Land Management Research Program
Prepared in cooperation with the Joint Fire Science Program

# 2021 Assessment of the Joint Fire Science Program's Fire Science Exchange Network

Scientific Investigations Report 2022–5052
Version 1.1, July 2022

U.S. Department of the Interior
U.S. Geological Survey

**Covers.** View of the Tunnel Fire seen from Bonito Park on April 19, 2022. [Photograph by U.S. Forest Service.]

# 2021 Assessment of the Joint Fire Science Program's Fire Science Exchange Network

By Natasha Collins, James Meldrum, Rudy Schuster, and Nina Burkardt

Land Management Research Program
Prepared in cooperation with the Joint Fire Science Program

Scientific Investigations Report 2022–5052
Version 1.1, July 2022

**U.S. Department of the Interior**
**U.S. Geological Survey**

U.S. Geological Survey, Reston, Virginia: 2022

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment—visit https://www.usgs.gov or call 1–888–ASK–USGS.

For an overview of USGS information products, including maps, imagery, and publications, visit https://store.usgs.gov/.



Suggested citation:
Collins, N., Meldrum, J., Schuster, R., and Burkardt, N., 2022, 2021 assessment of the Joint Fire Science Program's Fire Science Exchange Network: U.S. Geological Survey Scientific Investigations Report 2022–5052 (ver 1.1, July 2022), 109 p., https://doi.org/10.3133/sir20225052.

Associated data:
Schuster, R., Collins, N.H., Meldrum, J.R., and Burkardt, N., 2022, Online survey responses from users of the Joint Fire Science Program Fire Science Exchange Network from February 2021: U.S. Geological Survey data release, https://doi.org/10.5066/P9KA686Y.

ISSN 2328-0328 (online)

## Acknowledgments

We thank Ed Brunson, Karen Dante-Wood, and Molly Hunter from the Joint Fire Science Program Office for their feedback throughout the research process and facilitation of meetings with the JFSP Board. We thank the Joint Fire Science Program Board and especially Board advisors for their engagement and feedback. We thank the Fire Science Exchange Network program coordinators for their time and assistance in disseminating the survey. We thank Chris Lemieux and Kerry Grimm for their participation and valuable feedback in the peer review process. We also thank Kerry Grimm for her insights and conversation on the survey content and science topics. Lastly, we thank all the Fire Science Exchange Network respondents who took the time to respond to the survey.

Thank you to the following U.S. Geological Survey colleagues for their contributions to this report: Crista Straub, who helped with online survey formatting; Christopher Huber and Lucas Bair, who piloted our survey; and finally, Eric Larson and Stacy Lischka, who provided previous work on importance-performance analysis.

# Contents

Acknowledgments .....iii
Abstract .....1
Introduction .....1
Importance-Performance Analysis (IPA) .....3
Network Analysis .....3
Methods .....4
Phase One—Literature Review .....4
Phase Two—Survey Methods and Analysis .....4
Survey Development and Data Collection .....4
Survey Content .....6
Respondent Characteristics and Science Topics .....6
Importance Performance Analysis (IPA) .....7
Network Analysis .....7
Joint Fire Science Program Objectives .....8
Response Rate and Analysis .....8
Findings .....11
Phase One Results—Literature Review .....11
1) Scope of the JFSP FSEN Mission .....11
2) Number and Configuration of Exchanges .....12
3) Distribution of Resources .....13
4) Centralization of the network .....14
Summary of Phase One Results .....15
Phase Two: Survey Results .....15
Respondent Characteristics and Participation .....15
Importance-Performance Analysis for Key Science Topics .....24
Importance-performance Charts by Science Topic .....28
Network Analysis for Key Science Topics .....43
Information Gathering from the Exchange Network by Science Topic .....68
Prioritization of Fire Science Exchange Network Objectives .....87
Prioritization of Objectives by Respondent Location .....92
Summary .....96
Groupings of Exchanges .....97
Western Exchanges .....97
Eastern Exchanges .....98
Other (Independent) Exchanges .....99
Conclusions, Limitations, and Future Work .....100
References Cited .....101

## Figures

1. The 15 regional fire science exchanges of the Fire Science Exchange Network .....2
2. Example of the four-quadrant importance-performance analysis grid .....7
3. Example of a Sankey diagram untrimmed and trimmed for wildlife .....9

4. The number of regional fire science exchanges respondents participate in ....16
5. The proportion of respondents in each location who subscribe to their corresponding exchange ....17
6. Sankey diagram showing the participation of respondents in their location versus other regional fire science exchanges ....19
7. The affiliation of the Fire Science Exchange Network survey respondents with different organizations and groups....20
8. The number of regional fire science exchanges respondents participated in according to their work affiliation....21
9. The number of regional fire science exchanges respondents participated in according to their primary work role....22
10. The number of regional fire science exchanges respondents participated in according to their scope of work....23
11. The level of experience in wildland fire management and science of survey respondents....24
12. Frequency at which respondents selected each science topic for follow-up questions in the survey....25
13. Four quadrant importance-performance analysis graph displaying the relative importance and performance of the 16 science topics averaged across all survey respondents....27
14. Importance-performance analysis quadrant displaying how survey respondents rated the importance and performance of information for prescribed fire....29
15. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for fire behavior ....30
16. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for firefighter safety and incident management ....31
17. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for invasive plant species ....32
18. Importance-performance analysis quadrant displaying how respondents representing their regional fire science exchange location rated the importance and performance of information for wildland urban interface and infrastructure....33
19. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for post-fire recovery and management....34
20. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for vegetation....36
21. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for fuels management....37
22. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for fire regimes....38

23. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for smoke, air quality, and health.......39
24. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for wildlife.......40
25. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for soil.......41
26. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for watershed processes.......42
27. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for economic impacts.......63
28. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for social science and human dimensions.......45
29. Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for Indigenous knowledge.......46
30. The reliance of survey respondents on three different sources for information on wildlife.......48
31. The reliance of survey respondents on three different sources for information on invasive plant species.......49
32. The reliance of survey respondents on three different sources for information on vegetation.......50
33. The reliance of survey respondents on three different sources for information on watershed processes.......51
34. The reliance of survey respondents on three different sources for information on post-fire recovery and management.......52
35. The reliance of survey respondents on three different sources for information on fire behavior.......54
36. The reliance of survey respondents on three different sources for information on fire regimes.......55
37. The reliance of survey respondents on three different sources for information on fuels management.......56
38. The reliance of survey respondents on three different sources for information on prescribed fire.......57
39. The reliance of fire science exchange members on three different sources for information on smoke, air quality, and health.......58
40. The reliance of survey respondents on three different sources for information on wildland urban interface and infrastructure.......60
41. The reliance of survey respondents on three different sources for information on firefighter safety and incident management.......61
42. The reliance of survey respondents on three different sources for information on social science and human dimensions.......62
43. The reliance of survey respondents on three different sources for information on economic impacts.......63

44. The reliance of survey respondents on three different sources for information on soil ....64
45. The reliance of survey respondents on three different sources for information on Indigenous knowledge ....65
46. The average reliance of survey respondents on their regional exchange for all 16 science topics ....66
47. The average reliance of survey respondents in the 15 locations on their regional exchange for each of the 16 science topics ....67
48. Flow of information gathering from respondent location to all 15 regional fire science exchanges for wildlife ....69
49. Flow of information gathering from respondent location to all 15 regional fire science exchanges for invasive plant species....70
50. Flow of information gathering from respondent location to all 15 regional fire science exchanges for vegetation ....71
51. Flow of information gathering from respondent location to all 15 regional fire science exchanges for prescribed fire....73
52. Flow of information gathering from respondent location to all 15 regional fire science exchanges for watershed processes ....74
53. Flow of information gathering from respondent location to all 15 regional fire science exchanges for post-fire recovery and management....75
54. Flow of information gathering from respondent location to all 15 regional fire science exchanges for social science and human dimensions....76
55. Flow of information gathering from respondent location to all 15 regional fire science exchanges for Indigenous knowledge....78
56. Flow of information gathering from respondent location to all 15 regional fire science exchanges for fire behavior....79
57. Flow of information gathering from respondent location to all 15 regional fire science exchanges for fire regimes....80
58. Flow of information gathering from respondent location to all 15 regional fire science exchanges, including themselves for firefighter safety and incident management....82
59. Flow of information gathering from respondent location to all 15 exchanges for fuels management....83
60. Flow of information gathering from respondent location to all 15 regional fire science exchanges for smoke, air quality, and health....84
61. Flow of information gathering from respondent location to all 15 regional fire science exchanges for wildland urban interface and infrastructure....85
62. Flow of information gathering from respondent location to all 15 regional fire science regional exchanges for economic impacts....86
63. Flow of information gathering from respondent location to all 15 regional fire science exchanges for soil....88
64. The average reliance of survey respondents on “other” exchanges in the Fire Science Exchange Network across all 16 science topics....89
65. Reliance of survey respondents on other exchanges in the Fire Science Exchange Network across the 16 science topics....90
66. The prioritization of the six Joint Fire Science Program objectives divided into nine subobjectives and ranked by respondents out of 90 points ....91

67. Stacked graph of the prioritization of the six Joint Fire Science Program objectives divided into nine subobjectives by the 15 regional fire science exchange respondent locations....92
68. The prioritization of the “sharing information” objective according to Fire Science Exchange Network respondent location ....92
69. The prioritization of the “building relationships” objective according to Fire Science Exchange Network respondent location ....93
70. The prioritization of the “demonstrating research on the ground” objective according to Fire Science Exchange Network respondent location....93
71. The prioritization of the “synthesis of information” objective according to Fire Science Exchange Network respondent location ....94
72. The prioritization of the “supporting adaptive management” objective according to Fire Science Exchange Network respondent location....94
73. The prioritization of the “listing and describing information” objective according to Fire Science Exchange Network respondent location....95
74. The prioritization of the “identifying new research needs” objective according to Fire Science Exchange Network respondent location....95
75. The prioritization of the “assessing the applicability of research” objective according to Fire Science Exchange Network respondent location....96
76. The prioritization of the “assessing the quality of research” objective according to Fire Science Exchange Network respondent location....97

## Tables

1. Overview of literature provided by Joint Fire Science Program Board for secondary review....5
2. The 16 key fire science topics and definitions as presented in the 2021 Fire Science Exchange Network survey ....6
3. Science topic importance response categories, criteria, and five-point scoring system used for all 16 science topics ....7
4. Science topic performance question response categories, criteria, and five-point scoring system used for each topic ....8
5. Reliance on information source question response categories, criteria, and five-point scoring system used for each topic ....8
6. List of original six Fire Science Exchange Network objectives and subcomponents ....10
7. Number of respondents for the survey compared to the total number of subscribers and invitations sent....10
8. The number of survey respondents from each of the 15 Fire Science Exchange Program regional exchanges, with self-identified respondent location and the number of survey respondents who said they participate in each of the exchanges....15
9. The number of regional fire science exchanges respondents participate in ....16
10. Number of respondents who participate in each regional fire science exchange according to their location....18
11. Primary role and scope of the Fire Science Exchange Network survey respondents’ work....20
12. The number of regional fire science exchanges respondents participated in according to their work affiliation....21

13. The number of regional fire science exchanges in which respondents participated according to their primary work role ....22
14. The number of regional fire science exchanges respondents participated in according to their scope of work ....23
15. The frequency that respondents from the 15 regional fire science respondent locations selected each science topic as one of the top one to three topics in the survey that are relevant to their work ....26
16. Statistics for importance performance analysis displaying average values across all responses for importance and performance ....27
17. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for prescribed fire ....29
18. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for fire behavior ....30
19. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for firefighter safety and incident management ....31
20. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for invasive plant species ....32
21. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for wildland urban interface and infrastructure ....33
22. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for post-fire recovery and management ....34
23. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for vegetation ....36
24. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for fuels management ....37
25. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for fire regimes ....38
26. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for smoke, air quality, and health ....39
27. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for wildlife ....40
28. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for soil ....41
29. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for watershed processes ....42
30. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for economic impacts ....44
31. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for social science and human dimensions ....45
32. Statistics for importance and performance across all Fire Science Exchange Network respondent locations for Indigenous knowledge ....46
33. Descriptive statistics pertaining to the prioritization of the Joint Fire Science Program objectives ....91

# Abbreviations

| | |
|---|---|
| AFSC | Alaska Fire Science Consortium |
| CAFMS | Consortium of Appalachians Fire Managers and Scientists |
| CFSC | California Fire Science Consortium |
| FSEN | Fire Science Exchange Network |
| GBFSE | Great Basin Fire Science Exchange |
| GPE | Great Plains Fire Science Exchange |
| IPA | importance-performance analysis |
| JFSP | Joint Fire Science Program |
| LSFSC | Lake States Fire Science Consortium |
| NAFSE | North Atlantic Fire Science Exchange |
| NRFSN | Northern Rockies Fire Science Network |
| NWFSC | Northwest Fire Science Consortium |
| OWFFC | Oak Woodlands and Forests Fire Consortium |
| PFX | Pacific Fire Exchange |
| SFE | Southern Fire Exchange |
| SRFSN | Southern Rockies Fire Science Network |
| SWFSC | Southwest Fire Science Consortium |
| TPOS | Tallgrass Prairie and Oak Savanna Fire Science Consortium |
| USGS | United States Geological Survey |
| WUI | wildland urban interface |

# 2021 Assessment of the Joint Fire Science Program's Fire Science Exchange Network

By Natasha Collins, James Meldrum, Rudy Schuster, and Nina Burkardt


## Abstract

The U.S. Geological Survey (USGS), on behalf of the Joint Fire Science Program (JFSP), conducted an evaluation of the Fire Science Exchange Network (FSEN), which connects wildland fire scientists and practitioners through 15 individual exchanges across the United States to help address complex wildfire needs and challenges. The study was divided into two phases: The first phase was a literature review and synthesis from materials provided by the JFSP Board. Phase two, informed by the JFSP review, was an online survey sent to more than 16,000 exchange network users compiled from the electronic mailing lists for each exchange. Respondents were asked their opinions on the importance, quality, and delivery of information for 16 key fire science topics, the prioritization of FSEN objectives, and from where and to what extent respondents are gathering information on key topics. Overall, respondents believed that sharing information and building relationships are the most important objectives of the FSEN. Respondents believed the exchange network is successful in delivering information for many of the key science topics (for example, fire behavior, prescribed fire, firefighter safety, and incident management); gaps were identified in scientific resources available for some topics (for example, economic impacts, social science and human dimensions, Indigenous knowledge). Most respondents participated in one to two exchanges and relied heavily on their respondent location (the exchange in which they primarily live and [or] work) for information. Respondents also often relied on external sources outside of the exchange network. Regional patterns emerged in information gathering whereby respondents from exchanges in the western United States (for example, Northern Rockies, Southern Rockies, and Northwest) and respondents from exchanges in the eastern United States (for example, Southern, Oak Woodlands, and Tallgrass) frequently gathered information from each other.


## Introduction

The Joint Fire Science Program (JFSP) was established in 1998 as a partnership between the U.S. Department of the Interior and the U.S. Department of Agriculture Forest Service. The program provides funding and science delivery for scientific studies associated with managing wildland fire, fuels, and fire-impacted ecosystems to respond to emerging needs of managers, practitioners, and policymakers from local to national levels. The program is administratively run by its Program Office and directed by a 12-member Governing Board with members from the Forest Service, the Bureau of Land Management, the Bureau of Indian Affairs, the Fish and Wildlife Service, the National Park Service, the U.S. Geological Survey (USGS), and the Office of Wildland Fire. Subsets of the Governing Board act as Board advisors on several JFSP projects and serve as liaisons between the Board, Program Office, and external partners. The JFSP connects wildland fire science research to management of fire and fire-prone landscapes. The program is a useful model for tackling complex fire management questions and delivering knowledge and tools to land managers.

A 2008 review of the JFSP recommended the program develop a structured approach to effectively deliver fire science nationwide. This recommendation led to the initial establishment of the Fire Science Exchange Network (FSEN). The FSEN is a national collaboration of 15 regional fire science exchanges that provides the most relevant and current wildland fire science information to Federal, State, local, Tribal, and private stakeholders within ecologically similar regions to accelerate the awareness, understanding, adoption, and implementation of readily available wildland fire science information (fig. 1). These regional organizations are variably named "exchanges" and "consortia" but herein we refer to all as exchanges. The network brings fire managers, practitioners, and scientists together to address regional fire management needs and challenges.

The JFSP employs regular reflection and review of its mission, vision, and growth in a continued effort to improve the delivery and integration of fire science into management application and policy. To this end, the USGS Fort Collins Science Center worked with the JFSP under an interagency agreement to collect information to inform decision making

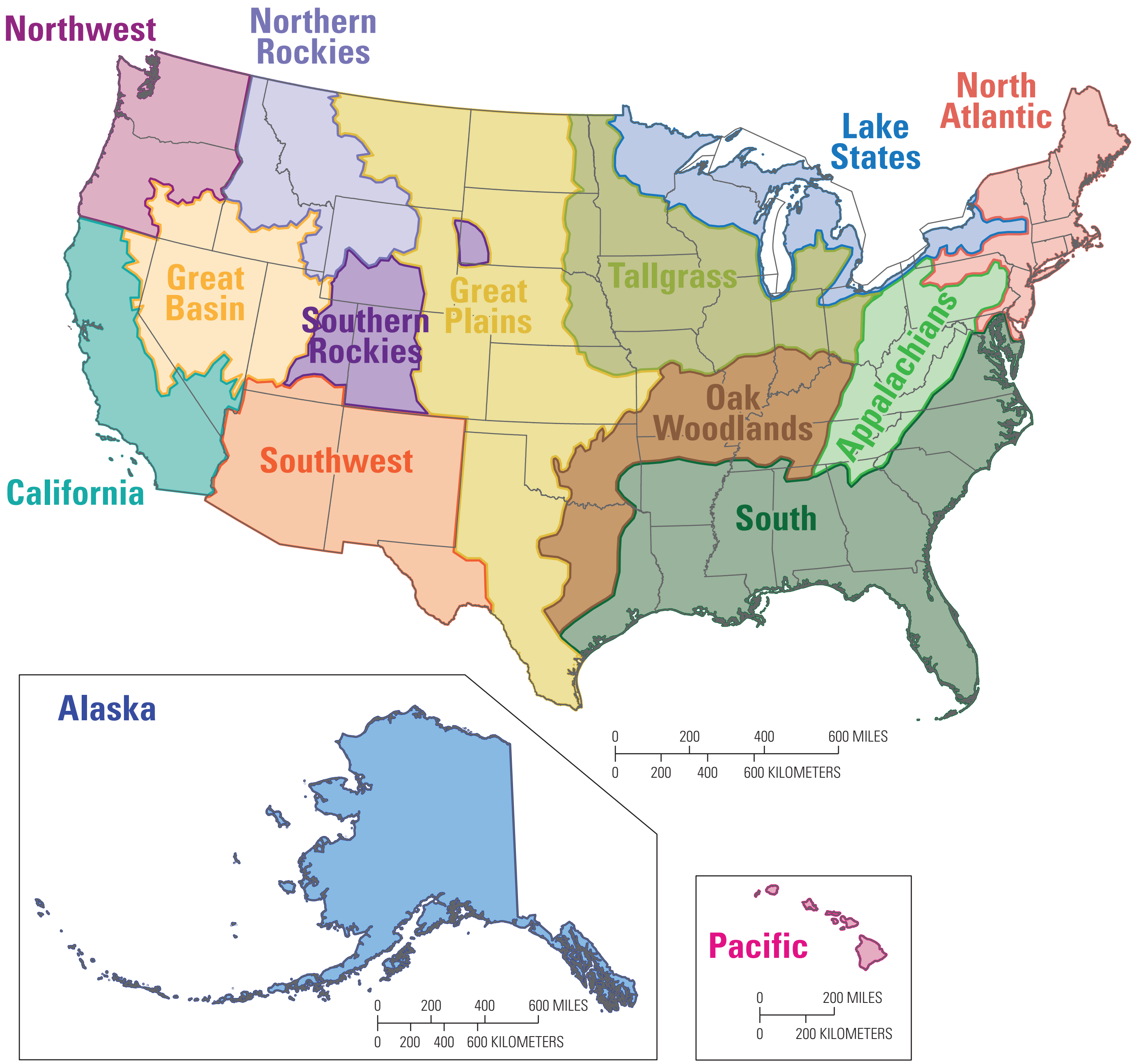



**Figure 1.** The 15 regional fire science exchanges of the Fire Science Exchange Network, taken from the Joint Fire Science Program website at https://www.firescience.gov/JFSP_exchanges.cfm.

associated with coordinating and prioritizing efforts, resource allocation, and management actions and decisions across the JFSP exchange network. The JFSP identified the following four information needs, and the USGS created the subsequent research objectives to help inform the JFSP Board's decision making:

1. *Scope of JFSP FSEN mission*—Gain user perspective on the relative importance of the six key objectives of the FSEN (JFSP, 2022) and their subcomponents;

2. *Number and configuration of exchanges*—Evaluate the importance, delivery, and information flow across exchanges to find any patterns, strengths, or gaps;

3. *Distribution of resources*— Evaluate to what extent each exchange delivers scientific resources for key wildfire science topics that are important to the exchange network's users, and identify exchanges that serve as key "hubs" for information; and

4. *Centralization of the network*—Investigate the relative reliance of exchange users on different information sources and patterns in information gathering across exchanges.

To meet the stated information needs, a secondary data analysis of results from existing JFSP reviews, an importance-performance analysis (IPA), and a network analysis were used.

## Importance-Performance Analysis (IPA)

This effort used a modified IPA evaluation framework to inform decision making associated with coordinating and prioritizing research efforts, resource allocation, and management actions and decisions across the JFSP exchange network. The IPA evaluation framework has been used for research and decision support for many years in a variety of topical areas (Oh, 2001). IPA was first introduced by Martilla and James (1977), and it was originally used to measure customer service and marketing strategies. The IPA model has since been adopted by various sectors such as recreation/tourism, and hospitality (Vaske and others, 1996; Go and Zhang, 1997; Oh 2001; Ziegler, Dearden, and Rollins, 2012), education (Alberty and Mihalik, 1989; O'Neill and Palmer, 2004), and healthcare (Dolinsky and Caputo, 1991).

IPA has been applied broadly within the field of environmental management to areas such as park visitor use, ecotourism, adaptive capacity, and related management (Hammitt, Bixler, and Noe, 1996; Wade and Eagles, 2003; Tonge and Moore, 2007; Lemieux and others, 2013). The USGS applied the IPA in an evaluation of the science needs to inform decisions on Outer Continental Shelf energy development in the Chukchi and Beaufort Seas, Alaska (Holland-Bartels and Pierce, 2011), and in an assessment of science needs in response to the Deepwater Horizon oil spill (National Science and Technology Council, 2012).

Lemieux and others (2013) explain that the IPA evaluation framework has been used as a way of understanding the needs and desires of clients to inform management decisions about how to respond to a particular management issue. The IPA provides a useful framework to perform a gap analysis, helps coordinate research and funding efforts, and supports land management and natural resource decisions. The IPA can provide systematic information and statistical analysis that helps decision makers make allocation decisions based on priorities and areas of concern. See Oh (2001) for a full review of the IPA and its capabilities as an evaluative framework. Overall, the IPA framework provides a highly transparent and replicable method to identify agency strengths, weaknesses, and areas for resource prioritization and appropriation (Lemieux and others, 2013).

## Network Analysis

Understanding the flow of scientific information is important, especially in settings where people are focused on similar issues but may work in different organizational settings or units. Coordinating the generation and use of relevant data and tools can be more effective if current patterns of information sharing are known. A network analysis was designed to reveal patterns of information acquisition within the JFSP exchange network. The central idea behind network analysis is that connections among people matter. Connections matter for human action, behavior, and decision making, and they are fundamental building blocks of social systems (Borgatti, Everett, and Johnson, 2018). Network theory has a long history, with its roots in physics and biology (Freeman, 2004), but social scientists began investigations using the approach in the 1930s (Moreno, 1934). Research in network theory specific to natural resource management appeared in the 1970s (see Holling, 1978) and has focused on understanding how the structure of networks affects adaptive capacity, social learning, collaboration, and governance (Sandström and Rova, 2010; Gerlak and Heikkila, 2011).

Some key characteristics that have been found to matter in relation to information-sharing networks include composition of networks, network size, and network density, in addition to other more complex structural measures of networks (Perry and others, 2018). Composition of networks describes variables such as the diversity of network members, network size is the number of network members, and network density measures the proportion of all possible ties among network members that are present. There are advantages and disadvantages associated with each of these network characteristics, and many of them are highly interrelated. For example, some research suggests that more cohesive, dense networks are more efficient and thus more capable of effective resource management because of close, strong ties between its members, which can indicate high trust and communication (Bodin and Crona, 2009). Alternatively, some research finds that less dense, more diverse networks enable greater adaptability and exchange of information, including more exposure to novel information because of connections with people and other groups who are different (Bodin and Crona, 2009). In essence, there are both potential benefits and disadvantages to different types of networks and network structures (Bodin and Crona, 2009).

Network analysis can be used to understand the connections that are used to gain or share subject knowledge and can uncover how respondents interact with the exchanges. Different types of visual diagrams can be developed according to this information to study the frequency, degree, and direction of participation of individuals in a network. For example, do members acquire information primarily from one exchange, or do they rely on more than one exchange? Are interactions based on type of information needed or on other factors? What other elements explain the structure and functions of the exchange networks? Network analysis was used in this study to help describe how respondents interact with the exchanges and how the exchanges interact (or do not) with each other.

# Methods

The evaluation was conducted from January 2020 through June 2021 using a mixed qualitative-quantitative methods approach. The first phase was a qualitative analysis via a literature review of existing materials provided by the JFSP Board. This review and associated discussions with the JFSP Board provided a basis for phase two, a quantitative analysis of an online survey sent to the exchange network subscribers. The methods for both phases are outlined in more detail below.

## Phase One—Literature Review

The USGS conducted a secondary literature review from existing material provided by the JFSP Board to understand the exchange network's status and relationship to its current mission. As summarized in table 1, this consisted of eight resources published between 2012 and 2019 and includes five peer-reviewed journal articles and three gray literature reports to the JFSP. Gray literature in this case are reports provided directly to the JFSP and that were not made available by commercial publishers. In addition, one of the provided resources (EnviroIssues, 2018b) further included as appendices two separate reports, a June 2016 report titled "Joint Fire Science Program—Connecting Science and Policy Assessment Report" (Hayman and Thomson, 2016) and a March 2017 report title "Science/Policy Work Group Final Report—Mechanisms for Integrating Fire Science and Policy" (EnviroIssues, 2017); these provided further details to the conclusions in the main report.

These resources draw conclusions from data generated through surveys, interviews, and focus group discussions. With some exceptions, the literature primarily draws from samples of "insiders," which refers to principal investigators and coordinators for the exchanges as well as JFSP leadership, or of "users," which refers to scientists, managers, and general public participants in the exchanges. These resources synthesize, discuss, and evaluate the needs, performance, and opportunities of the JFSP and the FSEN.

The results from the literature review were used to inform the phase two survey design and dissemination. For example, these resources were used to develop the list of 16 key wildfire science topics for the survey. These topics were based on a list from the EnviroIssues (2018a) survey that was modified with insights from USGS Wildland Fire Science Strategic Plan (Steblein and others, 2021) and conversations with the JFSP Board and exchange coordinators (see app. 1 for list of science topics and their definitions as listed in the survey). The USGS discussed the results of this review with the JFSP in developing the plan for phase two.

## Phase Two—Survey Methods and Analysis

This section includes a description of the process through which the survey was developed in cooperation with the JFSP Program Office and exchange representatives to ensure accuracy and usability of the results. Data collection methods are documented along with the survey questions and response categories. Finally, the survey response rates and data analysis are presented.

### Survey Development and Data Collection

The USGS designed and implemented an online survey of FSEN users. This survey was developed in cooperation with the JFSP Program Office and exchange representatives. The survey was developed by modifying questions that were used in previous research projects that employed similar constructs, and consisted of several iterations of question revisions among the research team and JFSP program office. The survey was reviewed and pilot-tested internally by two USGS scientists who were not subscribers of the FSEN.

To understand the information needs of and relationships among users of the FSEN, data were collected from the user populations within each exchange and across the exchange network. Because of the low time and cost barriers associated with contacting users via email and providing the survey exclusively online, USGS conducted a census of this population rather than taking a sample. The census included FSEN users who subscribed to at least one individual exchange information distribution list. An up-to-date email list was requested from the 15 regional exchanges and 12 provided a list of email addresses of exchange users and 3 opted to administer the survey themselves. For the 12 exchanges that provided email lists, duplicate email addresses were removed. Survey invitations and follow-up reminder emails were distributed using online survey software (Qualtrics XM). This software ensured

**Table 1.** Overview of literature provided by Joint Fire Science Program Board for secondary review.

[Users refers to scientists, managers, and general public participants in the exchanges, and insiders refers to principal investigators and coordinators for the exchanges, as well as Joint Fire Science Program (JFSP) leadership. FSEN, Fire Science Exchange Network; SWFSC, Southwest Fire Science Consortium; AFSN, Alaska Fire Science Network]

| Author(s) | Venue | Scope | Sample | Brief summary |
|---|---|---|---|---|
| Kocher and others (2012) | Journal | JFSP pre-FSEN | Users | Synthesizes initial needs assessments conducted by each of 14 individual exchanges (predates the North Atlantic exchange); focuses on science information topic needs and uses science delivery methods |
| Sicafuse and others (2013) | Report | Nationwide FSEN | Insiders | Reports on common themes from interviews with insiders from each exchange about identifying and overcoming common challenges faced by the exchanges |
| Hunter (2016) | Journal | JFSP pre-FSEN | Users | Evaluates performance of the JFSP in general as a boundary-spanning organization; focuses on JFSP-sponsored projects but not explicitly on the FSEN (that is, most assessed projects predate the FSEN) |
| Colavito (2017) | Journal | Single exchange (SWFSC) | Users | Reports on interviews with active respondents in a single exchange (Southwest) about the intersection of scientific information and wildfire management |
| EnviroIssues (2018a) | Report | Nationwide FSEN | Insiders, users | Reports on overarching themes from 30 interviews with insiders and key fire science users, science delivery experts, and agency leadership; focuses on key strengths of the FSEN, fire science needs for users, and opportunities for future directions |
| EnviroIssues (2018b) | Report | Nationwide FSEN | Policy makers and advisors | Discusses needs, opportunity, and strategies for JFSP to pursue integration of fire science into policy based on expert interviews, a working group, and workshop focused on that end. (Although not directly about the FSEN, the FSEN was discussed as potential mechanism for implementation.) |
| Maletsky and others (2018) | Journal | Nationwide FSEN | Insiders, users | Synthesizes results of the self-evaluation surveys conducted annually by individual exchanges from 2011 to 2015, primarily to assess the effectiveness of the overall FSEN at achieving the goal of bridging the gap between fire science research and practice |
| Colavito and others (2019) | Journal | Single exchange (AFSN) | Insiders, users | Examines activities of a single exchange (Alaska) to showcase its deliberate transition from an emphasis on science delivery to one on knowledge coproduction |

that responses were recorded anonymously, respondents could choose to opt out of the survey if desired, and respondents who completed the survey were automatically removed from further email correspondence.

The survey was launched during February of 2021 to all users with valid email addresses on the FSEN list. The survey was conducted entirely online and followed a modified Dillman method for contacting users via email (Dillman, 2007). The initial invitation to participate was sent on February 1 and was followed by four weekly email reminders until the survey closed on Friday, February 28. Thus, a total of five emails were sent with each reminder being sent only to respondents who had not yet completed the survey. Each email contained a link unique to that recipient to the online survey, which allowed individual users to enter and exit the survey as they wished and save answers. When users clicked the submit button at the end of the survey, the survey was considered complete, and they were sent no further emails. Since the survey was conducted with a population that included members of the general public, the study adhered to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). The USGS requested and received Office of Management and Budget approval to conduct the information collection via expedited review (OMB Control No. 1090-0011). Completed surveys were transferred to and maintained in secure storage facilities using approved data transmission and storage processes.

The three exchanges that did not provide email lists (Appalachians, Great Plains, and Pacific) distributed email invitations from their preferred email platform. The USGS provided an anonymous link to a survey identical to the one distributed by USGS. Follow-up reminder email templates and a timeline to follow were provided by USGS researchers for the three exchanges. Since email lists were not received from these three exchanges, it was not possible to remove duplicates, thus each week a list was provided to the exchanges of respondents who needed to be removed from future emails because they had received multiple invitations, they were no longer at the organization, or they declined participation.

## Survey Content

The online survey had 13 to 19 questions, depending on if 1 to 3 topics were selected to answer follow-up questions (that is, skip logic). Respondents completed the survey in 12 minutes, on average. The set of questions for each of these respondents was considered a survey "path." The answers to certain questions directed respondents to the appropriate survey path, reducing the burden on respondents and collecting the most relevant information from each respondent. Most survey questions were multiple choice or Likert-type scale questions, which asked respondents to respond on a numerical scale (for example, from 0 to 4). The survey also had questions with text form fields and concluded with an option to provide open-ended feedback. The content of the survey was divided into four main parts: respondent characteristics and science topics; importance-performance analysis (IPA); network analysis; and JFSP objectives (See app. 1 for the full survey as exported from the survey software).

## Respondent Characteristics and Science Topics

The survey started with background questions on the respondents, such as to which exchange(s) they subscribe, their organization affiliation, and the type and scope of work they do. They were also asked to select the exchange in which they are primarily based (that is, lived and [or] worked). This response was also used to identify their "respondent location." "Respondent location" or "regional exchange" was used when appropriate for several analyses presented in the results. As described below, not all respondents participate in the exchange that corresponds to their location.

The next set of questions in the survey pertained to 16 key wildfire science topics (table 2).

**Table 2.** The 16 key fire science topics and definitions as presented in the 2021 Fire Science Exchange Network survey.

| Science topics | Definition |
|---|---|
| Wildlife | Fire effects on wildlife and habitat |
| Invasive plant species | Fire effects on and interactions with invasive weeds and grasses (for example, cheatgrass) |
| Vegetation | Fire effects on and interactions with vegetation |
| Soil | Fire effects on soil |
| Watershed processes | Fire impacts on watersheds including erosion, riparian habitat, water quality, and so forth |
| Postfire recovery and management | Efforts undertaken to repair or improve fire damaged lands or repair or replace minor facilities damaged by fire |
| Fire behavior | Measurement or prediction of the manner in which a fire reacts (for example, fuel ignites, flame develops, and fire spreads) to the influences of fuel, weather, and topography |
| Fire regimes | Description of the current or historical patterns of fire occurrences, specifically frequency, size, and severity, in a given area or ecosystem |
| Fuels management | Assessment, planning, or effectiveness of fuels treatments or the practice of controlling wildland fuels through mechanical, chemical, biological, or manual means in support of land management objectives. (For the purposes of this list, this definition excludes prescribed fire because it has its own standalone category.) |
| Prescribed fire | Assessment, planning, or effectiveness of prescribed fire or a wildland fire originating from a planned ignition in accordance with applicable laws, policies, and regulations to meet specific land management objectives |
| Smoke, air quality, and health | Assessing and managing the effects of smoke from wildland fire and its impacts on air quality and mitigating human-caused visibility and health impacts |
| Wildland urban interface (WUI) and infrastructure | Effects of wildland fire or mitigation strategies on the area where structures and other human development meets undeveloped wildland fuels, including fire- adapted communities, visitors, and housing structures |
| Firefighter safety and incident management | Organized response to wildfire to protect life, public health and safety, infrastructure, and to minimize any disruption of governmental, social, and economic services |
| Social science and human dimensions | Community recovery from wildfire, societal perceptions of wildland fire and mitigation actions, or effectiveness of partnerships and collaborations |
| Indigenous knowledge | Fire management or ecological knowledge, practices, or skills developed in indigenous communities and passed down from generation to generation |
| Economic impacts | Monetary impacts, valuation of ecosystem services, and cost-benefit analysis |

## Importance Performance Analysis (IPA)

Importance and performance scores attained from the survey were plotted on a two-dimensional matrix with gridlines that reflected levels of performance adequacy and importance of the topic to the respondent (fig. 2). IPA grids are divided into four quadrants: Good Work as the upper-right quadrant for topics rated high in performance and importance, Gap as the upper-left quadrant for topics rated high in importance but low in performance, Reassess as the lower-left quadrant for topics rated low in importance and performance, and Sufficient as the lower-right quadrant for topics rated low in importance and high in performance. This method of division is consistent with Lemieux and others, 2013.

In this survey, respondents provided importance scores for all 16 science topics previously listed (table 2) using the response categories and five-point scale shown in table 3.

After rating importance for all 16 science topics, respondents were asked to select up to three science topics that were most relevant to their wildfire-related work. This was done for two reasons. First, minimizing topics reduced the survey burden on the respondent. Second, validity of the results depended on the respondent having a working knowledge of the topic to accurately respond to follow-up questions (Holland-Bartels and Pierce, 2011; National Science and Technology Council, 2012). Follow-up questions were asked for three constructs: performance, defined as the availability and functionality of scientific resources; reliance on three different sources of information; and which exchanges respondents go to for information. The latter two questions are discussed in the “Network Analysis” section. Performance scores for the selected science topics were measured using the response categories and five-point scale shown in table 4.

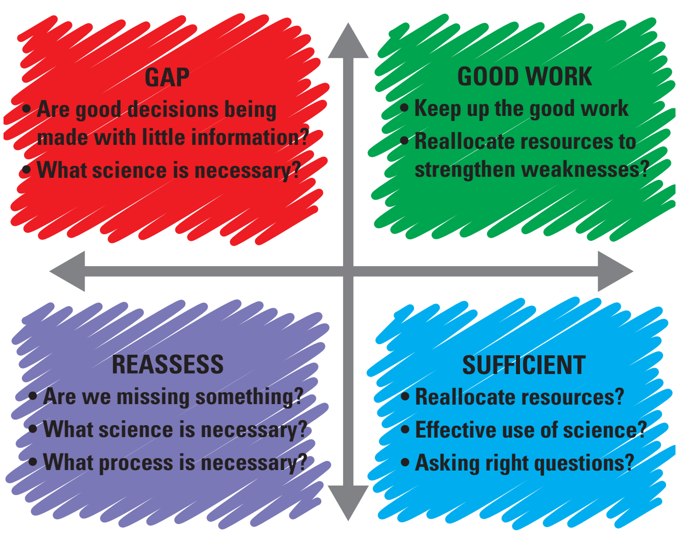



**Figure 2.** Example of the four-quadrant importance-performance analysis grid.

## Network Analysis

Respondents were asked additional follow-up questions for the one to three science topics to support a network analysis. Respondents were asked to identify level of reliance on three information sources: (1) your regional exchange; (2) other regional exchanges; and (3) external sources that are outside of the exchange network. Reliance scores for the selected science topics were measured using the response categories and five-point scale shown in table 5.

Respondents were also asked to indicate which of the exchanges they go to for information on the selected three topics. This information was used to create a flow diagram called a Sankey diagram for each science topic that depicts connections between each respondents’ location and the exchange(s) from which they gather information about that topic (Schmidt, 2008). To support the identification of patterns in the flow of information from all exchanges to each respondent’s location, each diagram is presented both in original form, where each connection is displayed as a line on the diagram, and in trimmed form, in which only connections representing 1 percent or more of the total number of connections observed for each topic are shown. Any exchanges with fewer than 1 percent of the total number of connections were represented as a single connection for completeness. This effectively trimmed any connections that represented only a relatively small number of information gathering pathways for a given science topic. For example (fig. 3), wildlife has 1,265 total connections,

**Table 3.** Science topic importance response categories, criteria, and five-point scoring system used for all 16 science topics.

| **Please rate how IMPORTANT each topic is to your work in the context of wildland fire management and science.** | | |
|---|---|---|
| **Rating** | **Criteria** | **Score** |
| Not at all important | Not important at all | 0 |
| Minimally important | Little consideration; only as an ancillary topic | 1 |
| Moderately important | Somewhat considered in my work | 2 |
| Important | Highly considered in my work | 3 |
| Critically important | Foundational to determining decisions in my work | 4 |

**Table 4.** Science topic performance question response categories, criteria, and five-point scoring system used for each topic.

| Rating | Criteria | Score |
|---|---|---|
| Not at all | Not well developed; not functional | 0 |
| Minimal | Very limited in scope, scale, or function | 1 |
| Moderate | Generally functional with notable insufficiencies or limitations | 2 |
| Good | Good; gaps may exist for minor elements | 3 |
| Robust | Robust; well developed and highly functional | 4 |

**Table 5.** Reliance on information source question response categories, criteria, and five-point scoring system used for each topic.

| Rating | Criteria | Score |
|---|---|---|
| No reliance | I do not use information from this source for my work | 0 |
| Minimal reliance | I use information from this source, but it would have little effect on my work if the source did not provide it | 1 |
| Moderate reliance | My work would still be possible but somewhat more difficult without the information provided by this source | 2 |
| Heavy reliance | My work would still be possible but a lot more difficult without the information provided by this source | 3 |
| Complete reliance | My work would not be possible without the information provided by this source | 4 |

including connections representing when a respondent gathers information from the exchange where they are located. The original diagram (left) depicts a rich network of interactions, but dominant patterns within this network are difficult to discern. In contrast, the trimmed diagram for wildlife (right) displays every 12 links as a single connection, demonstrating that most of the cross-exchange information flow about this topic is related to 6 exchanges (fig. 3).

## Joint Fire Science Program Objectives

Respondents were asked to allocate points indicating how they would prioritize the FSEN objectives (JFSP, 2022) to best meet their needs. They were provided a list in which the six original JFSP objectives were divided into nine individual concepts. This created nine FSEN objectives, since three of the objectives bundled two concepts within the singular objective (for example, the objective "share information and build relationships" was divided into two items: share information and build relationships; see table 6). This was done to avoid asking double-barreled questions and to tease apart the preferences of respondents within each objective in case one aspect of the objective was more important to some respondents than the other aspect. For this question, respondents were instructed to allocate 90 points across these 9 objectives, giving more points to objectives that were more important to them. For example, they could allocate a maximum of 90 points to 1 objective resulting in 0 points for the other 8 objectives, they could evenly give each objective 10 points, or any other combination that summed to 90.

## Response Rate and Analysis

Invitations for the survey were sent to a total of 16,331 subscribers, and 2,303 subscribers completed the survey for a total response rate of 14.1 percent (see table 7 for response rates by exchange). This response rate is within the range of response rates for online surveys reported in several metanalyses (for example, Sheehan, 2001; Manfreda and others, 2008; Shih and Fan, 2008). Most (90 percent) responses were received from the email invitation versus the anonymous link (10 percent). This may be because there were fewer subscribers invited for the three exchanges who administered the survey themselves, the emails were not from a third party, or for other reasons. Respondent location listed in table 7 below is indicated by shorthand titles used by the JFSP Program Office and will be referred to as such throughout the remainder of the report.

