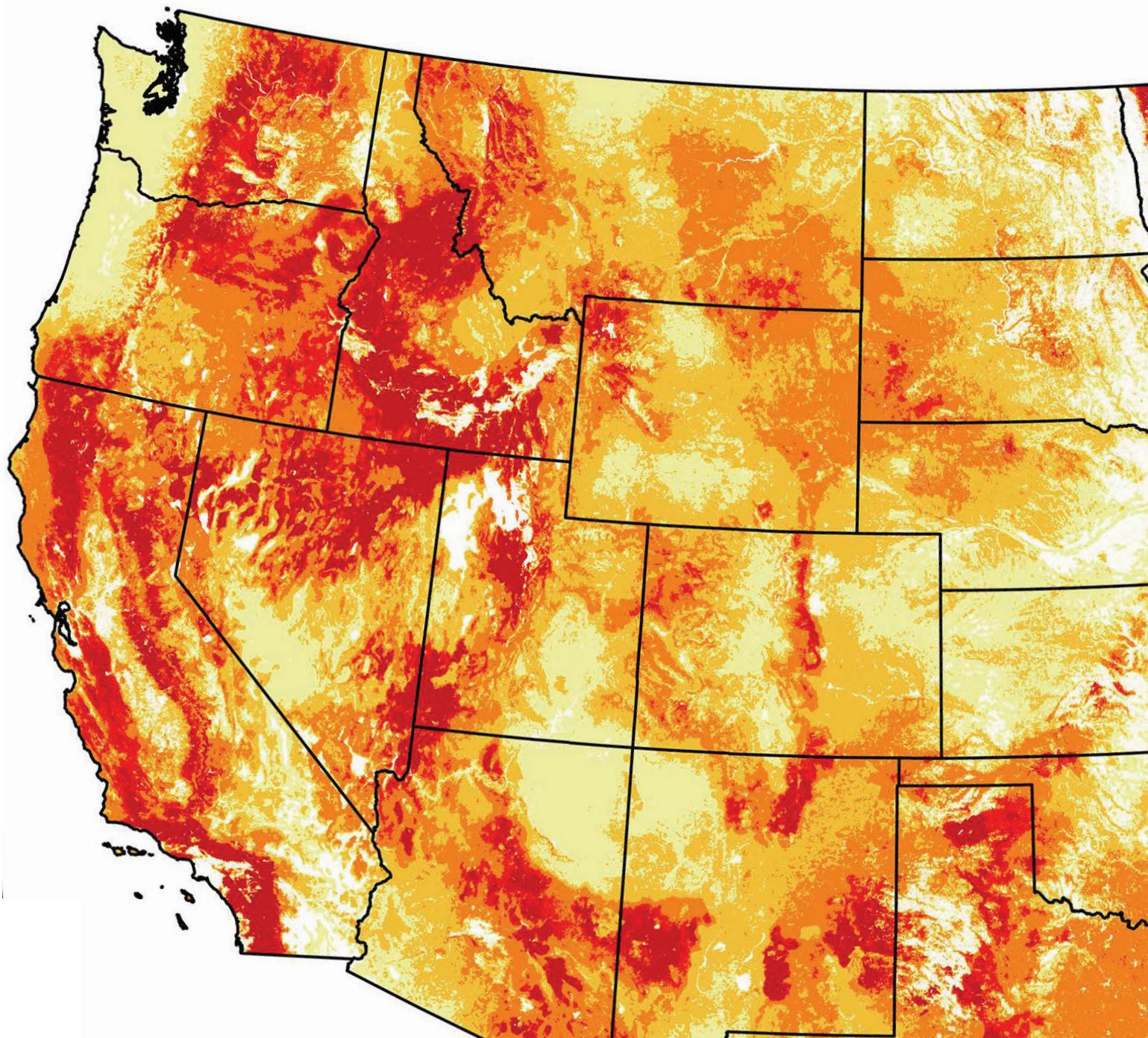


Promoting Understanding, Planning, & Collaboration:

An evaluation of the Wildfire Risk to Communities website



COLORADO FOREST
RESTORATION INSTITUTE

September 2021
CFRI -2111

Colorado Forest Restoration Institute

The Colorado Forest Restoration Institute (CFRI) was established in 2005 as an application-oriented, science-based outreach and engagement organization hosted by the Department of Forest and Rangeland Stewardship and the Warner College of Natural Resources at Colorado State University. Along with centers at Northern Arizona University and New Mexico Highlands University, CFRI is one of three Institutes that make up the Southwest Ecological Restoration institutes, which were authorized by Congress through the Southwest Forest Health and Wildfire Prevention Act of 2004. We lead collaborations between researchers, managers, and stakeholders to develop, synthesize, and apply locally-relevant, actionable knowledge to inform forest management strategies and achieve wildfire hazard reduction goals in Colorado and the Interior West. Our work informs forest conditions assessments, management goals and objectives, monitoring plans, and adaptive management processes. We help reduce uncertainties and conflicts between managers and stakeholders, streamline planning processes, and enhance the effectiveness of forest management strategies to restore and enhance the resilience of forest ecosystems to wildfires. We complement and supplement the capacities of forest land managers to draw upon and apply locally-relevant scientific information to enhance the credibility of forest management plans. We are trusted to be rigorous and objective in integrating currently-available scientific information into forest management decision-making. We do this through collaborative partnerships involving researchers, forest land managers, interested and affected stakeholders, and communities.

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Executive Summary

The 2018 Omnibus Bill mandated that the US Forest Service develop and publish nationally consistent geospatial data about community wildfire risk. Herein we evaluate whether the Wildfire Risk to Communities website (WRC, wildfirerisk.org) is meeting its objectives of improving understanding, informing planning, and promoting collaboration. For this analysis, we interviewed a range of wildfire practitioners and local-level decision makers. We assessed practitioner responses to the three key sections of the website (**Understand Risk, Reduce Risk, and Explore Risk**), documented examples of website use, identified commonly held strengths and weaknesses, and compiled recommendations for improvement. We sampled across geographic areas, audience types, and levels of familiarity with the website to ensure a diverse range of perspectives. The report and its findings are structured to provide actionable feedback to the WRC developer team and other stakeholders interested in wildfire risk to communities.

The **Understand Risk** section clearly defines complex terminology associated with wildfire risk in a way that is comprehensible to most audiences, and is particularly valuable for practitioners who are new to the field or have public communications roles. The **Reduce Risk** section provides a range of resources and community tools on relevant wildfire mitigation topics that are presented in a way most practitioners found valuable and wanted to see expanded. The **Explore Risk** section uses maps to spatially display different aspects of wildfire risk, and includes graphical representations of risk, allowing users to assess and compare risk between communities. The underlying spatial data from the **Explore Risk** section is also available for download, which gives sophisticated users the ability to conduct additional custom analysis.

Overall, the WRC includes appropriate content that closely aligns with recent and relevant research on wildfire risk. It clearly states its intent, audience, and limitations, and thoroughly documents methodology and data sources. While the WRC is not designed to assess intra-community risk—which is the scale at which most practitioners and decision makers work—it is the first easily accessible web portal that maps wildfire risk consistently across the United States, and provides “one-stop-shopping” for community wildfire practitioners and decision makers. Looking forward, to have an impact and achieve its stated objectives, the WRC should consider continuing outreach efforts to curated audiences, maintaining up-to-date spatial data, and showcasing innovative uses. It should also continue to refine and assess practitioner needs, and develop approaches and/or content to better connect practitioners and other interested stakeholders to locally relevant resources.

WRC Background

The Wildfire Risk to Communities (WRC) is an interactive website and data application jointly developed through a collaboration between the USDA Forest Service National Headquarters (Fire and Aviation Management), Rocky Mountain Research Station's Missoula Fire Sciences Laboratory, Pyrologix, and Headwaters Economics. The project emerged from the 2018 Omnibus Act (section 210) that directed the Secretary of Agriculture, through the Chief of the Forest Service, to develop and publish nationally consistent geospatial data about community wildfire risk. The intent of the project was to produce data (tables, charts, GIS layers), and an interactive website to help inform community leaders about their relative wildfire risk profile, the nature and effects of wildfire risk, and actions the community might take to manage and mitigate wildfire risk. The WRC and underlying spatial data cover the entire country, and it is unique in being the first application to map wildfire risk to communities at a national scale using a consistent methodology.

