Parks' geography in different ways, with some stating it went as far north as Hwy 180 and as far south as Sycamore Canyon, then extended east to Bellemont and West to Pitman Valley. Sherwood Forest Estates was generally not considered part of Parks by interviewees.



Appendix B: Evacuation behavior data

A final portion of the survey collected respondent data regarding their intended plans for evacuation during a fire event that threatened their Parks-area property. That data is presented below in Table A.

Table A: *Intended behaviors during a wildfire event that threatens the respondent’s Parks-area property.*

	Strongly disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Strongly agree
I would remain at home and help defend my home by putting out spot fires	24.0%	16.1%	18.7%	29.8%	11.4%
I would evacuate as soon as I hear about a fire that may impact my property	8.9%	21.6%	18.2%	30.0%	21.3%
I would evacuate, but return soon after the fire to defend my property from threats	9.9%	11.6%	20.9%	38.7%	18.9%
I would remain at home and safely shelter in my home without putting out spot fires	59.8%	21.7%	14.1%	2.1%	2.3%
I would wait to see how bad the wildfire is and evacuate if I think it is too dangerous	17.0%	13.7%	14.3%	34.2%	20.8%
Some members of this household would evacuate and others would remain to protect the property	40.8%	16.4%	20.5%	13.8%	8.5%
I would evacuate when the authorities tell me to do so	3.2%	3.5%	8.4%	24.2%	60.8%
I would attempt to suppress wildfires on properties neighboring my own	19.2%	10.8%	15.7%	35.2%	19.2%
My neighbors and I would work together to evacuate promptly	5.0%	5.0%	24.1%	34.4%	31.5%
My neighbors and I would work together to stay and defend our properties	27.7%	17.7%	27.4%	19.5%	7.7%
I would assist professional fire fighters in their efforts to protect values at risk from wildfire	15.8%	9.6%	18.7%	31.9%	24.0%
I would travel to my Parks-area property as quickly as possible to defend it	27.5%	14.0%	26.6%	18.1%	13.7%
I would remain on my Parks-area property regardless of authorities’ evacuation orders	59.0%	20.8%	13.9%	3.2%	3.2%
I would not know what to do during a wildfire	48.5%	19.6%	15.5%	12.3%	4.1%

Approximately 11.4% of survey respondents reported that they have previously evacuated from their home due to a wildfire. This could have been any home they have lived in in the past.

Coconino County uses the three-level Ready, Set, Go! (RSG) evacuation notification system during wildfire. Survey participants were provided with a description of the system and its levels, then asked a series of questions about its application during emergencies. Table B presents data collected about respondents' understandings of the RSG system.

Table B: *Intended behaviors during a wildfire event that threatens the respondent's Parks-area property.*

	Strongly disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Strongly agree
People expect to be notified by professionals about when to evacuate	0.6%	0.9%	4.1%	21.0%	73.5%
The RSG warning system for evacuation is clear	2.0%	3.5%	13.5%	26.3%	54.7%
The RSG warning system is the best way to ensure the safety of residents in my community	0.6%	1.4%	20.3%	31.3%	46.4%
The RSG warning system will not affect my plans during a wildfire	34.0%	21.7%	25.8%	9.7%	8.8%
Residents only need to evacuate if they are contacted as part of the RSG warning system	22.4%	23.3%	24.2%	15.5%	14.6%
All three levels of the RSG warning system will occur during wildfires	16.2%	13.9%	33.9%	15.0%	20.9%
I know how I would be contacted about evacuation using the RSG system	25.8%	17.6%	21.4%	14.7%	20.5%