The data were analyzed from February to June 2021 using three DOI-approved software programs: IBM SPSS Statistics (IBM Corp., 2020) statistical analysis software; R (R Core Team, 2021), a free software environment for statistical computing and graphics; and RStudio (Version 1.4), which is an integrated development environment for R. These software programs were used to examine frequency data and create the figures and graphics in this report. Excel (2008 ed.) was also used to create some of the tables and figures, including the box-and-whisker plots. SPSS was used to create IPA quadrant charts and most pie charts and tables. RStudio (R package networkD3 version 0.4) was used to create the Sankey diagrams. Importance-performance analysis and network analysis frameworks were used to guide the analysis.

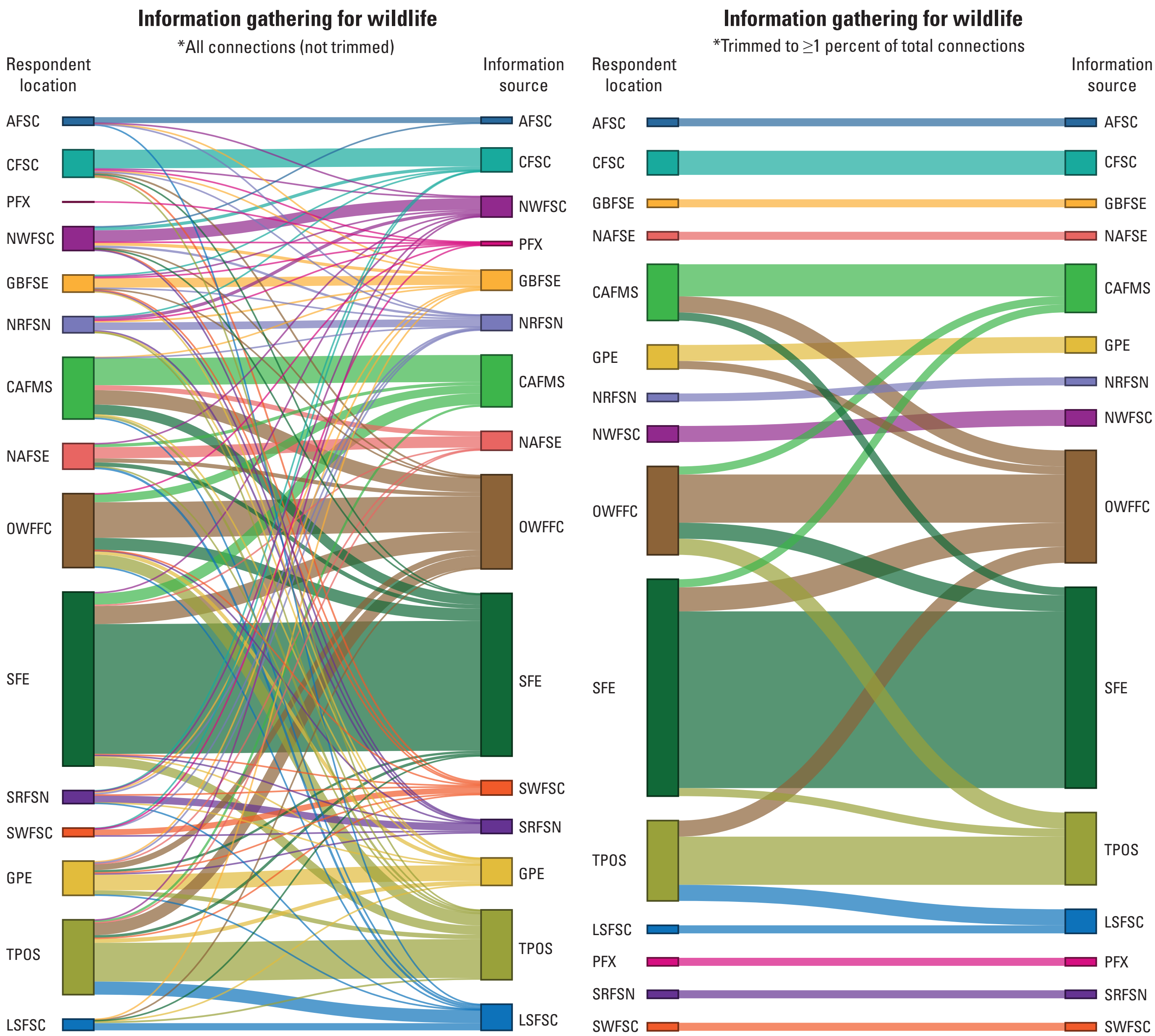



**Figure 3.** Example of a Sankey diagram untrimmed (left) and trimmed (right) for wildlife. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 6.** List of original six Fire Science Exchange Network objectives (left column) and subcomponents, which were used to create nine objectives listed on the survey (right column).

[JFSP, Joint Fire Science Program]

| Original JFSP objectives | Survey JFSP objectives (subdivided) |
|---|---|
| 1. Share information and build relationships | 1. Sharing information |
| | 2. Building relationships (for example, collaboration and networking) |
| 2. List and describe existing research and synthesis information | 3. Listing and describing existing research |
| | 4. Synthesis of information |
| 3. Identify and develop methods to assess the quality and applicability of research | 5. Assessing the quality of research |
| | 6. Assessing the applicability of research |
| 4. Demonstrate research on the ground | 7. Demonstrating research on the ground |
| 5. Support adaptive management | 8. Supporting adaptive management |
| 6. Identify new research, synthesis, and validation needs | 9. Identifying new research needs |

**Table 7.** Number of respondents for the survey compared to the total number of subscribers and invitations sent.

[Note that duplicate email addresses were not removed from the denominator when calculating "coverage"; coverage thus underestimates true response rates]

| Exchange | Total subscribers/invitations | Total responses | "Coverage" (percent) |
|---|---|---|---|
| 1 Alaska | 643 | 55 | 8.55 |
| 2 Appalachians[1] | 1,116 | 151 | 13.53 |
| 3 California | 1,844 | 222 | 12.04 |
| 4 Great Basin | 882 | 114 | 12.93 |
| 5 Great Plains[1] | 583 | 103 | 17.67 |
| 6 Lake States | 575 | 81 | 14.09 |
| 7 North Atlantic | 637 | 79 | 12.40 |
| 8 Northern Rockies | 1,297 | 153 | 11.80 |
| 9 Northwest | 1,746 | 178 | 10.19 |
| 10 Oak Woodlands | 1,506 | 168 | 11.16 |
| 11 Pacific[1] | 289 | 13 | 4.50 |
| 12 Southern | 5,306 | 552 | 10.40 |
| 13 Southern Rockies | 1,179 | 106 | 8.99 |
| 14 Southwest | 810 | 100 | 12.35 |
| 15 Tallgrass Prairie | 746 | 197 | 26.41 |
| **Total** | **218,885[2]** | **2,272** | **12.03** |

[1]Exchanges that opted to administer the survey themselves (Pacific invited 15 respondents from their list of 289 subscribers.)

[2]Value which includes 2,554 duplicate email addresses.

# Findings

This section is divided into two parts following the two project phases. First, the results from the literature review are presented according to the four research objectives and provide context for the following section. The second section focuses on the results from the online survey of FSEN users regarding their experience and participation in the network.

## Phase One Results—Literature Review

Key findings from the literature reviewed are summarized as they pertain to each of the four research objectives: scope of the JFSP FSEN mission; number and configuration of exchanges; resource allocation; and centralization. Each objective begins with an overview, followed by an analysis, and concludes with a synthesis of key points summarized and applied to the context of this study.

### 1) Scope of the JFSP FSEN Mission

The current goal of the FSEN is to accelerate the awareness, understanding, adoption, and implementation of readily available wildland fire science information, focused on six key objectives synthesized from the JFSP (2022) website. The six FSEN objectives as listed on the JFSP (2022) website are as follows:

1. share information and build relationships;
2. list and describe existing research and synthesis information;
3. identify and develop methods to assess the quality and applicability of research;
4. demonstrate research on the ground;
5. support adaptive management; and
6. identify new research, synthesis, and validation needs.

In the review of provided literature, all resources provided insights relevant to the scope of the JFSP FSEN mission. Kocher and others (2012) identified two primary opportunities for the new-at-that time FSEN: expediting science delivery by consolidating fire science information and building relationships to improve communication between managers and scientists. Subsequent evaluations consistently emphasized the core role of these objectives for the FSEN, and many noted the synergy between developing trusted relationships and the effective, useful delivery of science information; further, the literature consistently recognized these two areas as key strengths of the FSEN (Sicafuse and others, 2013; Hunter, 2016 EnviroIssues, 2018a; Maletsky and others, 2018).

Most prominently, all sources agreed on the critical importance of relationship building as a primary function of the FSEN. Not only is relationship building a critical objective, it also is broadly acknowledged to be an important strength of the FSEN. For example, Maletsky and others' (2018) review of the exchanges' self-evaluations demonstrated the effectiveness of the FSEN in improving and expanding relationships among fire scientists and practitioners. It is noted that practitioners' perspectives that the exchanges play "critical roles in developing and maintaining two-way communication" and that "the highest value… is the Exchange itself" (Maletsky and others, 2018, p. 6). Maintaining such communication is no small task, given the logistical issues and shortage of time for all parties involved, underscoring the importance of a dedicated FSEN focusing on the task of bridging communications (Sicafuse and others, 2013; Colavito, 2017; Colavito and others, 2019).

Another central objective is providing science delivery. As observed by Hunter (2016), a lack of awareness of the science and uncertainty of how to apply it were two of the most common barriers to managers using JFSP-funded science before the establishment of the FSEN. A key aspect of science delivery is going beyond simply pointing to relevant science products by further tailoring products to the specific needs that vary across the exchanges (Kocher and others, 2012) and serving as a "comprehensive, one-stop, neutral resource" for that customized information (EnviroIssues 2018a, p. 1); as such, the objective of effective, customized science delivery cannot be separated from relationship building. Both are supported by varied approaches to personalized and often face-to-face communication, including through site visits and tours, field trips, workshops, webinars, and participation at conferences and practitioner meetings (Sicafuse and others, 2013; Hunter, 2016; Colavito, 2017; EnviroIssues, 2018a; Maletsky and others, 2018). Although website development and maintenance were recognized as resource-intensive activities for most exchanges, they were also valuable in delivering information efficiently, building partnerships, and establishing credibility (Sicafuse and others, 2013; Maletsky and others, 2018).

There was also a closely related function of facilitating science coproduction. Science coproduction is the collaboration of multiple stakeholders to identify the scope, methods, and strategies to answer a scientific problem or question. As discussed by Colavito and others (2019), the coproduction of science offers many benefits and is seen by many as an effective way to increase the supply of actionable science. Focusing on a single exchange, the authors demonstrated a transition from science delivery to facilitating science coproduction. While participation in coproduction is not explicitly one of the stated objectives of the FSEN, the facilitation of science coproduction is consistent with, and could be considered a deeper level of engagement with several of the current objectives (especially "share information and build relationships," "demonstrate research on the ground," and "identify new research, synthesis, and validation needs"). Further noted is that coproduction is consistent with the underlying goal of the FSEN to accelerate the awareness, understanding, adoption, and implementation of readily available wildland fire science information.

Finally, a few reports discussed potential new directions for the FSEN. EnviroIssues (2018b) and the included appendices argued that the JFSP could take a more active role in navigating the science-policy interface and that the FSEN could contribute by identifying and coordinating fire science research needs and policy-relevant science gaps with agency personnel. Similarly, the existing science communication expertise of the exchanges could be leveraged to generate policy-focused briefings on priority fire science topics. EnviroIssues (2018b) also suggested the potential for the FSEN to support topic-driven interactions between scientists and the public, although this was deemed a relatively low priority. An additional potential growth area for the FSEN, noted by EnviroIssues (2018a), was the possibility of leveraging the existing interpersonal relationships and science delivery expertise to offer more trainings based on the latest scientific information.

Overall, past evaluations strongly support the importance of the first four objectives from the list above ("share information and build relationships," "list and describe existing research and synthesis information," "identify and develop methods to assess the quality and applicability of research," and "demonstrate research on the ground"), pertaining to building and maintaining communication across scientists and fire managers and leveraging those relationships to support tailored science delivery that is responsive to the needs of a specific user community. As demonstrated by the example of the Alaska exchange described by Colavito and others (2019), it is possible for exchanges to pivot from science delivery to a more active role in facilitating the coproduction of science; this is perhaps a natural extension of objectives five and six. Overall, the evaluations consulted all express support for the FSEN as an effective mechanism for pursuing all six stated objectives, and more broadly, working toward the goal of accelerating the awareness, understanding, adoption, and implementation of readily available wildland fire science information.

## 2) Number and Configuration of Exchanges

Currently, the FSEN consists of 15 regional exchanges, as shown previously in figure 1, which cover the entire United States. The first eight exchanges were established in 2009, six in 2011, and the final established in 2014. The regional exchange boundaries do not adhere to any geography, but they do broadly follow ecoregions while also reflecting a desire for individual exchanges to encompass areas with similar cultural uses of fire and fire management communities. Thus, the exchanges are intended to share common vegetation types and fire science needs within their boundaries.

A literature review found limited discussion pertinent to the specific number and geographical configuration of the exchanges. Kocher and others (2012) did not directly address the number or configuration of exchanges in their synthesis of the initial needs assessments conducted by the individual exchanges. However, they did find advantages in the regional scale of the exchanges, arguing that the regional scale is well positioned for effective relationship building; because the areas covered are not too large, exchanges can identify individual scientists and managers who are particularly active in the region and focus their efforts on building connections among them. The regional scale is also important for allowing exchanges to be responsive to their communities and needs (EnviroIssues, 2018a). Likewise, multiple interviews covered by Sicafuse and others (2013) noted that some of the exchanges succeeded in forming partnerships with other established fire science delivery networks and organizations that operate at similar scales.

Kocher and others (2012) demonstrated substantial variation across the top-priority scientific information needs identified by exchange users in each of the eight initial regions, suggesting the importance of having different exchanges focused on each. For example, Kocher and others (2012) posit the most commonly identified priority topics—fire effects to flora, fauna, soil, and water—were identified by five out of eight exchanges. Topics such as invasive species, ecosystem restoration, safety, mapping and imagery were identified as priorities by one exchange each.

Most other evaluations appear to have largely taken the current number and configuration of exchanges as a given, or at least to have treated any consideration of reconfiguration as outside of scope. In the main exception, EnviroIssues (2018a) reported that FSEN insiders and key stakeholders nearly all agree on the value of the existing ecoregional-based framework and emphasize the disadvantages of changing boundaries. Differences in science priorities appear to have persisted over time, as they stem from variations in local and regional characteristics, partners, audiences, ecosystems, and land ownership regimes; EnviroIssues (2018a, p. 1) reported "an overwhelming opinion that no treatment of a topic fully overlaps between regions" but rather that local nuances are critical.

Overall, most interviews reported in EnviroIssues (2018a) emphasized that any reconfiguration of exchanges would likely impose significant costs, including the loss of regional identities and relationships, and that any potential benefits need to be weighed against such costs. In addition, noted is the staggered funding cycle, in which only a subset of exchanges is open for competition in any given year. This competition would introduce additional complexities and potentially require either overlap or gaps in geographic coverage during the period of reconfiguration. However, the same report identified numerous areas of shared priorities across different regions, specific strengths in topical coverage and science delivery methods for individual exchanges, and even offers specific ideas for opportunities to use shared ecological conditions to redraw boundaries. Further, the report noted a minority perspective that changing boundaries could convey benefits including “greater cross-pollination, efficiency, consistency, and political weight” (EnviroIssues, 1018a, p. 12).

Previous evaluations provided only limited insight into this topic of whether boundaries should change or remain as drawn, with the exception of a strong general support for the existing number and configuration of the FSEN and the suggestions for potential changes embedded in the EnviroIssues (2018a) report. A broader survey of potential and actual users of the networks could be insightful for offering a more comprehensive view on the boundaries question than that offered by the key stakeholders reported on by EnviroIssues (2018a). To that end, further evaluation steps could collect richer data on managers’ perceived science information needs, scientists’ areas of inquiry, and both groups’ preferred science delivery approaches, building from the findings presented above. If such information could be matched to the respondents’ geographies of focus, it could then be analyzed to elucidate whether commonalities suggest possible alternative and (or) consolidated boundaries that would encompass shared areas of concerns.

## 3) Distribution of Resources

Resources available for the individual exchanges are capped according to criteria established and evaluated by the JFSP in 2012; levels for each exchange have not changed since then. Specifically, the JFSP laid out five criteria as relevant to determining relative resource allocation:

- Geographic size;
- Wildland fire occurrence, fuel treatment, and fire regime;
- Size and complexity of the management community served;
- Matching funding; and
- Effectiveness.

However, to date the JFSP has evaluated only the first three of these criteria, leaving “matching funding” and “effectiveness” outside of the consideration.

Consideration of the criteria for allocating resources across the different exchanges follows naturally upon the results of the preceding topics, the overall goal of the FSEN and the number and configuration of exchanges employed to pursue that goal. Reconfiguration of boundaries or mission would likely affect the current summary ratings, even without adjusting the criteria to be considered. However, the provided literature tended either to consider the FSEN as a whole or to focus on a single exchange as a case study. As such, it provided only limited information directly relevant to establishing or evaluating criteria to help determine the allocation of resources across the network of exchanges.

Given the broad agreement that the FSEN has been successful in its mission, to the extent the provided literature addressed resource allocation, the evaluations typically conveyed that the exchanges could be more successful with greater resources and implicitly argue that the FSEN thus merits greater overall funding. Sicafuse and others (2013) detailed the complexity and time-consuming nature of building and maintaining relationships among scientists and fire managers, which justifies substantial resources provided the JFSP continues to value that mission. Colavito and others (2019) made a similar point, further noting the importance of employing trusted experts rather than the less costly approach of treating boundary spanning (establishing connections both within and outside the organization) as entry-level work, as well as the need for greater resources in order to meet any expansion of the goals. Finally, EnviroIssues (2018a) mentioned the difficultly of acquiring funding for the specific mission of the exchanges from other sources, noting that most exchanges have been unsuccessful in their attempts to explore alternative or additional external funding streams.

In summary, the evaluation of the performance of individual exchanges on the current criteria and assessing the associated implications upon resource allocation is beyond the scope of this evaluation. Most notably, evaluating the effectiveness of the individual exchanges would require a targeted evaluation that would encompass both a detailed analysis of the exchanges’ own annual reports and the generation and analysis of third-party information. The other criteria could be reassessed for exchanges to support reallocations of relative spending caps based on an objective assessment of up-to-date statistics reflecting possible changes in wildfire and management community contexts; however, this is beyond the current project’s intended scope.

Regarding reconsideration of the criteria, the area with the most potential for adjustment pertains to the science information needs identified for each exchange. The historical information from needs assessments and annual reports produced by each exchange over the funding cycle could be leveraged to develop a more complete understanding of the breadth, complexity, and overlap of science information needs for any given exchange; increased breadth and complexity presumably necessitate greater resources to address. EnviroIssues (2018a) explicitly identified leaders in terms of addressing specific, high-priority science information topics or science delivery approaches that are of interest to multiple exchanges (as discussed in “Number and configuration of exchanges” above); if the FSEN leveraged this leadership such as through increased centralization (discussed in ”Centralization of the network” below), it stands to reason that such increased responsibility across the network might merit consideration in terms of commensurate increases in resource allocation.

## 4) Centralization of the network

Historically, the FSEN has operated as a decentralized network consisting of 15 independent entities. Although the JFSP Board has influence over scope and resource allocation for the exchanges, each individual exchange has the latitude to innovate within that scope and its resource constraints. There are two potential ways in which the board could increase centralization; an increase in top-down guidance, structure, or policy, or an increase in the sharing of resources and information. The former largely refers to the scope of the FSEN mission and would pertain to a change in the level of control exerted by the JFSP Board if desired. The latter could manifest in support for individual tasks, such as shared resources for website development, including hosting support or common design templates; developing a common database of studies to be shared across exchanges; or the structured sharing of science delivery products across areas with shared information needs, including across exchanges with similar ecotypes or priority concerns.

The FSEN was designed as a decentralized entity in part because of the diversity in geographic and institutional conditions across the United States. Early evaluations of the exchanges considered the exchanges as a whole and did not examine relationships among the exchanges or include discussions of centralization of the network.

The review of the provided literature found that exchanges value the regional focus and are generally uncomfortable with changing to a centralized national focus (Kocher and others, 2012; Sicafuse and others, 2013; EnviroIssues, 2018a). Each region has its own ecological, social, fire management, and institutional setting, and accordingly, each has its own priorities of fire science needs. A widely recognized key value of the FSEN is its support for tailoring science delivery and communications to these different regional contexts, through publications, websites, and in-person venues such as workshops, field trips, and participation in conferences (Kocher and others, 2012; Colavito, 2017; EnviroIssues, 2018a). There is some concern that a more centralized approach to science delivery would compromise this value (EnviroIssues, 2018a). Relatedly, literature noted the importance of preserving existing relationships with stakeholders, which could also be compromised by centralization (Kocher and others, 2012; EnviroIssues, 2018a; Maletsky and others, 2018; Colavito and others, 2019). As reported by EnviroIssues (2018a), adapting to local and regional information needs and science delivery preferences occurs not only through formal evaluation, but also through less formal means supported by informal engagement with active respondents in the fire science network. Some stakeholders further expressed that if the networks were expanded beyond regional scope, increasing the necessary connections would be time consuming and place additional burdens on exchange members.

However, despite the desire to maintain independence, exchange members identified valuable mechanisms for facilitating cross-exchange sharing, such as webinars, shared websites, and product templates (Sicafuse and others, 2013; EnviroIssues, 2018a; Maletsky and others, 2018). Opportunities exist for centralizing or networking some opportunities and activities. For example, some exchanges are recognized as having expertise in particular science delivery methods and could share that with other exchanges. Other exchanges have actively engaged in co-production and may be able to take leadership by developing best practices. Some high-priority topics, such as prescribed fire, smoke, and fuels management may be the focus of several exchanges and a national lead may be logical (EnviroIssues, 2018a), particularly because Kocher and others (2012) noted that there is a desire for a single website or publication that covers new science findings for managers when feasible.

More recent evaluations have considered the role of the JFSP and the exchanges in facilitating and promoting the integration of science into policy (EnviroIssues, 2018b). Although earlier reports highlighted the ways in which policymakers rely on syntheses of relevant science and the importance of their trusted science networks, a potential drawback is that these networks may be small and not include a diversity of perspectives and knowledge (Hayman and Thomson, 2016). A potential role for the JFSP is to become a central resource that agencies consult when responding to congressional inquiries related to fire science and policy. This ongoing communication with policy makers could also inform research and science delivery priorities for the exchanges (EnviroIssues, 2017).

Overall, independence is important for the exchanges because it allows them to fulfill the FSEN mission. Independence further allows individual exchanges to experiment with different science delivery and network-building approaches and subsequently learn from each other's successes and challenges. However, there is recognition (EnviroIssues, 2018a) that centralizing some functional aspects (such as websites and templates) and supporting research and science delivery on cross-cutting topics at a multi-region scale might make sense. This centralization might require more direct involvement from the JFSP Board, in part because it may involve sharing across ecosystems or common management issues that may not be geographically contiguous.

Suggestions for the board to provide leadership by facilitating the science-policy interface would also require a national, top-down focus. Development in this direction would likely require the board to stay abreast of agency needs and priorities, and to some extent direct funding to some of those priorities. Individual exchanges could lose some flexibility and independence in this scenario. This is connected to the "Scope of the JFSP FSEN mission" conversation, because explicitly jumping into the science-policy interface space would go beyond the current focus on fire management applications.

Next steps could provide insights on multiple questions related to potential centralization. Further analysis could build on EnviroIssues (2018a) in identifying areas of overlap and relative strengths. Such analysis could delve more deeply into whether and how exchanges currently are connected to each other, and into more explicitly enumerating the functions (for example, websites, meetings, and research coordination) that exchanges currently share or collaborate on. Next steps could add third-party perspectives on whether certain exchanges are hubs for specific information or expertise that others seek out, and relatedly, whether the users of the exchanges rely on more than one exchange for information needs.

## Summary of Phase One Results

Synthesis across the existing literature on the JFSP FSEN, and on individual exchanges as available, provides many valuable insights. Most notably, the analysis underscores the overall strength of the network in its current form for achieving the intended goal of accelerating the awareness, understanding, adoption, and implementation of readily available wildland fire science information. Indeed, as the executive summary to EnviroIssues (2018a, p. 2) states, "Across interviews [of 30 insiders and key stakeholders], what stands out is a shared acknowledgement among all interviewees of the unique value and service the FSEN provides for the fire science and manager community, and a strong desire to maintain it." The review of the provided literature concurs with that broad assessment; the JFSP FSEN fulfills its goal admirably well, in large part because of a maintained focus on self-evaluation and adaptation. However, the analysis demonstrates that the existing literature leaves many gaps pertaining to the topics of present interest to the JFSP. Indeed, these are the areas in which the subsequent data collection and further analysis were focused. Key results from the online survey are outlined in the following section.

## Phase Two: Survey Results

This section begins with an overview of background characteristics of the survey respondents, then reports the results from questions asked regarding 16 key wildfire science topics. Respondents rated the importance of these topics to their work, the availability and quality of scientific resources for these topics, their reliance on various sources for information on these topics, and which exchanges they go to for information on particular topics. It concludes by discussing how respondents ranked the importance of the six refined JFSP objectives as listed on the survey. Because of the low response rate from the Pacific, that exchange is missing from many of the analyses.

### Respondent Characteristics and Participation

Respondents were asked what exchange they are primarily based in (where they live and [or] work), which we refer to as the "respondent location." They were also asked in which exchanges they participate (for example, attend webinars, participate in events, receive emails from) (table 8).

**Table 8.** The number of survey respondents from each of the 15 Fire Science Exchange Program regional exchanges (left column), with self-identified respondent location (center column) and the number of survey respondents who said they participate in each of the exchanges (right column).

| Exchange | Q1: Number identifying exchange as their location | Q2: Number participating in each exchange |
|---|---|---|
| Alaska | 55 | 93 |
| Appalachia | 151 | 245 |
| California | 222 | 307 |
| Great Basin | 114 | 215 |
| Great Plains | 103 | 179 |
| Lake States | 81 | 190 |
| North Atlantic | 79 | 150 |
| Northern Rockies | 153 | 273 |
| Northwest | 178 | 330 |
| Oak Woodlands | 168 | 403 |
| Pacific | 13 | 55 |
| Southern | 552 | 754 |
| Southern Rockies | 106 | 198 |
| Southwest | 100 | 233 |
| Tallgrass Prairie | 197 | 318 |
| **Total** | **2,272** | **3,943** |

Individuals from all 15 exchanges responded to the survey, with varying degrees of participation across exchanges. Nearly a quarter of the respondents to the survey selected the Southern exchange as their respondent location, whereas the Pacific exchange had the smallest number of respondents at 13 individuals. For all other exchanges, responses ranged from 55 to 552 participants.

For the question on what exchange they participate in, most individuals (63.6 percent) participate in only one exchange, whereas 16.6 percent participate in two exchanges, 8.3 percent of respondents participate in three exchanges, and about 4 percent participate in four exchanges (fig. 4). Fewer respondents participate in 5 or more exchanges, yet a handful of individuals participate in up to all 15 exchanges (table 9). Some respondents do not participate in the exchange where they indicated they are located; for example, approximately 18 percent of respondents who identified as being located in the Great Plains Exchange region participate in a different exchange (fig. 5). The participation of respondents in the exchange network is also shown in table 10 and figure 6.

Figure 6 illustrates the participation flow (for example, attending webinars, participating in events, receiving emails) of survey respondents based on their location (left column), to the entire exchange network (right column). To support the visualization of main patterns, only flows of 25 or more individuals are shown in the trimmed diagram (right).

As the left, full diagram shows, subscribers mostly participate in the exchange where they are located, but all exchanges see participants from a large portion of the respondent locations. As the right, trimmed diagram shows, some exchanges, such as Alaska, California, Great Basin, and Pacific receive relatively few subscribers from other locations. Some exchanges see respondents from a different location without the inverse flow being observed. For example, in the trimmed diagram, some respondents from Appalachians participate in North Atlantic but respondents from North Atlantic are not shown as participating in Appalachians. Likewise, some participants in Great Plains have Tallgrass Prairie as their respondent location, but the right diagram does not depict participants in Tallgrass Prairie having Great Plains as their location. Respondents from California mostly participate in California, with the main exception being respondents from California participating in Northwest. There are also some relationships where members from both exchanges participate in each other's exchanges. For instance, Northwest has some participants who have their location as Northern Rockies and vice versa. Southern Rockies has some participants who have their location in Northern Rockies, whereas Southwest has some participants who have their location in Southern Rockies.

There is considerable overlap in participation among Oak Woodlands, Appalachians, Tallgrass Prairie and Southern, with Oak Woodlands as a central exchange connecting these exchanges. Oak Woodlands has participants from Appalachians, Southern, and Tallgrass Prairie locations; Appalachians has participants from Oak Woodlands and Southern locations; and

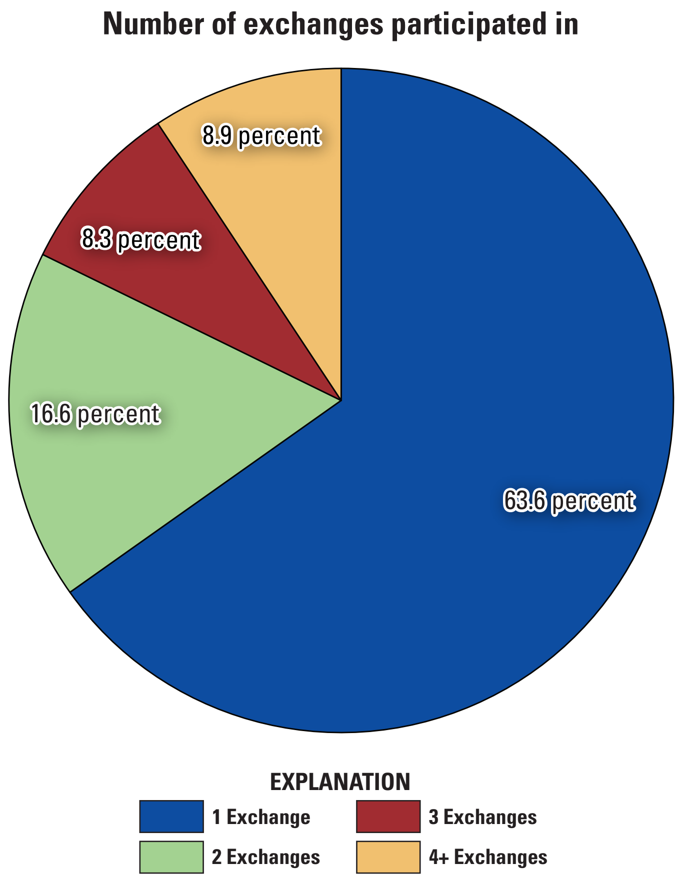



**Figure 4.** The number of regional fire science exchanges respondents participate in. Total does not amount to 100 percent because of nonresponses.

**Table 9.** The number of regional fire science exchanges respondents participate in.

[Total does not amount to 100 percent because of nonresponses]

| Number of exchanges participated in | Frequency | Percent |
|---|---|---|
| 1 exchange | 1,465 | 63.6 |
| 2 exchanges | 383 | 16.6 |
| 3 exchanges | 190 | 8.3 |
| 4 exchanges | 93 | 4 |
| 5 exchanges | 55 | 2.4 |
| 6 exchanges | 25 | 1.1 |
| 7 exchanges | 10 | 0.4 |
| 8 exchanges | 8 | 0.3 |
| 9 exchanges | 4 | 0.2 |
| 10 exchanges | 5 | 0.2 |
| 11 exchanges | 1 | 0 |
| 12 exchanges | 1 | 0 |
| 14 exchanges | 3 | 0.1 |
| 15 exchanges | 4 | 0.2 |
| **Total** | **2,247** | **97.4** |

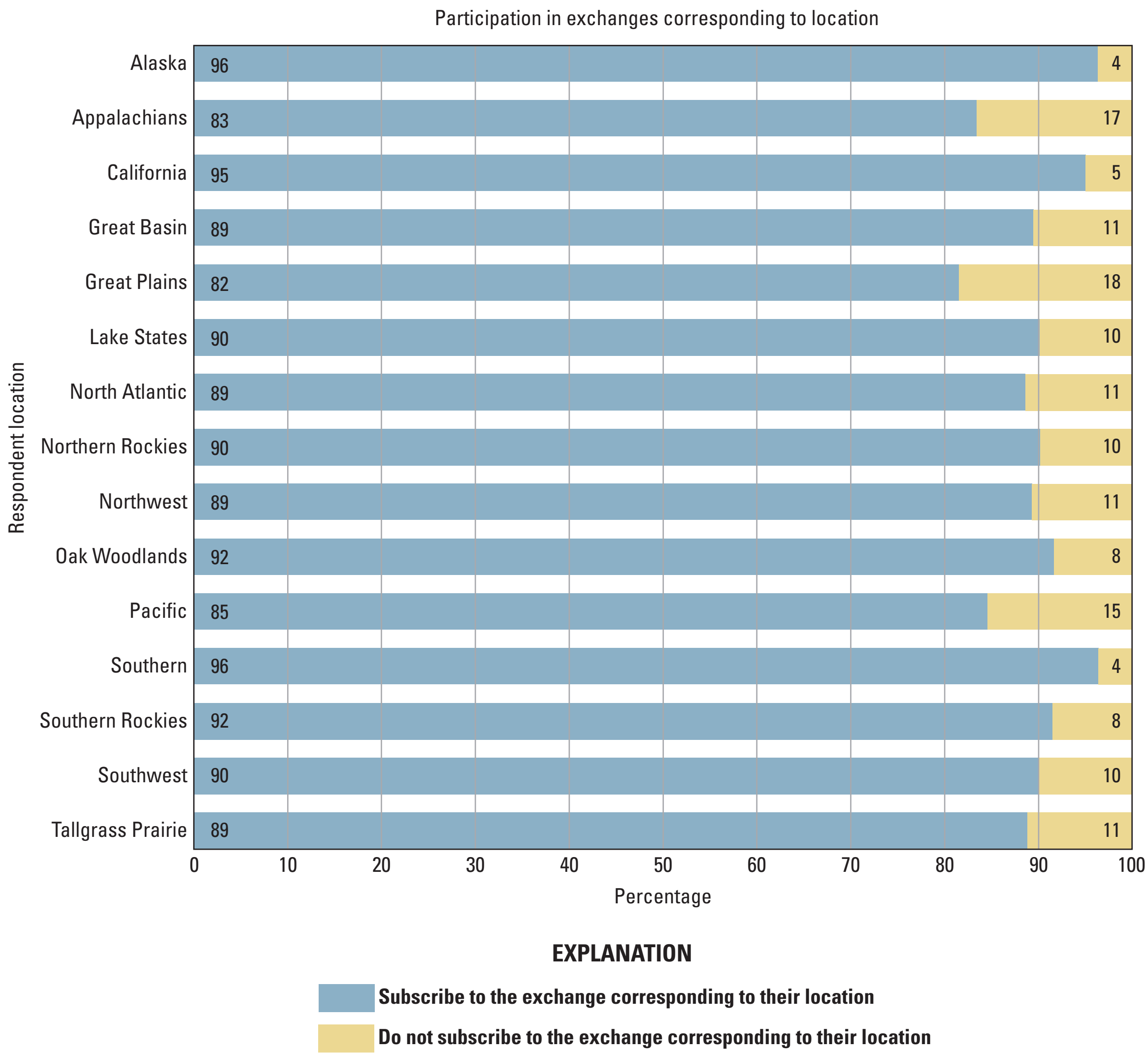



**Figure 5.** The proportion of respondents in each location who subscribe to their corresponding exchange. The percentages on the left (blue) indicate the percentage of respondents who subscribe to the exchange corresponding to their location, and the percentages on the right (yellow) indicate the percentage of respondents who do not subscribe to the exchange corresponding to their location.

Southern has participants from Appalachians and Oak Woodlands locations. Additionally, a moderate number of respondents go to Lake States from Tallgrass Prairie, and a small amount go to Tallgrass Prairie from Lake States.

Seen in this figure and emerging throughout the different analyses are regional patterns whereby exchange respondents frequently interact with exchanges that are geographically close to them, ultimately leading to two prominent geographic groupings: the western United States exchanges (Northwest, California, Northern Rockies, Great Basin, Southern Rockies, and Southwest) and the eastern United States exchanges (Great Plains, Tallgrass, Oak Woodlands, Southern, and Appalachians). The remaining three exchanges (Alaska, Pacific, and North Atlantic) belong to neither of the previous two groups and are thus referred to as “independents.” Although North Atlantic is geographically located in the eastern United States, it is considered independent because its respondents less frequently interact with any of the other exchanges (including its eastern neighbors). In fact, respondents from Alaska, Pacific, and North Atlantic locations are unique from the other exchanges because they tend not to gather information or participate in other exchanges, but participate mostly with their regional exchange.

Over half (50.11 percent) of respondents were affiliated with federal or state organizations, almost 11 percent were part of nonprofit organizations, and nearly 11 percent were university-based (fig. 7). The remainder of respondents identified as members of local organizations, the private sector, the general public, Tribal organizations, as private landowners, or selected “other.” Example statements from participants who selected “other” included retired individuals, consultants, those with foreign affiliations or of multiple organization affiliations, and private land managers.

**Table 10.** Number of respondents who participate in each regional fire science exchange according to their location.

[AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE, Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium]

| Respondent location | Number of respondents from location | Number of respondents who participate in each exchange | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AFSC | CAFMS | CFSC | GBFSE | GPE | LSFSC | NAFSE | NRFSN | NWFSC | OWFFC | PFX | SFE | SRFSN | SWFSC | TPOS |
| AFSC | 55 | 53 | 1 | 2 | 1 | 1 | 4 | 1 | 6 | 9 | 1 | 1 | 2 | 2 | 1 | 1 |
| CAFMS | 151 | 1 | 126 | 1 | 1 | 2 | 7 | 32 | 2 | 4 | 56 | 2 | 43 | 1 | 2 | 9 |
| CFSC | 222 | 3 | 2 | 211 | 24 | 0 | 3 | 0 | 14 | 32 | 9 | 10 | 17 | 6 | 23 | 2 |
| GBFSE | 114 | 4 | 3 | 16 | 102 | 3 | 3 | 2 | 24 | 17 | 4 | 2 | 10 | 15 | 16 | 2 |
| GPE | 103 | 1 | 2 | 1 | 12 | 84 | 2 | 0 | 9 | 4 | 20 | 0 | 14 | 10 | 5 | 17 |
| LSFSC | 81 | 6 | 5 | 1 | 0 | 3 | 73 | 10 | 2 | 3 | 12 | 0 | 12 | 1 | 2 | 32 |
| NAFSE | 79 | 1 | 12 | 2 | 0 | 1 | 10 | 70 | 3 | 4 | 18 | 0 | 19 | 1 | 3 | 2 |
| NRFSN | 153 | 6 | 4 | 15 | 19 | 7 | 2 | 4 | 138 | 43 | 3 | 6 | 8 | 28 | 18 | 4 |
| NWFSC | 178 | 8 | 3 | 22 | 20 | 4 | 3 | 3 | 39 | 159 | 7 | 13 | 14 | 8 | 18 | 6 |
| OWFFC | 168 | 0 | 29 | 2 | 0 | 18 | 11 | 5 | 2 | 4 | 154 | 1 | 45 | 3 | 8 | 39 |
| PFX | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 11 | 2 | 0 | 1 | 0 |
| SFE | 552 | 2 | 47 | 9 | 4 | 11 | 5 | 13 | 4 | 12 | 59 | 3 | 532 | 6 | 14 | 25 |
| SRFSN | 106 | 4 | 3 | 14 | 22 | 14 | 3 | 4 | 23 | 23 | 4 | 5 | 9 | 97 | 29 | 3 |
| SWFSC | 100 | 3 | 0 | 9 | 8 | 4 | 0 | 3 | 6 | 12 | 3 | 1 | 6 | 19 | 90 | 1 |
| TPOS | 197 | 1 | 8 | 2 | 2 | 27 | 64 | 3 | 1 | 3 | 53 | 0 | 21 | 1 | 3 | 175 |
| **Total** | **2,272** | **93** | **245** | **307** | **215** | **179** | **190** | **150** | **273** | **330** | **403** | **55** | **754** | **198** | **233** | **318** |

Almost half the respondents (48 percent) worked either locally or regionally in land management, and 22 percent selected fire management as their primary work role. The science and research group consisted of about 17 percent of respondents, most of whom worked regionally. The "other" category, representing 7 percent of respondents, included roles such as air quality, wildlife management, education, and communication. Only about 5 percent of respondents were primarily part of the general public. More than half of respondents worked locally (52 percent), whereas 38 percent worked regionally and about 10 percent worked nationally (table 11).

The number of exchanges in which respondents participated was then compared to the different respondent characteristics such as their affiliation, primary work role, and scope of work. As seen in the overall chart (fig. 4), regardless of a respondent's organization or affiliation, most respondents only participated in one exchange. Private landowners largely participated in fewer exchanges (87 percent in one exchange and 1 percent in four or more exchanges). Respondents who affiliated with local agencies, the general public, or the private sector were similar in terms of participation because 73–80 percent of these respondents participated in one exchange only, and fewer participated in multiple exchanges. For example, the private sector had the highest number of respondents who participated in four exchanges or more and it was only 10 percent of their group. Respondents from Tribal, State, Federal, nonprofit, and university affiliations showed similar participation in exchanges with most having participated in one exchange (59–68 percent), then two exchanges (18–24 percent), then three or more. The "other" category had the most respondents who participated in four or more exchanges (18 percent), whereas other organizations only had 1–12 percent participate in that many exchanges. See figure 8 and table 12.

Most respondents, regardless of their primary work role, participated in one exchange. Respondents from the general public had the most people who participated in only one exchange (75 percent) and respondents affiliated with science/research had the least number of people who participated in only one exchange (55 percent). All work roles had two exchanges as the next highest percentage (between 13 and 21 percent). Land management and the general public had few respondents between three and four or more exchanges (4–7 percent). Fire management, science/research, and other all had a slightly higher percentage of participation in four or more compared to three exchanges (10–15 percent). See figure 9 and table 13.