The WRC's primary intended audience is municipal, county, and state elected officials, land use planners, fire managers, and fire collaboratives. The website's FAQ notes that it has potential utility for a secondary audience of state and local government and neighborhood associations. The WRC is not explicitly designed for individual homeowners or others interested in assessing risk at fine scales, though such audiences may still find helpful information and resources on the site.

Objectives

The WRC has three overarching objectives as described in congressional legislation, on the website, and in source material referenced therein:

1. Improving user understanding of wildfire risk & mitigation
2. Informing proactive planning to manage and mitigate wildfire risks
3. Promoting collaboration and providing a starting point for community conversations

Website Organization

The WRC is structured around seven tabs. This includes three major sections titled “**Understand Risk**,” “**Explore Risk**,” and “**Reduce Risk**,” plus a “**Home**” page, “**About**” page, Data “**Download**” page, and “**Contact**” page. The **Understand Risk**, **Explore Risk**, and **Reduce Risk** sections, which are the central focus of this evaluation, each speak to the aforementioned objectives and comprise the bulk of the website’s content and functionality.

The **Understand Risk** (henceforth “**Understand**”) section provides explanations and definitions of key concepts related to wildfire risk. Specific topics and concepts described in detail include risk, hazard, vulnerability, likelihood, intensity, exposure, and susceptibility. It also includes a list and links to resources for further reading, to help website visitors gain a better understanding of wildfire risk.

The **Reduce Risk** (henceforth “**Reduce**”) section contains information on nine topics mostly related



to wildfire mitigation, prevention, and response (home ignition, home hardening, land use planning, wildfire preparedness, community health, wildfire prevention, wildfire response, fuel treatments, and post-fire recovery). The informational materials for each topic include: explanatory text, graphics, and videos; links to informational websites tailored to the specific topic; and white papers, reports, and peer reviewed journal articles.

In the **Explore Risk** section (henceforth “**Explore**”), data are displayed spatially in maps and graphically in charts, allowing users to compare locations across the United States. The interactive mapping functionality allows users to search by area (state, county, community, etc.) and see a visual representation of wildfire risk across four subthemes:

- *Risk to homes* provides a composite measure of wildfire likelihood paired with fire behavior.
- *Wildfire likelihood* provides an estimate of burn probability.
- *Exposure type* estimates the relative proportions of homes directly and indirectly exposed to wildfires from flames and embers.
- *Social vulnerability* displays demographic data for vulnerable populations (families in poverty, people with disabilities, people over 65, difficulty with English, households with no car, and mobile homes).

Explore also includes a glossary of relevant terms and brief descriptions of how they are measured, quantified, and/or represented. It also links to a technical report that describes specific methodologies, data sources, and analysis parameters regarding wildfire risk calculations.

The **Download** page allows users to download data layers displayed in the **Explore** section, plus several additional layers. Data are available for download in GIS raster format and tabular summaries by area (community, county, and state). The **About** page includes the FAQ and Fact Sheet PDF; news (including press releases and links to recorded webinars), descriptions and links to the home organization for the team of developers; and an overview of federal policies with which the WRC is aligned, namely the National Cohesive Wildland

Fire Management Strategy and Shared Stewardship. Lastly, the **Contact** page provides automated forms to submit questions or comments, or to subscribe to an email list for updates.

Limitations

The WRC acknowledges the following limitations:

- It is best for comparing risk among, rather than within, communities
- It is not designed to consider risk at the local, neighborhood, or individual home scale
 - The data are not locally calibrated and are not fine scale
- It is not intended to replace state, regional, or local risk assessments
- The project is focused on risk to communities with an emphasis on homes (which are derived from census population data and physical locations of structures and buildings)
- It does not consider wildfire impacts to other important assets such as watersheds, landscape health, or infrastructure
- The tool is not predictive, and there are no climate projections, and
- Updates and releases after summer 2020 are dependent on funding and are not yet confirmed.

Evaluating the WRC

The US Forest Service announced the release of the WRC in early April 2020. The following month, LANDFIRE hosted two informational webinars, one providing an overview of features of the WRC, and the second explaining the data and methods behind it. That same month, the principal developers approached the Colorado Forest Restoration Institute to conduct a third-party pilot study evaluating the WRC.

The evaluation is designed to assess whether the WRC is meeting its purpose and intent as set forth by Congress, and the report provides actionable insights and feedback the WRC developer team can apply to improve the effectiveness of the WRC web application and help it achieve its intended

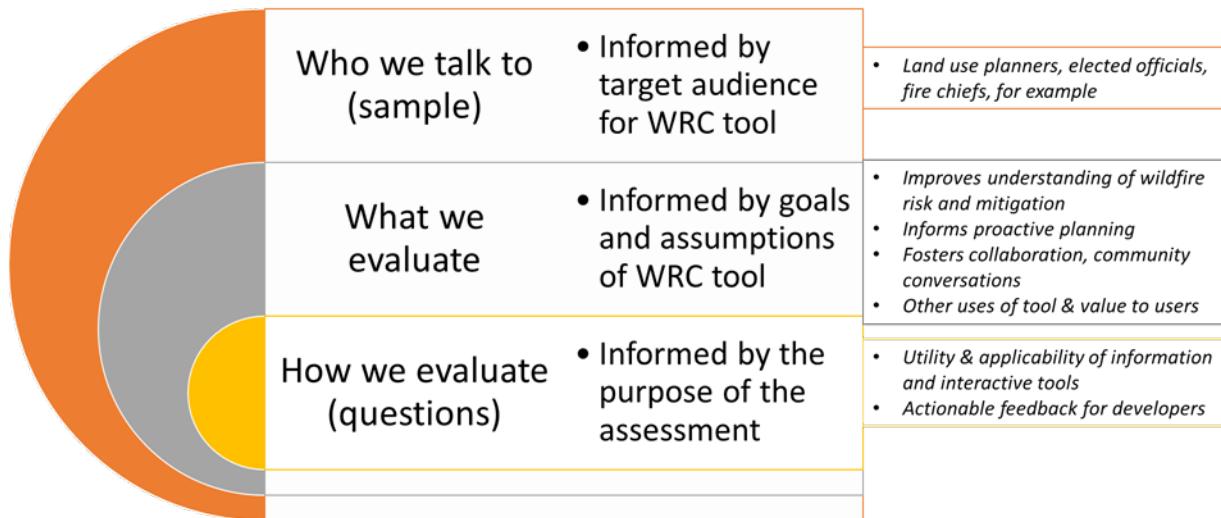


Figure 1. WRC Assessment framework, detailing how the audience we target and the questions we ask are informed by the WRC goals and objectives

purposes.¹ We assess the utility and applicability of the WRC's information and interactive tools to its target audience of individuals responsible for mitigating wildfire risk in their communities. This study did not comprehensively assess to what extent WRC is reaching this target audience across the country.

Methods

Prior to finalizing the methods for this assessment, we reviewed available background documents, met with the WRC project co-leads, and conducted a brief literature review on evaluation of decision support tools. We developed an assessment framework (Figure 1) structured around the following themes:

- Demographics and decision authority
- General perceptions of utility and value
- Section-specific perceptions of the utility of information and functions across the website
- Feedback for developers

Sampling & Demographics

We interviewed four members of the developer team to clarify assumptions and expected utility of the WRC, and to understand what feedback would be most valuable to them. The developers'

interests informed the survey. Developers expressed an interest in hearing from a variety of users representing the target audience, and with different levels of experience with the website. We identified five broad categories of intended user groups:

- Land use and other community planners
- County Sheriffs, Fire Protection Districts, fire chiefs (including county wildfire fire programs)
- Federal, state, or tribal agencies with fire management responsibilities (e.g., the Bureau of Land Management, state forest service)
- Fire and forest health collaboratives, as well as “boundary-spanning” organizations and nonprofits that support and promote collaborations by providing specialized expertise and services.
- City, county, or state elected officials (e.g., county commissioners or town council members)

We developed a purposeful sampling strategy to achieve representation of experience levels across these categories. We also sampled across geographies to ensure diverse regional perspectives. We identified place-based networks in four western states (California, Colorado, New Mexico, and Utah), and contacted leaders who helped us identify a list

¹ Note that a formal quality assurance evaluation was outside the scope of this study; we have not thoroughly assessed performance across browsers or devices, nor have we evaluated it for accessibility compliance

of 5-8 potential interviewees in each state who work in different roles within the WRC's target audience. Simultaneously, we reached out to web developers who provided a convenience sample of more experienced users to ensure recruitment at that level. After compiling a list of approximately 50 potential contacts stratified by audience type and geography, we sent recruitment emails to 46 individuals and received affirmative responses from 22. We pilot tested our survey on the four network leaders, which yielded only minor adjustments in question order to the survey. As such, we retained those four participants as part of our total sample of 26 interviewees (Table 1).