In terms of respondent scope of work and how many exchanges they participated in, the results are as follows. For respondents who worked locally, most participated in one exchange (72 percent). Comparatively, about half (52 percent) of respondents who worked nationally participated in one exchange whereas nearly a quarter (23 percent) participated in four or more exchanges. Respondent participation, no matter the work scope, was between 12 and 18 percent for individuals who participated in two exchanges. There are smaller but similar percentages of people who participated in three exchanges (6 to 12 percent). See figure 10 and table 14.

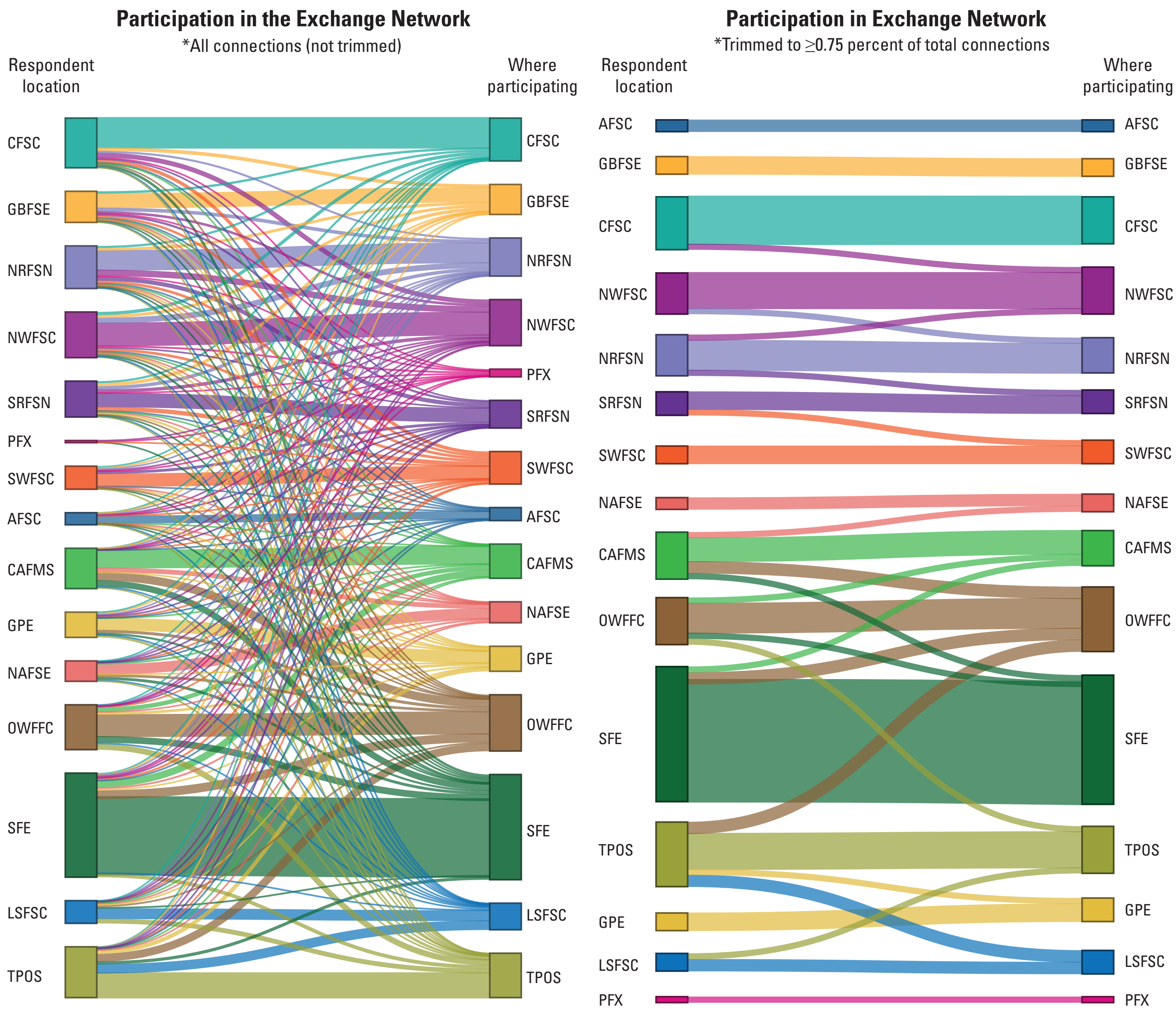



**Figure 6.** Sankey diagram showing the participation of respondents in their location versus other regional fire science exchanges, with the magnitude set to only display connections of 25 individuals or more. The left-hand column represents the exchanges where respondents are located with the size of the rectangle corresponding to the quantity of individuals. The right-hand column shows which exchanges respondents participate in. The diagram on the left shows all connections whereas the diagram on the right has been trimmed to show the stronger connections. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

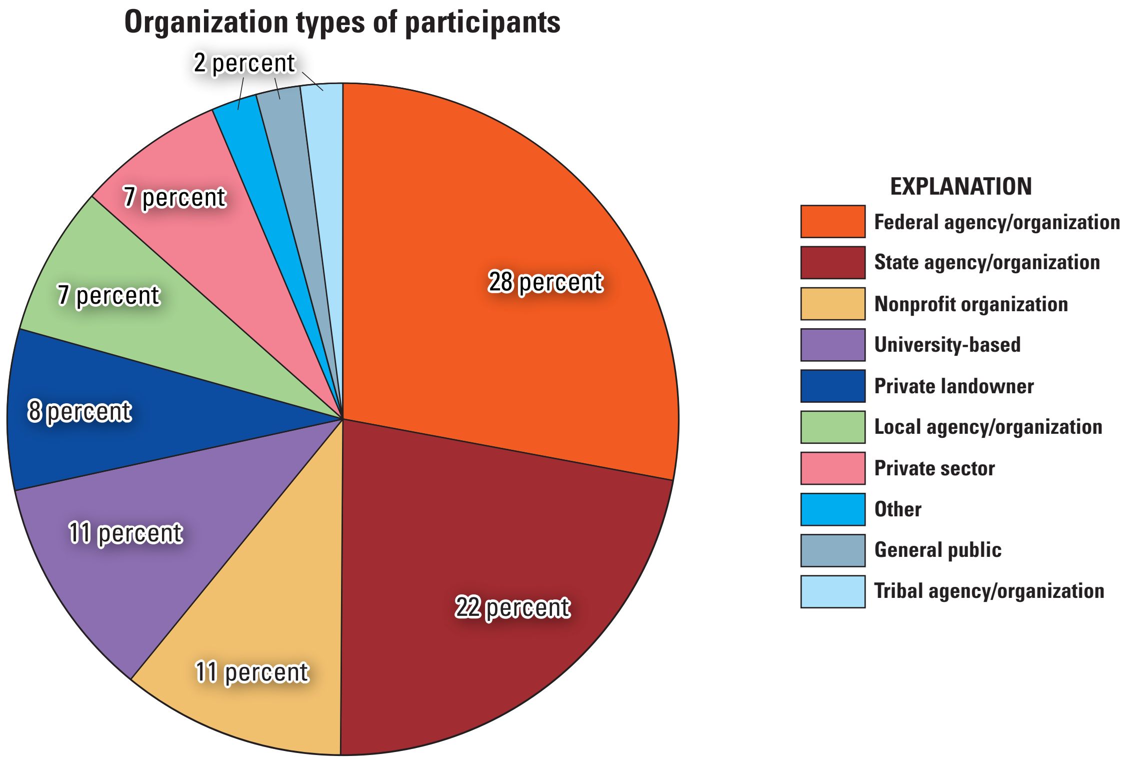



**Figure 7.** The affiliation of the Fire Science Exchange Network survey respondents with different organizations and groups.

**Table 11.** Primary role and scope of the Fire Science Exchange Network survey respondents' work.

[%, percent]

| Primary work role | Local | Regional | National | Total |
|---|---|---|---|---|
| Land management | 33% | 15% | 1% | 49% |
| Fire management | 10% | 8% | 4% | 22% |
| Science/research | 2% | 11% | 4% | 17% |
| General public | 4% | 1% | 0% | 5% |
| Other | 3% | 3% | 1% | 7% |
| **Total** | **52%** | **38%** | **10%** | **100%** |

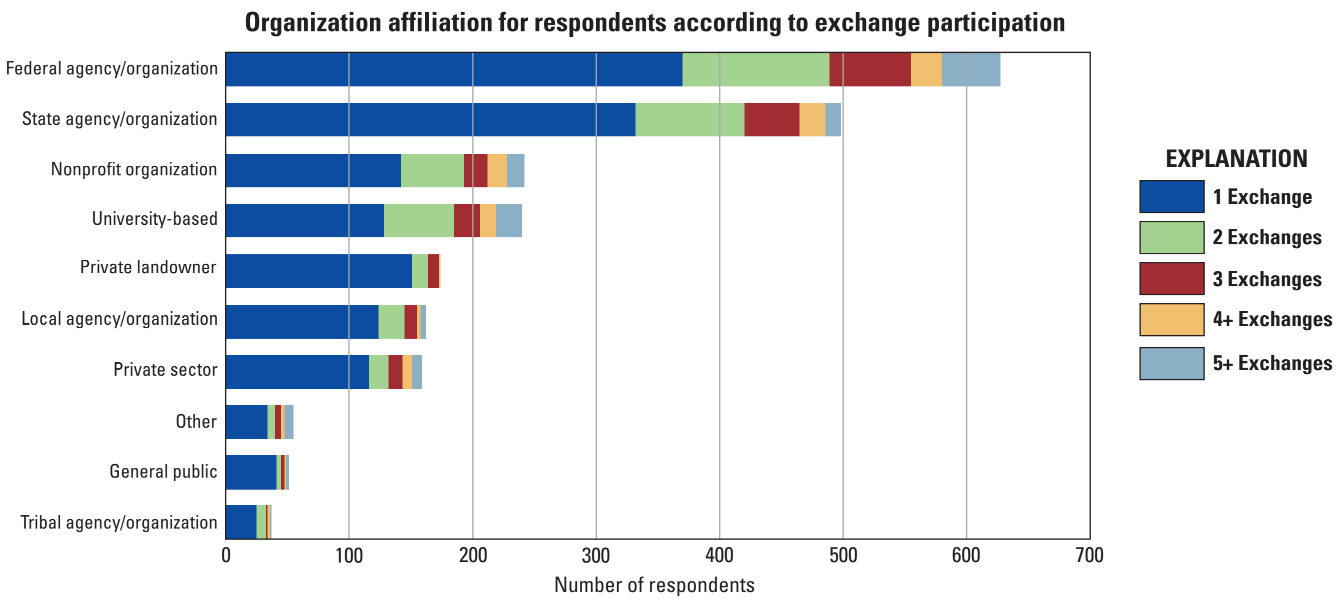



**Figure 8.** The number of regional fire science exchanges respondents participated in according to their work affiliation.

**Table 12.** The number of regional fire science exchanges respondents participated in according to their work affiliation.

| Number of exchanges | Respondent affiliation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Tribal | Local | State | Federal | Nonprofit | University-based | Private landowner | Private sector | General public | Other |
| 1 exchange | 25 | 124 | 332 | 370 | 142 | 116 | 151 | 116 | 41 | 34 |
| 2 exchanges | 8 | 21 | 88 | 119 | 51 | 16 | 13 | 16 | 4 | 6 |
| 3 exchanges | 1 | 10 | 45 | 66 | 19 | 11 | 9 | 11 | 3 | 5 |
| 4 exchanges | 2 | 3 | 21 | 25 | 16 | 8 | 1 | 8 | 1 | 3 |
| 5 exchanges | 0 | 3 | 9 | 21 | 7 | 4 | 0 | 4 | 1 | 2 |
| 6 exchanges | 0 | 1 | 2 | 15 | 2 | 2 | 0 | 2 | 0 | 0 |
| 7 exchanges | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 2 | 0 | 1 |
| 8 exchanges | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 1 |
| 9 exchanges | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 10 exchanges | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 11 exchanges | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 12 exchanges | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 exchanges | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 15 exchanges | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |

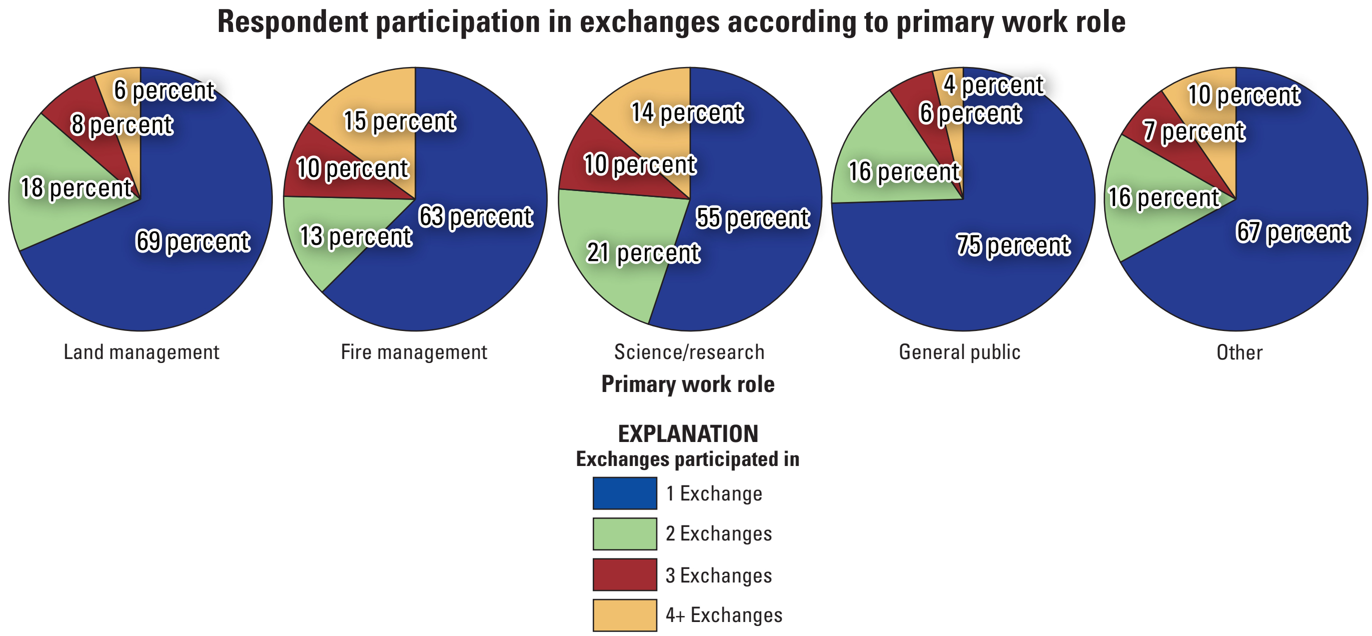



**Figure 9.** The number of regional fire science exchanges respondents participated in according to their primary work role.

**Table 13.** The number of regional fire science exchanges in which respondents participated according to their primary work role.

| Number of exchanges participated in | Primary work role | | | | |
|---|---|---|---|---|---|
| | Land management | Fire management | Science/ research | General public | Other |
| 1 exchange | 754 | 307 | 209 | 79 | 112 |
| 2 exchanges | 196 | 63 | 80 | 17 | 27 |
| 3 exchanges | 87 | 47 | 38 | 6 | 12 |
| 4 exchanges | 35 | 29 | 19 | 2 | 8 |
| 5 exchanges | 16 | 20 | 17 | 1 | 1 |
| 6 exchanges | 4 | 13 | 7 | 0 | 1 |
| 7 exchanges | 2 | 4 | 2 | 1 | 1 |
| 8 exchanges | 3 | 1 | 1 | 0 | 3 |
| 9 exchanges | 0 | 4 | 0 | 0 | 0 |
| 10 exchanges | 1 | 2 | 1 | 0 | 1 |
| 11 exchanges | 0 | 0 | 1 | 0 | 0 |
| 12 exchanges | 0 | 0 | 1 | 0 | 0 |
| 14 exchanges | 0 | 1 | 1 | 0 | 1 |
| 15 exchanges | 2 | 0 | 2 | 0 | 0 |

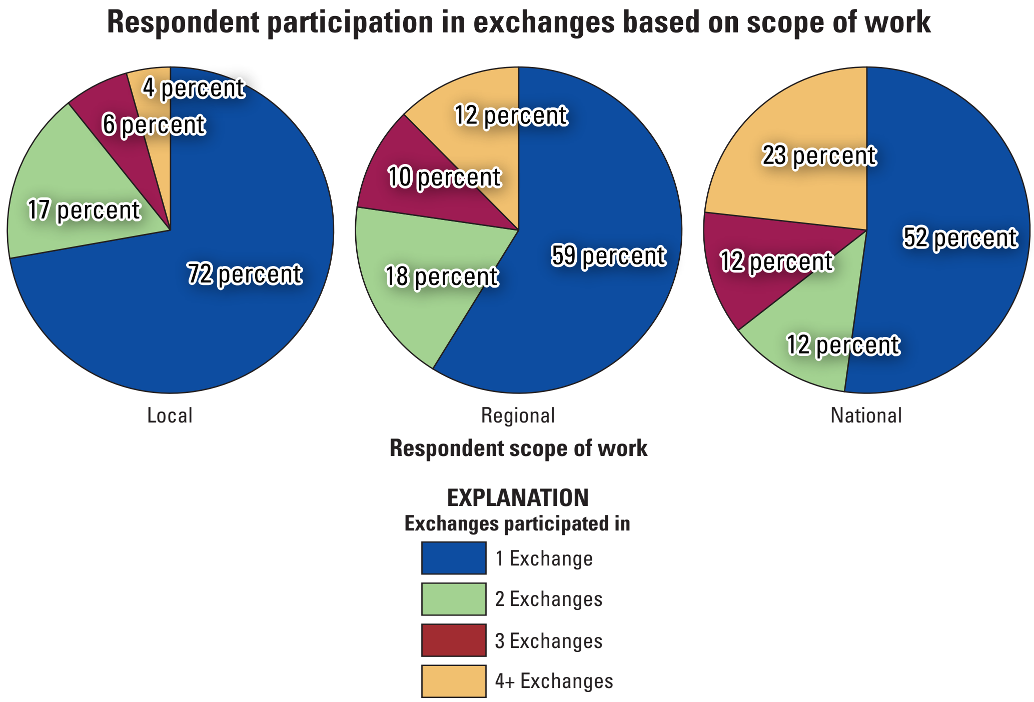



**Figure 10.** The number of regional fire science exchanges respondents participated in according to their scope of work. The total sum may exceed 100 percent because of rounding.

**Table 14.** The number of regional fire science exchanges respondents participated in according to their scope of work.

| Number of exchanges participated in | Scope of work | | |
|---|---|---|---|
| | Local | Regional | National |
| 1 exchange | 845 | 497 | 119 |
| 2 exchanges | 199 | 156 | 28 |
| 3 exchanges | 75 | 87 | 28 |
| 4 exchanges | 26 | 55 | 12 |
| 5 exchanges | 15 | 26 | 14 |
| 6 exchanges | 6 | 7 | 12 |
| 7 exchanges | 2 | 4 | 4 |
| 8 exchanges | 1 | 5 | 2 |
| 9 exchanges | 1 | 2 | 1 |
| 10 exchanges | 0 | 4 | 1 |
| 11 exchanges | 0 | 0 | 1 |
| 12 exchanges | 0 | 0 | 1 |
| 14 exchanges | 0 | 1 | 2 |
| 15 exchanges | 0 | 1 | 3 |

Most respondents had previous experience in wildland fire management and science. Nearly 60 percent of respondents identified wildland fire management and science as constituting most of their work experience or indicated they regularly work in the field. Another 20 percent had experience working in the field but with supervision. Approximately 6 percent of respondents had formal education in the field without associated work experience, and another 5 percent of respondents had no previous experience on wildland fire management and science. The "other" category, which was around 10 percent, consisted of individuals giving detailed and nuanced descriptions of their background. See figure 11.

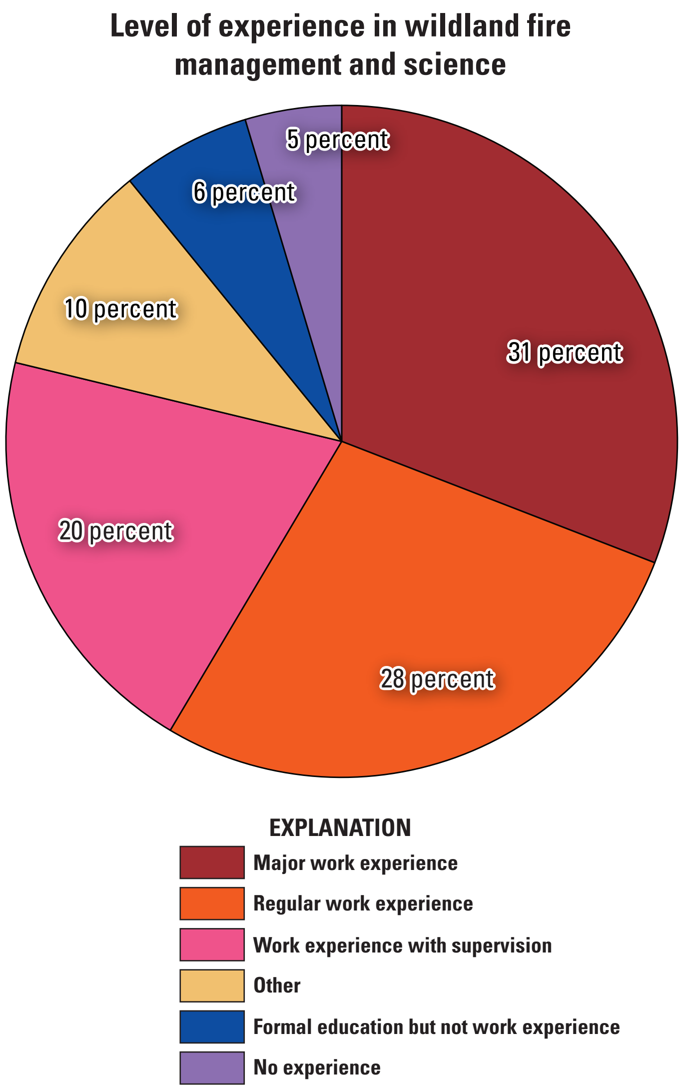



**Figure 11.** The level of experience in wildland fire management and science of survey respondents. The total sum may be less than 100 percent because of rounding.

## Importance-Performance Analysis for Key Science Topics

In this section respondents were asked to rate the importance of all 16 science topics to their work on a Likert-type scale of 0 to 4, with a value of 0 meaning that the topic had no importance and 4 meaning that the topic was foundational to their work (table 3). Respondents were also asked to rate the performance of one to three science topics that were most relevant to their work. Performance was defined as the functionality of the data and tools available for the topic, also rated on a Likert-type scale of 0 to 4 (table 4). The performance of topics was only rated by respondents who selected the topic(s) for follow-up questions. Some topics were selected more than others; for example, the top five most selected topics across the network were prescribed fire, wildlife, vegetation, fuels management, and invasive plant species (fig. 12). In fact, vegetation was one of the most selected topics for all 15 respondent locations. Fire behavior, wildland urban interface (WUI) and infrastructure, and post-fire recovery and management were also commonly selected topics for multiple respondent locations (table 15). For a more detailed overview of the frequency at which respondents from the network selected these topics, see table 15.

Results from these questions were plotted on IPA graphs with average performance values on the x-axis and average importance values on the y-axis. IPA graphs are divided into four quadrants: Good Work, Reassess, Sufficient, and Gap. Topics or exchanges were placed in the Good Work quadrant when respondents rated them to have high importance and performance (both values greater than 2.0) and were placed in the Reassess quadrant when they were given low importance and performance (both values less than 2.0). Topics or exchanges were placed in the Sufficient quadrant when they were given low importance (values less than 2.0), but high performance (values greater than 2.0). Lastly, topics or exchanges given high importance (values greater than 2.0), but low performance (values less than 2.0), were placed in the Gap quadrant. In addition, topics or exchanges were conservatively placed into the Gap quadrant when they fell on the line between two quadrants (their importance and [or] performance values were equal to 2.0). Standard deviations are reported in tables corresponding to each IPA figure. This section begins by discussing the results of the average scores provided by all respondents for the 16 science topics and then presents more detailed graphs which focus on each science topic, allowing a comparison in the responses across the exchange network.

Figure 13 and table 16 show how respondents rated the importance of all 16 science topics and the scientific resources that are available for the topics they consider most relevant to their work. Most of the science topics fall into the Good Work quadrant, indicating that these topics are

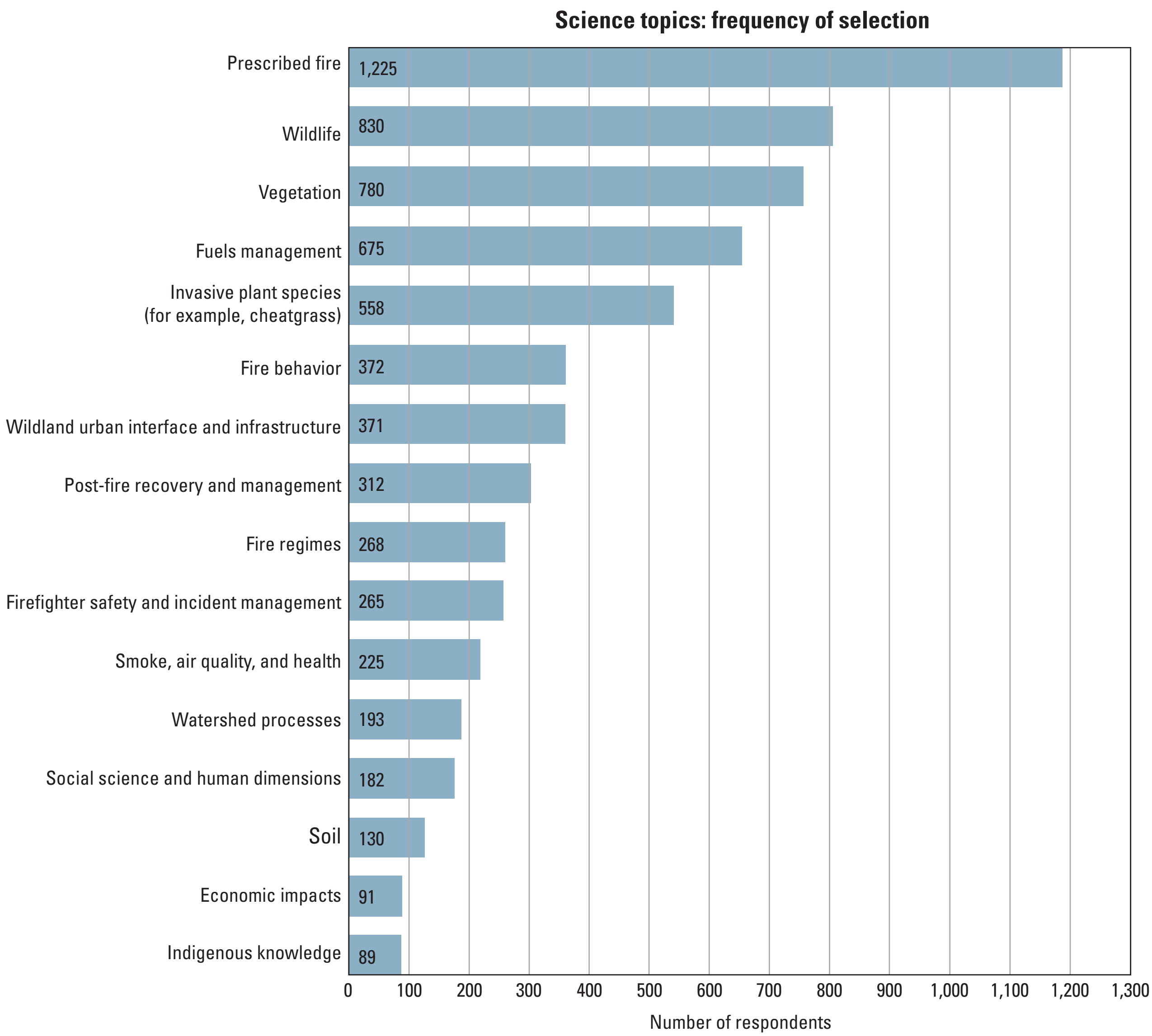



**Figure 12.** Frequency at which respondents selected each science topic for follow-up questions in the survey (respondents could choose one to three topics most relevant to their work).

both of high importance to respondents and that there are adequate scientific resources for these topics. Of the topics that were placed into this quadrant, prescribed fire was most frequently selected (number of times selected [n]=1,225), followed by wildlife (n=830) and vegetation (n=780). The average performance rating for all the topics in the Good Work quadrant fell between 2.0 and 3.0, meaning that respondents said the data, tools, and programs available were between "generally functional with notable insufficiencies or limitations" to "good; gaps may exist for minor elements." Vegetation and prescribed fire were rated the highest in terms of importance, indicating that respondents believed these topics are foundational to their work. Economic impacts and social science and human dimensions are in the Gap quadrant meaning they are of high importance but do not have adequate scientific resources available. Lastly, Indigenous knowledge was rated lower on the importance and performance scale. Indigenous knowledge also was the topic that was selected by the fewest survey respondents (n=89). The standard deviations for most of the topics ranged from 0.78 (vegetation) to 1.32 (firefighter safety and incident management), suggesting that respondents more similarly rated vegetation compared to firefighter safety and incident management.

**Table 15.** The frequency that respondents from the 15 regional fire science respondent locations selected each science topic as one of the top one to three topics in the survey that are relevant to their work.

[Respondents were asked follow-up questions regarding the topics they selected. Topics are displayed in order of the frequency they were selected across the network (right-hand total column). The number of respondents who selected the topic, according to their location, is also summed in the bottom row total. AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE, Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; WUI, Wildland Urban Interface]

| Science topics | Respondent location | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AFSC | CAMFS | CFSC | GBFSE | GPE | LSFSC | NAFSE | NRFSN | NWFSC | OWFFC | PFX | SFE | SRFSN | SWFSC | TPOS | Total |
| Prescribed fire[1] | 3 | 104[2] | 66[2] | 18 | 65[2] | 52[2] | 50[2] | 40[2] | 58[2] | 130[2] | 0 | 429[2] | 23[2] | 32[2] | 155[2] | 1,225 |
| Wildlife[1] | 15[2] | 73[2] | 48[2] | 24[2] | 40[2] | 20[2] | 35[2] | 21 | 30 | 89[2] | 1 | 307[2] | 18 | 17 | 92[2] | **830** |
| Vegetation[1] | 22[2] | 56[2] | 72[2] | 61[2] | 48[2] | 23[2] | 24[2] | 43[2] | 45[2] | 74[2] | 3[2,3] | 164[2] | 23[2] | 28[2] | 94[2] | **780** |
| Fuels management[1] | 16[2] | 24 | 119[2] | 33[2] | 15[2] | 14 | 25[2] | 77[2] | 76[2] | 28[2] | 3[2,3] | 129[2] | 57[2] | 45[2] | 14 | **675** |
| Invasive plant species[1] | 4 | 44[2] | 41 | 57[2] | 37[2] | 18[2] | 14 | 16 | 15 | 67[2] | 7[2] | 121[2] | 12 | 5 | 100[2] | **558** |
| Fire behavior | 13[2] | 15 | 41 | 16 | 9 | 18[2] | 16[2] | 46[2] | 39[2] | 15 | 5[2] | 79 | 21 | 17 | 22[2] | **372** |
| WUI and infrastructure | 9 | 19 | 60[2] | 7 | 4 | 11 | 10 | 39[2,3] | 41[2] | 15 | 2 | 73 | 43[2] | 22 | 16 | **371** |
| Post fire recovery and management | 12 | 12 | 46 | 41[2] | 13 | 6 | 3 | 39[2,3] | 37 | 12 | 4[2] | 28 | 21 | 31[2] | 7 | **312** |
| Fire regimes | 18[2] | 15 | 21 | 8 | 11 | 16 | 15 | 20 | 30 | 16 | 1 | 60 | 9 | 14 | 14 | **268** |
| Firefighter safety and incident management | 7 | 29[2] | 19 | 11 | 9 | 11 | 15 | 35 | 30 | 14 | 3[2,3] | 41 | 15 | 12 | 14 | **265** |
| Smoke air quality and health | 8 | 9 | 20 | 9 | 9 | 6 | 4 | 17 | 31 | 8 | 0 | 79 | 7 | 6 | 12 | **225** |
| Watershed processes | 8 | 6 | 30 | 16 | 5 | 6 | 7 | 16 | 18 | 6 | 1 | 27 | 16 | 25[2] | 6 | **193** |
| Social science and human dimensions | 4 | 11 | 21 | 11 | 8 | 9 | 3 | 19 | 19 | 7 | 4[2] | 19 | 24[2] | 9 | 14 | **182** |
| Soil | 9 | 6 | 17 | 13 | 10 | 3 | 5 | 8 | 9 | 8 | 1 | 21 | 6 | 8 | 6 | **130** |
| Economic impacts | 1 | 3 | 8 | 6 | 13 | 3 | 4 | 6 | 11 | 8 | 0 | 17 | 5 | 6 | 0 | **91** |
| Indigenous knowledge | 2 | 1 | 17 | 2 | 2 | 13 | 2 | 5 | 18 | 5 | 1 | 4 | 5 | 6 | 6 | **89** |
| **Total** | **151** | **427** | **646** | **333** | **298** | **229** | **232** | **447** | **507** | **502** | **36** | **1,598** | **305** | **283** | **572** | **6,566** |

[1]Indicates top five overall topics.

[2]Indicates the top five topics for each respondent location.

[3]Topics that are tied for top five values.

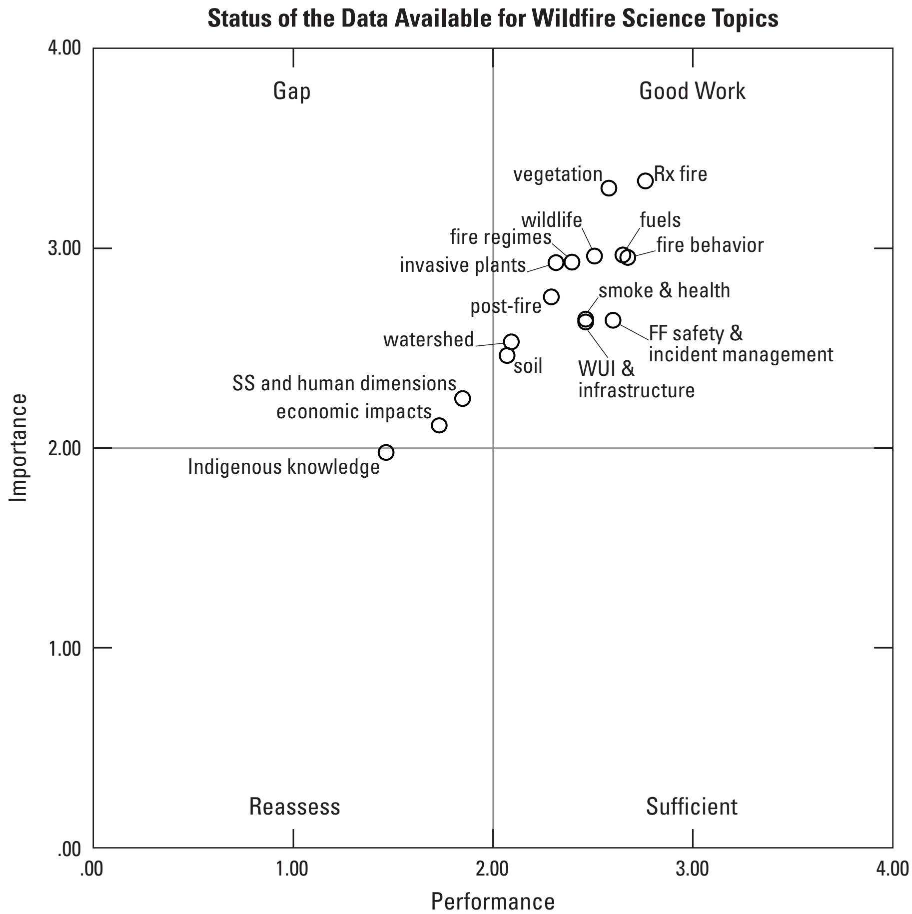



**Figure 13.** Four quadrant importance-performance analysis graph displaying the relative importance and performance of the 16 science topics averaged across all survey respondents. Some science topics are abbreviated. (FF safety & incident management, firefighter safety and incident management; fuels, fuels management; invasive plants, invasive plant species; post-fire, post-fire recovery and management; Rx, prescribed fire; smoke & health, smoke, air quality, and health; SS and human dimensions, social science and human dimensions; watershed, watershed processes; WUI & infrastructure, wildland urban interface and infrastructure)

**Table 16.** Statistics for importance performance analysis displaying average values across all responses for importance, performance, number of individuals who chose the topic as their top one to three topics relevant to their work, and the standard deviation of performance for the 16 key science topics.

[N, number (of times selected); Std Dev, standard deviation]

| Topic | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| | | | Gap | | | |
| Economic impacts | 4,660 | 2.11 | 1.13 | 91 | 1.73 | 0.96 |
| Social science and human dimensions | 4,952 | 2.25 | 1.11 | 182 | 1.85 | 0.85 |
| | | | Reassess | | | |
| Indigenous knowledge | 4,363 | 1.98 | 1.19 | 89 | 1.46 | 0.83 |
| | | | Good work | | | |
| Soil | 5,432 | 2.46 | 1 | 130 | 2.07 | 0.9 |
| Watershed processes | 5,575 | 2.53 | 1.06 | 193 | 2.09 | 0.8 |
| Smoke, air quality, and health | 5,794 | 2.63 | 1.12 | 225 | 2.46 | 0.83 |
| Firefighter safety and incident management | 5,813 | 2.64 | 1.32 | 265 | 2.61 | 0.9 |
| Fire regimes | 6,454 | 2.93 | 0.95 | 268 | 2.4 | 0.81 |
| Post-fire recovery and management | 6,071 | 2.76 | 1.08 | 312 | 2.29 | 0.81 |
| Wildland urban interface and infrastructure | 5,844 | 2.65 | 1.18 | 371 | 2.46 | 0.86 |
| Fire behavior | 6,512 | 2.95 | 0.97 | 372 | 2.68 | 0.74 |
| Invasive plant species | 6,516 | 2.93 | 0.99 | 558 | 2.32 | 0.84 |
| Fuels management | 6,524 | 2.97 | 1.03 | 675 | 2.66 | 0.78 |
| Vegetation | 7,336 | 3.3 | 0.78 | 780 | 2.59 | 0.75 |
| Wildlife | 6,598 | 2.96 | 1 | 830 | 2.5 | 0.77 |
| Prescribed fire | 7,396 | 3.34 | 0.91 | 1,225 | 2.77 | 0.8 |

## Importance-performance Charts by Science Topic

In this section, IPA graphs are presented for each science topic. Topics are presented in the following order: 1) topics where respondents from all locations rated them to be in the Good Work quadrant; 2) topics mostly placed in Good Work; 3) topics placed in Gap or Good Work; and 4) topics placed across the grid. In these charts each point represents the average values for the topic from respondents with a given respondent location. Results pertain to the self-identified respondent locations; not all respondents participate in the exchange that corresponds with their location (fig. 5). Accordingly, IPA results address how respondents perceive the importance of a science topic and the performance of available resources for that topic, which include but are not limited to the exchange that covers their location. There are three different colors that indicate the groupings for respondent location: blue dots indicate respondent locations that are part of the western group; red dots indicate respondent locations that are part of the eastern group; and green dots indicate locations that do not consistently belong to either region (independents). In many of these analyses, Pacific is missing owing to a low response rate and lack of responses for either importance or performance values.

For the prescribed fire topic, all 15 exchanges are in the Good Work quadrant. See figure 14 and table 17. This was the topic that was most frequently selected by respondents as a key topic relevant to their work. Although all the locations fall into the Good Work quadrant, there is notable variation across the locations regarding the importance that different respondents rated prescribed fire. For example, on average respondents from Southern, Tallgrass Prairie, and Oak Woodlands rated the importance of prescribed fire as 3.5 or greater, suggesting that this topic was very important or critical to their work. On the other hand, respondents from Alaska, Great Basin, Southern Rockies, and Pacific rated prescribed fire with a mean of below 3.0 for importance, indicating that this topic was only moderately important to their work. Pacific did not have responses on the performance of this topic, so they are not included in figure 14. Eastern locations are grouped above (higher importance) the western locations.

For fire behavior, the locations are tightly clustered together in the Good Work quadrant indicating that overall, this topic was both important and had adequate information available for respondents in all 15 locations. All locations are in the Good Work quadrant, and eastern locations are clustered together. See figure 15 and table 18.

For firefighter safety and incident management, all the locations are relatively clustered into the Good Work quadrant. Great Basin is slightly outside of the general grouping with a lower relative importance and performance value than most of the other locations, but is still in the Good Work quadrant. Overall, it appears that firefighter safety and incident management was an important topic to respondents with adequate data, tools, and programs available across locations. All three locations are clustered in Good Work. See figure 16 and table 19.

Respondents from most of the locations rated the topic of invasive plant species as important and with high performance for their region. Southwest and Alaska fall on the border between the Gap and Good Work quadrants, because respondents from these locations indicated a low to moderate availability and quality of scientific resources for the topic. For Alaska, invasive plant species were rated as the lowest importance compared to the other locations. The standard deviations for this topic range from 0.67 (Pacific) to 1.17 (Alaska). All three of the locations form a cluster, with the eastern locations more closely grouped. See figure 17 and table 20.

For WUI and infrastructure, the locations fall mostly in the upper right quadrant but are more spread out across the quadrant compared to some of the other science topics. The 12 locations that fall in Good Work vary slightly in terms of the importance (between 2.21 and 3.22) and performance (between 2.22 and 3.0). Pacific and Lake States fall on the border between the Gap and Good Work quadrants, where respondents from Pacific rated this topic as more important than Lake States respondents. Great Plains falls uniquely in the very middle of the diagram, indicating that respondents rated WUI and infrastructure as a moderately important topic with moderate performance. These three locations are conservatively interpreted as being in the Gap quadrant because they have a mean performance rating of 2.0 (for Pacific and Great Plains only one respondent answered this question, and for Lake States the standard deviation is 0.63). More research or responses may be needed to understand what quadrant exchange participants in the Great Plains exchange region would place this topic in. Western locations tend to be above the eastern and independent locations. See figure 18 and table 21.

For the topic of postfire recovery and management, most locations are clustered together in the Good Work category, whereas Pacific and California fall on the border of the Gap quadrant. Many of the locations are close to the border between the two upper quadrants, but Pacific and California had the lowest ratings for performance on this topic, suggesting that more scientific resources are needed for postfire recovery and management in these areas. For this topic, the standard deviation for performance is between 0.67 (Pacific) and 1.18 (Alaska). California has a standard deviation of 1.01 for its performance. Western locations are clustered above (higher importance) the eastern locations. See figure 19 and table 22.

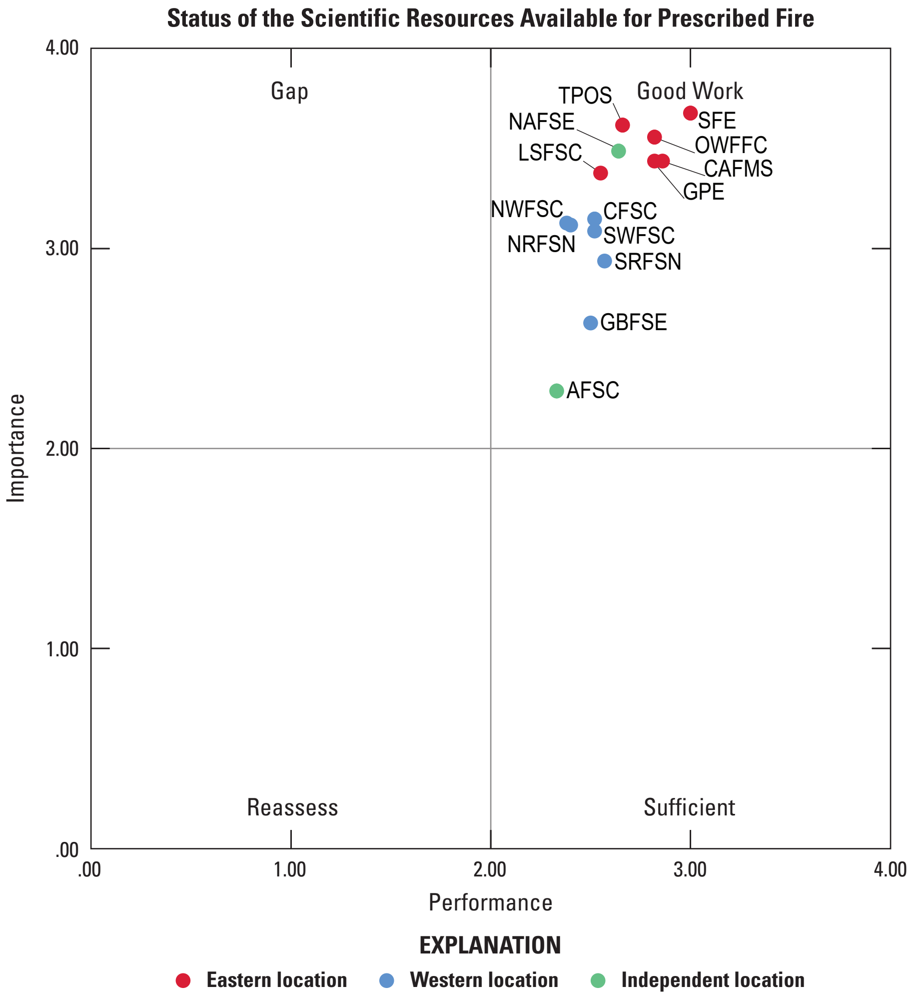



**Figure 14.** Importance-performance analysis quadrant displaying how survey respondents rated the importance and performance of information for prescribed fire, by regional fire science exchange respondent location. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 17.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for prescribed fire.

[N, number (of times selected); Std Dev, standard deviation; --, no data; SFE, Southern Fire Exchange; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; NAFSE, North Atlantic Fire Science Exchange; GPE, Great Plains Fire Science Exchange; CAFMS, Consortium of Appalachians Fire Managers and Scientists; LSFSC, Lake States Fire Science Consortium; CFSC, California Fire Science Consortium NWFSC, Northwest Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; GBFSE, Great Basin Fire Science Exchange; AFSC, Alaska Fire Science Consortium; PFX, Pacific Fire Exchange]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| Good Work | | | | | | |
| SFE | 1,999 | 3.68 | 0.59 | 429 | 3 | 0.75 |
| TPOS | 698 | 3.62 | 0.64 | 155 | 2.66 | 0.7 |
| OWFFC | 595 | 3.56 | 0.66 | 130 | 2.82 | 0.53 |
| NAFSE | 269 | 3.49 | 0.74 | 50 | 2.64 | 0.58 |
| GPE | 347 | 3.44 | 0.74 | 65 | 2.86 | 1.19 |
| CAFMS | 496 | 3.44 | 0.77 | 104 | 2.82 | 0.71 |
| LSFSC | 264 | 3.38 | 0.76 | 52 | 2.55 | 0.82 |
| CFSC | 681 | 3.15 | 1.06 | 66 | 2.52 | 0.95 |
| NWFSC | 539 | 3.13 | 0.88 | 58 | 2.38 | 0.76 |
| NRFSN | 471 | 3.12 | 0.94 | 40 | 2.4 | 1.03 |
| SWFSC | 306 | 3.09 | 1.12 | 32 | 2.52 | 0.82 |
| SRFSN | 300 | 2.94 | 1.12 | 23 | 2.57 | 0.82 |
| GBFSE | 294 | 2.63 | 1.13 | 18 | 2.5 | 0.71 |
| AFSC | 112 | 2.29 | 1.26 | 3 | 2.33 | 1.11 |
| PFX[1] | 25 | 2.08 | 1.38 | 0 | -- | -- |

[1]No respondents from this location rated the performance of this science topic.

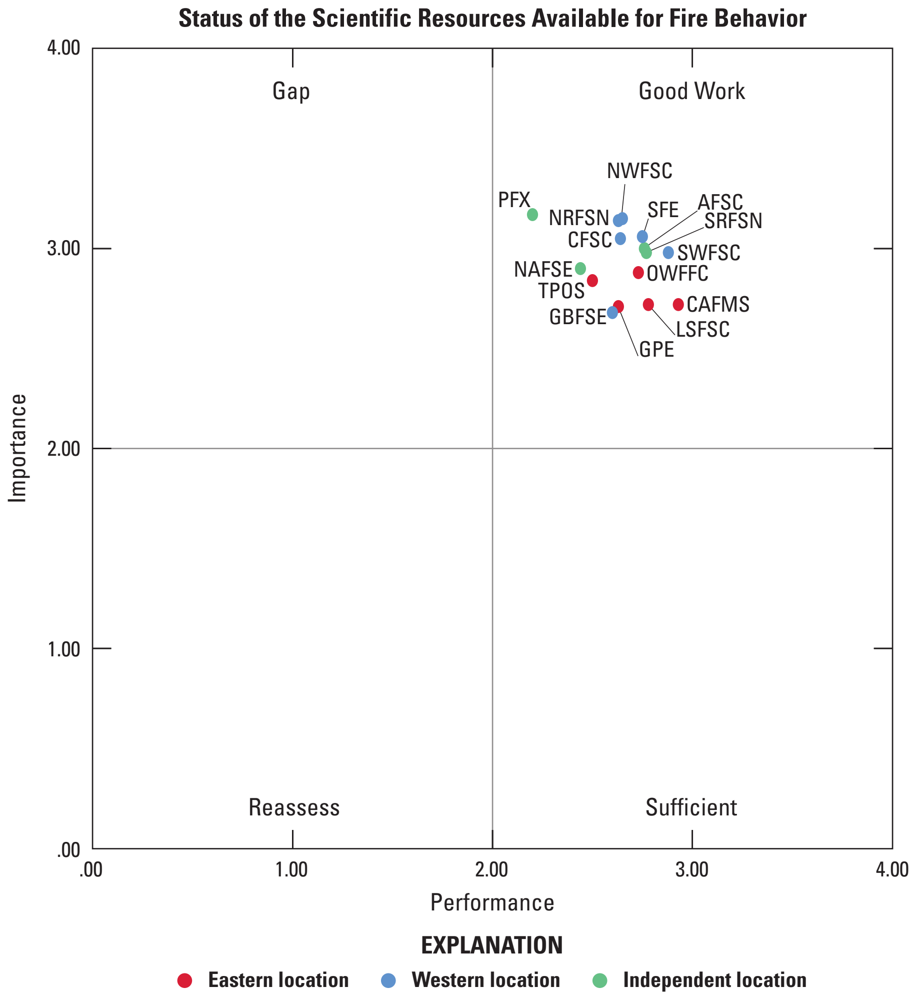



**Figure 15.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for fire behavior. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 18.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for fire behavior.

[N, number (of times selected); Std Dev, standard deviation; PFX, Pacific Fire Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; SFE, Southern Fire Exchange; CFSC, California Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; LSFSC, Lake States Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; GPE, Great Plains Fire Science Exchange; GBFSE, Great Basin Fire Science Exchange]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| | | | Good Work | | | |
| PFX | 38 | 3.17 | 0.83 | 5 | 2.2 | 0.84 |
| NRFSN | 475 | 3.15 | 0.89 | 46 | 2.65 | 0.67 |
| NWFSC | 533 | 3.14 | 0.84 | 39 | 2.63 | 0.82 |
| SFE | 1,643 | 3.06 | 0.92 | 79 | 2.75 | 0.69 |
| CFSC | 658 | 3.05 | 0.99 | 41 | 2.64 | 0.84 |
| SRFSN | 303 | 3 | 1.09 | 21 | 2.76 | 0.62 |
| SWFSC | 292 | 2.98 | 0.97 | 17 | 2.88 | 0.7 |
| AFSC | 149 | 2.98 | 1.19 | 13 | 2.77 | 0.73 |
| NAFSE | 226 | 2.9 | 1.01 | 16 | 2.44 | 0.63 |
| OWFFC | 466 | 2.88 | 0.88 | 15 | 2.73 | 0.59 |
| TPOS | 551 | 2.84 | 0.96 | 22 | 2.5 | 0.8 |
| LSFSC | 215 | 2.72 | 1.01 | 18 | 2.78 | 1 |
| CAFMS | 395 | 2.72 | 1.06 | 15 | 2.93 | 0.92 |
| GPE | 271 | 2.71 | 0.94 | 9 | 2.63 | 0.52 |
| GBFSE | 297 | 2.68 | 1.15 | 16 | 2.6 | 0.63 |

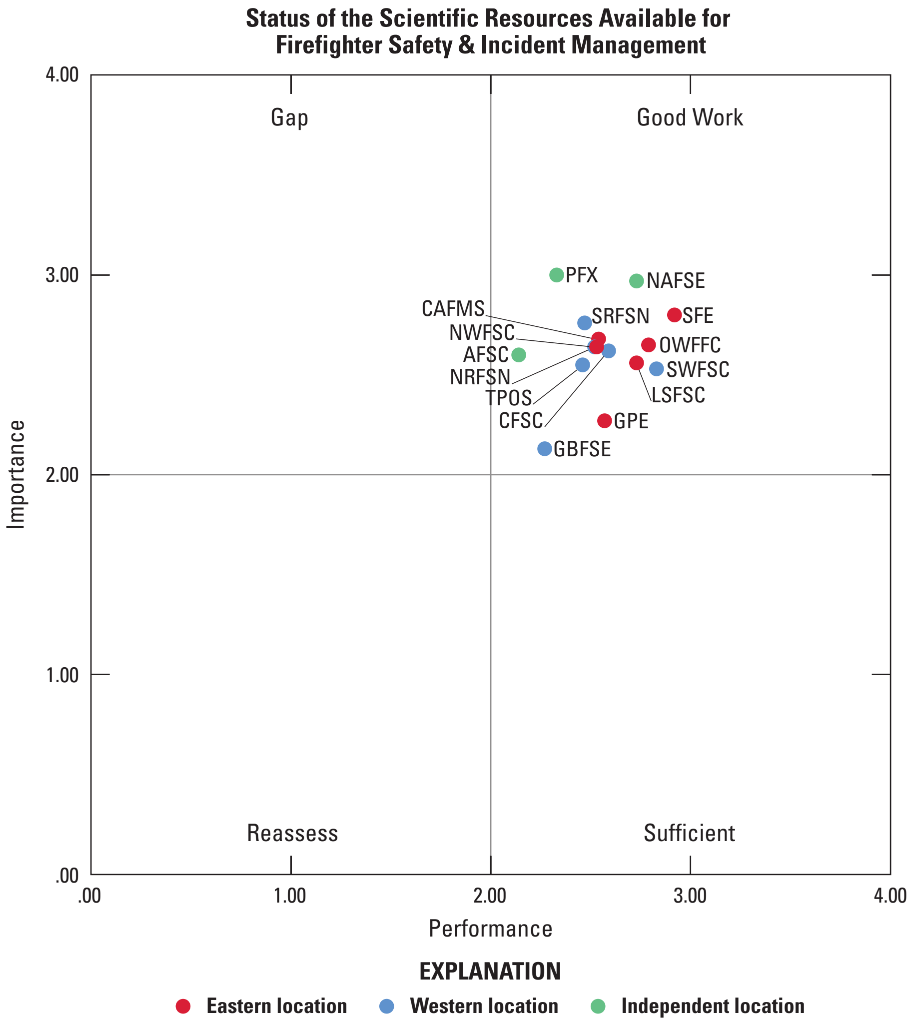



**Figure 16.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for firefighter safety and incident management. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 19.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for firefighter safety and incident management.

[N, number (of times selected); Std Dev, standard deviation; PFX, Pacific Fire Exchange; NAFSE, North Atlantic Fire Science Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; CAFMS, Consortium of Appalachians Fire Managers and Scientists; OWFFC, Oak Woodlands and Forests Fire Consortium; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; CFSC, California Fire Science Consortium; AFSC, Alaska Fire Science Consortium; LSFSC, Lake States Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; SWFSC, Southwest Fire Science Consortium; GPE, Great Plains Fire Science Exchange; GBFSE, Great Basin Fire Science Exchange]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| | | | Good Work | | | |
| PFX | 36 | 3 | 1.35 | 3 | 2.33 | 0.58 |
| NAFSE | 232 | 2.97 | 1.21 | 15 | 2.73 | 0.96 |
| SFE | 1,496 | 2.8 | 1.24 | 41 | 2.92 | 0.88 |
| SRFSN | 279 | 2.76 | 1.36 | 15 | 2.47 | 1.06 |
| CAFMS | 388 | 2.68 | 1.43 | 29 | 2.54 | 0.84 |
| OWFFC | 435 | 2.65 | 1.29 | 14 | 2.79 | 0.89 |
| NRFSN | 394 | 2.64 | 1.36 | 35 | 2.53 | 0.99 |
| NWFSC | 452 | 2.64 | 1.38 | 30 | 2.52 | 0.83 |
| CFSC | 563 | 2.62 | 1.22 | 19 | 2.59 | 0.87 |
| AFSC | 130 | 2.6 | 1.39 | 7 | 2.14 | 0.38 |
| LSFSC | 202 | 2.56 | 1.35 | 11 | 2.73 | 0.9 |
| TPOS | 493 | 2.55 | 1.3 | 14 | 2.46 | 0.88 |
| SWFSC | 248 | 2.53 | 1.35 | 12 | 2.83 | 0.83 |
| GPE | 227 | 2.27 | 1.34 | 9 | 2.57 | 0.98 |
| GBFSE | 238 | 2.13 | 1.47 | 11 | 2.27 | 1.19 |

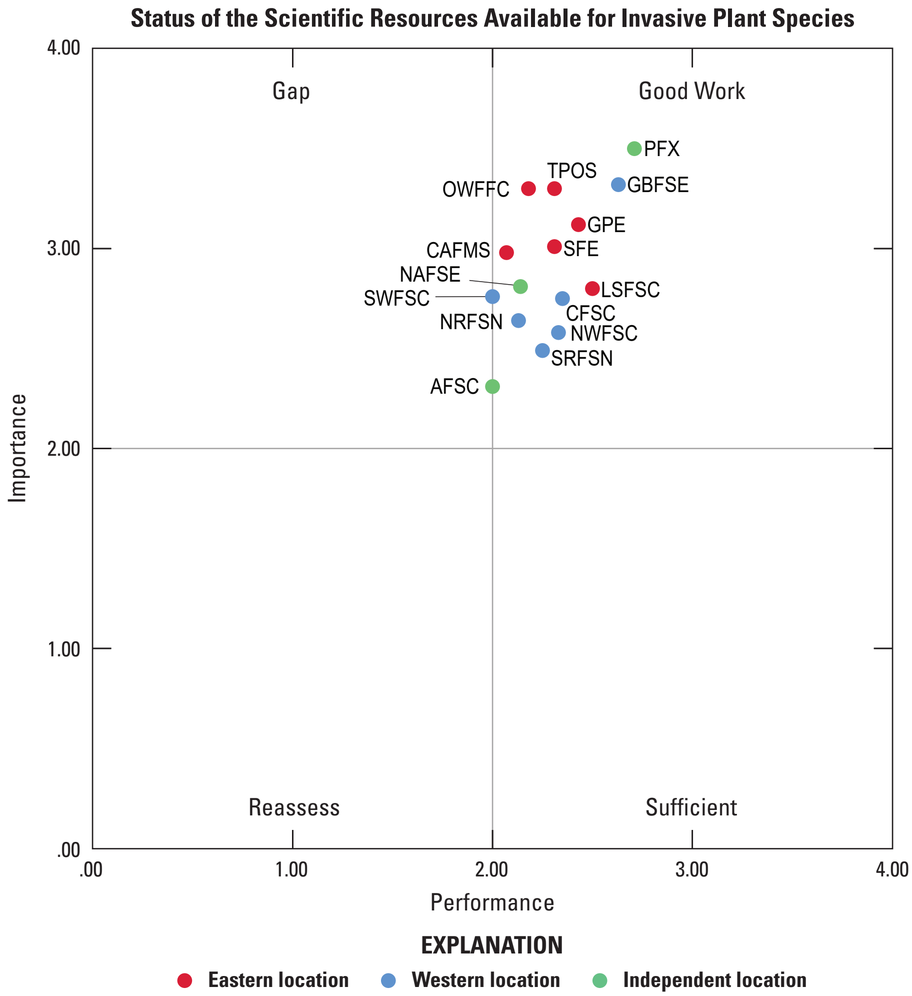



**Figure 17.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for invasive plant species. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 20.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for invasive plant species.

[N, number (of times selected); Std Dev, standard deviation; SWFSC, Southwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; PFX, Pacific Fire Exchange; GBFSE, Great Basin Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; GPE, Great Plains Fire Science Exchange; SFE, Southern Fire Exchange; CAFMS, Consortium of Appalachians Fire Managers and Scientists; NAFSE, North Atlantic Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; CFSC, California Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| | | | Gap | | | |
| SWFSC | 270 | 2.76 | 1 | 5 | 2 | 0.82 |
| AFSC | 118 | 2.31 | 1.17 | 4 | 2 | 0.67 |
| | | | Good Work | | | |
| PFX | 42 | 3.5 | 0.67 | 7 | 2.71 | 0.82 |
| GBFSE | 375 | 3.32 | 0.86 | 57 | 2.63 | 0.8 |
| OWFFC | 555 | 3.3 | 0.74 | 67 | 2.18 | 0.8 |
| TPOS | 641 | 3.3 | 0.78 | 100 | 2.31 | 0.75 |
| GPE | 315 | 3.12 | 0.92 | 37 | 2.43 | 0.9 |
| SFE | 1,626 | 3.01 | 0.89 | 121 | 2.31 | 0.74 |
| CAFMS | 432 | 2.98 | 0.89 | 44 | 2.07 | 1 |
| NAFSE | 219 | 2.81 | 0.91 | 14 | 2.14 | 0.58 |
| LSFSC | 221 | 2.8 | 1.14 | 18 | 2.5 | 0.84 |
| CFSC | 602 | 2.75 | 1.14 | 41 | 2.35 | 0.83 |
| NRFSN | 399 | 2.64 | 0.98 | 16 | 2.13 | 0.64 |
| NWFSC | 447 | 2.58 | 1.06 | 15 | 2.33 | 0.99 |
| SRFSN | 254 | 2.49 | 1.12 | 12 | 2.25 | 0.68 |

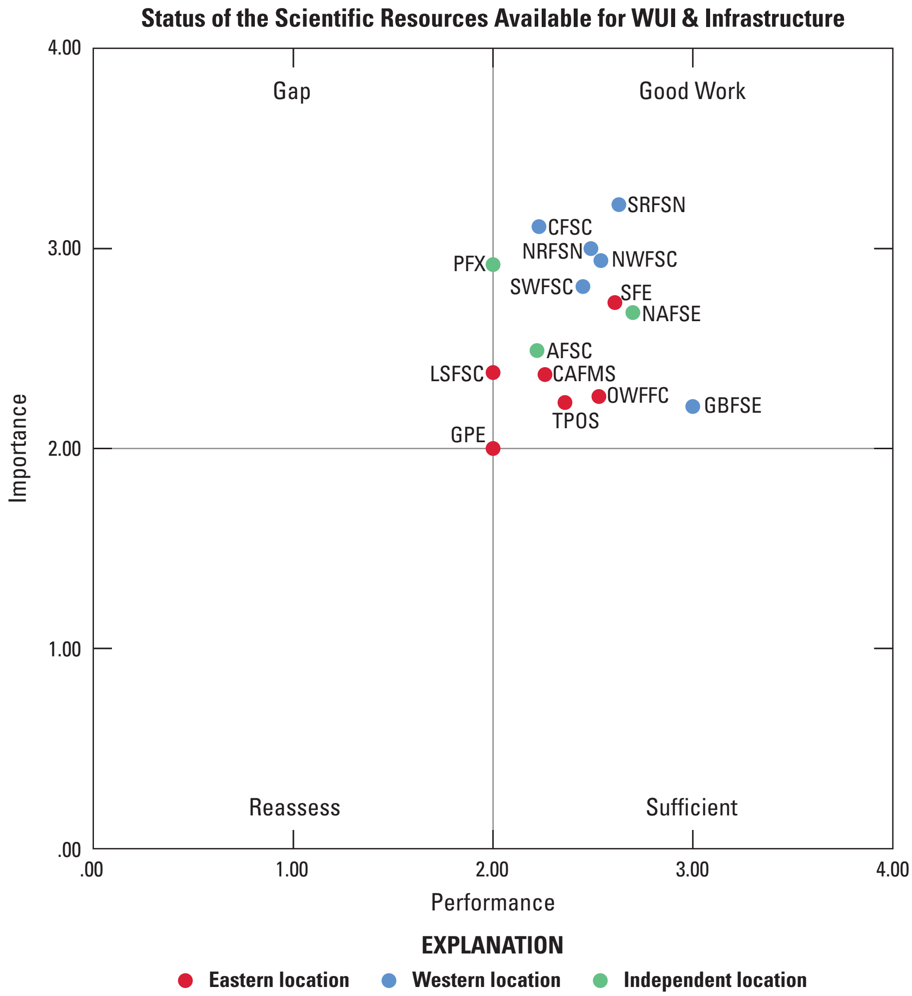



**Figure 18.** Importance-performance analysis quadrant displaying how respondents representing their regional fire science exchange location rated the importance and performance of information for wildland urban interface and infrastructure. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 21.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for wildland urban interface and infrastructure.

[N, number (of times selected); Std Dev, standard deviation; PFX, Pacific Fire Exchange; GPE, Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; CFSC, California Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; SWFSC, Southwest Fire Science Consortium; SFE, Southern Fire Exchange; NAFSE, North Atlantic Fire Science Exchange; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; OWFFC, Oak Woodlands and Forests Fire Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| Gap | | | | | | |
| PFX | 35 | 2.92 | 1 | 2 | 2 | 0 |
| GPE | 200 | 2 | 1 | 4 | 2 | 0 |
| LSFSC | 188 | 2.38 | 1.23 | 11 | 2 | 0.63 |
| Good Work | | | | | | |
| SRFSN | 325 | 3.22 | 1.01 | 43 | 2.63 | 0.85 |
| CFSC | 677 | 3.11 | 1.03 | 60 | 2.23 | 0.93 |
| NRFSN | 453 | 3 | 1.01 | 39 | 2.49 | 0.73 |
| NWFSC | 499 | 2.94 | 1.1 | 41 | 2.54 | 0.81 |
| SWFSC | 278 | 2.81 | 1.11 | 22 | 2.45 | 0.83 |
| SFE | 1,459 | 2.73 | 1.19 | 73 | 2.61 | 0.8 |
| NAFSE | 209 | 2.68 | 1.22 | 10 | 2.7 | 0.82 |
| AFSC | 127 | 2.49 | 1.32 | 9 | 2.22 | 0.83 |
| CAFMS | 343 | 2.37 | 1.16 | 19 | 2.26 | 0.81 |
| OWFFC | 370 | 2.26 | 1.14 | 15 | 2.53 | 1.13 |
| TPOS | 431 | 2.23 | 1.18 | 16 | 2.36 | 1.15 |
| GBFSE | 250 | 2.21 | 1.18 | 7 | 3 | 1.15 |

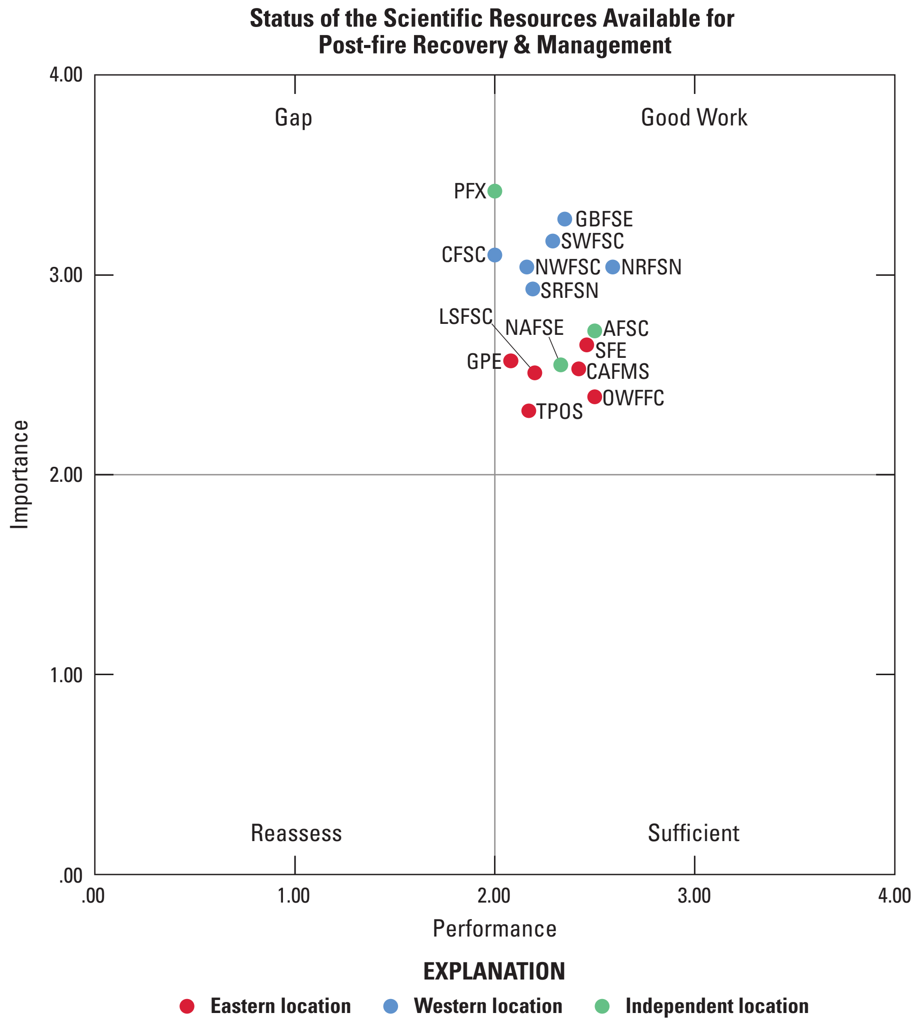



**Figure 19.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for post-fire recovery and management. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 22.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for post-fire recovery and management.

[N, number (of times selected); Std Dev, standard deviation; PFX, Pacific Fire Exchange; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; SWFSC, Southwest Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; AFSC, Alaska Fire Science Consortium; SFE, Southern Fire Exchange; GPE, Great Plains Fire Science Exchange; NAFSE, North Atlantic Fire Science Exchange; CAFMS, Consortium of Appalachians Fire Managers and Scientists; LSFSC, Lake States Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| | | | Gap | | | |
| PFX | 41 | 3.42 | 0.67 | 4 | 2 | 0.82 |
| CFSC | 675 | 3.1 | 1.01 | 46 | 2 | 0.83 |
| | | | Good Work | | | |
| GBFSE | 371 | 3.28 | 0.89 | 41 | 2.35 | 0.8 |
| SWFSC | 314 | 3.17 | 0.95 | 31 | 2.29 | 0.82 |
| NRFSN | 453 | 3.04 | 0.94 | 39 | 2.59 | 0.64 |
| NWFSC | 520 | 3.04 | 1.04 | 37 | 2.16 | 0.99 |
| SRFSN | 299 | 2.93 | 1 | 21 | 2.19 | 0.68 |
| AFSC | 136 | 2.72 | 1.18 | 12 | 2.5 | 0.67 |
| SFE | 1,414 | 2.65 | 1.04 | 28 | 2.46 | 0.74 |
| GPE | 254 | 2.57 | 1.06 | 13 | 2.08 | 0.9 |
| NAFSE | 196 | 2.55 | 1.05 | 3 | 2.33 | 0.58 |
| CAFMS | 362 | 2.53 | 1.15 | 12 | 2.42 | 1 |
| LSFSC | 198 | 2.51 | 1 | 6 | 2.2 | 0.84 |
| OWFFC | 390 | 2.39 | 1.11 | 12 | 2.5 | 0.8 |
| TPOS | 448 | 2.32 | 1.16 | 7 | 2.17 | 0.75 |

In terms of vegetation, responses from all the locations except for Pacific fall closely together into the Good Work category. Respondents from Pacific placed vegetation in the Gap quadrant suggesting that although these respondents rated vegetation nearly as important or more than most of the other locations, there is considerably lower performance compared to the rest of the locations. The independents fall more on the left (lower performance) compared to the other two locations. See figure 20 and table 23.

The fuels management topic is mostly clustered in Good Work with some variation across locations in terms of importance. For example, on the high end, many respondents from Southern Rockies believed fuels management is critical to their work. On the low end of the importance scale, on average, the respondents from Tallgrass Prairie considered this topic to be moderately important. North Atlantic falls in the Gap quadrant but is close to the border with Good Work, and falls in the middle in terms of the importance its respondents assigned to this topic compared to the other locations. The two geographic groupings are clustered where western are above (higher importance) the eastern locations, whereas the independents have two locations in the Good Work quadrant and one in the Gap quadrant. See figure 21 and table 24.

For the topic of fire regimes, the locations are loosely grouped together in the upper right-hand quadrant where most of them fall into the Good Work category. North Atlantic falls slightly into the Gap quadrant, whereas Tallgrass Prairie and Great Basin are on the border. These locations are conservatively placed into the Gap quadrant following the decision rule described above. The standard deviation for Tallgrass Prairie is 0.39 and Great Basin is 0.76. Western locations are grouped above the eastern locations. See figure 22 and table 25.

For the topic of smoke, air quality, and health, most of the locations fall into the Good Work quadrant and are relatively closely clustered together. Only Southwest falls into the Gap for this topic, and Southern Rockies is on the border (with a standard deviation of 0.82) indicating that the data, tools, and programs available for this topic may not be sufficient for the relative importance of the topic for respondents. No respondents from Pacific selected this topic as their top one to three topics to answer follow-up questions, thus the performance values have been left blank and it was not included in the graph. The three location groupings are interspersed. See figure 23 and table 26.

For wildlife, most of the locations are in the Good Work category, meaning that respondents rated this topic as moderate or higher importance and moderate to good performance. For respondents in California, wildlife is considered a Gap topic, meaning that respondents considered it important but with low availability and quality of scientific resources. Similarly, respondents in Pacific and Southwest considered wildlife important, but their ratings suggest they do not have sufficient scientific resources available for the topic. Only one respondent from Pacific answered the question for wildlife, and the standard deviation for Southwest is 0.79. The rest of the locations rated wildlife in the Good Work quadrant. Eastern locations are grouped slightly to the upper right compared to the rest, western locations are to the lower right, and the independents (green) fall in between. See figure 24 and table 27.

Respondents varied across locations in how they rated the performance of soil as a science topic, but all believed it is an important topic. As a result, all 15 locations plot in the top half of the graph, in either the upper left or upper right quadrants. For about half of the locations (Great Basin, Southwest, Alaska, Northwest, Northern Rockies, Oak Woodlands, and Tallgrass Prairie), soil falls into the Good Work category, indicating respondents thought there were adequate data, tools, and programs available for the topic. For the other half, (Pacific, California, Southern Rockies, North Atlantic, Southern, Lake States, and Appalachia), soil falls into the Gap category, indicating that there were not adequate scientific resources available in these locations. Great Plains plots on the border between the Gap and Good Work quadrants with a performance value of 2.0 and standard deviation of 0.94. Eastern locations are grouped more to the left (lower performance) and western are grouped more to the right (relatively higher performance ratings). See figure 25 and table 28.

For watershed processes, the results were similar to those for soil, in that respondents closely rated all the topics as moderately important or higher but differed in the extent to which they rated performance. However, compared to soil, the disparity in performance rating was smaller and the locations plot loosely in the middle of the diagram. Pacific and Tallgrass Prairie fall on the border of the two quadrants, so they are conservatively interpretated as being in the Gap quadrant. Pacific only had one respondent for this topic, and Tallgrass Prairie has a standard deviation of 0.63. Eastern locations are grouped below the western locations. See figure 26 and table 29.

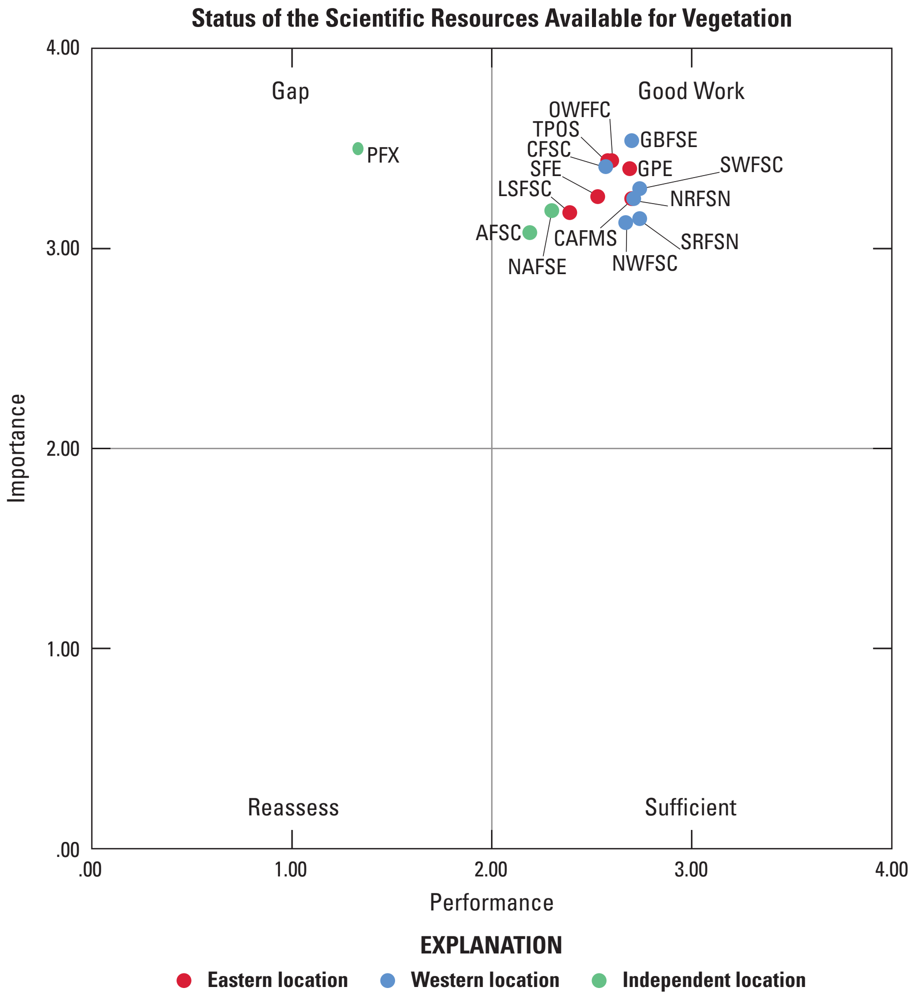



**Figure 20.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for vegetation. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 23.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for vegetation.

[N, number (of times selected); Std Dev, standard deviation; PFX, Pacific Fire Exchange; GBFSE, Great Basin Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; CFSC, California Fire Science Consortium; GPE, Great Plains Fire Science Exchange; SWFSC, Southwest Fire Science Consortium; SFE, Southern Fire Exchange; NRFSN, Northern Rockies Fire Science Network; CAFMS, Consortium of Appalachians Fire Managers and Scientists; NAFSE, North Atlantic Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| Gap | | | | | | |
| PFX | 42 | 3.5 | 0.52 | 3 | 1.33 | 0.58 |
| Good Work | | | | | | |
| GBFSE | 400 | 3.54 | 0.72 | 61 | 2.7 | 0.81 |
| OWFFC | 575 | 3.44 | 0.6 | 74 | 2.6 | 0.72 |
| TPOS | 668 | 3.44 | 0.67 | 94 | 2.58 | 0.73 |
| CFSC | 739 | 3.41 | 0.85 | 72 | 2.57 | 0.7 |
| GPE | 340 | 3.4 | 0.83 | 48 | 2.69 | 0.66 |
| SWFSC | 327 | 3.3 | 0.78 | 28 | 2.74 | 0.71 |
| SFE | 1,761 | 3.26 | 0.74 | 164 | 2.53 | 0.81 |
| NRFSN | 471 | 3.25 | 0.78 | 43 | 2.7 | 0.6 |
| CAFMS | 490 | 3.25 | 0.75 | 56 | 2.71 | 0.81 |
| NAFSE | 249 | 3.19 | 0.87 | 24 | 2.3 | 0.7 |
| LSFSC | 251 | 3.18 | 0.87 | 23 | 2.39 | 0.78 |
| SRFSN | 324 | 3.15 | 0.78 | 23 | 2.74 | 0.54 |
| NWFSC | 542 | 3.13 | 0.91 | 45 | 2.67 | 0.77 |
| AFSC | 157 | 3.08 | 0.93 | 22 | 2.19 | 0.87 |

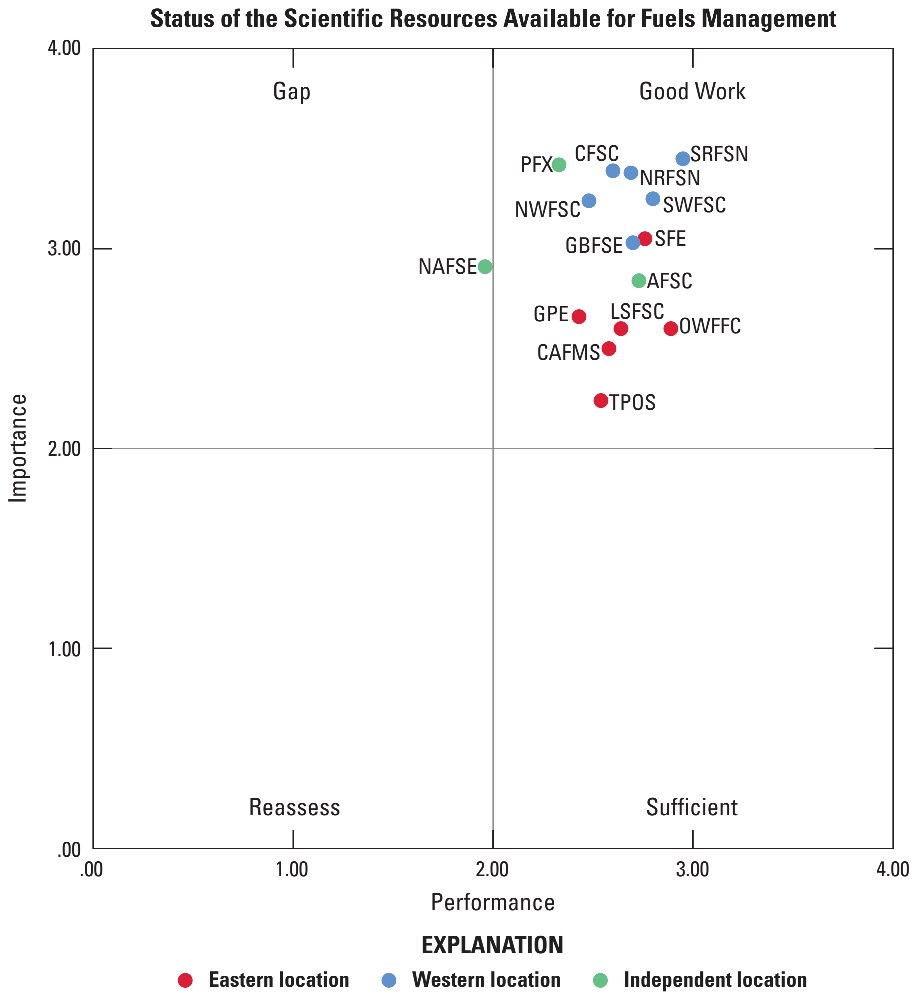



**Figure 21.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for fuels management. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 24.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for fuels management.