Table 1. Interviews by source

Interview Source	Interview Count
State network leads	4
Local practitioners	22
Additional experienced users	4
Total	26

Participants from six states were interviewed, and two interviewees represented national-level organizations. We interviewed at least three representatives from each category of target audience. Since we included network leaders in the sample, the data over-represent the category of collaboratives and boundary-spanning organizations. It is also important to note that several interviewees identified themselves as belonging to multiple categories. We achieved almost even representation

across three levels of website familiarity. Low familiarity participants had either never looked at the website or had only superficially explored; medium familiarity participants had explored more thoroughly, shared, or discussed the WRC with others; and high familiarity participants had used one or more components of the WRC, or downloaded and used spatial data from the site (though such users were not necessarily equally familiar with all parts of the website) (Figure 2).

Analysis

We conducted semi-structured interviews lasting 60-90 minutes via video teleconferencing software (Zoom and Microsoft Teams), which allowed for broader geographic representation as well as the ability to share screens and view user navigation through the site. Interviews were recorded with permission, transcribed, and coded for key themes using Microsoft Excel. The project co-leads met regularly during analysis to discuss and modify themes and synthesize results. Representative quotes from interviewees (anonymized as numbers) are used throughout the report to illustrate themes.

Findings

In this section we begin by discussing participant perceptions of the WRC content, uses, strengths, and weaknesses, for the major sections of the website (Understand, Reduce, and Explore & Spatial Data). When possible, we include exemplar quotes from participants to provide context and better articulate

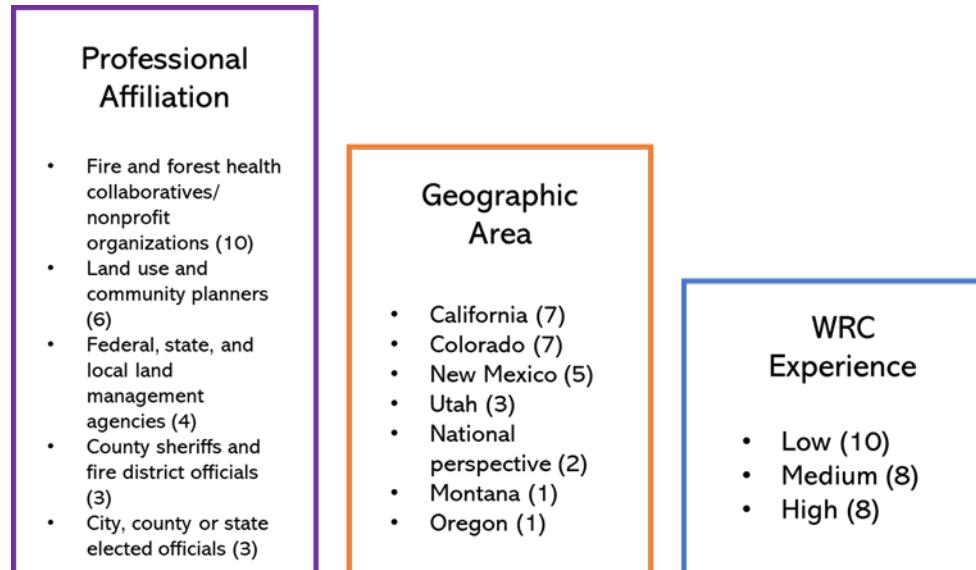


Figure 2. Number of interviewees audience type, geographic area, and level of experience

the diverse range of ideas we encountered. We also note pertinent suggestions and recommendations for improving different components of the website, and briefly discuss findings for other parts of the website.

Understand Risk

Overview

The **Understand** section of the website directly supports the WRC's objective of improving understanding of wildfire risk and mitigation by explicitly defining complex terminology used in wildfire risk management. The glossary located in the Explore section provides additional terminology and definitions to support this objective. Interviewees generally perceived the content and terminology presented in the **Understand** section as applicable, straightforward, and understandable. We highlight some of the more common and pertinent strengths and weaknesses noted by interviewees below (Table 2).

In terms of utility, people with different backgrounds or levels of expertise described different audiences for whom they felt it would be most useful. Respondents with more experience in fire/fuels planning or management felt this section was less useful for themselves (e.g., redundant with existing knowledge), but could be useful for educating engaged non-professionals (i.e., students, Firesafe Councils and Fire Adapted Communities, elected officials, early career staff, real estate agents, and engaged or skeptical landowners). People whose background or experience was outside fire/fuels

management, or who were new to the field, tended to see it as more useful for themselves, both for self-education and particularly for promoting consistent language when communicating with the public (see case study in Box 1). “*The simplicity of this is a great starting point...it makes it less scary, less bureaucratic, so for someone starting out who needs to learn a lot...it helps them get to a point where they can understand it rather than become an expert,*” (21). Wildfire risk is inherently complex, and the WRC clearly defines various components that contribute to risk, which enables nuanced understanding and informed conversations between stakeholders. Regarding its value for promoting consistent language, one boundary-spanning organization representative noted that the section could be useful “*to provide people with the big picture and get them on the same page,*” (15).

Some terms were perceived as less well-communicated than others, with the term “susceptibility” drawing the most criticism (this was anticipated by a developer, who noted it was a particularly difficult term to communicate effectively). Some felt the concept was oversimplified (“*...it doesn't get to true susceptibility of a home... there is such variation...susceptibility at this scale is too general,*” [19]); and others felt it was too complex for communicating to the public (“*I can't point [a member of the public] to this...because I would feel I have to explain [the term] to them,*” [18]). These perspectives are difficult to reconcile; the first points to inherent data limitations of the WRC, and the second speaks to place-based variability in resident sophistication and scientific literacy. Interviewees with communications responsibilities suggested

Table 2. Strengths and weaknesses of the **Understand Risk** section

Strengths	Weaknesses
Generally accessible language for a lay public (esp. likelihood and intensity)	Terms too simplistic or general for practitioners with fire/fuels experience
Practitioners can pull consistent vocabulary from the terminology, and the page provides a good list of resources for practitioners	Some terminology less accessible, more controversial (e.g., <i>susceptibility, exposure</i>)
Clean, modern layout with intuitive icons and graphics	Less interactive or eye catching than other parts of site
Cross-links easily with other parts of the site	Scroll-heavy, especially on mobile

Box 1. Example of use

One interviewee who was highly familiar with the WRC provided examples that underscore how resources across the website contribute to increasing understanding of wildfire risk and mitigation, both for practitioners and for the publics they work with.

The biggest piece for me as leader of this project was, I needed to get my vocabulary correct—how do we define risk? [This resource] really helped with that, it makes it really clear. I have read the papers, but I don't digest as much as I should, I'm not a scientist (at least, not anymore). This boils it down for managers. Really helpful for how we are talking with the public. But we've used it a lot more than that – we built a story map that uses the iconography and concepts from [the Understand section and glossary], and it links to different parts of the WRC site... COVID meant we had to find ways to communicate without public meetings. We built the story map...it tells the story about our community engagement...we decided this was the right way to do the [National Environmental Policy Act] scoping process. So far it has been received well (10).

making the intended audience for the content on the page clear and explicit so that practitioners in similar roles know whether to share with homeowners and other members of the public. This comment was made for other sections of the website as well and is elaborated further below.

Understand resources

The list of resources at the bottom of the page was received positively by those who commented on it, and titles were familiar to some. Interviewees identified some potential uses for those resources, including referencing them when preparing a Community Wildfire Protection Plan, using them as a basis for an educational curriculum, and providing these resources to engaged or skeptical stakeholders as vetted, legitimate references to support the need for action. One person suggested developers make sure the list of resources is occasionally updated; this person also suggested that, as the resource list expands, developers consider adding a searchable library.

Understand layout and graphics

Responses to the graphics were universally positive. One had used a screenshot of the graphic in an informal presentation with collaborators. Many people liked the clean layout, though one felt it required too much scrolling, especially on the mobile version. Cross-linkages to other parts of the site were cited as helpful, but many interviewees clicked away from **Understand** almost immediately to explore

other parts of the site. This may be because there is not as much content (and content is less interactive) here than in other parts of the site. As one participant with high familiarity noted, “I haven’t used this much...I always want to get into the **Explore** section,” (9). Some suggested adding more pictures or diagrams to illustrate concepts and to make it more eye catching. To address the scrolling issue, one person suggested resizing the graphics on the mobile version.