[N, number (of times selected); Std Dev, standard deviation; NAFSE, North Atlantic Fire Science Exchange; SRFSN, Southern Rockies Fire Science Network; PFX, Pacific Fire Exchange; CFSC, California Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; NWFSC, Northwest Fire Science Consortium; SFE, Southern Fire Exchange; GBFSE, Great Basin Fire Science Exchange; AFSC, Alaska Fire Science Consortium; GPE, Great Plains Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; LSFSC, Lake States Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; Tallgrass Prairie and Oak Savanna Fire Science Consortium]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| | | | Gap | | | |
| NAFSE | 227 | 2.91 | 0.96 | 25 | 1.96 | 0.73 |
| | | | Good Work | | | |
| SRFSN | 352 | 3.45 | 0.84 | 57 | 2.95 | 0.69 |
| PFX | 41 | 3.42 | 0.79 | 3 | 2.33 | 0.58 |
| CFSC | 728 | 3.39 | 0.89 | 119 | 2.6 | 0.84 |
| NRFSN | 511 | 3.38 | 0.76 | 77 | 2.69 | 0.71 |
| SWFSC | 322 | 3.25 | 0.86 | 45 | 2.8 | 0.73 |
| NWFSC | 554 | 3.24 | 0.85 | 76 | 2.48 | 0.89 |
| SFE | 1,636 | 3.05 | 0.9 | 129 | 2.76 | 0.71 |
| GBFSE | 336 | 3.03 | 0.96 | 33 | 2.7 | 0.68 |
| AFSC | 142 | 2.84 | 1.23 | 16 | 2.73 | 0.96 |
| GPE | 261 | 2.66 | 1.03 | 15 | 2.43 | 0.85 |
| OWFFC | 421 | 2.6 | 1.07 | 28 | 2.89 | 0.75 |
| LSFSC | 200 | 2.6 | 1.14 | 14 | 2.64 | 0.74 |
| CAFMS | 360 | 2.5 | 1.1 | 24 | 2.58 | 0.72 |
| TPOS | 433 | 2.24 | 1.09 | 14 | 2.54 | 0.52 |

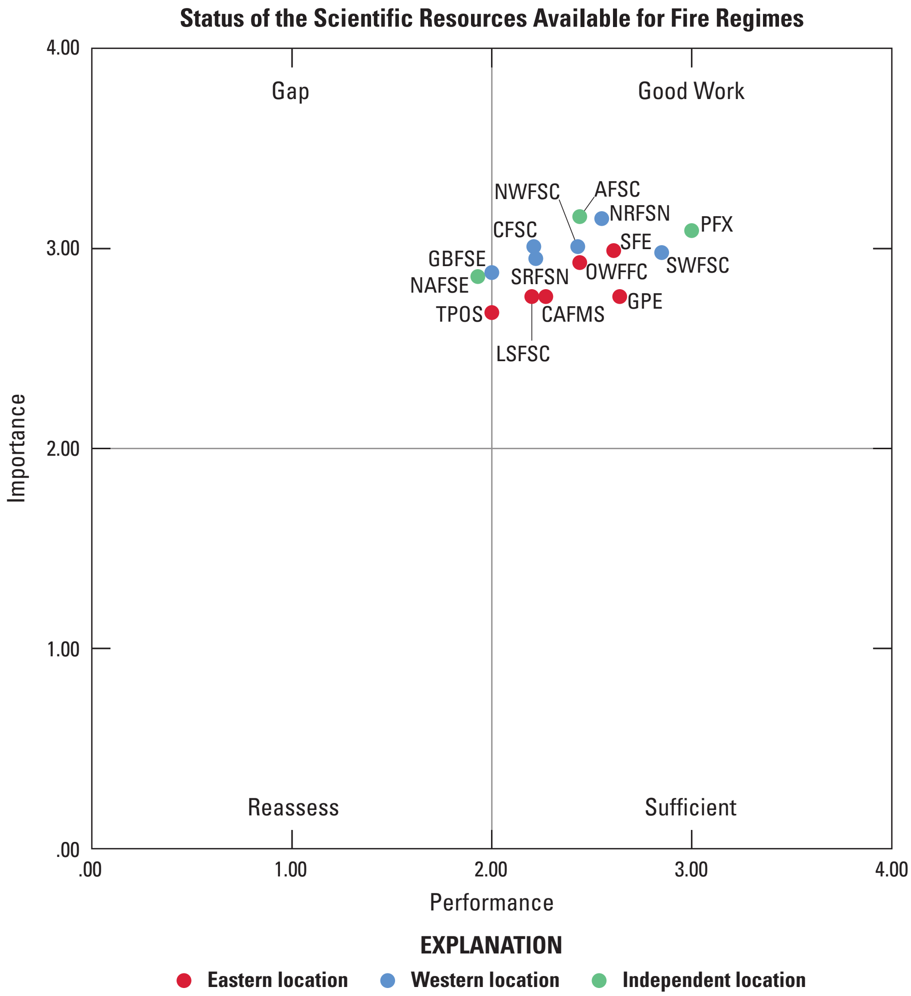



**Figure 22.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for fire regimes. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE, Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 25.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for fire regimes.

[N, number (of times selected); Std Dev, standard deviation; --, no data; NAFSE, North Atlantic Fire Science Exchange; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; AFSC, Alaska Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; PFX, Pacific Fire Exchange; NWFSC, Northwest Fire Science Consortium; CFSC, California Fire Science Consortium; SFE, Southern Fire Exchange; SWFSC, Southwest Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; OWFFC, Oak Woodlands and Forests Fire Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; LSFSC, Lake States Fire Science Consortium; GPE, Great Plains Fire Science Exchange]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| Gap | | | | | | |
| NAFSE | 220 | 2.86 | 1.02 | 15 | 1.93 | 0.73 |
| TPOS | 520 | 2.68 | 0.92 | 14 | 2 | 0.39 |
| GBFSE | 325 | 2.88 | 1.01 | 8 | 2 | 0.76 |
| Good Work | | | | | | |
| AFSC | 161 | 3.16 | 1.07 | 18 | 2.44 | 0.86 |
| NRFSN | 473 | 3.15 | 0.81 | 20 | 2.55 | 0.69 |
| PFX[1] | 34 | 3.09 | 0.94 | 1 | 3 | -- |
| NWFSC | 514 | 3.01 | 0.9 | 30 | 2.43 | 0.86 |
| CFSC | 653 | 3.01 | 0.99 | 21 | 2.21 | 1.18 |
| SFE | 1,591 | 2.99 | 0.91 | 60 | 2.61 | 0.74 |
| SWFSC | 295 | 2.98 | 0.97 | 14 | 2.85 | 0.69 |
| SRFSN | 298 | 2.95 | 1.13 | 9 | 2.22 | 0.67 |
| OWFFC | 481 | 2.93 | 0.85 | 16 | 2.44 | 0.89 |
| CAFMS | 398 | 2.76 | 1.01 | 15 | 2.27 | 0.7 |
| LSFSC | 215 | 2.76 | 0.93 | 16 | 2.2 | 0.56 |
| GPE | 276 | 2.76 | 0.88 | 11 | 2.64 | 0.92 |

[1]Because N=1, no standard deviation was calculated.

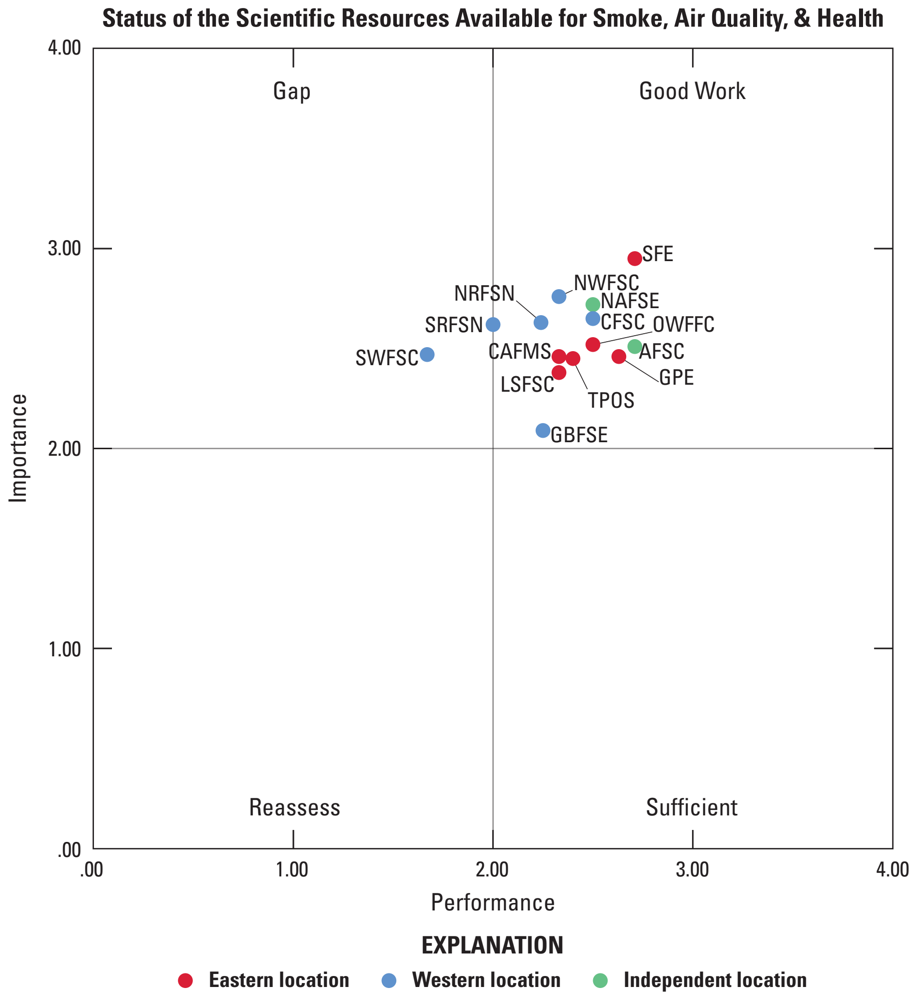



**Figure 23.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for smoke, air quality, and health. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 26.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for smoke, air quality, and health.

[N, number (of times selected); Std Dev, standard deviation; --, no data; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; SFE, Southern Fire Exchange; NWFSC, Northwest Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; CFSC, California Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; OWFFC, Oak Woodlands and Forests Fire Consortium; AFSC, Alaska Fire Science Consortium; GPE, Great Plains Fire Science Exchange; CAFMS, Consortium of Appalachians Fire Managers and Scientists; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; LSFSC, Lake States Fire Science Consortium; PFX, Pacific Fire Exchange; GBFSE, Great Basin Fire Science Exchange]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| Gap | | | | | | |
| SRFSN | 262 | 2.62 | 1.08 | 7 | 2 | 0.82 |
| SWFSC | 245 | 2.47 | 1.22 | 6 | 1.67 | 0.82 |
| Good Work | | | | | | |
| SFE | 1,580 | 2.95 | 1.04 | 79 | 2.71 | 0.75 |
| NWFSC | 475 | 2.76 | 1.15 | 31 | 2.33 | 0.76 |
| NAFSE | 212 | 2.72 | 1.13 | 4 | 2.5 | 0.58 |
| CFSC | 574 | 2.65 | 1.11 | 20 | 2.5 | 0.95 |
| NRFSN | 395 | 2.63 | 1.06 | 17 | 2.24 | 1.03 |
| OWFFC | 411 | 2.52 | 1.06 | 8 | 2.5 | 0.53 |
| AFSC | 123 | 2.51 | 1.23 | 8 | 2.71 | 1.11 |
| GPE | 244 | 2.46 | 1.08 | 9 | 2.63 | 1.19 |
| CAFMS | 357 | 2.46 | 1.15 | 9 | 2.33 | 0.71 |
| TPOS | 470 | 2.45 | 1.12 | 12 | 2.4 | 0.7 |
| LSFSC | 188 | 2.38 | 1.08 | 6 | 2.33 | 0.82 |
| PFX[1] | 26 | 2.17 | 1.11 | 0 | -- | -- |
| GBFSE | 232 | 2.09 | 1.23 | 9 | 2.25 | 0.71 |

[1]This topic ranked as important by subscribers who do not reside in this exchange region; individuals who subscribe to and reside in this exchange region did not rank the performance of this topic.

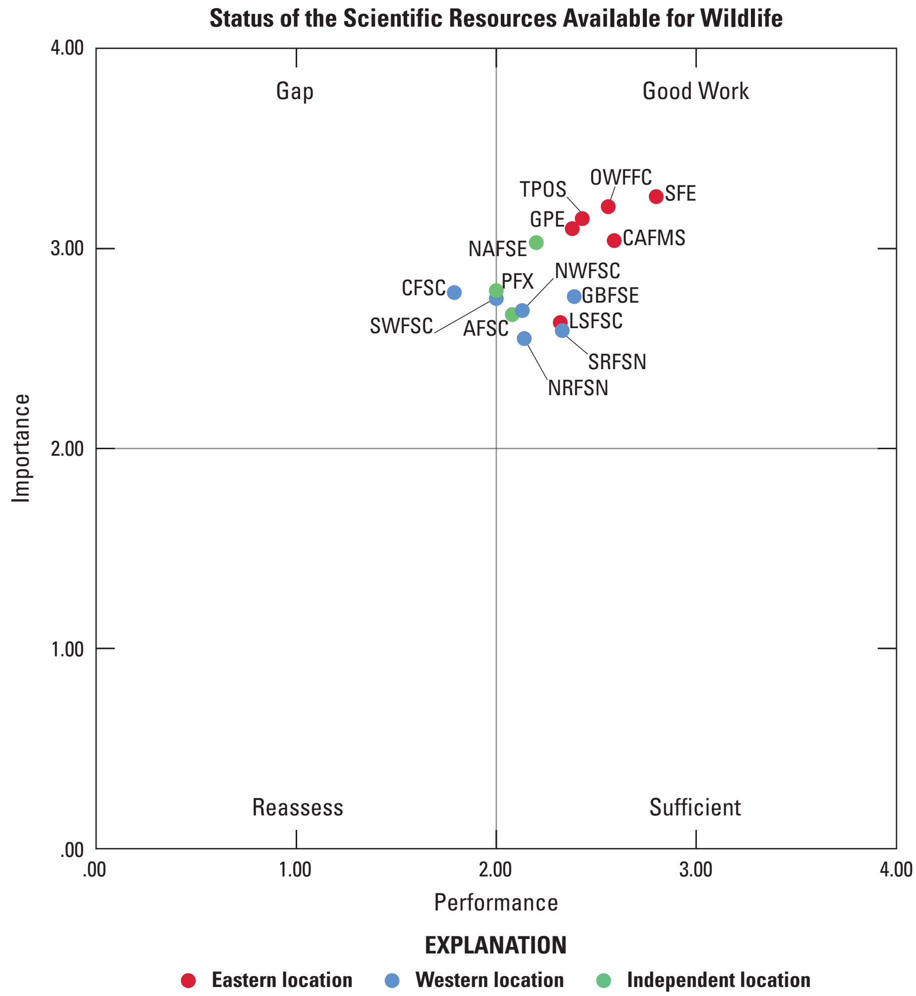



**Figure 24.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for wildlife. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 27.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for wildlife.

[N, number (of times selected); Std Dev, standard deviation; --, no data; CFSC, California Fire Science Consortium; PFX, Pacific Fire Exchange; SWFSC, Southwest Fire Science Consortium; SFE, Southern Fire Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; GPE, Great Plains Fire Science Exchange; CAFMS, Consortium of Appalachians Fire Managers and Scientists; NAFSE, North Atlantic Fire Science Exchange; GBFSE, Great Basin Fire Science Exchange; NWFSC, Northwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; LSFSC, Lake States Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; NRFSN, Northern Rockies Fire Science Network]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| | | | Gap | | | |
| CFSC | 608 | 2.78 | 1.16 | 48 | 1.79 | 0.8 |
| PFX[1] | 33 | 2.75 | 0.75 | 1 | 2 | -- |
| SWFSC | 273 | 2.79 | 1.08 | 17 | 2 | 0.79 |
| | | | Good Work | | | |
| SFE | 1,774 | 3.26 | 0.85 | 307 | 2.8 | 0.7 |
| OWFFC | 539 | 3.21 | 0.8 | 89 | 2.56 | 0.71 |
| TPOS | 608 | 3.15 | 0.85 | 92 | 2.43 | 0.7 |
| GPE | 313 | 3.1 | 0.98 | 40 | 2.38 | 0.63 |
| CAFMS | 441 | 3.04 | 0.92 | 73 | 2.59 | 0.72 |
| NAFSE | 236 | 3.03 | 0.84 | 35 | 2.2 | 0.72 |
| GBFSE | 312 | 2.76 | 1.03 | 24 | 2.39 | 0.58 |
| NWFSC | 463 | 2.69 | 1.07 | 30 | 2.13 | 0.63 |
| AFSC | 136 | 2.67 | 1.28 | 15 | 2.08 | 0.95 |
| LSFSC | 208 | 2.63 | 1.04 | 20 | 2.32 | 0.95 |
| SRFSN | 267 | 2.59 | 1.08 | 18 | 2.33 | 0.84 |
| NRFSN | 387 | 2.55 | 1.05 | 21 | 2.14 | 0.85 |

[1]Because N=1, no standard deviation was calculated.

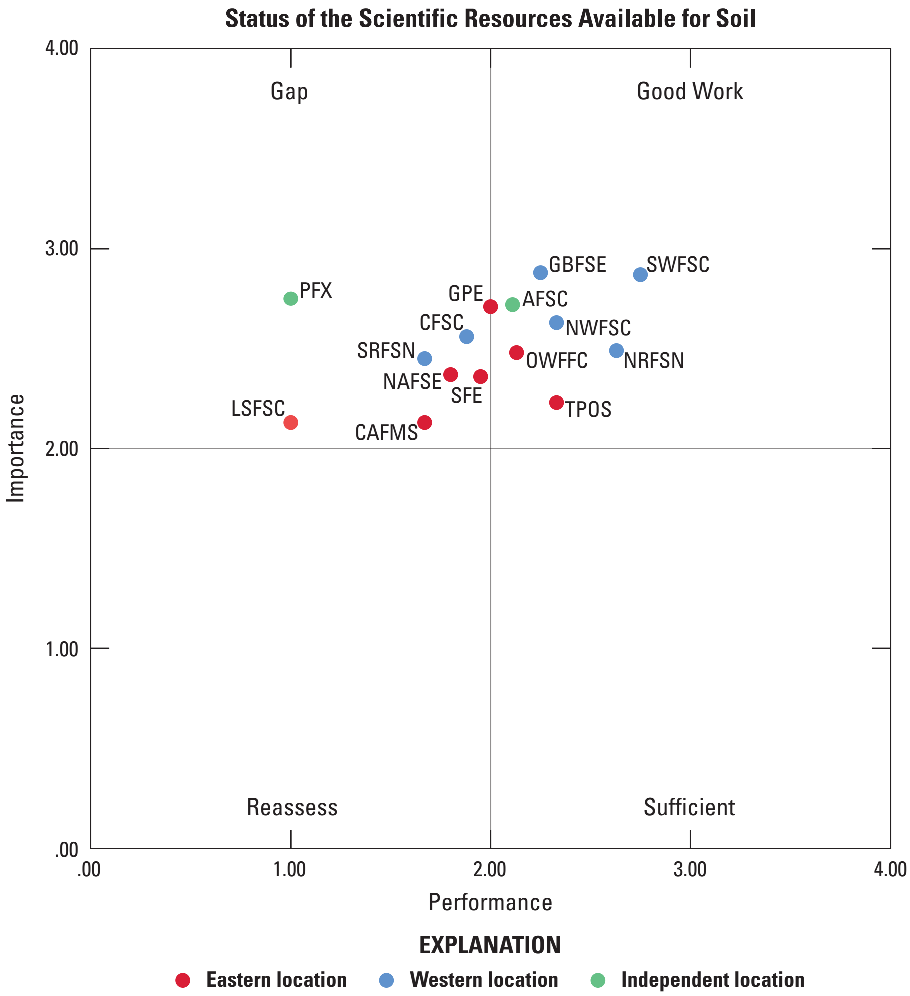



**Figure 25.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for soil. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 28.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for soil.

[N, number (of times selected); Std Dev, standard deviation; --, no data; PFX, Pacific Fire Exchange; CFSC, California Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; NAFSE, North Atlantic Fire Science Exchange; SFE, Southern Fire Exchange; LSFSC, Lake States Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; GPE, Great Plains Fire Science Exchange; GBFSE, Great Basin Fire Science Exchange; SWFSC, Southwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; NWFSC, Northwest Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; OWFFC, Oak Woodlands and Forests Fire Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| | | | Gap | | | |
| PFX[1] | 33 | 2.75 | 0.75 | 1 | 1 | -- |
| CFSC | 556 | 2.56 | 1.06 | 17 | 1.88 | 1.11 |
| SRFSN | 247 | 2.45 | 0.99 | 6 | 1.67 | 0.82 |
| NAFSE | 185 | 2.37 | 0.99 | 5 | 1.8 | 0.45 |
| SFE | 1,263 | 2.36 | 0.98 | 21 | 1.95 | 0.94 |
| LSFSC | 168 | 2.13 | 0.92 | 3 | 1 | 1 |
| CAFMS | 305 | 2.13 | 0.94 | 6 | 1.67 | 0.82 |
| GPE | 271 | 2.71 | 0.96 | 10 | 2 | 0.94 |
| | | | Good Work | | | |
| GBFSE | 322 | 2.88 | 1.05 | 13 | 2.25 | 0.62 |
| SWFSC | 281 | 2.87 | 0.94 | 8 | 2.75 | 0.71 |
| AFSC | 136 | 2.72 | 1.01 | 9 | 2.11 | 0.6 |
| NWFSC | 450 | 2.63 | 1.01 | 9 | 2.33 | 0.87 |
| NRFSN | 374 | 2.49 | 1.03 | 8 | 2.63 | 0.92 |
| OWFFC | 412 | 2.48 | 0.91 | 8 | 2.13 | 0.99 |
| TPOS | 429 | 2.23 | 0.98 | 6 | 2.33 | 0.82 |

[1]This topic ranked as important by subscribers who do not reside in this exchange region; individuals who subscribe to and reside in this exchange region did not rank the performance of this topic.

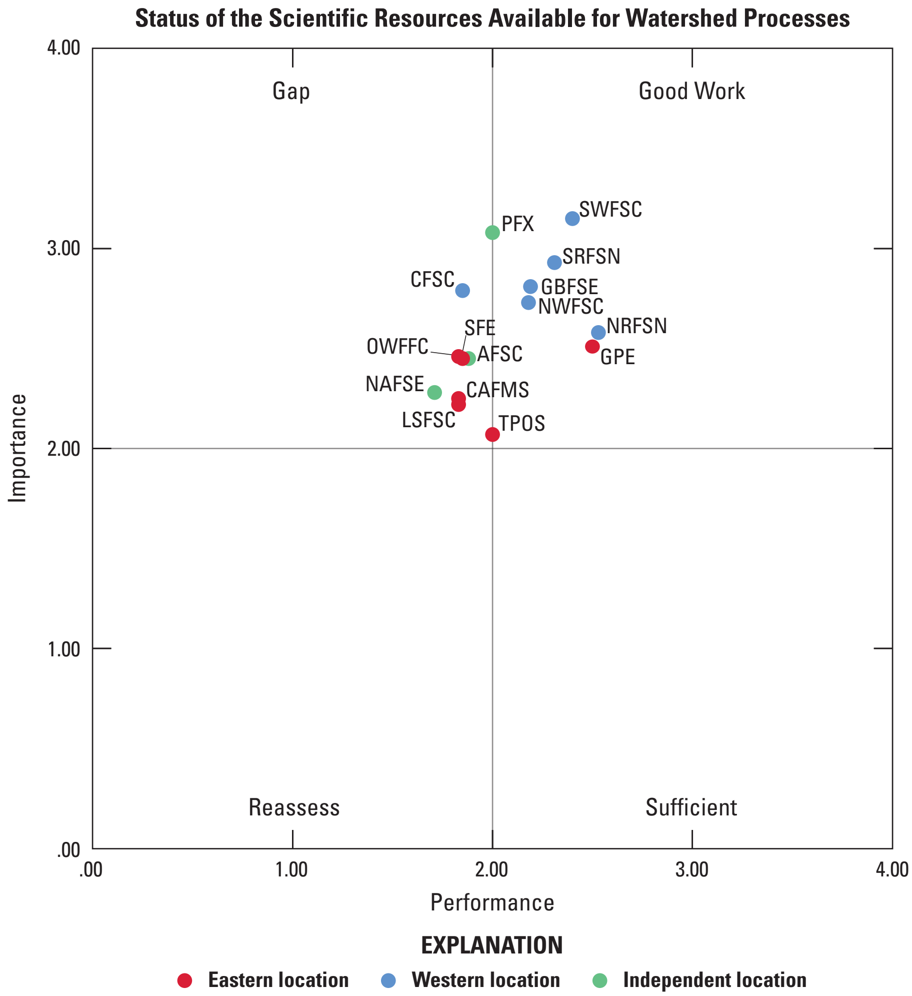



**Figure 26.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for watershed processes. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 29.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for watershed processes.

[N, number (of times selected); Std Dev, standard deviation; --, no data; CFSC, California Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; AFSC, Alaska Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; PFX, Pacific Fire Exchange; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; SWFSC, Southwest Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; GBFSE, Great Basin Fire Science Exchange; NWFSC, Northwest Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; GPE, Great Plains Fire Science Exchange]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| Gap | | | | | | |
| CFSC | 597 | 2.79 | 1.09 | 30 | 1.85 | 0.82 |
| OWFFC | 403 | 2.46 | 1 | 6 | 1.83 | 0.75 |
| SFE | 1,310 | 2.45 | 1 | 27 | 1.85 | 0.78 |
| AFSC | 125 | 2.45 | 0.94 | 8 | 1.88 | 0.83 |
| NAFSE | 178 | 2.28 | 1.19 | 7 | 1.71 | 0.76 |
| LSFSC | 178 | 2.25 | 1.14 | 6 | 1.83 | 0.75 |
| CAFMS | 320 | 2.22 | 1.04 | 6 | 1.83 | 0.75 |
| PFX[1] | 37 | 3.08 | 0.79 | 1 | 2 | -- |
| TPOS | 398 | 2.07 | 1.03 | 6 | 2 | 0.63 |
| Good Work | | | | | | |
| SWFSC | 306 | 3.15 | 0.95 | 25 | 2.4 | 0.76 |
| SRFSN | 296 | 2.93 | 0.94 | 16 | 2.31 | 0.87 |
| GBFSE | 317 | 2.81 | 1.03 | 16 | 2.19 | 0.75 |
| NWFSC | 469 | 2.73 | 1.05 | 18 | 2.18 | 0.73 |
| NRFSN | 390 | 2.58 | 1.04 | 16 | 2.53 | 0.74 |
| GPE | 251 | 2.51 | 0.99 | 5 | 2.5 | 1 |

[1]Because N=1, no standard deviation was calculated.

For the topic of economic impacts, the locations largely cluster to the left side of the IPA chart, meaning that respondents indicated that the information available for this topic is generally lacking. The locations fall across the Gap and Reassess quadrants, meaning that the respondents also varied in the degree of importance given to this topic across locations. Southern is the only location for which respondents rated economic impacts in the Good Work quadrant, though it is very close to the border, meaning that respondents believe economic impacts are moderately important and have moderate performance. Otherwise, Great Plains and Lake States fall on the border of Good Work and Gap, with Lake States very close to plotting in the very middle of the chart (standard deviation=1). The low number of respondents from Lake States who selected this topic adds ambiguity as to where this topic falls for this location. Southern Rockies, Northwest, California, Southwest, Northern Rockies, and Great Basin all fall into Gap, and plot relatively closely together. Oak Woodlands, Alaska, and North Atlantic, fall very closely to the border of Gap but plot in Reassess, and Appalachians plot in Reassess. Lastly, no respondents from Pacific or Tallgrass Prairie chose this topic, thus those locations are not displayed on the chart. The two independents are right next to each other (Pacific omitted) and western locations are grouped slightly above and to the left, whereas eastern locations are grouped more loosely below the others. See figure 27 and table 30.

Respondents from Northern Rockies, Northwest, and Southern locations rated the topic of social science and human dimensions in the Good Work quadrant, indicating moderate importance and performance for this topic in these locations. However, all three locations fall closely on the border with the Gap quadrant, indicating that although respondents find this topic to be important, there was not a high amount of data, tools, or programs available for the topic relative to other topics. There are also two locations – Appalachians and Tallgrass Prairie – for which this topic falls into the Reassess quadrant, although these locations are close to the border with the Gap quadrant. Lastly, the remaining ten locations fall into the Gap quadrant. Many of these locations are clustered closely near the middle of the IPA diagram, but the Pacific location is slightly removed and closer to the center of the quadrant. Western locations are clustered above the grouping of the eastern locations, and both eastern and western locations plot in both the Gap and the Good Work quadrants. See figure 28 and table 31.

For Indigenous knowledge, the locations are relatively spread out, mostly to the left side of the diagram. Only respondents in the Southwest placed this topic in the Good Work category, whereas the respondents from the rest of the exchanges rated the topic between Gap and Reassess. Responses from Southern Rockies, Great Plains, Oak Woodlands, Southern, Appalachians, and Tallgrass Prairie indicated that Indigenous knowledge may not be a priority science topic. On the other hand, respondents from Northwest, California, Lake States, Northern Rockies, Great Basin, North Atlantic, Pacific, and Alaska indicated that Indigenous knowledge is an important topic, but they do not have adequate scientific resources available. Pacific and Alaska are on the border with a performance rating of 2.0 and standard deviation of 0.82 (Pacific) and standard deviation of 0.67 (Alaska). The groupings are spread out, but more western locations are in the upper quadrants of Gap and Good Work, whereas the eastern locations fall mostly into the Reassess quadrant. The independents (green) follow more closely with the western locations. See figure 29 and table 32.

## Network Analysis for Key Science Topics

In this section respondents were asked two questions, first, "*How RELIANT are you on scientific products and resources about [topic x] from the following sources in the context of wildland fire related decision making? (Likert scale of 0 to 4),*" where the possible sources were "*Your regional Exchange Network*," "*Other regional Exchange Networks*," and "*External sources that are outside of the Exchange Network*"; and second, "*From which of the following Exchange Networks do you gather scientific products and resources? (Select all that apply).*" The results detailed below are organized by the 16 priority fire science topics so they can be compared across respondent locations for each topic. Across all topics, most members generally rated their reliance on external sources highest, followed by their regional exchange, and lastly other exchanges for all 16 topics. "Regional exchange" refers to the exchange that covers a respondent's location. When discussing reliance results, a value of 0 was given by respondents when they had no reliance on the information source, 1 indicates minimal reliance, 2 indicates moderate reliance, 3 indicates heavy reliance, and 4 indicates complete reliance (refer to table 5 for more details). For the second question regarding information gathering, patterns of information gathering emerged that are geographic in nature, where respondents in the East or West often gather information from exchanges that border their home locations or are otherwise nearby.

Overall, for wildlife, respondents from all 15 locations except for Pacific rated their reliance as moderate (between 0.9 and 2.5 on a scale out of 4) on all three sources. Respondents from Pacific indicated that they only rely on external sources. Respondents from all 15 locations rely more on external sources than the exchange network, with respondents from Pacific at the high end since they rated their average reliance as a value of 3. After external sources, individuals rely more on their regional exchange than on other exchanges. This is especially true for Great Basin and Southern, whose respondents indicated the greatest difference in their reliance on their respondent location compared to other exchanges. Respondents in some locations rely similarly on their regional exchange and other exchanges,

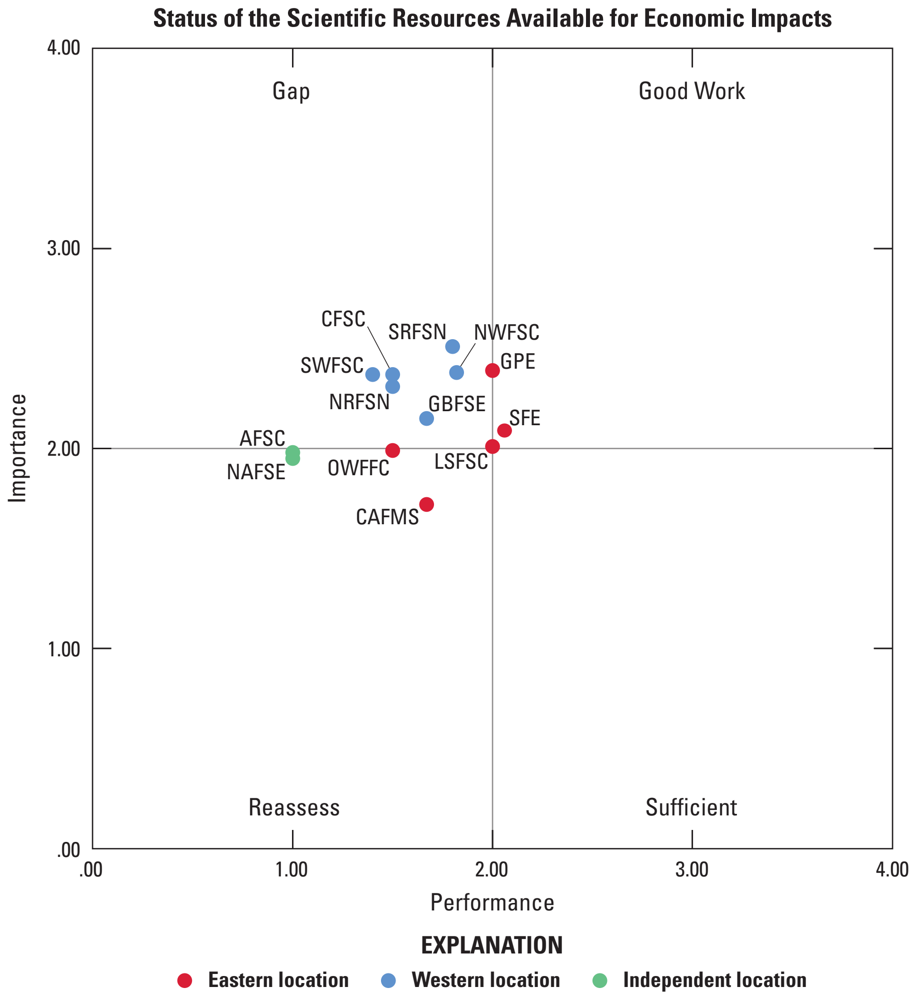



**Figure 27.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for economic impacts. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium)

**Table 30.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for economic impacts.

[N, number (of times selected); Std Dev, standard deviation --, no data; PFX, Pacific Fire Exchange; SRFSN, Southern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; CFSC, California Fire Science Consortium; SWFSC, Southwest Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; GBFSE, Great Basin Fire Science Exchange; GPE, Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; AFSC, Alaska Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; CAFMS, Consortium of Appalachians Fire Managers and Scientists; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| **Gap** | | | | | | |
| PFX[1] | 34 | 2.83 | 0.72 | 0 | -- | -- |
| SRFSN | 254 | 2.51 | 1.05 | 5 | 1.8 | 1.1 |
| NWFSC | 409 | 2.38 | 1.08 | 11 | 1.82 | 1.08 |
| CFSC | 520 | 2.37 | 1.14 | 8 | 1.5 | 0.93 |
| SWFSC | 230 | 2.37 | 1.18 | 6 | 1.4 | 0.55 |
| NRFSN | 349 | 2.31 | 1.05 | 6 | 1.5 | 1.05 |
| GBFSE | 239 | 2.15 | 1.1 | 6 | 1.67 | 1.03 |
| GPE | 239 | 2.39 | 1.15 | 13 | 2 | 1.04 |
| LSFSC | 159 | 2.01 | 1.04 | 3 | 2 | 1 |
| **Reassess** | | | | | | |
| OWFFC | 327 | 1.99 | 1.16 | 8 | 1.5 | 0.76 |
| AFSC[2] | 99 | 1.98 | 1.27 | 1 | 1 | -- |
| NAFSE | 152 | 1.95 | 1.09 | 4 | 1 | 0.82 |
| CAFMS | 248 | 1.72 | 1.11 | 3 | 1.67 | 1.15 |
| TPOS[1] | 282 | 1.47 | 1.03 | 0 | -- | -- |
| **Good Work** | | | | | | |
| SFE | 1,119 | 2.09 | 1.1 | 17 | 2.06 | 1.03 |

[1]This topic ranked as important by subscribers who do not reside in this exchange region; individuals who subscribe to and reside in this exchange region did not rank the performance of this topic.

[2]Because N=1, no standard deviation was calculated.

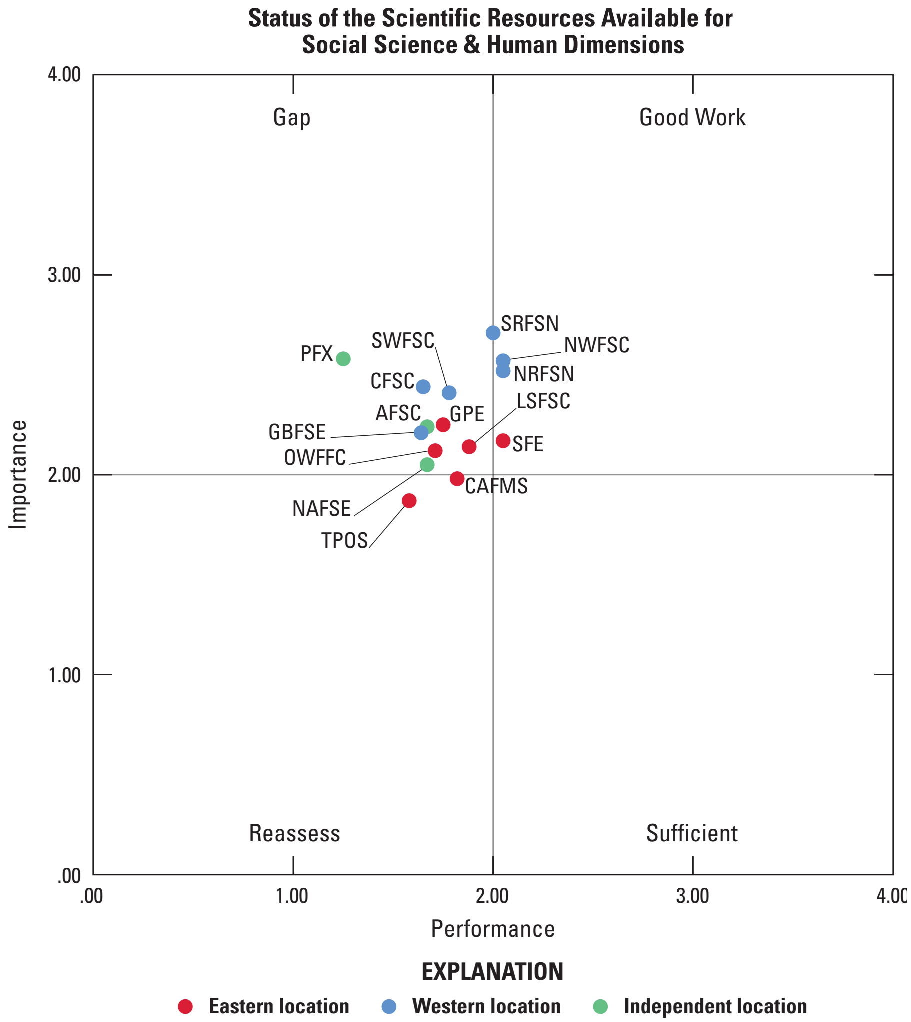



**Figure 28.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for social science and human dimensions. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 31.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for social science and human dimensions.

[N, number (of times selected); Std Dev, standard deviation; PFX, Pacific Fire Exchange; CFSC, California Fire Science Consortium; SWFSC, Southwest Fire Science Consortium; GPE, Great Plains Fire Science Exchange; AFSC, Alaska Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; SRFSN, Southern Rockies Fire Science Network; LSFSC, Lake States Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; NAFSE, North Atlantic Fire Science Exchange; CAFMS, Consortium of Appalachians Fire Managers and Scientists; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; SFE, Southern Fire Exchange]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| Gap | | | | | | |
| PFX | 31 | 2.58 | 1.16 | 4 | 1.25 | 0.96 |
| CFSC | 526 | 2.44 | 1.14 | 21 | 1.65 | 0.88 |
| SWFSC | 236 | 2.41 | 1.07 | 9 | 1.78 | 0.83 |
| GPE | 225 | 2.25 | 1.08 | 8 | 1.75 | 1.04 |
| AFSC | 110 | 2.24 | 1.15 | 4 | 1.67 | 0.58 |
| GBFSE | 250 | 2.21 | 1.09 | 11 | 1.64 | 0.92 |
| SRFSN | 274 | 2.71 | 1.13 | 24 | 2 | 0.72 |
| LSFSC | 169 | 2.14 | 1.16 | 9 | 1.88 | 0.64 |
| OWFFC | 345 | 2.12 | 0.99 | 7 | 1.71 | 0.95 |
| NAFSE | 160 | 2.05 | 1.18 | 3 | 1.67 | 0.58 |
| Reassess | | | | | | |
| CAFMS | 285 | 1.98 | 1.11 | 11 | 1.82 | 0.87 |
| TPOS | 360 | 1.87 | 1.1 | 14 | 1.58 | 1 |
| Good Work | | | | | | |
| NRFSN | 388 | 2.57 | 1.13 | 19 | 2.05 | 0.85 |
| NWFSC | 431 | 2.52 | 1.04 | 19 | 2.05 | 0.97 |
| SFE | 1,162 | 2.17 | 1.06 | 19 | 2.05 | 0.78 |

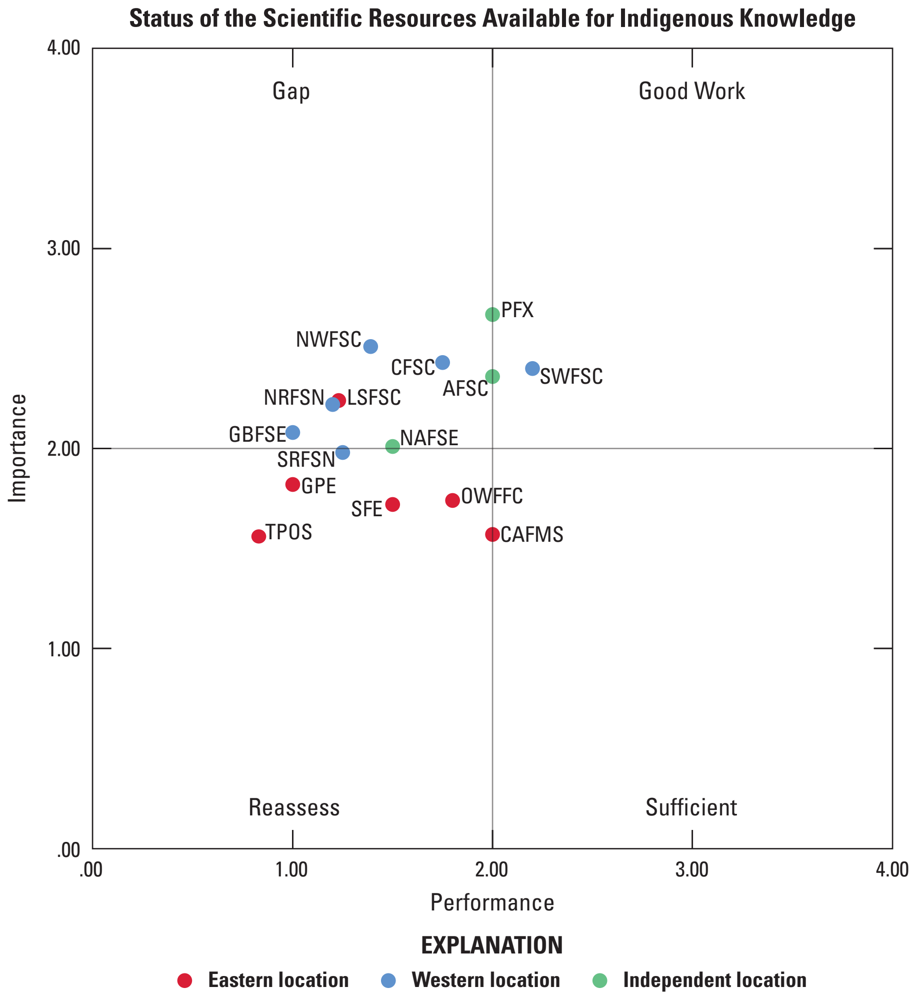



**Figure 29.** Importance-performance analysis quadrant displaying how survey respondents representing their regional fire science exchange location rated the importance and performance of information for Indigenous knowledge. (blue, western location; red, eastern location; green, independent location; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

**Table 32.** Statistics for importance and performance across all Fire Science Exchange Network respondent locations for Indigenous knowledge.

[N, number (of times selected); Std Dev, standard deviation; NWFSC, Northwest Fire Science Consortium; CFSC, California Fire Science Consortium; LSFSC, Lake States Fire Science Consortium; NRFSN, Northern Rockies Fire Science Network; GBFSE, Great Basin Fire Science Exchange; NAFSE, North Atlantic Fire Science Exchange; PFX, Pacific Fire Exchange; AFSC, Alaska Fire Science Consortium; SRFSN, Southern Rockies Fire Science Network; GPE, Great Plains Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; CAFMS, Consortium of Appalachians Fire Managers and Scientists; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; SWFSC, Southwest Fire Science Consortium]

| Respondent location | Importance | | | Performance | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std Dev | N | Mean | Std Dev |
| Gap | | | | | | |
| NWFSC | 429 | 2.51 | 1.13 | 18 | 1.39 | 0.99 |
| CFSC | 529 | 2.43 | 1.19 | 17 | 1.75 | 0.83 |
| LSFSC | 177 | 2.24 | 1.11 | 13 | 1.23 | 0.84 |
| NRFSN | 331 | 2.22 | 0.99 | 5 | 1.2 | 0.64 |
| GBFSE | 235 | 2.08 | 1.16 | 2 | 1 | 0.8 |
| NAFSE | 157 | 2.01 | 1.11 | 2 | 1.5 | 0.58 |
| PFX | 32 | 2.67 | 0.89 | 1 | 2 | 0.82 |
| AFSC | 118 | 2.36 | 1.1 | 2 | 2 | 0.67 |
| Reassess | | | | | | |
| SRFSN | 202 | 1.98 | 1.14 | 5 | 1.25 | 0.68 |
| GPE | 182 | 1.82 | 1.12 | 2 | 1 | 0.9 |
| OWFFC | 286 | 1.74 | 1.17 | 5 | 1.8 | 0.8 |
| SFE | 921 | 1.72 | 1.16 | 4 | 1.5 | 0.74 |
| CAFMS | 227 | 1.57 | 1.17 | 1 | 2 | 1 |
| TPOS | 302 | 1.56 | 1.22 | 6 | 0.83 | 0.75 |
| Good Work | | | | | | |
| SWFSC | 235 | 2.4 | 1.17 | 6 | 2.2 | 0.82 |

though still slightly preferring their respondent location, such as Southern Rockies and Northern Rockies. Respondents in the rest of the locations (that is, Appalachians, California, Great Plains, Lake States, North Atlantic, Northwest, Oak Woodlands, Southwest, and Tallgrass Prairie) rely moderately more (difference of 0.3 to 0.5) on their regional exchange versus other exchanges. See figure 30.

For invasive plant species, respondents from all 15 locations again rely more on external sources than on the exchange network, all having rated their reliance between 2 and 2.5 on a scale out of 4, indicating moderate reliance. The respondents' own regional exchange is also more relied upon than other exchanges, yet there is variation in the degree to which respondents rely on exchanges other than their own. For example, respondents in Alaska rely on their regional exchange and other exchanges equally. In contrast, Pacific, Great Basin, Southern, North Atlantic, and Northwest rely more on their regional exchanges versus other exchanges. Tallgrass Prairie, Southwest, Southern Rockies, Northern Rockies, Lake States, Great Plains, California, and Appalachians all rely moderately more (a difference of 0.3 to 0.5) on their regional exchanges than other exchanges for information on invasive plant species. See figure 31.

For vegetation, the overall reliance values given by respondents are between 1 and 2.6 on a scale out of 4. Again, for every location respondents rely most on external sources, then on their regional exchange, and lastly on other exchanges. Respondents in Pacific only rated their reliance on their regional exchange (1.3, which indicates minimal reliance) and external sources (2.3, which indicates a moderate level of reliance). Respondents in Alaska rely minimally on other exchanges for information on vegetation. Respondents in California, Lake States, Southern, Southwest, and Tallgrass Prairie also have low reliance on other exchanges for information on this topic. Respondents in Oak Woodlands, Tallgrass Prairie, Alaska, Appalachians, and Great Basin all rely only slightly more on external sources than their regional exchanges. See figure 32.

For watershed processes, respondents rated their reliance as moderate to heavy on external sources (value of 1.9 and higher), moderate on their regional exchange (values near 2), and with relatively low reliance on other exchanges (all values below 2). Respondents in most of the locations rely more on external sources than their regional exchange. The exceptions to this are Alaska, Tallgrass Prairie, and Pacific. Respondents in Alaska and Pacific rely equally on external sources and their regional exchange, and only slightly on other exchanges. Tallgrass Prairie is unique because its respondents rely more on their regional exchange than on external sources, and they rely somewhat on other exchanges (a value of 1.6). Respondents from the rest of the locations rely most on external sources, then their regional exchange, then other exchanges. See figure 33.

For post-fire recovery and management, the values for the three sources for information are in a similar range to the values for other science topics (between 1 and 2.6). External sources are the most relied on for most of the locations (value of 2 or greater). Lake States is an anomaly in that its respondents rely mostly on their regional exchange for this topic and minimally on external sources and other exchanges. Respondents from the rest of the locations rely moderately on external sources (between 1.8 and 2.7 on a scale out of 4). Respondents in North Atlantic and Northern Rockies rely much more on external sources than the other two information sources. Respondents in Alaska, Great Basin, and Lake States rely very little on other exchanges, whereas the rest of the locations rated their reliance as slightly higher but still low, never reaching above 1.7. See figure 34.

The reliance of respondents on the three sources for information on fire behavior is similar to other topics in that the reliance values do not go above 2.6. Overall, respondents rely more on external sources than the exchange network, but this is not always the case. Respondents in Southern, Oak Woodlands, Pacific, Great Plains locations all rely more on their regional exchange over external sources and other exchanges. Respondents from Appalachians, Lake States, and Pacific locations rely almost equally on external sources and their regional exchanges. Respondents in Appalachians rely minimally on other exchanges, whereas respondents in Alaska and Great Basin rely moderately on this information source. Respondents in the rest of the locations rely minimally to moderately (between a value of 1 and 2) on other exchanges for information on fire behavior. Respondents in Alaska and Northern Rockies rely slightly more on external sources than their regional exchange (a difference of 0.2), whereas respondents in California, Great Basin, North Atlantic, Northwest, Southern Rockies, Southwest, and Tallgrass Prairie all rely moderately more on external sources than the exchange network (difference of 0.4 or more). See figure 35.

For most locations, respondents rely most strongly on external sources, then on their regional exchange, and lastly on other exchanges for information on fire regimes. However, respondents in Oak Woodlands, Alaska, and Pacific rely more on their regional exchanges than the other two information sources. In fact, although Pacific respondents rely equally on external sources and other exchanges, they rely more heavily on their respondent location (a value of 3, indicating heavy reliance). Respondents in Alaska and Southern rely minimally on other exchanges (around a value of 1) but moderately on their regional exchanges (value of 2 or greater). The difference in reliance on external sources over respondents' regional exchanges is small to moderate for most of the other locations, with slightly more reliance on external sources. In contrast, respondents from California, Great Basin, and Northwest rely moderately more (difference of 0.5 or greater) on external sources. Southwest respondents are unique in that they rely equally on external sources and their regional exchange. In terms of the difference between these respondents' own regional exchanges and other exchanges, the differences are small to moderate (0.2 to 0.5). See figure 36.

For fuels management, respondents in several of the locations rely more on their regional exchange than on the other two information sources. The most notable examples are Alaska and Pacific (difference of 0.6 or more), but respondents

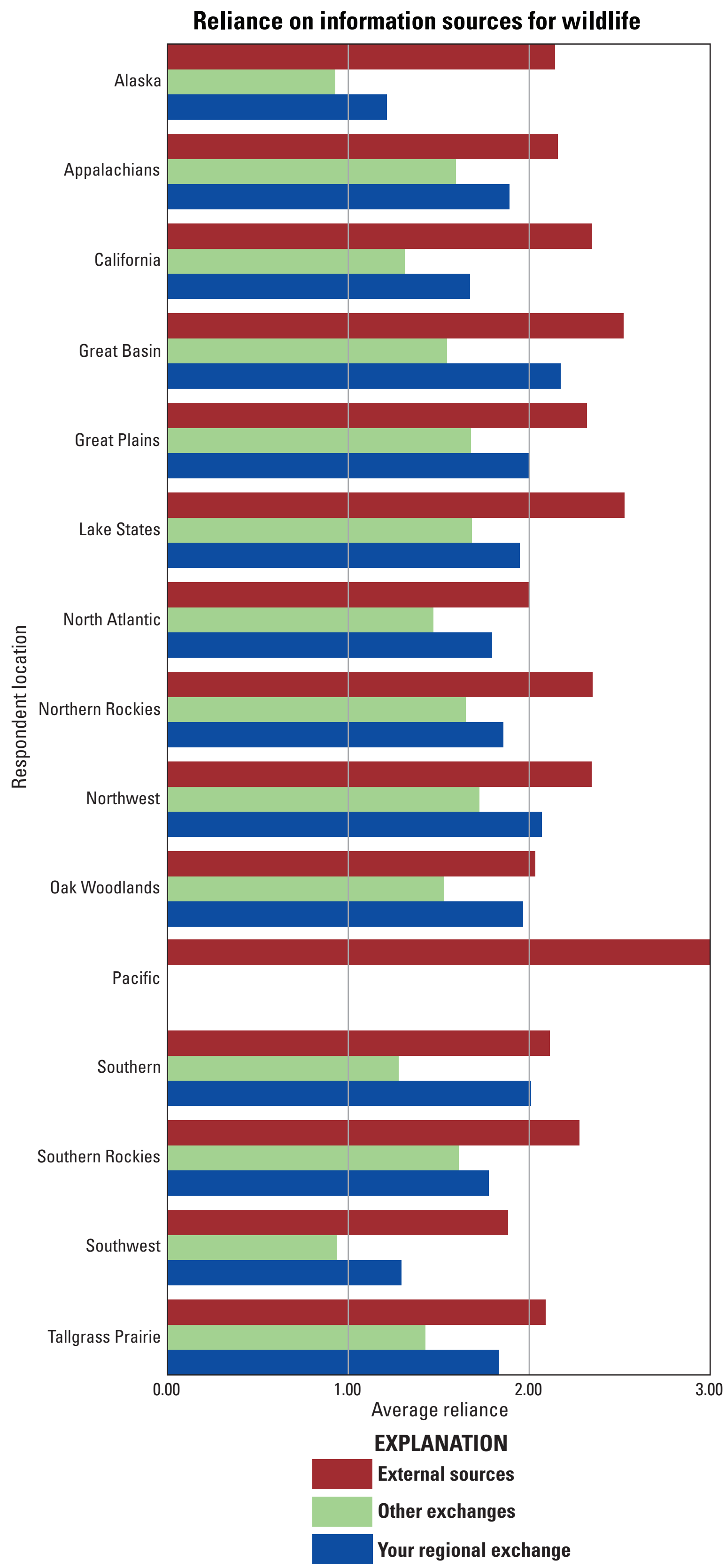



**Figure 30.** The reliance of survey respondents on three different sources for information on wildlife, by Fire Science Exchange Network respondent location.

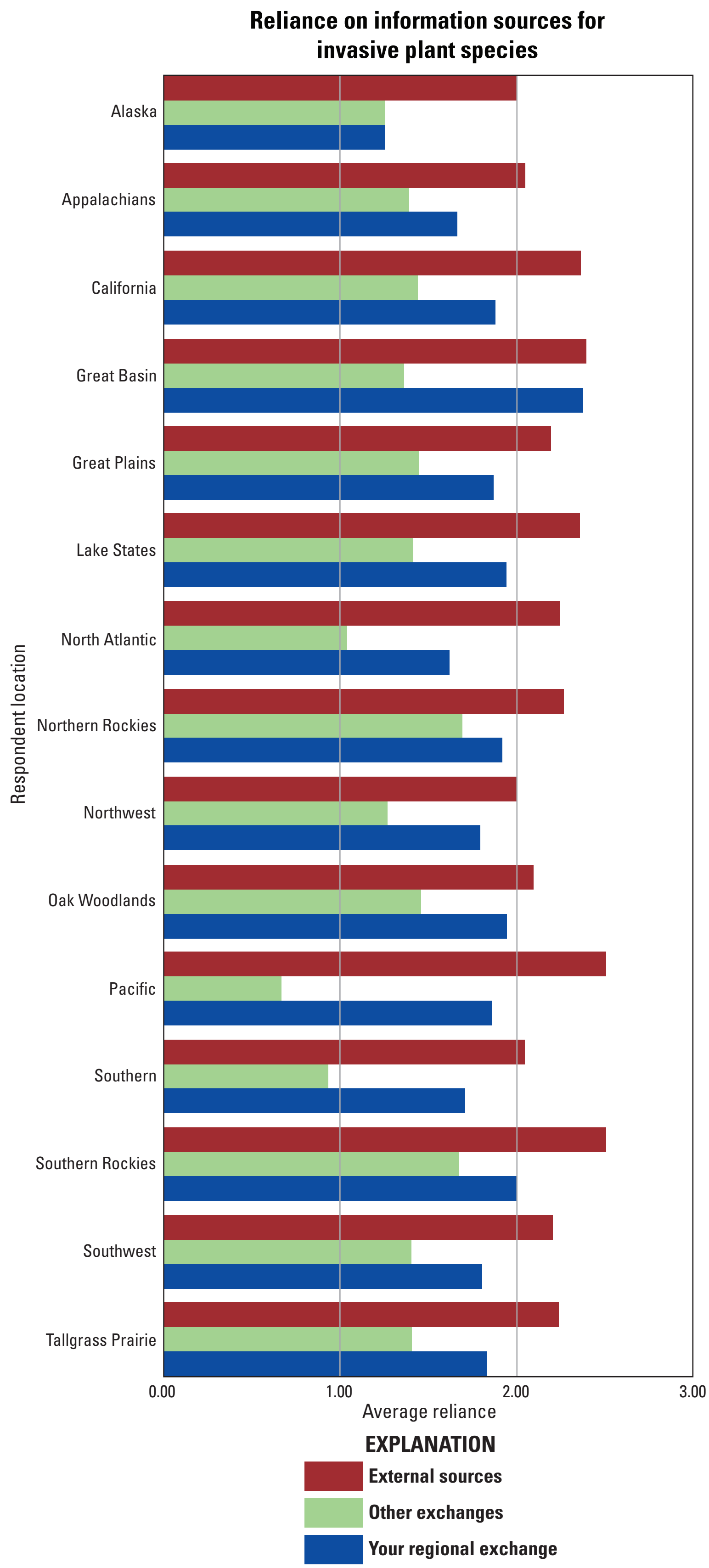



**Figure 31.** The reliance of survey respondents on three different sources for information on invasive plant species, by Fire Science Exchange Network respondent location.

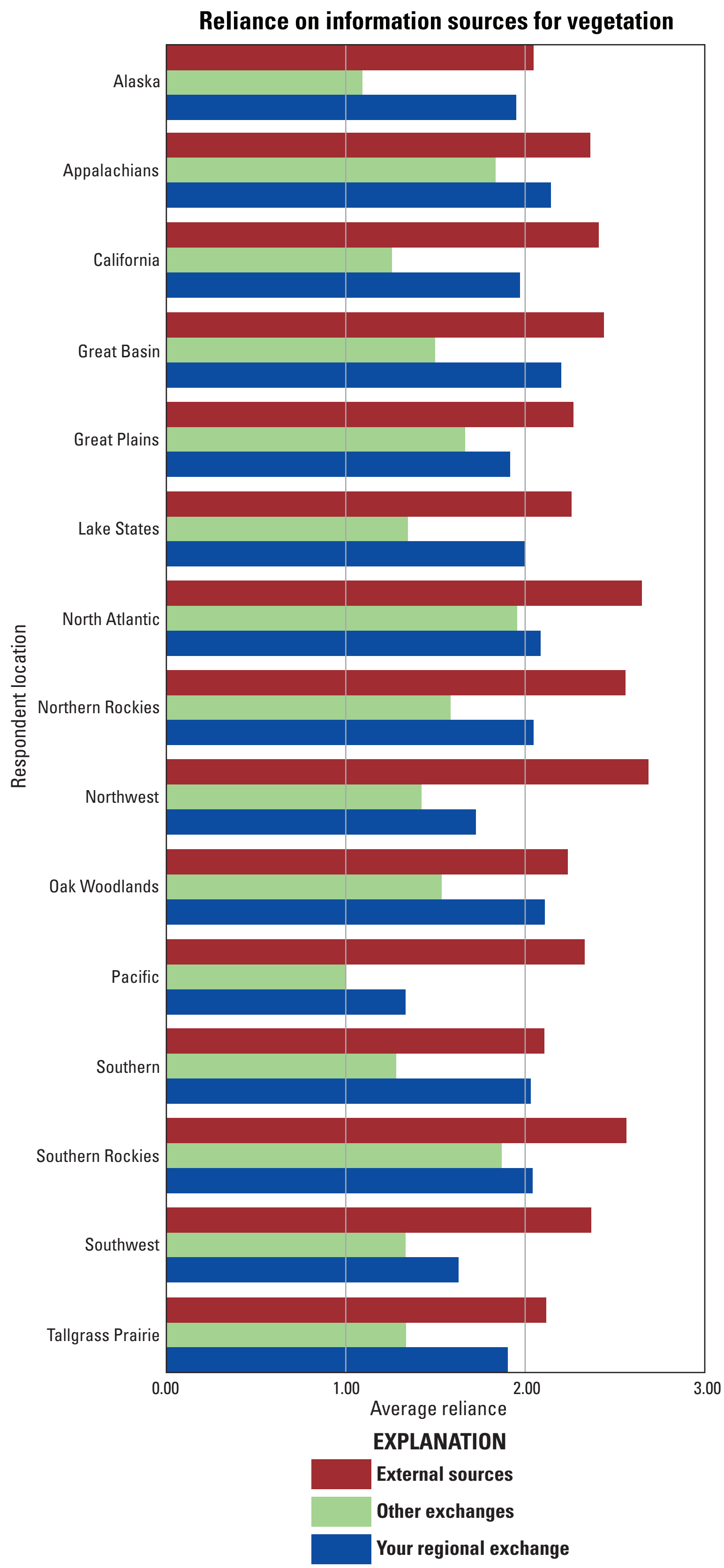



**Figure 32.** The reliance of survey respondents on three different sources for information on vegetation, by Fire Science Exchange Network respondent location.

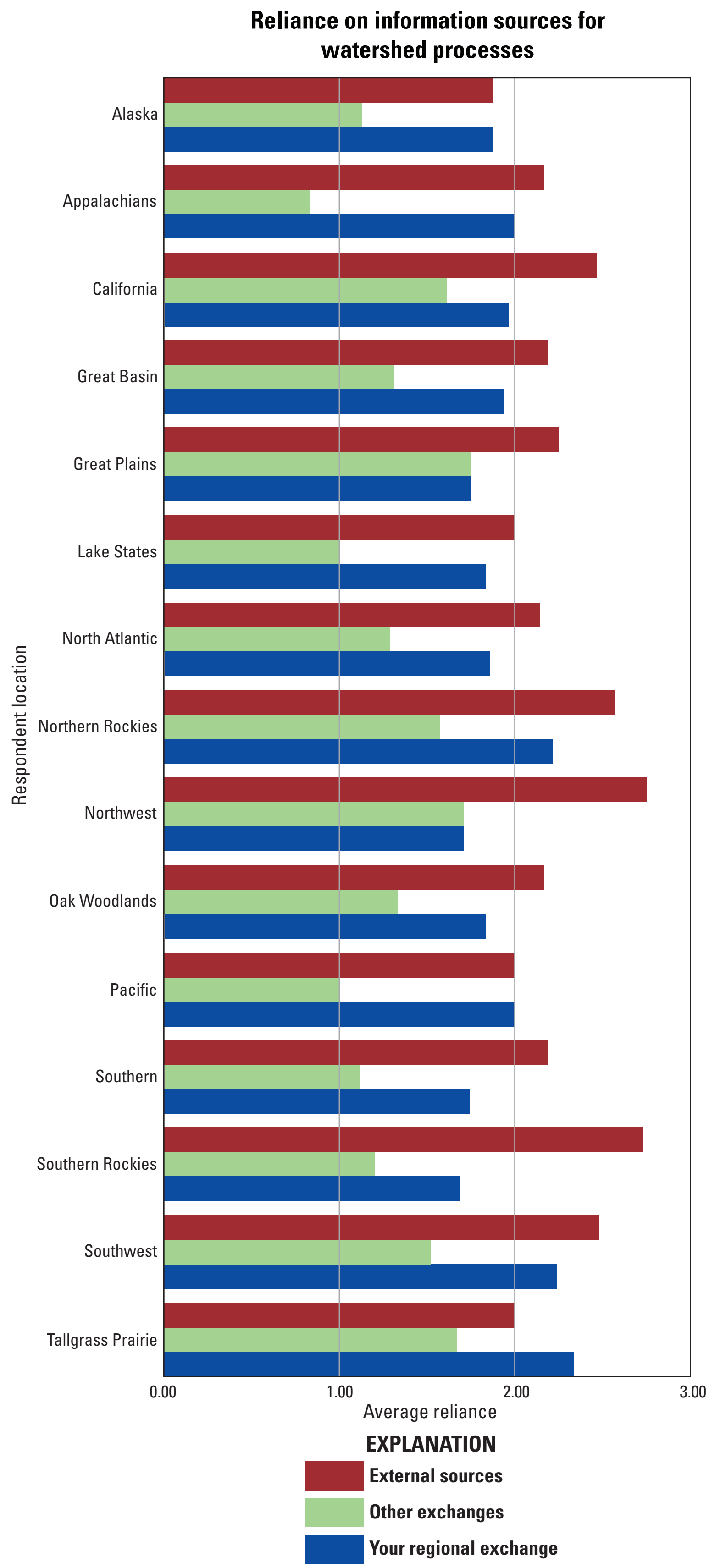



**Figure 33.** The reliance of survey respondents on three different sources for information on watershed processes, by Fire Science Exchange Network respondent location.

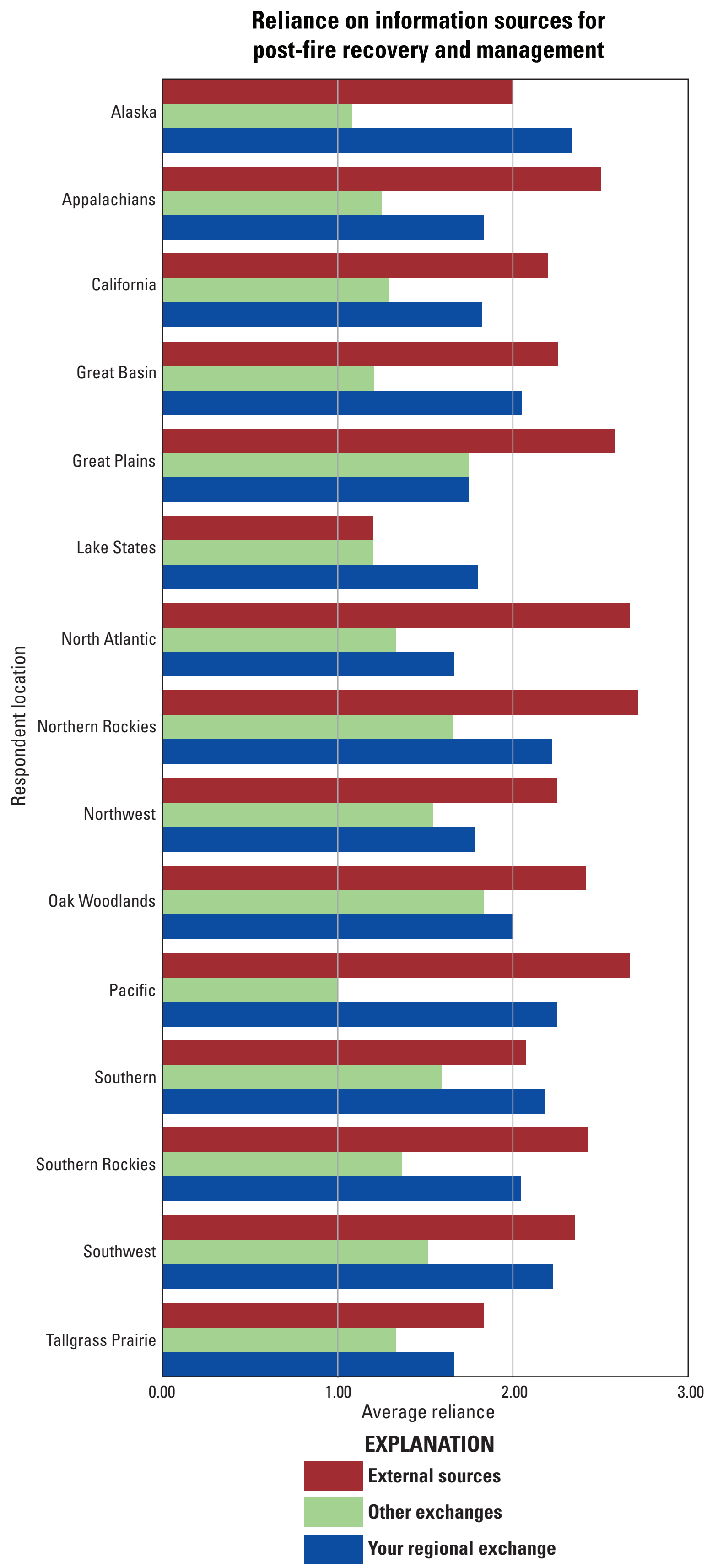



**Figure 34.** The reliance of survey respondents on three different sources for information on post-fire recovery and management, by Fire Science Exchange Network respondent location.

in Appalachians, California, and Southern locations also rely most on their regional exchanges for information on this topic. For the other locations, there is the typical trend where external sources are the most relied upon. For example, Tallgrass Prairie and Southern Rockies respondents rely moderately more on external sources versus the exchange network (differences of 0.3 to 0.5). In other locations, the reliance on external sources is still greater than the exchange network; the difference is greatest between external sources and other exchanges. Examples of these exchanges include Great Basin, Great Plains, Lake States, North Atlantic, Northern Rockies, and Northwest. Across all respondent locations, other exchanges are the least relied upon information source (nearly all the reliance values are below 2). For example, although respondents in the Appalachians rely on all three sources almost equally, they still rely less on other exchanges. In addition, respondents in the Southern location rely much more on their regional exchange versus other exchanges for this topic. See figure 37.

For prescribed fire, respondents in many locations rely highest on external sources compared to the other two information sources (most values for external sources are 2 or above). In contrast, respondents in Oak Woodlands, California, Lake States, Southern, and Appalachians locations rely more on their regional exchange for information on this topic than other sources. For the other locations, in general respondents rely on external sources the most, followed by their regional exchange, and lastly other exchanges.

Alaska stands out because respondents in that location rely twice as much on other exchanges than on either their regional exchange or external sources, on this scale. For all other locations, respondents rely moderately on other exchanges for gathering information on this topic, and this information source is the least relied upon compared to the other sources. Great Basin and Southern Rockies were the only locations that had a small difference in their respondents' reliance on their regional exchange compared to other exchanges, yet they still rely more on their regional exchange. There were no responses from respondents in the Pacific location on their reliance on information sources for the topic of prescribed fire. See figure 38.

For smoke, air quality, and health, and as seen with many of the other topics, there is greater reliance on external sources over other sources, especially for California, Great Plains, and Northwest locations. Respondents in the Appalachians, Great Basin, North Atlantic, Tallgrass Prairie, and Oak Woodlands locations all rely slightly to moderately (0.2 to 0.6) more on external sources and equally or slightly more on their regional exchanges versus other exchanges. Respondents in Northern Rockies, Northwest, and Southwest locations rate sources in the same order, but both locations rely considerably less on other exchanges for information on this topic (values of 1.4 or lower). Alaska is again unique in that its respondents rely much more (a difference of 0.8) on their regional exchange than the other two information sources for this topic. Respondents in the Southern Rockies also rely more on their regional exchange for information on this topic, though only slightly, and respondents in the Lake States locations rely equally on their regional exchange and other exchanges, but less on external sources. Respondents in Lake States and North Atlantic overall have lower reliance on all three sources compared to other locations (their values indicate minimal to moderate reliance). There were no responses from respondents in the Pacific location on this topic, and respondents from Northern Rockies did not rate their reliance on other exchanges. See figure 39.

For WUI and infrastructure, most respondents rely on external sources more or equally as much as they rely on the exchange network, except for Alaska, where respondents rely on their regional exchange most, followed by external sources, and then other exchanges. The reliance values for the three sources fell between 1 to 2.7 out of a scale of 4, which is a similar range compared to the other topics. Tallgrass Prairie stands out since respondent reliance is high on external sources (a value of 2.6) but minimal for their respondent location (value of 1). The reliance of Tallgrass Prairie respondents on their regional exchange is even lower than that of their reliance on other exchanges, which is uncommon. Respondents in the Lake States location rely strongly on external sources for information on this topic and much less on their regional exchange or on other exchanges. For this topic, respondents in many locations rely approximately equally on multiple sources. Respondents in Great Plains rely equally on all three sources, and respondents in Great Basin and Oak Woodlands locations rely equally on external sources and their regional exchanges and slightly less on other exchanges. Respondents in the Southern location rely nearly equally on external sources and their regional exchange and less on other exchanges. Respondents in the Pacific rely equally on their regional exchange and other exchanges, but more on external sources. Respondents in most other locations rely more on external sources than their regional exchange, and less on other exchanges. See figure 40.

For firefighter safety and incident management, respondents tended to rate their reliance on external sources highest, except for in Great Plains, where external sources and the regional exchange were rated equally. Other exchanges have the lowest reliance rating for most locations, except for Southern Rockies, Oak Woodlands, North Atlantic, and Great Basin, where respondents rated their reliance on other exchanges as equal to their reliance on their regional exchange, and Pacific, where external sources were rated higher than the regional exchange. Respondents in Alaska, Appalachians, North Atlantic, Northern Rockies, Northwest, Oak Woodlands, Pacific, Southern, and Southern Rockies locations rated their reliance on external sources as moderate or much higher than their reliance on the exchange network (difference of 0.4 or greater). For California, Lake States, Southwest and Tallgrass Prairie locations, external sources were rated slightly higher than the exchange network. See figure 41.

For social science and human dimensions, respondents from all locations rated their reliance highest on external sources, then on their regional exchanges, and lastly other exchanges, except for respondents in the North Atlantic who rated all three of these sources equally. In general, respondents in most locations rely slightly more on their regional exchange

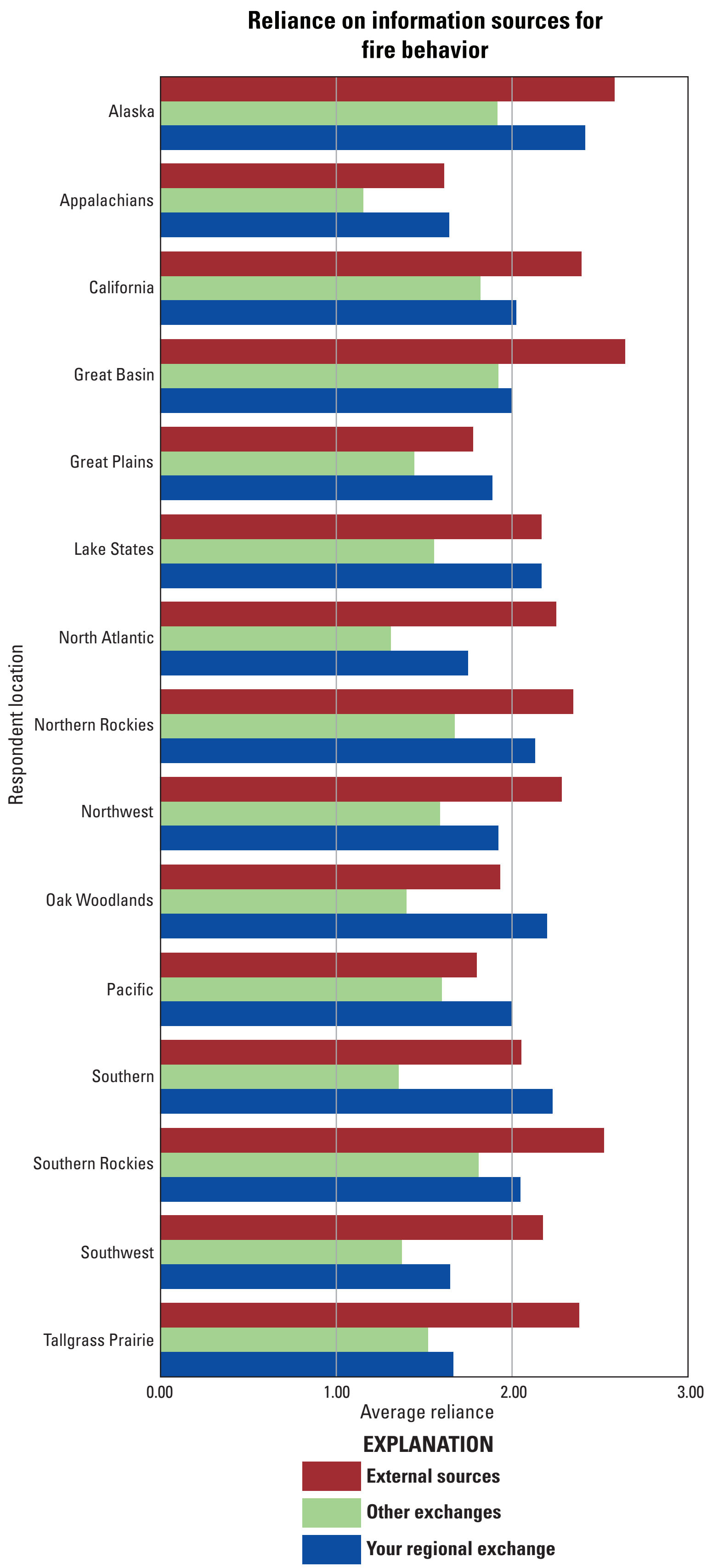



**Figure 35.** The reliance of survey respondents on three different sources for information on fire behavior, by Fire Science Exchange Network respondent location.

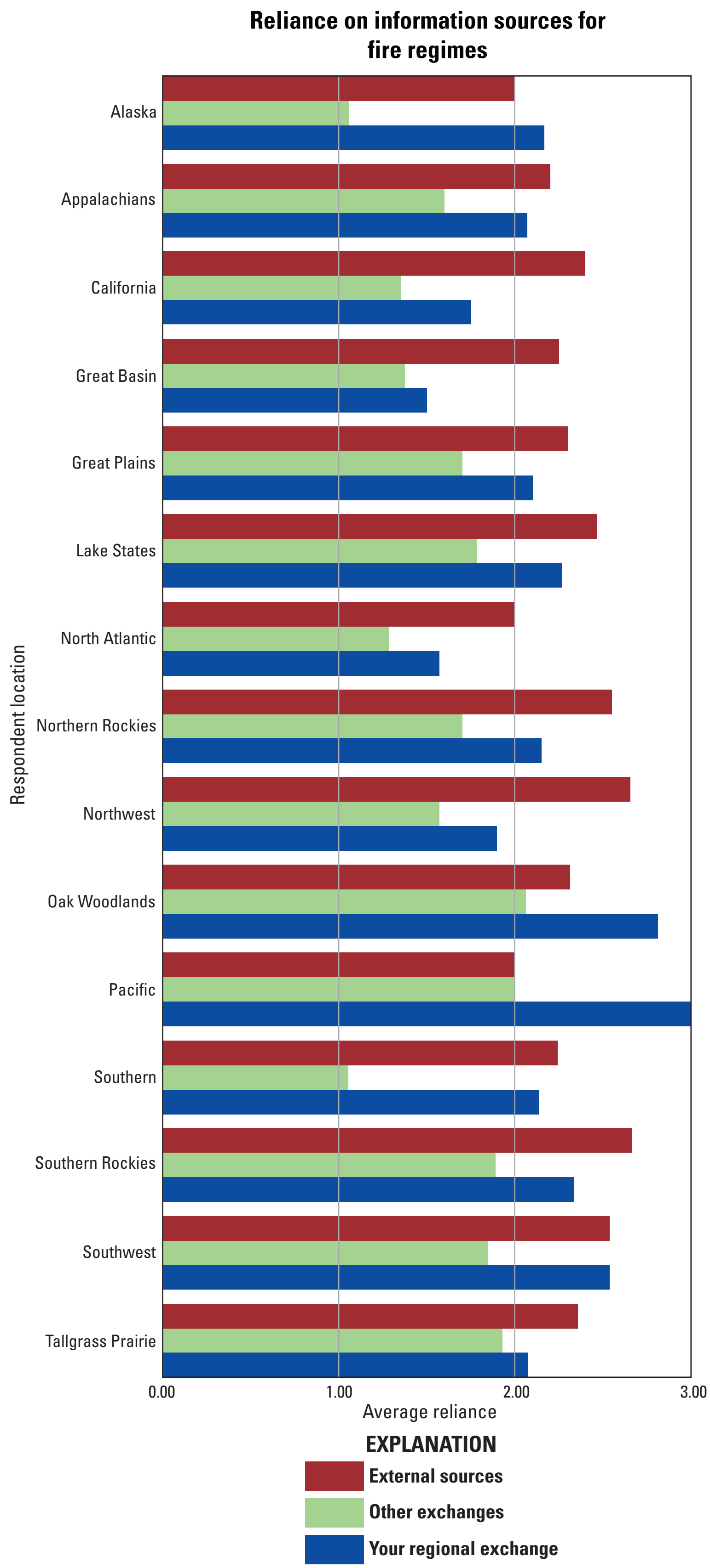



**Figure 36.** The reliance of survey respondents on three different sources for information on fire regimes, by Fire Science Exchange Network respondent location.

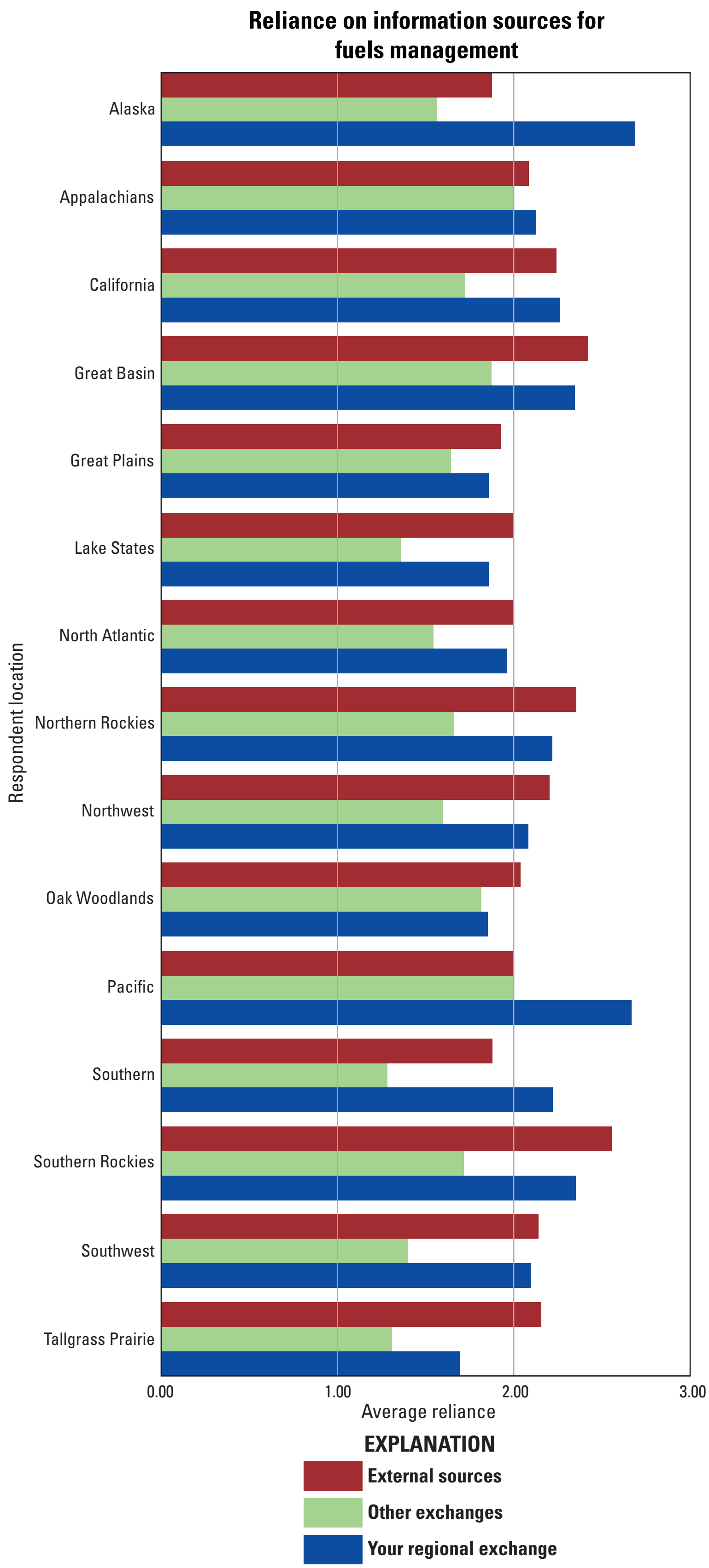



**Figure 37.** The reliance of survey respondents on three different sources for information on fuels management, by Fire Science Exchange Network respondent location.