Reduce Risk

Overview

The **Reduce** section contains several embedded webpages for each of nine topics (home ignition, home hardening, land use planning, wildfire preparedness, community health, wildfire prevention, wildfire response, fuel treatments, and post-fire recovery). Each sub-page contains three sections: “**About**” (some combination of text, infographics, and videos); “**Community Tools**” (large buttons with links, logos, and brief descriptions of national-level organizations or programs that relate to that specific topic); and “**Research & Science**” (white papers and peer reviewed journal articles tailored to each topic). Table 3 summarizes strengths and weaknesses commonly noted by interviewees. This part of the website received more attention than the Understand section, generating many ideas for potential uses and suggestions for how to improve content and functionality.

Table 3. Strengths and weaknesses of the **Reduce Risk** section

Strengths	Weaknesses
All topics relevant	Audience is unclear; some parts are appropriate for homeowners, other parts (like Community Tools) are not
Infographics and videos useful for sharing, communicating with public; resources useful for countering skeptics	Scroll-heavy design is overwhelming; “Community Tools” buttons are large and inefficient use of space
Several programs/ organizations under “Community Tools” were new to some interviewees	“Community Tools” needs to contain or link directly to more tools identified as useful to practitioners in the target audience (not just to external websites that may contain them)

Reduce Risk topics

All nine topics were highlighted as relevant and appropriate by at least one respondent, with home hardening, home ignition zone, land use planning, and community health most often identified as applicable. Most interviewees agreed this was a good list of topics. Several people suggested additional topics, including: evacuation (decision-making, collaboration around, systems used in); biomass (removal, utilization, and economic development of); and community resilience (as either a new topic or an addition to the existing topic of community health). Additionally, collaboration was mentioned by three people as an important crosscutting topic to add, which could include resources about facilitation and best practices for stakeholder engagement related to WRC topic areas. It was noted that collaboration is an important prerequisite for reducing wildfire risk in communities, and it requires specific skillsets, capacity, and willingness to engage, which are not always present in communities seeking to address wildfire risk. Providing such resources could further the WRC’s objective of promoting collaboration.

Reduce Risk page components

The **About** and **Research & Science** components of the **Reduce** pages were well-received, especially by practitioners with public outreach and communications responsibilities, who said they either had or could potentially use the graphics, videos, or references for sharing with landowners, homeowners, stakeholders, and other members of the public. The resources were seen as accessible and shareable on websites or through social media

(discretely or as part of a scheduled campaign), or as presentation graphics or handouts used to educate skeptical homeowners. *“Those home hardening and land use graphics would be useful for our land use staff when they’re talking to people about a new building permit or doing roof or deck work,”* (24). Critical feedback for the **About** section was that some of the graphics were blurry, and they should have higher resolution and be expandable. While some interviewees wanted ready-made, downloadable handouts, others wanted to embed pieces of the WRC (text, infographics, figures, etc.) into their own customized outreach material.

Resources within the **About** and **Research & Science** components were seen as well-vetted and reliable. One person stated, *“I should refer people to this...it’s comprehensive and it’s coming from a national source, so it has a little more weight behind it,”* (4). This might be especially valuable when there are trust issues between a local community and land management agency. An elected official pointed to the general utility of the research & science resources for land use planning, home ignition zones, and home hardening, saying *“Yeah, we’ll be able to use this stuff to justify our actions to the public,”* (26). One land manager was more specifically interested in the topic of fuel treatments: *“...there needs to be more of a discussion about fuels treatments...everyone’s like, ‘HIZ is important and land use planning is important, but don’t cut trees.’ It’s a huge piece of the puzzle. It’s controversial. We need more supporting information,”* (10).

In the **Community Tools** component, some of the programs and organizations were new to some interviewees, including AirNow, Hispanic Access

Foundation, National Wildfire Coordinating Group, and Community Planning Assistance for Wildfire. This section also received the most criticism in terms of layout and efficiency, with some finding the design overwhelming. While the **About** component was seen as providing shareable and accessible information, this section was perceived as being more for practitioners, given their focus on national-level organizations and programs rather than local resources. One person pointed out that the buttons direct you away from the WRC, and instead should automatically open in a new tab, so that users can click around and explore those sites without having to navigate back to the WRC. The large buttons required a lot of scrolling in some cases, and some people felt there was insufficient information provided about what specific tools and resources they would find if they clicked on it. One planner suggested, “*too much scrolling...make it a list, or a matrix that has the service types by organizations that offer them, instead of big buttons*” (22). An elected official stated, “*I don't have time to go digging around on those websites,*” and desired an at-a-glance summary of what they would find there (26).

Expanded content: toolkits and case examples

There were several suggestions for expanded content with the **Community Tools** section, with toolkits for practitioners being the most frequently mentioned. In addition to collaboration toolkits mentioned earlier, several people indicated the potential utility of communications toolkits for practitioners to communicate with different kinds of audiences. Suggested content for these modules included sample language, talking points, and creative commons clipart or high-resolution graphics for inclusion in presentations to the public. There is also interest in understanding and communicating the motivations underlying proactive wildfire mitigation so these examples could be used to hone messaging in different places. Users at several levels were interested in resources around the concept of “risk.” One person wanted tools to assist in communicating with communities about various kinds of risk. These topics might include the social tradeoffs of risk, calculated risk, and understanding proactive risk management. Risk concepts for decision-makers and land managers might include

information about how to take risks and reward risk taking. Elected officials might be interested in materials for communicating with insurers about wildfire risk in their communities.

Some wanted more specific examples of success cases illustrating how to apply particular tools: “*... maybe provide real examples for land use planning; it's good in concept, but it should provide more case studies on how to get to that point of success,*” (5). For example, the Explore section maps areas that are either directly exposed from vegetation, or indirectly exposed from embers or home-to-home ignition. Since this feature goes beyond traditional wildfire risk maps, practitioners would benefit from resources in the Reduce section to help them understand how the type of risk to which areas are exposed can inform county land use planning and building codes (perhaps by prioritizing fuel treatments in indirectly exposed areas, and prioritizing home hardening in directly exposed areas). Rather than developing new case studies from scratch, WRC developers could curate examples from some of the community tools websites they link to, such as the Community Planning Assistance for Wildfire program. It may also be helpful for the WRC to showcase success stories and lessons learned as they occur from practitioners who have used the WRC to facilitate mitigation efforts in their communities.

Multiscale needs

One challenge acknowledged by a few interviewees was that of providing consistent resources at a national scale that are equally applicable at local scales, where conditions and community contexts are highly variable. This challenge is further complicated when targeting resources at audiences that are not well versed in wildfire risk. Many interviewees assumed that the tools were geared towards non-practitioners and were quick to point out the need for more localized resources, including regionally important organizations and programs. When reminded of the target audience of practitioners, many people still felt that the WRC needed to somehow bridge between information at the national level and at least the state level, if not more local, given that many practitioners work at the community scale. Within the community tools section, scalable frameworks and templates

could be developed (or curated from elsewhere) so practitioners could adapt them for local needs.

Further, interviewees suggested that including links to appropriate state-level networks could help inform planning and facilitate conversations. For example, one interviewee stated:

"This is a great spot to start...to the extent that it could provide local or state specific information, that would really add value...we want people to be able to access that stuff. Could the website do that? It probably could. It's a database exercise. Cooperative extension, fire science consortia produce information in their states or regions that are more contextualized to place—in a similar way we're using the mapping tool with the county location, you could enter your location on [the Reduce Risk] page and it could link to a second tier of resources that are regionally or locally relevant. Both [cooperative extension and the fire science consortia] have clear geographic scopes and service needs, they already database all their stuff anyway, so doing a data transfer and making data accessible on this website wouldn't be that heavy of a lift," (7).

This insight applies to other parts of the WRC as well and is elaborated later in the report. Of course, the WRC and Reduce section cannot be everything to everyone; the section's inherent strength is the holistic and comprehensive nature of the topics and their component resources, which could help situate local conversations and encourage the use of a wide range of mitigation actions.

Explore Risk & Spatial Data Download

Overview

Overall, the Explore section with its map viewer, graphical display and accompanying spatial data was well received. Both the "All Lands" and "Populated Places" datasets contain relevant information for reducing wildfire risk, including fire behavior, burn probability, exposure type, and vulnerability. The Explore section also included components related to community population and housing. We summarize the most commonly mentioned and pertinent strengths and weaknesses participants made while reviewing the Explore section (Table 4), and also detail other relevant findings.