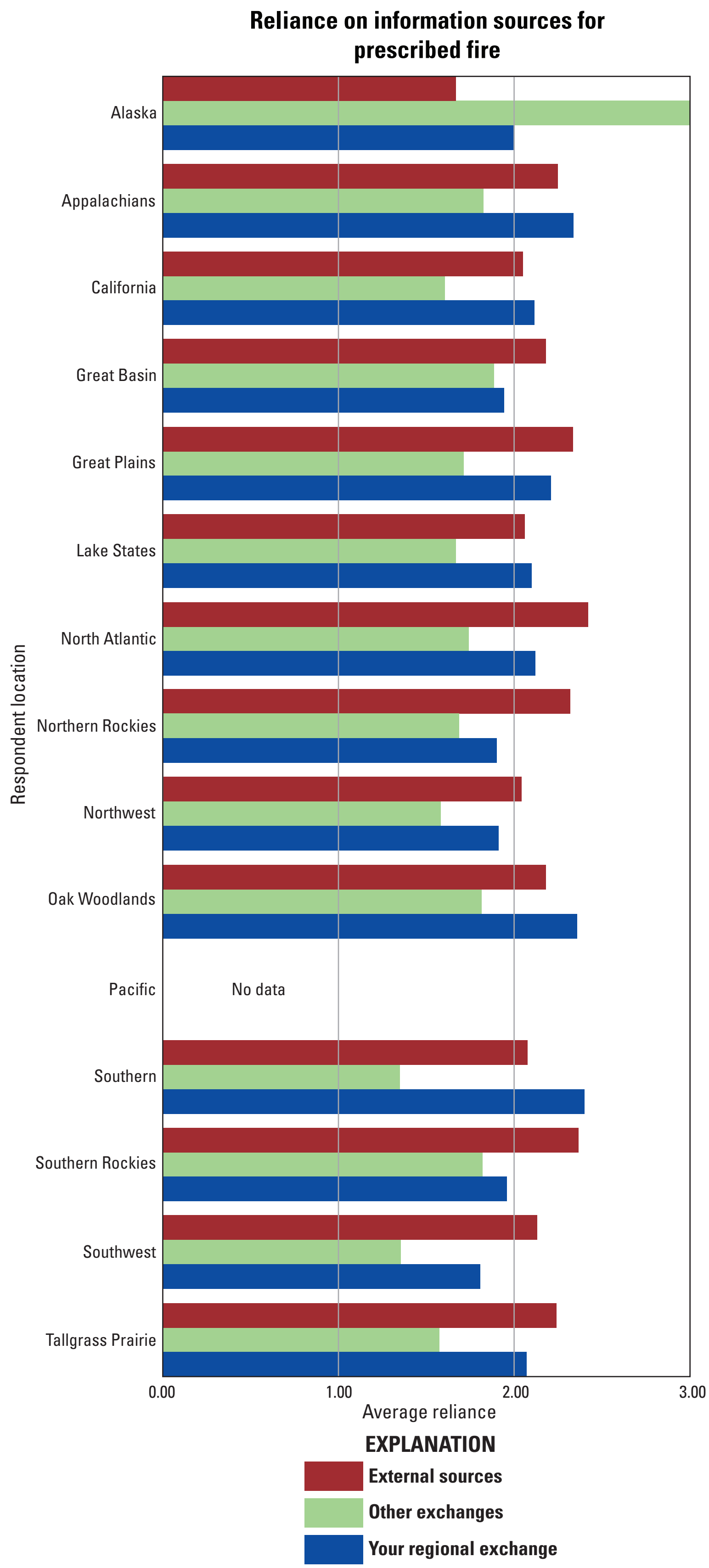



**Figure 38.** The reliance of survey respondents on three different sources for information on prescribed fire, by Fire Science Exchange Network respondent location.

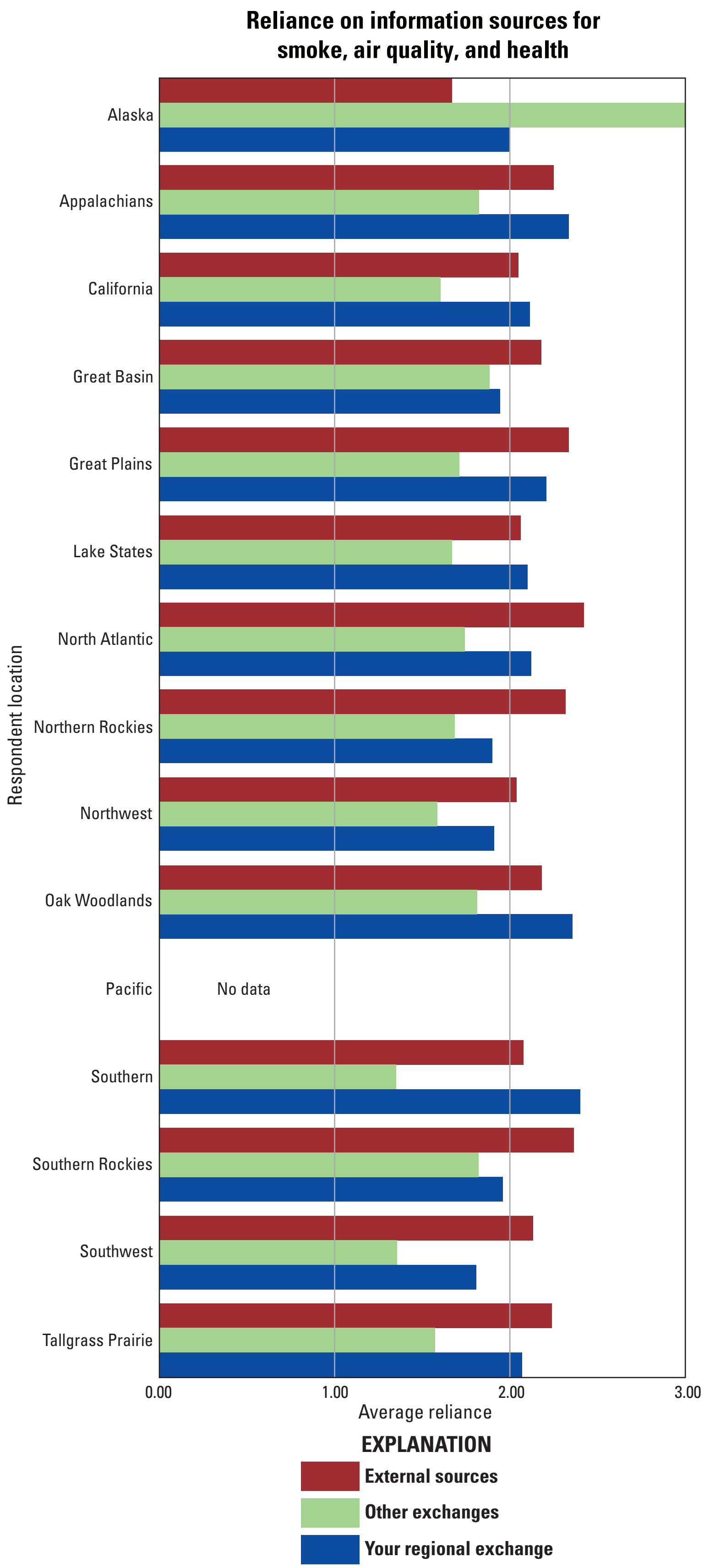



**Figure 39.** The reliance of fire science exchange members on three different sources for information on smoke, air quality, and health.

compared to other exchanges. However, respondents in the Pacific, Northwest, and Southern locations rely notably more (difference of 0.5 or more) on their regional exchanges over other exchanges. The difference in reliance between external sources and other sources is considerable for Southwest, Tallgrass Prairie, Southern Rockies, Pacific, Appalachians, Northern Rockies, and California locations (difference of 0.5 to 1.3). Respondents in the Southwest have the highest reliance on external sources overall, with a value of 3, which indicates heavy reliance. Respondents in the Pacific rely the least on other exchanges, with a value below 1, meaning that respondents have little to no reliance on this information source for this topic. For Southern, Oak Woodlands, Northwest, Lake States, Great Basin, and Alaska, the difference between external sources and the exchange network is moderate (difference of 0.3 to 0.5). Lastly, for Great Plains the differences are minimal since respondents there rely only slightly more on external sources, then on their regional exchange, and lastly on other exchanges. See figure 42.

For economic impacts, respondents from Pacific and Tallgrass Prairie locations did not respond to the reliance question. The Alaska location did not have responses for rating external sources, but those respondents rated their reliance on their regional exchange as heavy (value of 3) and other exchange networks as moderate (value of 2.3) for this topic. Respondents in the Southern location also rated their reliance on their regional exchange higher than the other sources for economic impacts. Respondents in the Northwest location rely slightly more on their regional exchange than on external sources, and much less on other exchanges. Respondents in Great Basin equally rely on their regional exchange and external sources and very little on other exchanges. Respondents in the rest of the locations rely more on external sources than the other exchange networks. Respondents in Southwest, Southern Rockies, California, Great Plains, Northern Rockies, and North Atlantic locations rated their reliance on external sources much higher (one value point or more) than the exchange network. Of these locations, respondents in California and Southwest rely equally or slightly more on their respondent location versus other exchanges, whereas respondents in the other locations rely comparatively much more on their regional exchange (difference of 0.4 or greater). Respondents in the Appalachians location rated their reliance on external sources slightly higher than the exchange network, and they rely more on other exchanges than their regional exchange for this topic. Respondents in Lake States rely more on external sources, and equally on their regional versus other exchanges. Respondents in Oak Woodlands rely moderately more on external sources (value of 2), then their regional exchange (value of 1.3), and lastly on other exchanges (value of 0.8). See figure 43.

For soil, external sources again are the most relied upon, although for Lake States and Pacific, respondents equally rely on external sources and their regional exchanges. Respondents in Alaska, Great Basin, Northwest, and Southern Rockies locations all rely on external and regional exchanges most, with a slightly greater reliance on external sources. For the rest of the locations (that is, California, Great Plains, North Atlantic, and Southern), respondents rely moderately more (difference of 0.4 to 0.5) on external sources than on their regional exchanges. Southern Rockies and Southwest locations have the highest reliance values overall, with moderate to heavy reliance on external sources (values of 2.6 and 3). Respondents in Tallgrass Prairie, Southwest, Northern Rockies, and Appalachians locations rely much more on external sources than the other two sources. Oak Woodlands is unique in that respondents there rely moderately more (difference of 0.3) on their regional network than the other sources. Respondents in the Southern Rockies and Pacific also rely moderately on other exchanges to gather information for soil (value of 2 or higher). See figure 44.

For Indigenous knowledge, respondents rely considerably more on external sources over the exchange networks for information; in fact, respondents in all the locations rated their reliance on external sources to be the greatest (values from 1 to 3 out of scale of 4), except for Southwest where the regional exchange is relied on slightly more than external sources. Alaska is also an exception because respondents there rely equally little on the three information sources (reliance value of 1). Compared to other topics, there is higher overall reliance on other exchanges for this topic.

Respondents from Southern, Southwest, and Tallgrass Prairie indicated similar amounts of reliance on each of the three sources. Respondents in the Southern and Southwest locations have moderate reliance on the three sources (values of 2 to 2.5), but respondents in Southern locations rely slightly more on their regional exchange, whereas respondents in Southwest rely more on external sources. Tallgrass Prairie has a lower overall reliance for all three sources (values of 0.8 to 1.2) since respondents there only rely somewhat on any source, and they rely most on external sources. Respondents in Appalachians, Lake States, North Atlantic, and Northern Rockies locations all rely considerably more on external sources than the other two information sources (differences of up to 2 values). In general, respondents rely equally or the least on other exchanges, except in California and Southern Rockies, where respondents in both locations rely more on other exchanges than their regional exchanges. There were no responses from Great Plains on this topic, and respondents from Pacific only rated their information gathering for their regional exchange, which was rated as minimal reliance for this topic (value of 1). See figure 45.

To look more holistically at the exchange network, the average reliance of respondents on their regional exchange was analyzed using the results from the previous figures. Figure 46 shows descriptive statistics for the distribution of the percentage of respondents from each location that rely strongly on their regional exchange across the 16 different science topics. This figure is based on the data from the question on reliance, in which respondents were asked to rate their reliance on three different information sources (their regional exchange, other exchanges, or external sources) for the 16 science topics on a scale of 0 to 4. This figure only displays data where respondents had a strong reliance on their regional exchange; in other words, only in cases where respondents

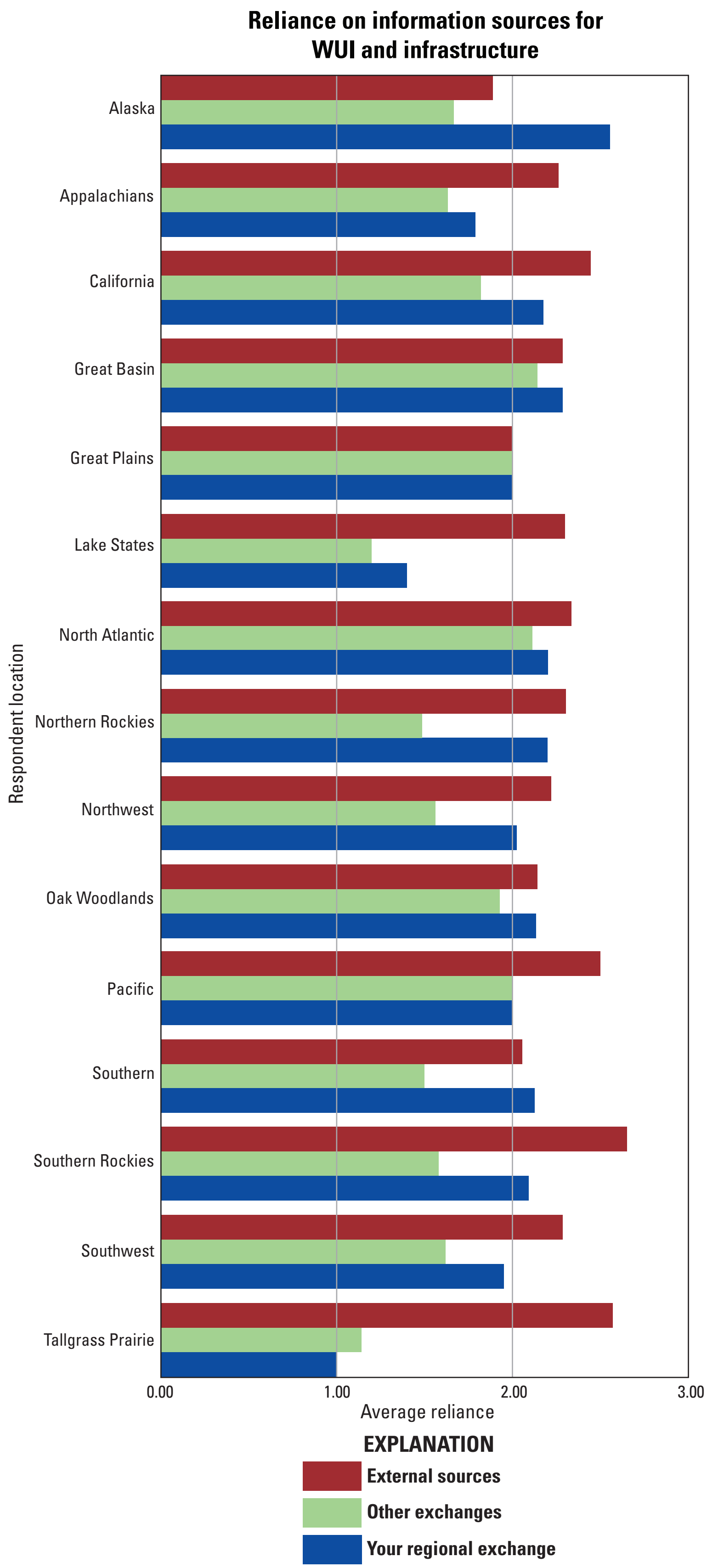



**Figure 40.** The reliance of survey respondents on three different sources for information on wildland urban interface and infrastructure, by Fire Science Exchange Network respondent location.

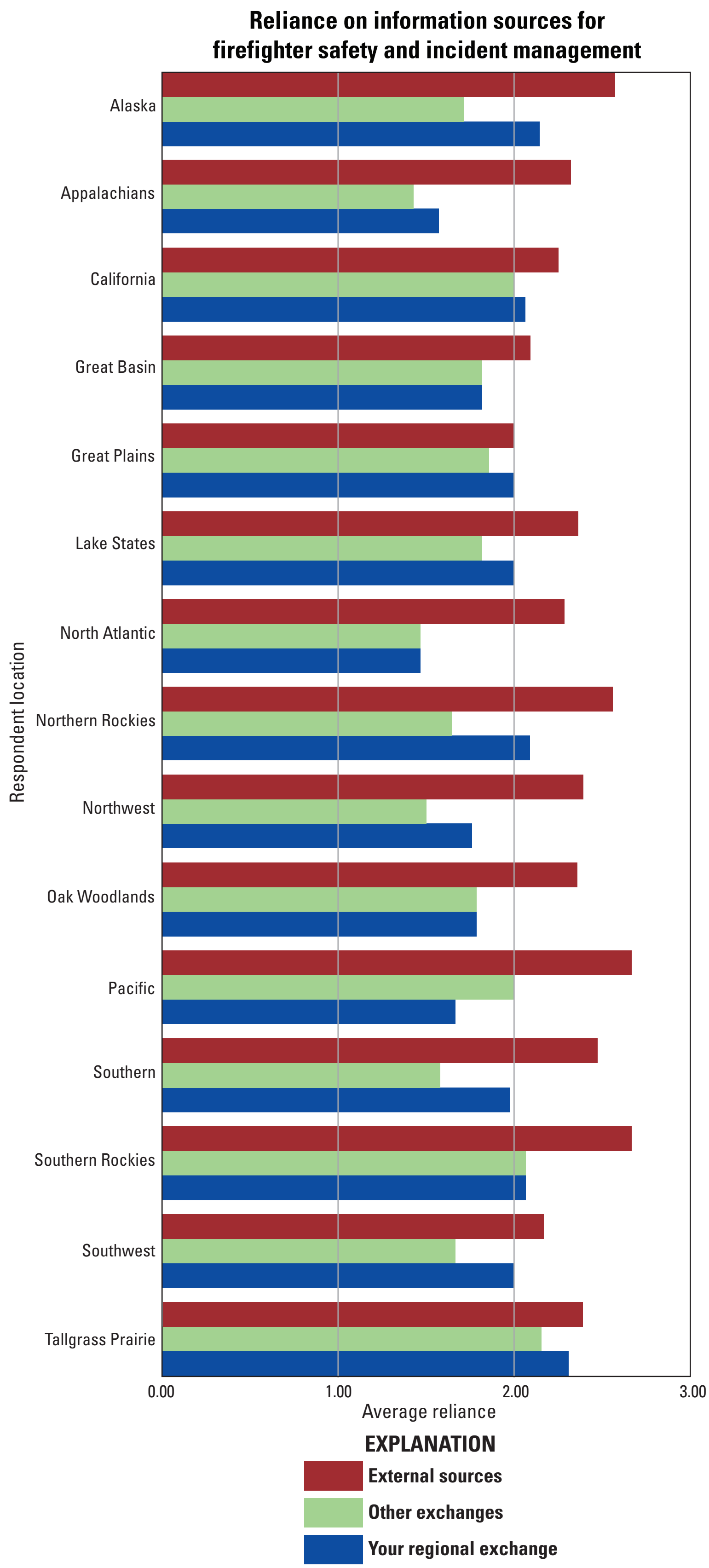



**Figure 41.** The reliance of survey respondents on three different sources for information on firefighter safety and incident management, by Fire Science Exchange Network respondent location.

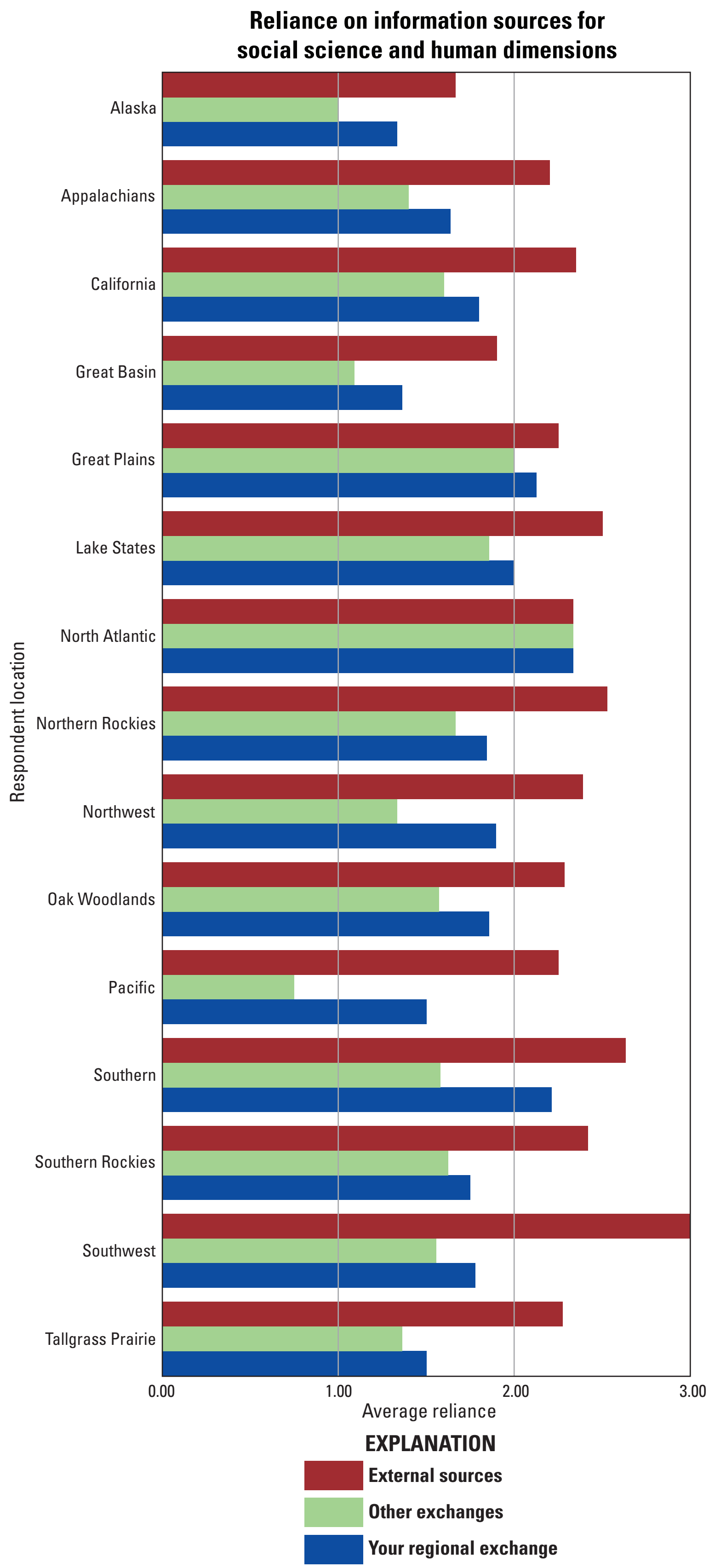



**Figure 42.** The reliance of survey respondents on three different sources for information on social science and human dimensions, by Fire Science Exchange Network respondent location.

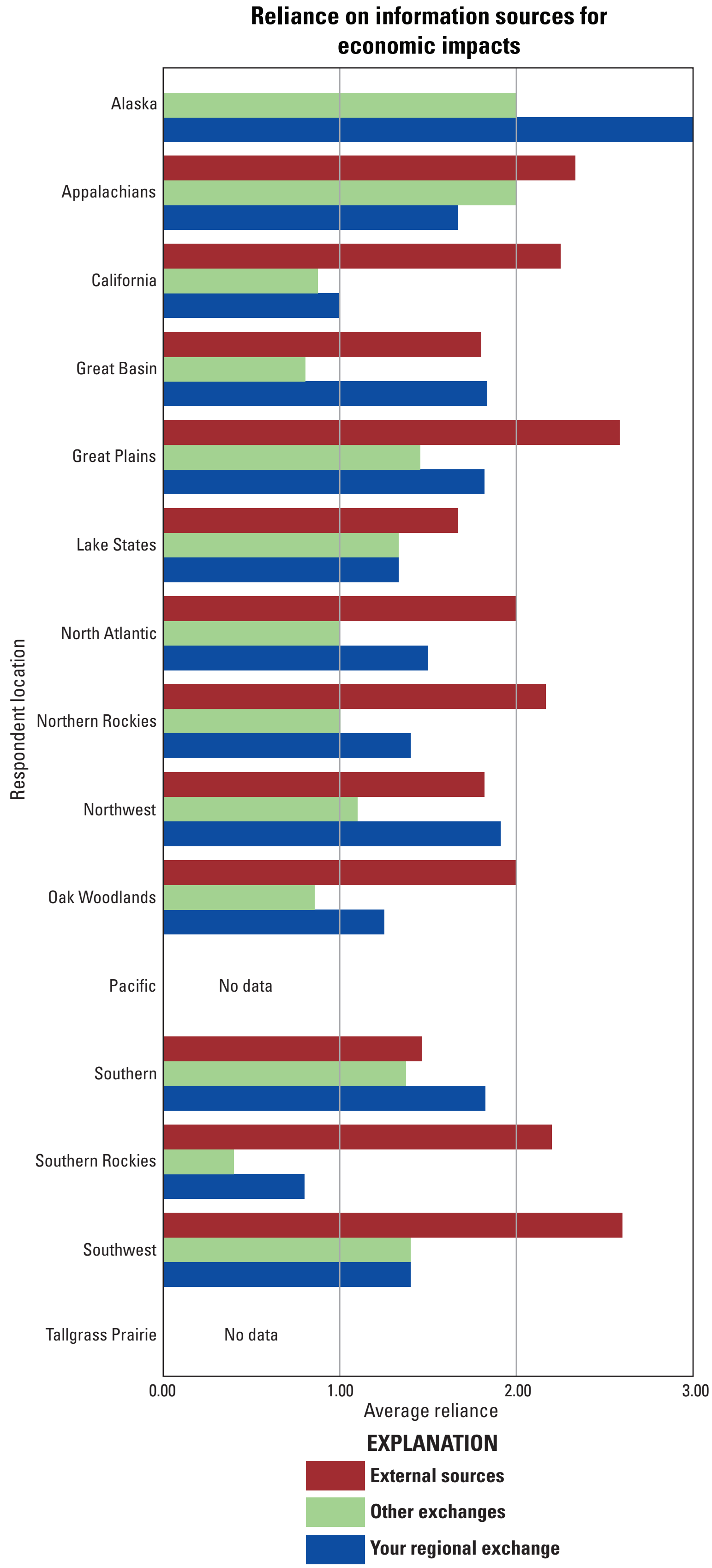



**Figure 43.** The reliance of survey respondents on three different sources for information on economic impacts, by Fire Science Exchange Network respondent location.

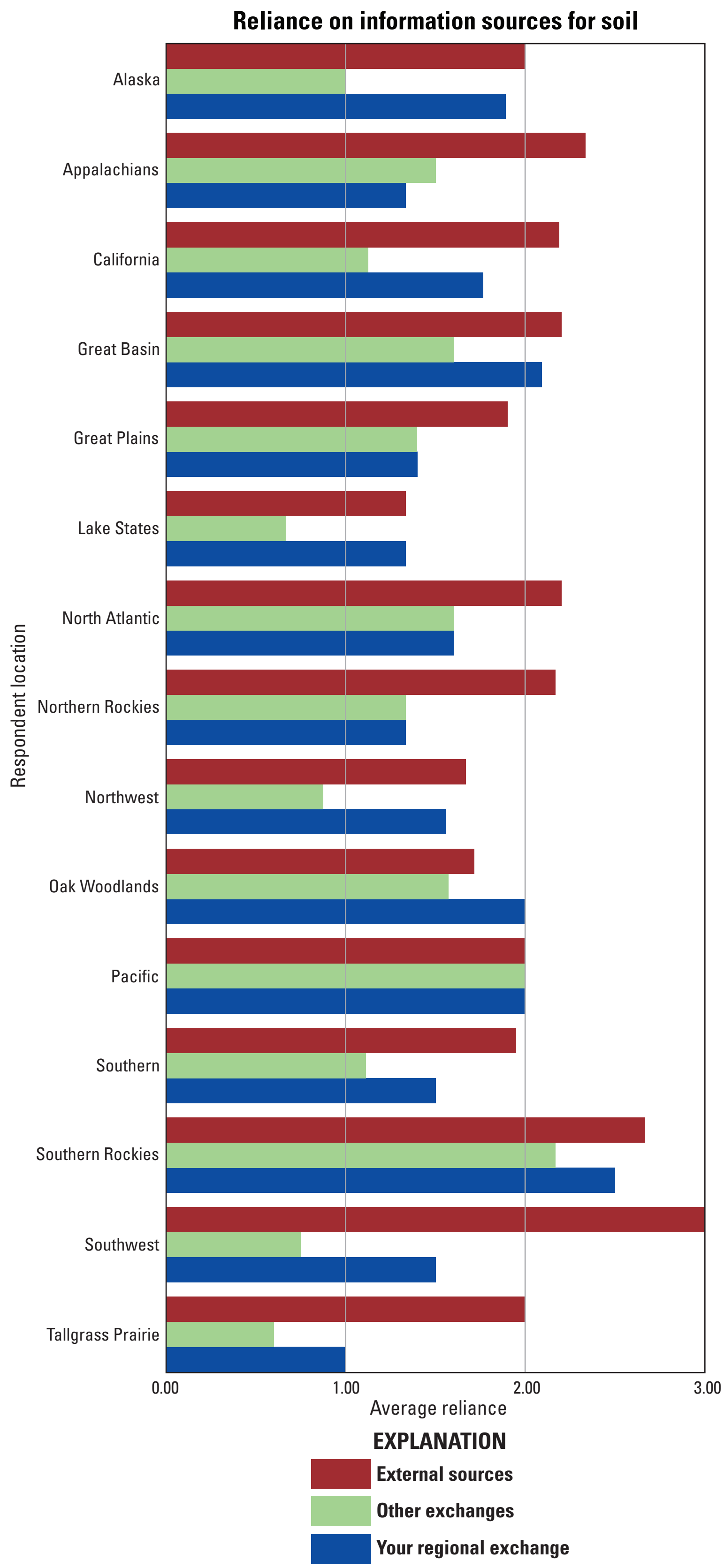



**Figure 44.** The reliance of survey respondents on three different sources for information on soil, by Fire Science Exchange Network respondent location.

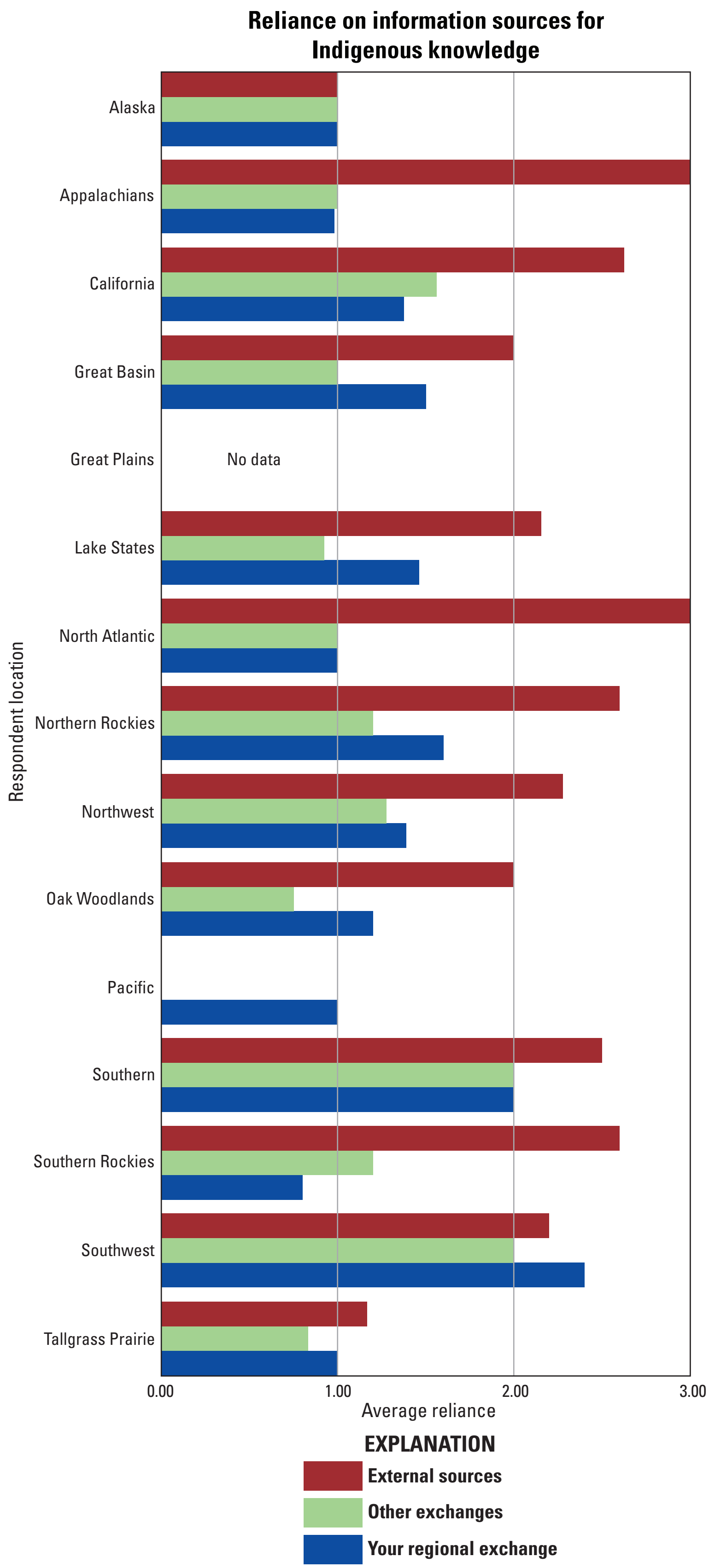



**Figure 45.** The reliance of survey respondents on three different sources for information on Indigenous knowledge, by Fire Science Exchange Network respondent location.

rated their reliance on their regional exchange with a value of 3 or 4 (heavy or complete reliance). Thus, it excludes results where respondents rated their reliance on their regional exchange as low (a value of 1 or 2; minimal or moderate) and excludes any results regarding reliance on external sources or other exchange networks.

Figure 46 displays the data as a box-and-whisker plot. In these diagrams there is a box, in which the spacings between the top and bottom of the box indicate the degree of spread in the data, and lines extending from the boxes (whiskers) indicate variability outside the upper and lower quartiles (indicated by the gray and orange sections inside of the boxes). The top whisker indicates a maximum (topic for which reliance was highest), the bottom whisker indicates a minimum (topic for which reliance was lowest), the line separating the gray and orange inside of the box indicates the median, and the average is indicated by the yellow dot in the middle of each box. Based on the average, respondents in Appalachians, Great Plains, Lake States, Pacific, and Tallgrass Prairie locations rely less on their regional exchange for information, relative to their peers. On the other hand, respondents in Alaska, Oak Woodlands, Southern, and Southern Rockies locations have a relatively higher reliance on their regional exchange. Alaska has the highest overall average reliance percentage (36 percent). All respondents from Pacific and Alaska (100 percent) rely on their regional exchange for at least one topic. For Northwest, there is a consistent percentage of reliance on all science topics for the regional exchange, since there is a small range between the maximum and minimum for this location. Pacific is unique because for many topics none (0 percent) of its respondents rely on their regional exchange, thus the box is on the 0 percent line for Pacific.

In figure 47, the data from figure 46 has been separated and detailed to show the percentage of reliance on the regional exchange by respondents in each location and for each of the 16 science topics. The purpose of this figure is to give an overview of how respondents rated their reliance on their respondent location across the 16 science topics. An additional figure that separates this chart by science topic can be found in appendix 1 (fig. 1.1). On the high end, all respondents in Alaska rely on their regional exchange for information on economic impacts, 67 percent of North Atlantic respondents rely on their regional exchange for information on social science, and 100 percent of Pacific respondents and 75 percent of Oak Woodlands respondents rely on their regional exchanges for fire regimes.

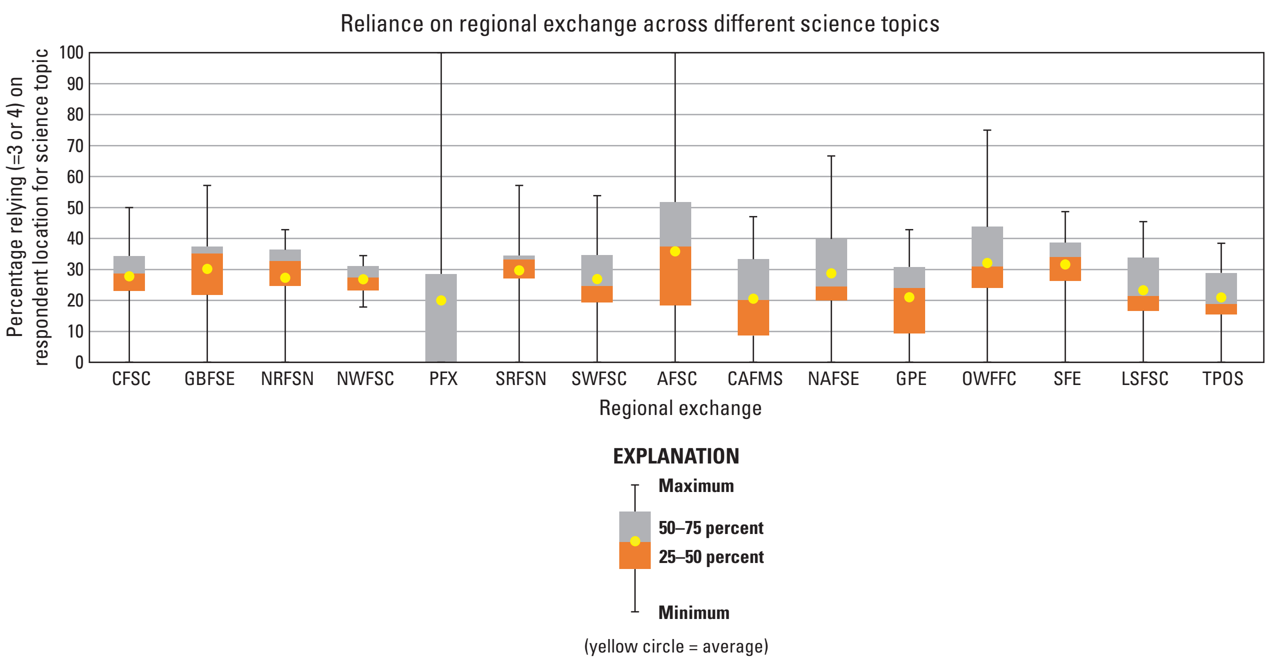



**Figure 46.** The average reliance of survey respondents on their regional exchange for all 16 science topics. The spacing between the top and bottom of each box indicates the degree of spread in the data, and the whiskers indicate the variability outside of the upper (gray) and lower (orange) quartiles. The line separating the orange and gray sections is the median, and the yellow dot is the average. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

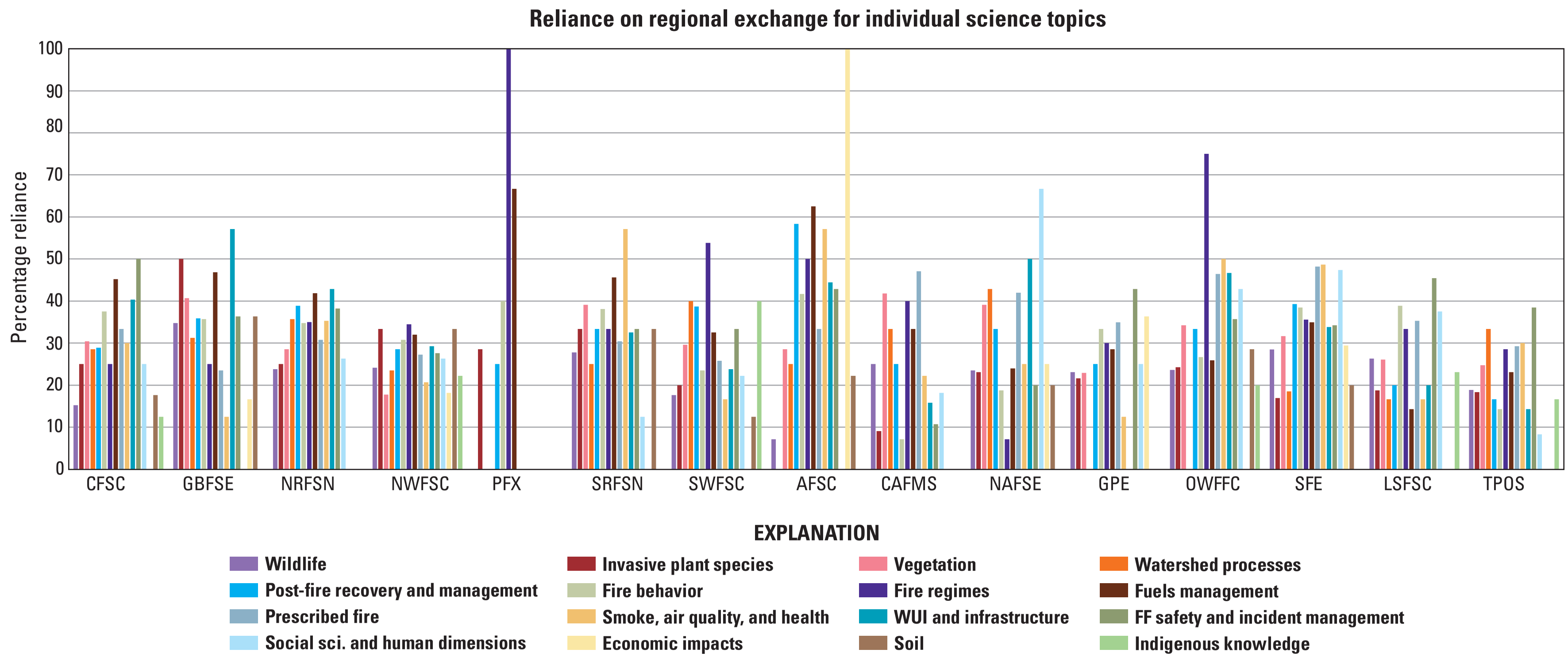



**Figure 47.** The average reliance of survey respondents in the 15 locations on their regional exchange for each of the 16 science topics. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; sci., science; WUI, wildland urban interface; FF, firefighter)

Alaska, on average and for multiple topics, had respondents with higher reliance on their regional exchange than any other exchange. In addition to 100 percent reliance on their regional exchange for information about economic impacts, respondents from Alaska rely strongly on their regional exchange for information about post-fire (58 percent), fire regimes (50 percent), fuels (63 percent), and smoke (57 percent) topics. Other locations only had a maximum of two topics for which 50 percent or more of their respondents rely on their regional exchanges, whereas Alaska has five such topics. The science topic of fire regimes stands out for having 50 percent or more respondents in many locations relying on their regional exchange for information about it, including the Pacific (100 percent), Alaska (50 percent), Oak Woodlands (75 percent), and Southwest (54 percent) locations.