Many practitioners are primarily interested in intra-community risk

The Explore section maps wildfire risk nationwide. It explicitly states that it is meant to compare inter-community risk rather than intra-community risk. Several interviewees found the maps and spatial data helpful, with one person saying:

"It's definitely useful at the county scale—which are the communities in the county with the highest vulnerability? Or which have the highest probability that they're going to experience a fire—that one is very straightforward and useful. When you look at it for identifying priority areas for treatments it gets weaker. But it's still a good communication tool...it's also kind of this super trusted source, right? It's going to confirm data that I have. It might be redundant, but it's also... nice

Table 4. Strengths and weaknesses of the **Understand Risk** section

Strengths	Weaknesses
Easy to navigate	Most participants cared more about intra-community risk than between-community risk
No account or login needed	Data too coarse to be used in planning or decision-making
Combination map and graphic was visually appealing	Many practitioners question burn probability, want more transparency about models and sources
"Populated Areas Only" viewer helpful	Glossary is difficult to find
Helps validate other data sources	Concern that lower risk characterization will hinder local mitigation efforts

to be able to lean on something as authoritative as that...Some people need to see it more than one way, and I feel like that's a helpful way to say 'look, I'm not making this up...' A second source is always helpful for people doing outreach," (8).

However, the majority of forestry wildfire practitioners and planners we spoke with worked with a small number of communities (e.g., within one or two counties or one or two watersheds), and as such, they were more concerned about intra-community risk than inter-community risk. There are far fewer practitioners who work at broader regional or state scales, where inter-community risk becomes more important. As noted by a fire protection district representative, "*This tool is approaching useful, it's heading in the right direction... but we are focused on a postage stamp sized area, we need it to be more granular,*" (23). The practitioners who found the most value in the Explore section maps included those who managed national grant programs, or those who worked with a variety of communities spread across multiple states. In those cases, the Explore section maps allowed them to quickly get a snapshot of how different aspects of wildfire risk varied across a variety of diverse and disparate communities.

In order to make the Explore section and spatial data inform proactive planning and be useful for the majority of practitioners who work at the community level, the maps and underlying fire modeling would need to be locally validated and calibrated, and of sufficient resolution and quality to accurately assess intra-community risk, how risk varies between neighborhoods within one community, or how risk varies within one neighborhood. We acknowledge this level of detail is currently beyond the scope and capacity of the WRC developer team. Many interviewees also acknowledged this, with one experienced user saying, "*The relative risk is a brilliant way to attack it. [They] can't give you parcel-level data, but it's great for comparison. That's a genius social science move. And they're very transparent about how they calculated the relative risk,*" (21).

Tension between nationally consistent WRC data and local data

It should be noted that when we discussed the maps in the Explore section, approximately 1/3 of interviewees were aware of state-level spatial wildfire risk data that were comparable to the WRC national-scale wildfire risk data. They often referenced their state's Wildfire Risk Assessment Portal, or in California the Fire and Resource Assessment Program. Interviewees varied in their preference for local, state, and national data, and offered pros and cons for each, depending on their intended purpose. Some participants preferred local datasets when available because they were locally calibrated and validated by local experts; one interviewee said, "*Is this national-level data going to give me the level of detail I need? We need that local calibration before we can use it...it's validating, you can see we have a lot of risk...but from a local management perspective, it's a bit coarse,*" (3). Other interviewees saw a lot of value in the national dataset because it was perceived as a more authoritative source and facilitated comparisons between communities and states. Two local practitioners preferred the WRC to their states' risk portals because they found it easier to use and navigate, with one admitting, "*I haven't used the [state risk assessment] a whole lot, actually. I think I got in there once...but it's not as easy as this [WRC] website. It's clean, easy, and I don't have to login, I hate logging in!*" (22).

Often practitioners would start with one wildfire risk map and switch to another if the first didn't "look right". This occurred when either wildfire risk was consistently high across their entire area of interest despite practitioners perceiving local variation, or when maps indicated low risk across the area of interest when practitioners perceived the area as having high risk. Misalignment between what the wildfire likelihood map showed, and one interviewee's perception of local risk led him to state, "*We don't believe the data... it doesn't sync with my understanding of risk around here, and it makes my job harder,*" (25). However, the interviewee went on to say that they felt the same way about their state's risk assessment as well, pointing to a larger issue with decision support tools that direct resources towards some places and away from others.

Expanding Explore Risk's functionality

While interviewees generally liked the spatial data and maps, they had several ideas for expanded features, such as:

- exporting maps to pdf
- adding custom shapefiles into the Explore section
- exporting WRC spatial data as KML files
- providing WRC data as a web service capable of being pulled into other online mapping platforms and tools such as SimTable

Spatial data maintenance

Some interviewees noted that wildfire risk will change over time: in the short term as wildfires occur, fuel treatments are implemented, and the wildland urban interface expands; and longer-term, as climate change occurs. Burn probability and fire behavior modeling based on historical wildfire occurrence may not be indicative of burn probability or fire behavior in the future. Due to these considerations, the Explore section map and associated spatial data should be regularly updated to stay relevant, as fewer practitioners will want to use out-of-date data.

Examples of use

Several interviewees provided examples of how they had used either the Explore section or had downloaded data to use. Developers had anticipated potential uses like grant applications and public engagement, and several interviewees validated these uses. One user took a screenshot in the Risk to Homes Explore tool to include in a grant application (ultimately successful) to illustrate the high level of risk exposure in the area of interest. Another user directed a colleague who was applying for a grant to the vulnerability information for their community. One collaborative coordinator said, “I could imagine this would be useful for stakeholder engagement, like bringing it up during a meeting. It allows stakeholders to cruise around without requiring ArcMap...it gives the public a place to see [their community] in a broader geographic context,” (3). Three interviewees suggested the WRC had potential utility for identifying communities in which to invest human or financial resources, but acknowledged the data are too coarse to use as a stand-alone for this purpose.

Other reported uses of the Explore section and spatial data include:

- A California practitioner included screenshots illustrating risk from the Explore tool in a Community Wildfire Protection Plan (CWPP).
- Another interviewee working in multiple states had pulled up the Explore tool in public meetings with stakeholders to show relative risk in the early stages of CWPP development.
- A GIS-savvy interviewee used the Risk to Structures data layer to create pre-planning maps for the Emergency Manager, which were used to inform their fire district’s training priority areas, and to designate moderate to high-risk areas for land use codes (albeit unenforced/voluntary compliance).
- A data analyst who works with municipal governments nationwide used Flepgen in a Monte-Carlo based risk model for a client city.

One interviewee provided an example of a less appropriate use of the WRC. A federal employee who interacts regularly with the public provided an example of potential misuse of the Explore tool by a homeowner in a recently developed community adjacent to public lands.

“We had been contacted by somebody in a community who said, ‘you need to restrict exploding targets right now, because we are rated extreme [risk], and look at what it says on this website [the WRC]...Well they weren’t seeing the colors correctly, so I went back and I’m like, that makes no sense... Typically, our lands end up getting grazed down at least once a year, so there’s no fine dead fuels to speak of and we really don’t have a high spread risk down in the area they were talking about...He’s, you know, somebody that is really intent on our agency doing what he wants us to do with fire prevention and fire restrictions... his housing development encroached into that area right where people traditionally went out and did target shooting as they have done for decades, and ride around on four wheelers and whatever. And they don’t like that. They don’t like the shooting and they want to look for reasons to shut it down, and so we responded to them and said ‘no, you’re reading the thing wrong, and while we appreciate

your input that's not how restrictions are decided we don't just do it because you want, and it depends on seasonality and etc.,' you know. Basically, I saw the website used improperly...They were trying to weaponize it" (19).

Still, this interviewee and many others pointed to the value of the Explore section as an engagement and education tool. While data limitations prohibit the WRC from mapping fire risk at fine scales, the site provides nationally consistent maps, graphical representations, community tools and resources, and universal definitions that create a common baseline from which stakeholders, together with practitioners, can have informed discussions.

Other Parts of the WRC

Contact

A member of the developer team pointed out in an interview that they had received few inquiries through the Contact Form. Of the six interviewees who were asked about the Contact Form, half were accustomed to this kind of interface and said they would have no problem using it: "*I would want to know about the inputs on map products. This interface would be sufficient...you'd probably get funneled to an info@ email, but I would be fine using it," (3).* The other half said they would not use it, preferring to email a person directly (preferably someone they know). "*Nobody uses these; if they do, they are thinking hard about it but lack other connections. The key is making sure whoever reads it is well equipped to connect them to the right people (not just resources) at the right scale. The quality of the response they get will determine whether they use it again or not," (7).*

About

We did not ask interviewees to comment on the **About** section, but we did direct several people there as questions arose. Many of the comments and questions we heard (e.g., about who the audience is, or why you can't zoom in further on the map) are directly addressed in the FAQ. People commented that this section was helpful once they were able to find it. We recommend linking to the FAQ from the Home page or finding other ways to elevate FAQ visibility on the site. In addition to the FAQ, there is a section explaining the federal policies context underlying the WRC. One proactive interviewee

that had looked at this section ahead of time stated "*good job on the **About** page... I'm fond of it being an Act of Congress to create a legitimate website that recommends specific agencies and datasets" (11).*

Conclusions and Recommendations

Appropriateness of Content

The WRC includes a wealth of information about the components of wildfire risk. It defines complex terminology, maps components of wildfire risk consistently, and provides a variety of community resources and tools that stakeholders can use to reduce wildfire risk. Overall, the WRC aligns with a broad range of recent research and scientific consensus on wildfire risk, wildfire risk assessments, and wildfire mitigation (Calkin et al., 2014; Smith et al., 2016; McCaffery et al., 2013). This body of literature has developed foundational principals and overarching conceptual models of wildfire risk management in the wildland urban interface. This research often frames the primary objective as community protection and reduced home loss, but also takes into account fire behavior, ecology, social dynamics, vulnerability, and the specific risk reduction actions stakeholders can take. For example, Calkin et al. (2014) frame the overarching objective as one focused on reducing home loss. Along with articulating various sub-objectives (reducing wildfire occurrence, addressing development in fire prone areas, increasing resistance to home ignition, and reducing home susceptibility to loss) this work recommends specific mitigation actions (preventing ignition, managing vegetation, preparedness and suppression response, smart land use and zoning, and managing the home ignition zone), and identifies the primary stakeholder group responsible for each. The WRC addresses each of these components in detail. Likewise, it addresses these components in an integrated fashion as per Smith et al. (2016), who frame wildfire risk as a social and ecological challenge requiring a solution that integrates multiple lines of research and scientific disciplines into community preparedness, mitigation, and response. Further, the WRC addresses a diverse range of topics, many of which overlap with a synthesis of social science

research on wildfire mitigation. McCaffery et al. (2013) note the importance of understanding relevant social dynamics in areas with high wildfire risk, and the importance of the wide range of topics and concepts that must be utilized holistically to address wildfire risk to communities. The WRC adequately addresses the components, issues, and needs identified by this body of research. It frames the primary challenge in similar terms to these research efforts, and through the various components on the website, it incorporates the majority of sub-objectives, actions, and relevant stakeholders critical to addressing wildfire risk. Importantly, it does so in a way that is scientifically grounded, visually appealing, and easily understandable to a broad audience.

The WRC takes an innovative approach to mapping wildfire risk consistently across the United States. It promotes standardized terminology on risk and provides a range of community tools and resources that practitioners and local-level decision makers can use to reduce wildfire risk in their communities. It is one of the first easily accessible tools that can assess different aspects of wildfire risk and compare risk between communities using a nationally consistent and appropriate methodology. The WRC explicitly states it is not a formal wildfire quantitative risk assessment (Scott et al., 2013), nor is it designed to replace state-level assessments or assess intra-community risk. That said, it still fills an important niche and is a high-quality resource for inexperienced practitioners who need to quickly learn about wildfire risk in their community and the wildfire mitigation actions they need to consider. If maintained, it will continue to provide valuable spatial data that will prove useful for practitioners in areas not covered by a state wildfire risk assessment portal. While the extent to which the WRC will promote collaboration and foster community conversations about reducing wildfire risk is yet to be seen, it includes many of the components that are necessary prerequisites for those endeavors.

Audience

The WRC website describes its audience as “municipal, county, and state elected officials; land use planners; fire managers; and fire collaboratives...” with potential utility for “other departments in

state, county, and municipal governments, as well as neighborhood associations.” This encompasses a wide range forestry and wildfire practitioners and decision makers who work at various scales and have varying degrees of agency over different aspects of wildfire risk, mitigation, and community protection. Overall, much of the information on the WRC is appropriate for these audiences, who are well positioned to reduce wildfire risk in communities. As indicated in the Understand section findings, a critical audience for the WRC is new foresters and wildfire mitigation practitioners in under-resourced agencies. Practitioners whose expertise lay in another field tended to assess the WRC as more valuable; the less professional experience these new forestry and wildfire practitioners had to begin with, the more valuable the WRC tools and resources were. While this general observation should be evaluated further, it speaks to an opportunity for the WRC to potentially educate a wide range of practitioners and is a consideration for designing future outreach efforts.

Homeowners: an accidental audience

A recurring theme across many interviews was confusion about the intended audience, and specifically how different parts of the website seemed to be geared towards different audiences. One interviewee said, “you need to figure out who this is for. A practitioner can handle a lot more content, detail, and nuanced analysis. Homeowners are going to find this—if it’s not for them, steer them away” (22). Another practitioner echoed this idea, saying “make sure the audience is clear. It’s useful to me and my coalition partners, but not useful for me in my role as a public educator” (18). Regardless of whether they felt it was appropriate for homeowners or not (many did), interviewees largely agreed being clear about the intended audience is vital for any website.

Homeowners and the general public are explicitly excluded as a target audience for the WRC. (the FAQ states that “while not designed for individual homeowners, the website may offer helpful and informative resources for this audience”). Developers were intentional and transparent about this, acknowledging that the data are not appropriate for assessing risk at the individual home or neighborhood scale. However, the WRC is

designed to be attractive, accessible, and easy to use, so it appeals to audiences beyond those targeted. In addition to the title of the website, the accessibility of some of its components (such as the terminology and graphics on the Understand section and some of the entry-level information in the “about” portion of Reduce topics like Home Ignition Zone and Home Hardening) led some interviewees to think the WRC is intended for engaged community members, including homeowners looking for information on wildfire risk. Despite homeowners not being the intended audience, the WRC website is being shared widely through a variety of networks (e.g., Fire Adapted Communities) and regardless of intent, is still being accessed by homeowners and community members. Several of our study participants noted they shared or intended to share the WRC with this audience, and voiced concern that the target audience should be made clear to avoid potential misinterpretation of information or confusion.

The intended audience is stated on the WRC’s landing page, but the viewer must scroll down past the hero image to read this text. Perhaps the simplest fix would be reducing the size of that image on the landing page, so viewers realize there is more content if they scroll down. Given the wide appeal and potential utility of the WRC to different audiences, however, developers could find ways to indicate the specific material appropriate for different audiences. While this could be as complicated as restructuring the website around different user profiles and points of entry (suggested by some interviewees), a more feasible approach might be creating a separate page or pop-up to redirect homeowners and non-practitioner community members to appropriate sections of the website, and perhaps even suggest how they might find locally appropriate resources, or use the resources provided. Another potential avenue for increased outreach to target various audiences relates to highlighting case studies and examples of how others have used the WRC for different applications (e.g., mapping, planning, or community engagement). Video tutorials either embedded on the WRC website or on a platform like YouTube could provide examples illustrating how different audiences might use community tools, resources, maps, or spatial data; they could also show

how individuals have used the website in innovative ways, as a means of encouraging others to do the same.

Linking to State & Local Resources

The WRC has an abundance of information, spatial data, and community tools and resources. By design most are national in extent. This provides standardization and suggests to website visitors that information is coming from reputable sources. Several interviewees suggested including links to state or local resources—interviewees emphasized that doing this could help catalyze action in at-risk communities. Numerous interviewees noted that it would be difficult for website visitors unfamiliar with local wildfire mitigation efforts to know how to start, i.e., how to take action locally in their own community. Consider a homeowner who is forwarded the link to the WRC website from their local US Forest Service Public Information Officer. While the website provides general information about wildfire risk in their community via the Explore Section, and general strategies to mitigate risk in the Reduce Section, it does not provide that homeowner with locally relevant information or a way of connecting with local resources or managers.

Linking to state-level organizations (e.g., State Forest Service, State Fire Adapted Communities, Firewise, state-level networks of forestry collaboratives, university extension units, state wildfire risk assessment portals, or Firesafe Councils) would provide website visitors a way of learning more about locally relevant information, efforts, and opportunities, and potentially lead them to contact information for local organizations focusing on wildfire mitigation. It could better direct them to locally relevant resources to answer questions like, ‘*How can I get started mitigating my home?*’ and ‘*who do I call first?*’. We recognize the impracticability of connecting to hyper-local community focused groups, initiatives, and information, which may change frequently over time, but providing links to state-level organizations would be a valuable addition and may be a workable compromise. Linking to state-level organizations would provide a way for website visitors to learn more about local efforts and opportunities, and provide contact

information for local specialists. Connecting website visitors with state-level resources could be one way of helping bridge the gap and achieve the WRC goals of promoting collaboration and facilitating the community conversations critical to addressing wildfire risk. As one interviewee stated, “*Behavior won’t change unless you make the connection to people on the ground, websites won’t do it,*” (20). While this quote speaks to the fundamental challenge faced by the WRC, providing state-level resources could get information consumers one step closer to taking action, enabling them to more easily find relevant local resources, opportunities, and contacts for risk mitigation in their area.

Reaching Underserved Communities

The interviewees we spoke with represented a range of communities with variable resources at their disposal to plan for and mitigate wildfire risk. We spoke with practitioners who worked for both high- and low-capacity organizations, and practitioners who worked with both affluent and underserved communities. This speaks to the vast social and ecological differences between communities across the West (let alone across the nation), and in turn, the wide range of need and capacity for reducing wildfire risk. Some states have more resources for wildfire risk and mitigation activities than others. For example, many practitioners in the generally well-resourced state of California were already aware of many of the community tools and resources presented in the WRC, with one stating:

“I had looked through this site before and thought it was great, though not for California—we’re beyond this level...it will be good for community groups that are just getting started... But once they’ve got the basics, I would want them to look at the FRAP data...That said, something that works for California may not work for the rest of the country” (12).

Several practitioners that identified as well-resourced, regardless of their geographic location, were already using the same material (e.g., Ready, Set, Go), and/or had developed their own similar, yet locally relevant, guidance and outreach material. Similarly, practitioners in these communities often had access to local spatial wildfire risk data

(quantitative risk assessments, fuelscape, fire models, etc). Some appreciated the redundancy and availability of multiple data sources, while others felt it was at best unnecessarily duplicative, or at worst confusing and contradictory.

There were some indications that the WRC could be of particular value to practitioners in under-resourced communities. “*It’s good for people lacking data, and folks at the county and sub-county level could really benefit because it describes things that they may not be familiar with*” (19). Another suggested that the WRC should do more to attract tribes by providing resources directly relevant to them. Several of the community tools in the Reduce section were new to two of the three people we interviewed from Utah, and one of them said “*this will be useful for people that do mapping in Utah...there isn’t much information available, and communities are really stubborn, you need evidence*” (26).

Some interviewees felt that the WRC would be helpful for under-resourced communities but only if it also linked to locally relevant resources on the addition of certain features, such as links to more local resources. “*Rural communities in [my] county are run by volunteers. They need something like this, but to be useful it would need to link back to local resources*” (23). Others pointed out that making the population vulnerability layer in the Explore section spatial would enhance their ability to serve under-resourced communities: “*we need to know where on the landscape those underserved populations are that need help*,” (4).

Language and English literacy barriers

Language barriers and English literacy were additional concerns that related to working with underserved communities. Some of the interviewees noted that the WRC information would be helpful in the communities they worked with, but was impractical because of the language barrier. Some communities had low English literacy rates. Translating the WRC into other languages would expand access to this information for traditionally underserved communities. Spanish and Hmong were the two languages that interviewees specifically identified as a need, but this would vary by community. While most participants noted that the Understand section was generally interpretable for

a lay audience, some also noted residents with poor English reading skills would struggle to understand concepts and definitions therein.

Outreach & Awareness Building

The WRC launched in April of 2020. The launch included social media advertisements and webinars. Outreach was also pushed through USFS regional offices, the Fire Learning Network, and Landfire, which hosted two webinars (“Data, Science and Methods behind the WRC” and “Using the WRC website”). After the initial outreach, additional outreach during the summer and fall of 2020 included feature articles about the WRC in the Rocky Mountain Research Station’s Science Spotlight and the National Fire Protection Association Journal. There have been several updates to the WRC since then, after which, the WRC was again promoted through various outlets. The WRC launch likely suffered from poor timing, coinciding with both the escalation of the global COVID-19 pandemic and a bad wildfire season in the western United States.

While we did not analyze data related to website traffic, brief snapshots of analytics on website visitation provided by Headwaters Economics indicate both increased total traffic, and an expanding geographic distribution of visitors over time. Given this, the WRC may wish to capitalize on this trend and build more awareness about the WRC platform. At least 38% of the practitioners we interviewed had low familiarity with the WRC prior to our interview. Several interviewees only visited the website for the first time after we initially contacted them about the WRC evaluation we were conducting. Some but not all participants briefly explored the website to prepare for the interview.

Further, when we were walking participants through the different website components during the interview, they noted that, although they had previously visited the website, they had not found all the information and content we introduced them to. This may be because they reviewed it quickly or could be related to larger and more systematic issues related to website navigation. While interviewees felt the layout of the WRC was easy to navigate overall, it contains a great deal of information, much of which is cross-linked in multiple parts of the site.

This should make that information easier to find, but it may also cause the user to get disoriented or distracted as they move through the website, potentially missing valuable information. The WRC development team could consider using this same sort of walk-through approach we used during the interview during future targeted outreach. This could ensure users are aware of the website’s full range of functionality and components. Additional ideas for analyzing website analytics are discussed below in Future Research.

Throughout our interviews we noted specific organizations that may benefit from additional targeted outreach. These include state forestry organizations, the National Association of Conservation Districts, Firewise Communities, Firesafe Councils, the Western Governors Association, Association of State Foresters, and other groups who employ community foresters such as counties and other local governments. These groups often employ practitioners who engage with the public but may not have sufficient resources or capacity to develop their own educational and outreach material, nor have the capacity to develop or use fire models or other spatial data on wildfire risk. These groups in particular may have unmet needs, and if made aware of the WRC, may be especially receptive to it.

Intentional coordination with other federal agencies was recommended by one interviewee, who felt the WRC would reach a wider audience if it were less Forest Service-centric. *“I know that they were tapped by the Congress to [develop the WRC] in the Omnibus Bill...it’s on behalf of the country, it should reflect that this isn’t just about National Forest system lands and their neighbors. USFS isn’t the only agency responding to wildfire. There should be more interagency cooperation,”* (19). This suggestion of increasing cooperation to help develop and promote the WRC with other federal agencies, as well as state-level actors, could create additional buy-in publicity and avenues for outreach to expand the audience.

Future Research

This evaluation generated several ideas for potential future research. We frame these ideas as questions that the WRC development team could investigate to inform future updates.

How can the WRC help meet the needs of underserved or low-income communities?

Our study anecdotally supports the conclusion that the WRC may be of particular value to under-resourced indigenous tribes, states, and rural communities. This speaks to the potential for targeted outreach to these groups to raise their awareness of the tool and how to use it. However, the developers may wish to first better understand their unique needs and capacity related to mapping wildfire risk, perhaps through additional follow-up with some of these populations, perhaps using focus groups.

Who is the WRC reaching, and is it reaching its target audience?

While our initial evaluation provided an in-depth perspective from a diverse range of practitioners, a widespread survey would be a better tool to assess overall reach, and help answer some of the initial questions posed by the development team, such as ‘*who is the WRC reaching, and are they the target audience?*’ A survey would also be valuable if the development team was interested in a more robust evaluation of whether the website is meeting its goals. Questions about how different segments or groups are using the WRC differently could also be addressed through a combination of categorical and scale metrics. Surveys could also gather feedback to help prioritize certain kinds of updates or the addition of new features. Surveys could be distributed through key national or regional networks such as those described above. Open-ended questions could also identify novel uses or successful applications of WRC tools. Analysts could then follow up with respondents to gather richer information and develop user case studies and success stories.

How and why is WRC usage changing over time?

Pairing surveys with deeper analysis of web metrics already being collected by developers could identify and even explain changes in usage over time and identify regional hotspots of use. This effort could also assess differences in visitation and use between the different website sections using either total visits, unique users, or time on page. Cumulatively these analyses could be used to inform effective outreach strategies. The development team could also assess if website visitation increases following outreach efforts; for example, conducting outreach in a particular state that lacks a statewide risk assessment may result in increased visitation as compared to outreach in states that are already well-resourced.

References

Calkin, David E., et al. “How risk management can prevent future wildfire disasters in the wildland-urban interface.” *Proceedings of the National Academy of Sciences* 111.2 (2014): 746-751.

McCaffrey, Sarah, et al. “Social science research related to wildfire management: an overview of recent findings and future research needs.” *International Journal of Wildland Fire* 22.1 (2012): 15-24.

Scott, Joe H., Matthew P. Thompson, and David E. Calkin. “A wildfire risk assessment framework for land and resource management.” (2013).

Smith, Alistair MS, et al. “The science of firescapes: achieving fire-resilient communities.” *Bioscience* 66.2 (2016): 130-146.

Appendices

A. List of Suggestions

The following list compiles suggestions we recorded during the assessment, some of which were not included elsewhere in this report. They are organized by website section and our estimate of how feasible they are to implement. Minor or short-term changes would be relatively easy fixes to improve user experience of the website. Medium or longer-term changes may be more involved but might still be relatively “light lifts.” Items under the “Wish list” heading were ideas we heard that would likely require more substantial changes, and a greater investment of time and resources for the development team and may not be feasible or desirable.

Understand Risk

- Minor/Short-term Changes
 - “Updates” button at the bottom of page: for button beside “Stay informed about Wildfire Risk to Communities”, consider changing text from “Updates” to “Subscribe” or “Connect with Us.” This would 1) communicate action, and 2) better reflect the destination tab’s contents.
 - Link to the Glossary from this page
- Medium/Longer-term Changes
 - Continue to refine and improve the explanation for susceptibility
 - A few additional graphics or images to illustrate concepts could help, but not too many: several interviewees found the graphic for “susceptibility” helpful for understanding this concept and thought additional graphics might increase engagement on the Understand page. However, interviewees also liked the clean and modern layout, and too many images could cause clutter.
 - Keep the list of resources up-to-date
 - Consider adding a searchable library of publications and resources (including the articles and publications listed in other parts of the website)

Reduce Risk

- Minor/Short-term Changes
 - Have links for Community Tools open in a new tab
 - Acronym check: the “Home Hardening” page diagram presents “WUI Code Concepts for the Home” without defining WUI
 - Improve the resolution of graphics and make them expandable
- Medium/Longer-term Changes
 - Redesign the layout for the Community Tools section, making more efficient use space (e.g., make the buttons smaller, or include a summary of the information and specific tools that can be found there)
 - Continue to add new resources as they become available
 - Add sample language, talking points, and creative commons clipart or high-resolution graphics and make it available for download so people can include it in outreach material and presentations to the public
 - Showcase success stories/ lessons learned from WRC users applying the tool in their communities

- Wish list

- Add or expand topics and resources to address:
 - » Collaboration (collaborative process, facilitation skills, collaborative planning tools, etc.)
 - » Risk communication (social tradeoffs of risk, calculated risk, how to take risks and reward risk-taking, understanding proactive risk)
 - » Understanding motivation for doing wildfire mitigation work
 - » Evacuation (decision-making, collaboration around, systems used in)
 - » Resources for indigenous tribes
 - » Community resilience
 - » Insurance (how to keep them in your community)
 - » Biomass (removal, utilization, and economic development of)
 - » Affordable options for each topic (e.g., cleaning gutters for home hardening)
- Provide or link to case studies illustrating successful application of various tools
- Within the community tools section, develop scalable frameworks and templates (or curate from elsewhere) that practitioners could adapt for local needs.

Explore Risk/Spatial Data

- Minor/Short-term Changes

- Glossary
 - » When pointed out, interviewees found the glossary quite helpful, but many didn't realize it was there. Highlight, bold, or change the color of the underline beneath glossary terms in the left panel so that viewers recognize the terms are linked to additional content
 - » Have a “teaser” definition pop up when the cursor hovers over a defined term
 - » Place the Question Mark glossary icon in the sidebar header (to the right of “Exposure Type”, “Risk to Homes” etc.)
 - » Consider adding a definition of ember transfer

- Interactive Map

- » Upon finding their communities, several interviewees tried to zoom into their neighborhoods, and felt other users would try to do the same. Explain why users can't zoom in past a point. This could be a pop-up text box that says “Why can't I zoom more?” that links to the FAQs section “What are the limitations of this data?”
- » If someone navigates to a new community on the map, allow them to click something to automatically navigate to that location and update the data.

- Sidebar

- » Provide link to data sources or dataset used in the model in the sidebar; provide a link to the methods paper
- » Provide quantitative explanation of what “lower” and “higher” mean for risk and likelihood (e.g., have explanation of log scale pop up when you hover over it)

- Medium/Longer-term Changes

- Make the sidebar graphics more interactive (e.g., clicking on a dot for “risk to homes” takes you to the data for that community)
- Expand features and functionality of Explore Risk, such as exporting maps to pdf; adding custom shapefiles into the Explore section; exporting WRC spatial data as KML files; providing WRC data

- as a web service capable of being pulled into other online mapping platforms and tools such as SimTable
 - Keep the spatial data up-to-date (e.g., updating the fuel scape to account for recent wildfires)
 - Allow users to look at the full map of the US without having to type in a state
- Wish list
 - Population Vulnerability:
 - » Make this data spatial
 - » Add categories for deaf populations, people with respiratory difficulties, any available data on transient populations, and additional income metrics
 - Add data layers:
 - » Road networks
 - » Ignition sources
 - » Major fire perimeters
 - Model:
 - » Prevailing winds and smoke, smoke impacts
 - » Risks to other socio-economic values, water supply, watersheds
 - Provide a high-level video tutorial for practitioners interested in learning about how to use the downloadable datasets

Other parts of the WRC

- Contact
 - Ensure that inquiries submitted through the Contact page continue to receive timely and high-quality responses
- About
 - Make the FAQ section easier to find
 - Link to the FAQ from the Home page
- Home
 - Reduce the size of the hero image on the landing page, so viewers realize there is content describing the intended audience if they scroll down

Overall Website

- Translate into additional languages
- Add tutorials illustrating how different audiences might use community tools, resources, maps, or spatial data
- Provide case studies and examples of how others have used the WRC for mapping, planning, or community engagement purposes (these could be short videos)
- Icons and symbology use:
 - Make sharing permissions clear: include a statement somewhere that addresses copyright restrictions and answers the question “Can I use these icons and symbols in a presentation or elsewhere?”
 - Allow practitioners to download graphics for their own use: if they are available to use freely, consider providing a downloadable slide deck, clip art, etc.

B. Decision Points

This report is intended to provide actionable feedback for the development team as they consider how best to maintain, improve, and potentially expand the WRC initiative. While the minor and moderate fixes and Wish list suggestions are presented above, below we present several larger overarching questions or decision points. Unlike the fixes and suggestions above, these questions should be more thoughtfully considered. They represent different directions the WRC could take and have the potential to guide future content, applicability and utility of the WRC.

1. Who is the audience for different parts of the WRC?

a. The WRC appeals to a wide audience, and different parts are appropriate for different audiences, including “unintended” audiences like homeowners, the press, etc. Identify the appropriate information for these different (and overlapping) audiences and look for ways to direct them to the right places on the website. There are implications for expanding or restricting this intended audience. A wide variety of stakeholders must be involved if the WRC is to facilitate community conversations and help catalyze actions, but doing so complicates website design and stakeholder engagement

2. How should the Developer Team target future outreach?

a. How does the WRC development team intend to conduct future outreach? Does it have the capacity to conduct the intended outreach? Should outreach efforts be standardized or tailored for unique audiences? While it might necessitate additional resources to tailor outreach to specific and curated audiences, it will likely be more impactful and could encourage more widespread use. A more formal needs assessment of underserved communities may help improve engagement. Partnering with other federal agencies and including new initiatives and resources could also help guide outreach and help the WRC stay relevant.

3. How to best address the scale mismatch between a national wildfire risk website and local action?

a. The WRC is a national website yet states its objectives are to inform proactive planning, facilitate conversations and mitigate wildfire risk at community scales. Truly facilitating these actions at the local level will require locally relevant spatial data, information, and resources. Tailoring this information to communities could more impactfully affect change. The development team must decide if it is satisfied with the content and national scale as it exists, or if it wants to dive deeper to provide more locally relevant information. Depending on that decision, it should assess the capacity for and resources needed to do so. Providing state-level resources could get information consumers one step closer to the local level so they can more easily find relevant local resources, opportunities, and contacts for risk mitigation in their area. Connecting practitioners to state-level grants databases, risk assessment portals, and organizational networks would also help catalyze actions.