## Information Gathering from the Exchange Network by Science Topic

The following section uses Sankey diagrams to show the flow of information between respondent locations and various exchanges inside the FSEN for the key science topics. Sankey diagrams are a type of flow diagram in which the width of the colored bands between the left to right side is proportional to the flow rate, which in this case represents the number of respondents from each location (left side) that go to that each exchange (right side) for a given science topic. The exchanges on the left side of the diagram represent the locations of respondents who answered the question "which exchanges do you go to for information on topic X," whereas the right side represents the exchanges that these respondents go to for that information. In other words, the information seekers come from locations shown on the left and gather information from the exchanges on the right. There are two Sankey diagrams for each of the 16 science topics, one displaying all connections, and one displaying the trimmed network. As reflected in the diagrams displaying all connections, in most cases information sharing occurs in a rich network that involves most, if not all, exchanges providing information to respondents in most, if not all, locations. However, discussion focuses on the connections displayed in the trimmed network, which represent the dominant patterns observed for each topic. The diagrams are organized according to dominant geographic (eastern or western) patterns in information gathering; the subgroups are (1) information gathering among eastern exchanges is dominant, (2) information gathering among western exchanges is dominant, (3) information gathering occurs within both eastern and western exchanges separately, and (4) information gathering occurs across the geographic groupings.

For the topic of wildlife, several respondents primarily gather information from their regional exchange that matches their location, including Southwest, Southern Rockies, Great Basin, Alaska, North Atlantic, Northern Rockies, Northwest, California, and Pacific. Apart from these exchanges, there is one key pattern in information gathering for wildlife, in which Oak Woodlands (OWFFC) has the most respondents from other locations going to its exchange for information on this topic. Respondents from Appalachians, Oak Woodlands, and Southern locations are gathering information from each of the corresponding exchanges, with more respondents from this group going to Oak Woodlands than to other exchanges. Respondents from Oak Woodlands, Southern, and Tallgrass Prairie locations also participate in information gathering from Oak Woodlands and Tallgrass Prairie, but respondents from Tallgrass Prairie do not similarly go to Southern. A considerable number of respondents from the Tallgrass Prairie location go to Lake States for information on wildlife, but a similar link from Lake States to Tallgrass Prairie is not observed. Respondents from the Great Plains gather information from the Oak Woodlands as well as from their own regional exchange. See figure 48.

For invasive plant species, respondents in numerous locations primarily gather information from their corresponding regional exchange, including Alaska, California, North Atlantic, Northern Rockies, Southern Rockies, and Pacific. Great Basin respondents mostly gather information on invasive plant species from their regional exchange, though some Great Basin respondents go to Southwest and Northwest exchanges for information on this topic. Again, a lot of information gathering is happening amongst exchanges in the eastern United States, including Great Plains, Oak Woodlands, Appalachians, Lake States, Southern, and Tallgrass Prairie. Respondents from Appalachians, Oak Woodlands, and Southern locations gather information from each of the corresponding exchanges, albeit with respondents gathering more from Oak Woodlands than the other two exchanges. Tallgrass Prairie and Great Plains respondents also gather information from each other's corresponding exchanges for this topic. See figure 49.

This Sankey diagram (fig. 50) shows similar patterns in information gathering for vegetation as was seen for wildlife and invasive species, in terms of the high levels of information gathering across respondents in the eastern exchanges. Oak Woodlands appears to be an information hub for this topic, because respondents from Appalachians, Southern, Great Plains, Tallgrass Prairie, and Oak Woodlands locations all go to the Oak Woodlands exchange for information on vegetation. Respondents from Oak Woodlands also gather information on vegetation from Appalachians, Southern, and Tallgrass Prairie exchanges. Further, Great Plains respondents gather information from Oak Woodlands and Tallgrass Prairie. Many respondents go to Southern for information. Most of these are from the Southern location, and others are respondents from Appalachians and Oak Woodlands. Southern respondents gather information from Oak Woodlands and Appalachians, and some Southern respondents go to Tallgrass Prairie. Tallgrass Prairie is another popular exchange in that Oak Woodlands, Southern, and Great Plains respondents all go to Tallgrass Prairie for information on vegetation. Tallgrass Prairie respondents are gathering information from Oak Woodlands and Lake States, but Lake States respondents are not gathering information from Tallgrass Prairie.

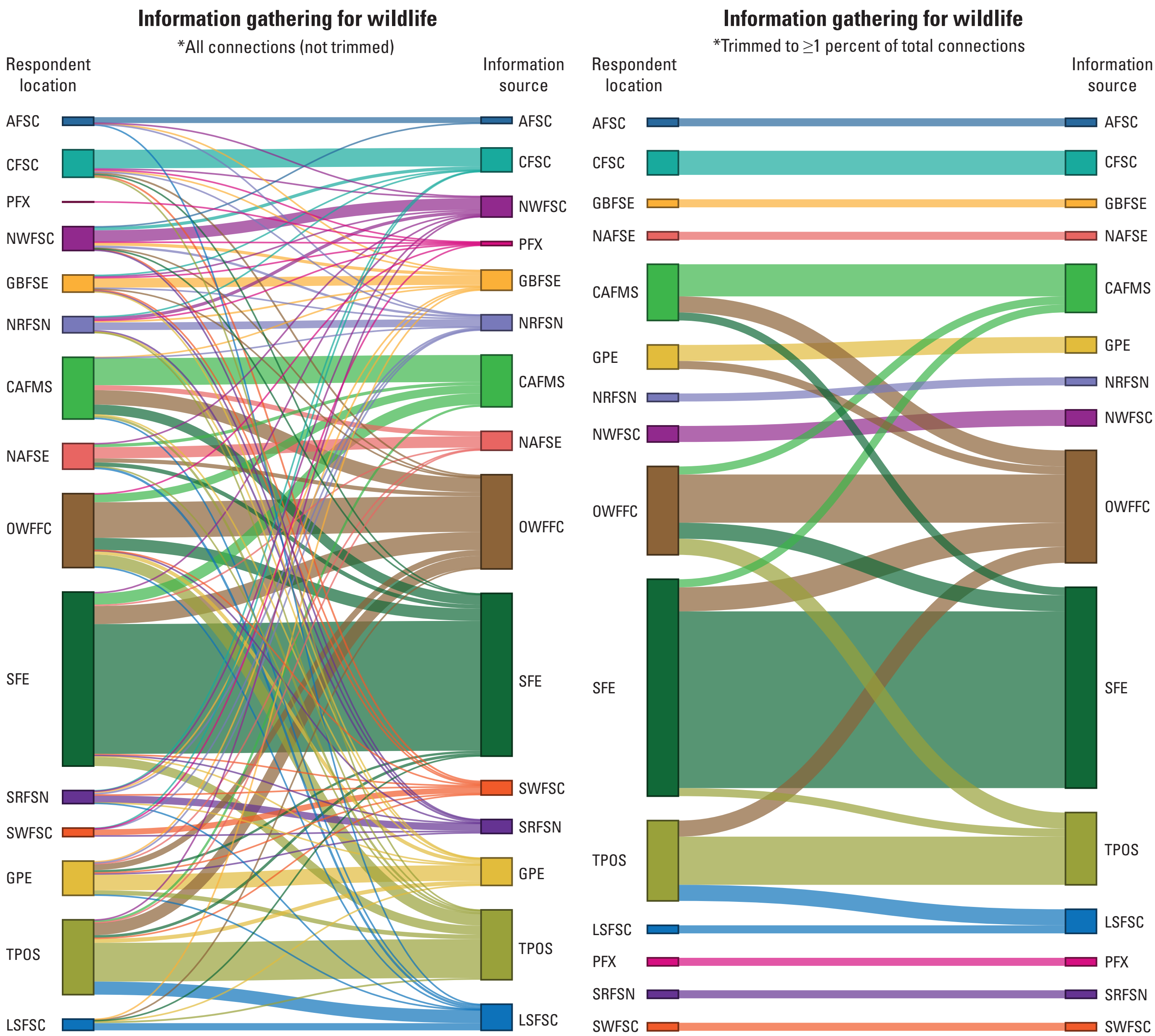



**Figure 48.** Flow of information gathering from respondent location (left column) to all 15 regional fire science exchanges (right column) for wildlife. Diagram on left shows all connections and diagram on the right is the same information but trimmed. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

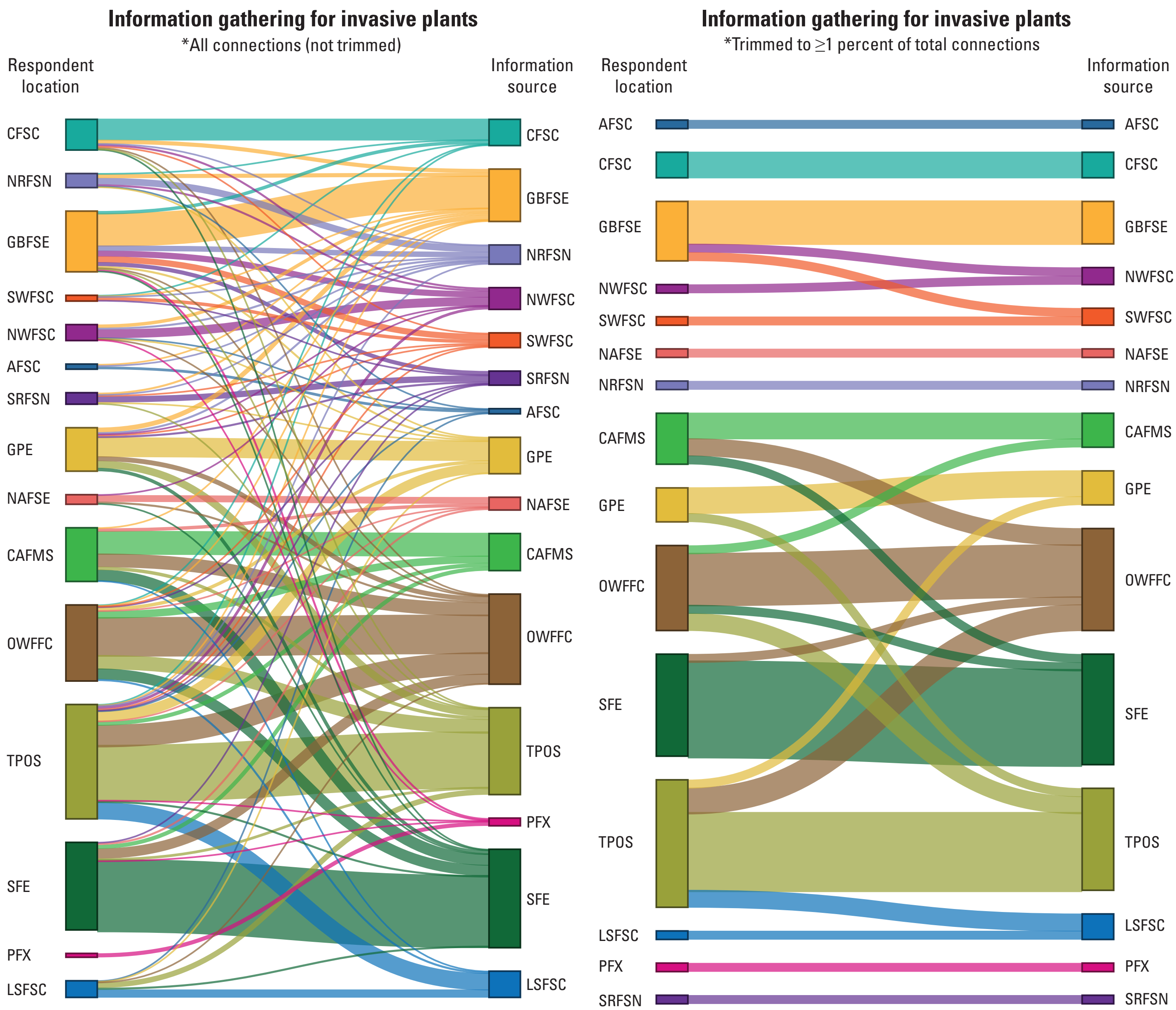



**Figure 49.** Flow of information gathering from respondent location (left-hand column) to all 15 regional fire science exchanges (right-hand column) for invasive plant species. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

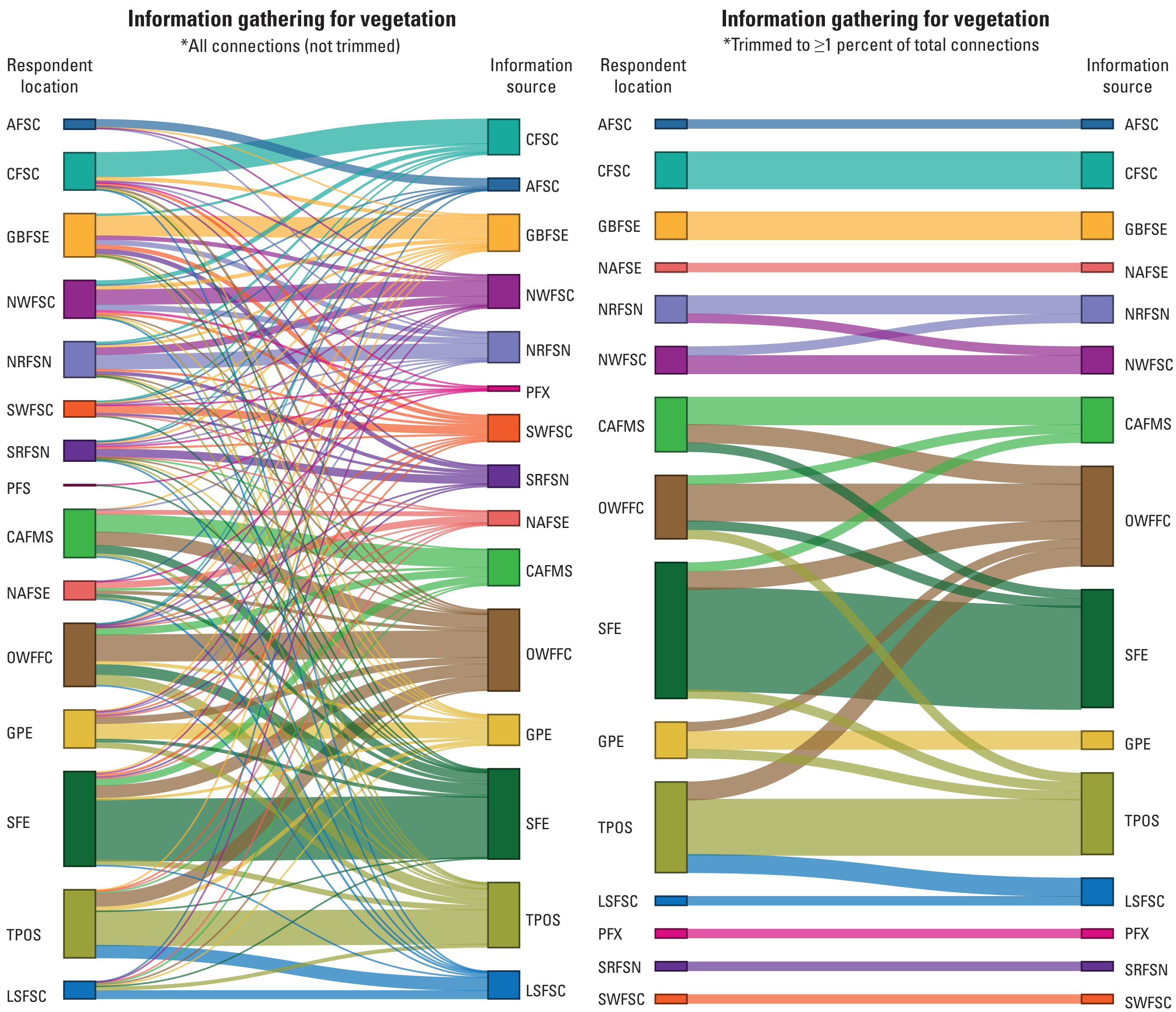



**Figure 50.** Flow of information gathering from respondent location (left-hand column) to all 15 regional fire science exchanges (right-hand column) for vegetation. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

Alaska, California, Great Basin, North Atlantic, Southern Rockies, and Southwest respondents primarily gather information from their corresponding regional exchange. Some respondents in Northern Rockies and Northwest locations gather information from each other's corresponding exchanges. See figure 50.

For the topic of prescribed fire, respondents from California, North Atlantic, Northern Rockies, Northwest, Great Plains, Lake States, and Southwest are gathering information mostly from their corresponding regional exchanges. The eastern exchanges are active for this topic. Oak Woodlands is a relatively frequent exchange from which to gather information for this topic, with large amounts of respondents going to Oak Woodlands from Appalachians, Southern, and Tallgrass Prairie locations. Many Tallgrass Prairie respondents are going to Lake States, and some to Great Plains, but neither of these interactions are happening the other direction. On the other hand, respondents from Appalachians, Oak Woodlands, and Southern locations gather information from each other's corresponding exchanges for this topic. Many respondents from the Appalachians location go to Oak Woodlands for information on prescribed fire, and Southern respondents gather information from the Appalachians. Southern, Oak Woodlands, and Tallgrass Prairie respondents also gather information from each other's corresponding exchanges. Many Tallgrass Prairie and Southern respondents go to the Oak Woodlands to gather information on prescribed fire, and many Oak Woodlands respondents go to the Southern for information as well. See figure 51.

For watershed processes, respondents from Alaska, Lake States, Appalachians, and Oak Woodlands locations mostly get information from their corresponding regional exchanges. Most of the information gathering from other exchanges on this topic is moderate, and most of the associated activity occurs amongst the western exchanges. Northern Rockies, Northwest, and Southern Rockies stand out as having comparatively more respondents going to them for information from different locations. Respondents from California, Northern Rockies, and Southern Rockies use Northwest for information on watershed process. Southern Rockies has respondents coming to it for information from the Southwest, Northern Rockies, and Great Basin locations. Many respondents go to Northern Rockies for information on this topic, including those from California, Northwest, Southern Rockies, and Southwest locations. Respondents from Northern Rockies and Southern Rockies gather information from each other's corresponding exchanges, and respondents from Northern Rockies and Northwest gather information from Great Basin.

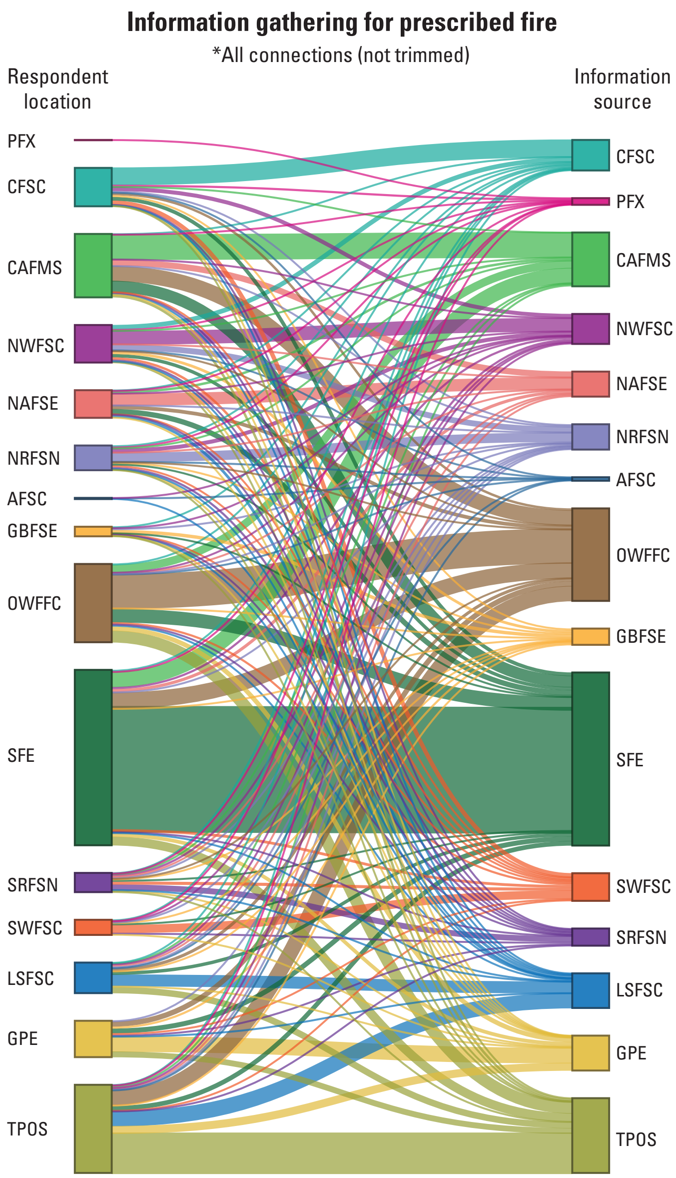
California and Southern mostly have respondents from their own corresponding locations going to them for information, except for numerous respondents from the Southwest going to the California location. Respondents from a few locations (Southern, Great Plains, and Tallgrass Prairie) go to Oak Woodlands, but respondents from Oak Woodlands do not go to the corresponding other exchanges. See figure 52.

For post-fire recovery and management, respondents from Alaska, Appalachians, Great Plains, and Oak Woodlands tend to gather information mostly from their corresponding regional exchanges. Although western exchanges are dominant for this topic, it is important to note the small amount of eastern exchange information gathering shown in the diagram (fig. 53). Respondents from the Southern location gather information from Oak Woodlands as well as their corresponding exchange. There is a lot of information gathering in the western region, with California, Southwest, Northwest respondents gathering information from all the corresponding exchanges. There is also information gathering between Northern Rockies and Southern Rockies, with respondents from these locations going to each other's exchanges. Northwest respondents go to many other exchanges for information about post-fire recovery and management, including California, Northern Rockies, Great Basin, Pacific, and Southwest.

Northern Rockies and Southwest respondents are going to Southern Rockies for information and the Southern Rockies respondents are going to California, Northern Rockies, and Southwest. Respondents from the Southwest tend to gather information only from their corresponding regional exchange and California. California, Northwest, and Southern Rockies respondents are going to Great Basin for post-fire information, but Great Basin respondents are only gathering information from Northwest and their own corresponding exchange. See figure 53.

For social science and human dimensions, respondents gather information across many of the exchanges, especially the western exchanges. The large number of connections shown on the trimmed diagram on the right (fig. 54) suggest that information sharing about social science and human dimensions does not follow any clear, dominant patterns. Respondents from Alaska, Great Basin, Southwest, Lake States, and Pacific locations mostly gather information from their own corresponding regional exchanges. However, Northwest respondents gather information from Pacific, respondents from Tallgrass Prairie gather information from Lake States, and respondents from California, Northwest, and Northern Rockies locations gather information on this topic from Great Basin. Some respondents from the west gather information from exchanges in the east, including respondents from California gathering information from the Oak Woodlands exchange and some respondents from Southern Rockies gathering information from the Southern exchange.

Respondents from many other locations go to the California exchange for information about social science and human dimensions, including respondents from Northern Rockies, Northwest, Southern Rockies, and Southern locations. Many respondents from Southern Rockies go to Southwest for information on this topic. Northwest, Northern Rockies, and Southern Rockies respondents gather information from each other's corresponding exchanges. Respondents from Northwest and Southern Rockies locations go to five external exchanges, in addition to their corresponding regional exchanges, to gather information on this topic.



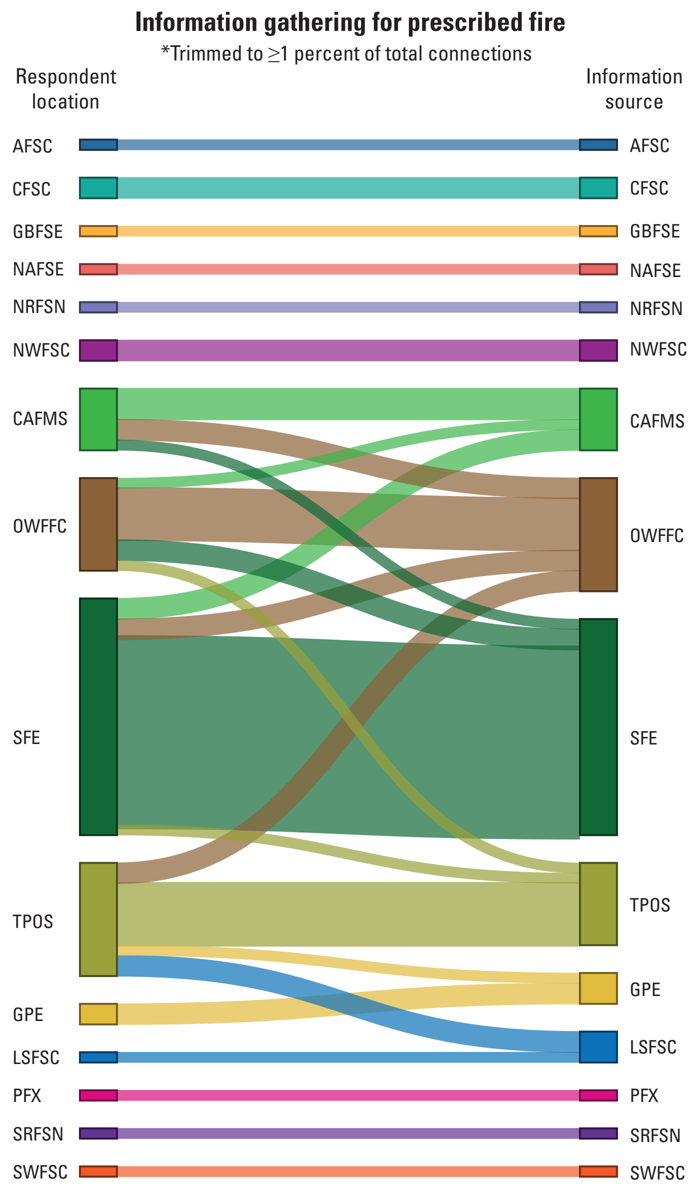




**Figure 51.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for prescribed fire. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

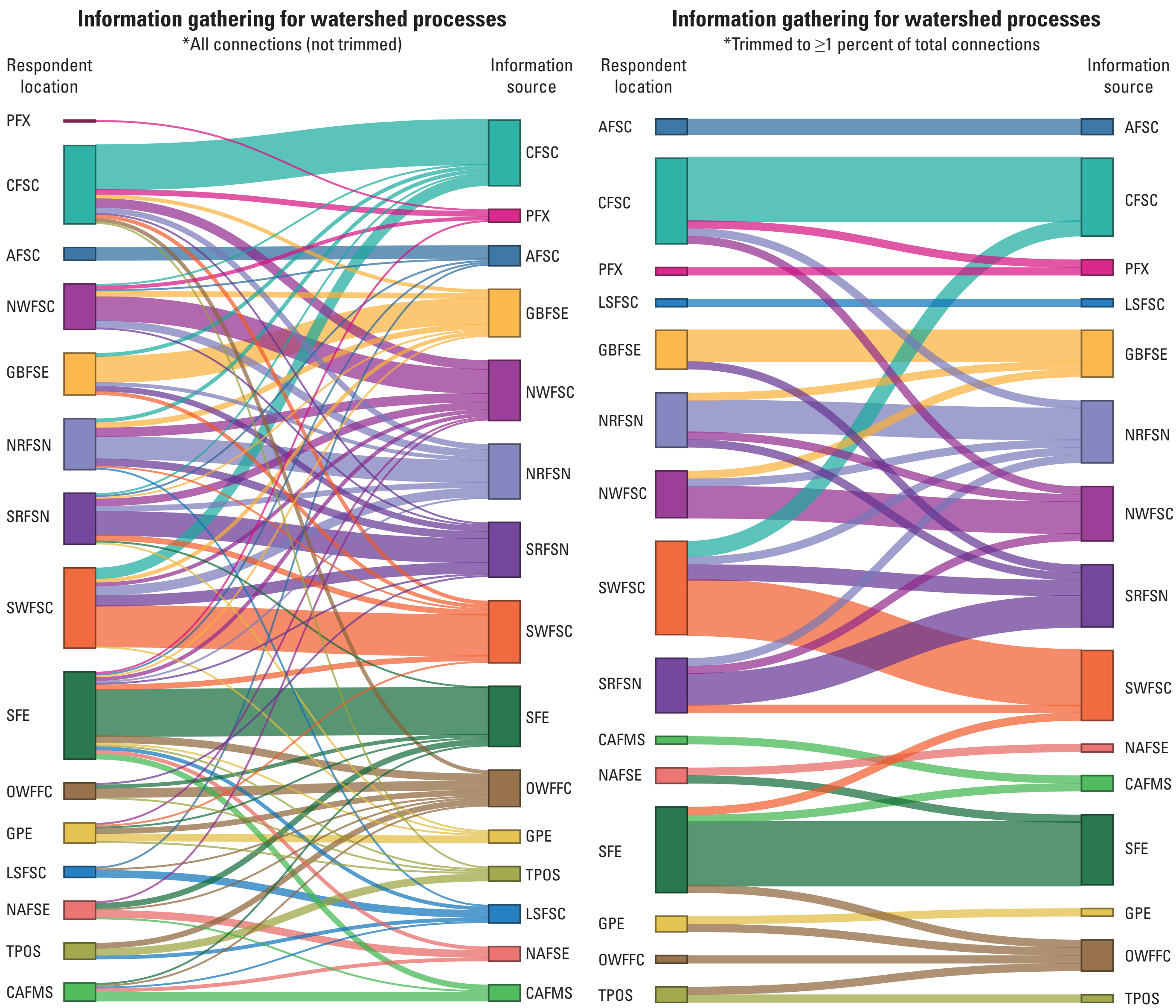



**Figure 52.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for watershed processes. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

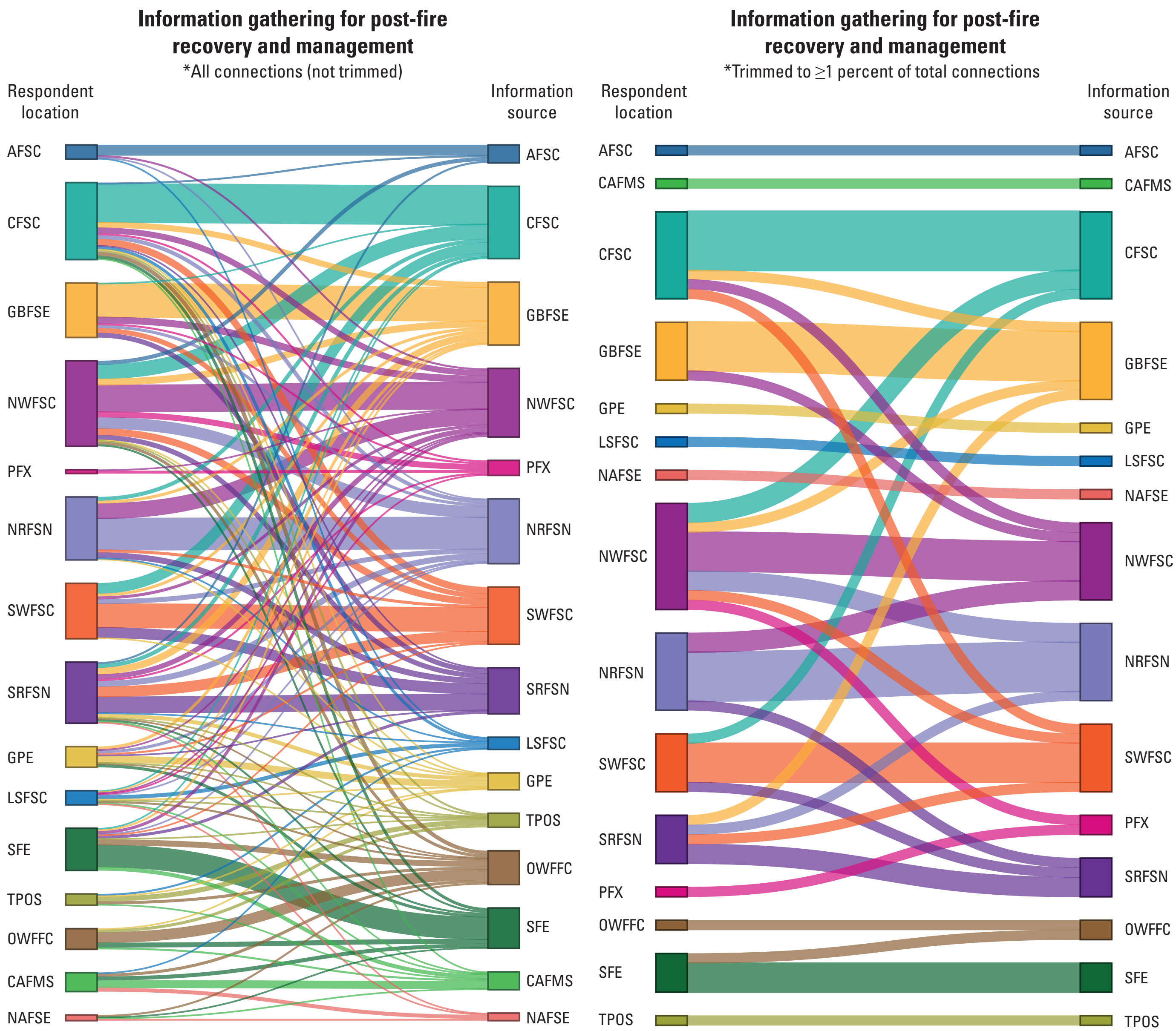



**Figure 53.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for post-fire recovery and management. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

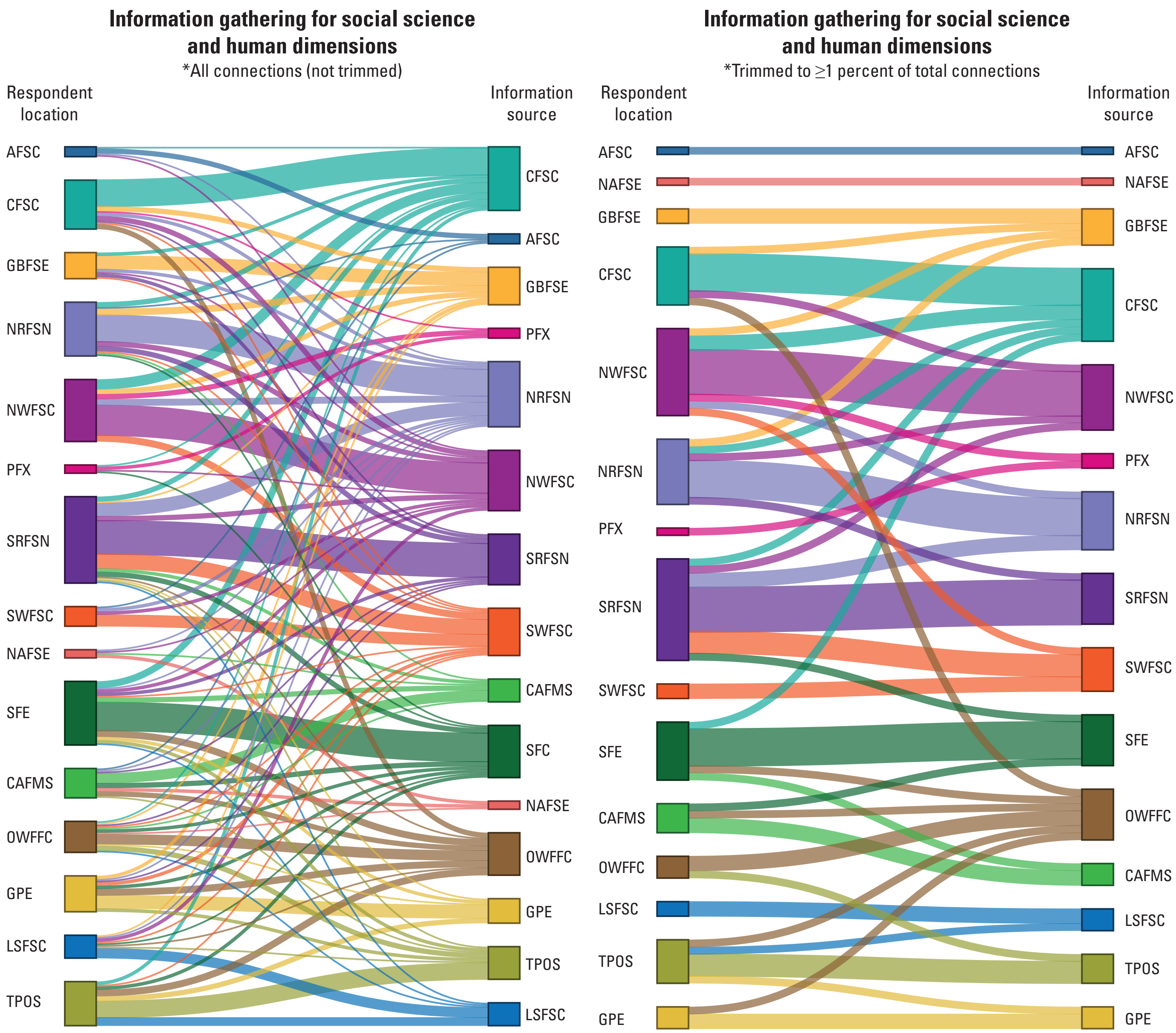



**Figure 54.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for social science and human dimensions. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

For the eastern region, Oak Woodlands appears to be a hub for information on this topic because respondents from California, Southern, Appalachians, Great Plains, and Tallgrass Prairie locations go there for information. Most of the respondents in the eastern region gather information from other eastern exchanges; for example, Appalachians respondents are gathering information from Southern and Oak Woodlands, and Tallgrass Prairie respondents are gathering information from Lake States, Great Plains, and Oak Woodlands. Southern respondents are an exception in that they gather information not only from eastern exchanges but also from California. See figure 54.

Because there were few responses for Indigenous knowledge overall, a trimmed Sankey diagram would be identical to the diagram showing all connections and thus is not shown (fig. 55). The rich network of connections shown in the figure suggests no dominant patterns. For some locations, respondents indicated that they mostly gather information from their corresponding regional exchange. these were: Oak Woodlands, Alaska, Pacific, North Atlantic, Great Plains, Appalachians, and Great Basin locations. Respondents from California and Northwest locations are relatively more active in gathering information from other exchanges for this topic. These locations have relatively high numbers of respondents gathering information from other exchanges, and they are the top exchanges that respondents from other locations go to for information on Indigenous knowledge. For example, California respondents gather information from Great Basin, Northwest, Southwest, Oak Woodlands, and Pacific, as well as smaller numbers gathering from other exchanges. Northwest and Southwest respondents gather information from the California exchange, and California respondents gather information from the Northwest and Southwest exchanges. Respondents in the Northwest location gather information mostly from their corresponding regional exchange as well as California and Northern Rockies.

In another notable pattern, Oak Woodlands is a popular source for information gathering on this topic, including for respondents from Lake States, Southern, and California exchanges. Lake States respondents are gathering information from many exchanges, most notably Tallgrass Prairie and Oak Woodlands, whereas only Tallgrass Prairie and Lakes States respondents gather information from Lake States. Pacific has some notable levels of respondents gathering information from California and Northwest, and Alaska has respondents gathering information from Southwest and Northwest locations. Some Southern respondents are going to Appalachians for information on Indigenous knowledge. See figure 55.

For the science topic of fire behavior, respondents from Alaska, Appalachians, Great Basin, North Atlantic, Southwest, and Oak Woodlands locations gather information primarily from their corresponding regional exchanges. Otherwise, two geographic groupings emerge. In the West, California respondents gather information from their corresponding exchange and the Great Basin exchange, whereas respondents from Great Basin only gather information from their own regional exchange on this topic. Respondents from many locations go to the Southwest exchange for information on this topic, including respondents from California, Northern Rockies, Southern Rockies, and Southwest locations. Northern Rockies, Northwest, and Southern Rockies respondents gather information from each other's exchanges.

In the East, respondents from Lake States and Tallgrass Prairie) locations gather information from each other's exchanges; Southern respondents also gather information from the Tallgrass Prairie exchange. Southern and Tallgrass Prairie respondents gather information from the Oak Woodlands exchange, but Oak Woodlands respondents only gather information on fire behavior from their corresponding regional exchange. See figure 56.

For the topic of fire regimes, respondents typically gather information from exchanges that border their locations. Respondents from Alaska, Great Basin, Great Plains, North Atlantic gather information primarily from their corresponding regional exchanges. Northern Rockies and Southern Rockies respondents gather information on this topic from each other's exchanges, as well as their own. Northern Rockies and Northwest respondents also gather information on this topic from each other's exchanges. Northwest respondents are the only ones to gather information from the Southwest and California exchanges; neither of these relationships happen in the other direction. Respondents from Tallgrass Prairie and Lake States locations gather information on fire regimes from each other's exchanges, as seen with many other science topics. Southern respondents also gather information from the Tallgrass Prairie exchange. In the East, Appalachians, Oak Woodlands, and Southern respondents all gather information from each other's exchanges. See figure 57.

Alaska, Lake States, Great Basin, North Atlantic, Southern, Southern Rockies, Southwest, and Tallgrass Prairie respondents mostly go to their corresponding regional exchanges for information on firefighter safety and incident management. There are many information gathering relationships for this topic that do not go both directions. For example, Northern Rockies had the highest number of responses for this topic and its respondents go to many exchanges for information, including Great Basin, Northwest, California, and Southern Rockies, whereas Northwest respondents are the only non-Northern Rockies respondents who go to the Northern Rockies exchange for information about this topic in substantial numbers. Northwest respondents also go to California and Southwest exchanges, but the inverse is not observed. Northwest and California respondents go to the Southwest exchange for information on this topic, but Southwest respondents only go to their corresponding regional exchange. Great Plains respondents gather information from the Southern Rockies exchange, but not vice versa.

In the East, Appalachians respondents go to Oak Woodlands and Southern exchanges for information, but only respondents from the Appalachians go to the Appalachians exchange for information on this topic. Southern respondents only go to their corresponding regional exchange, but Appalachians and Oak Woodlands respondents gather information from the Southern exchange as well. See figure 58.

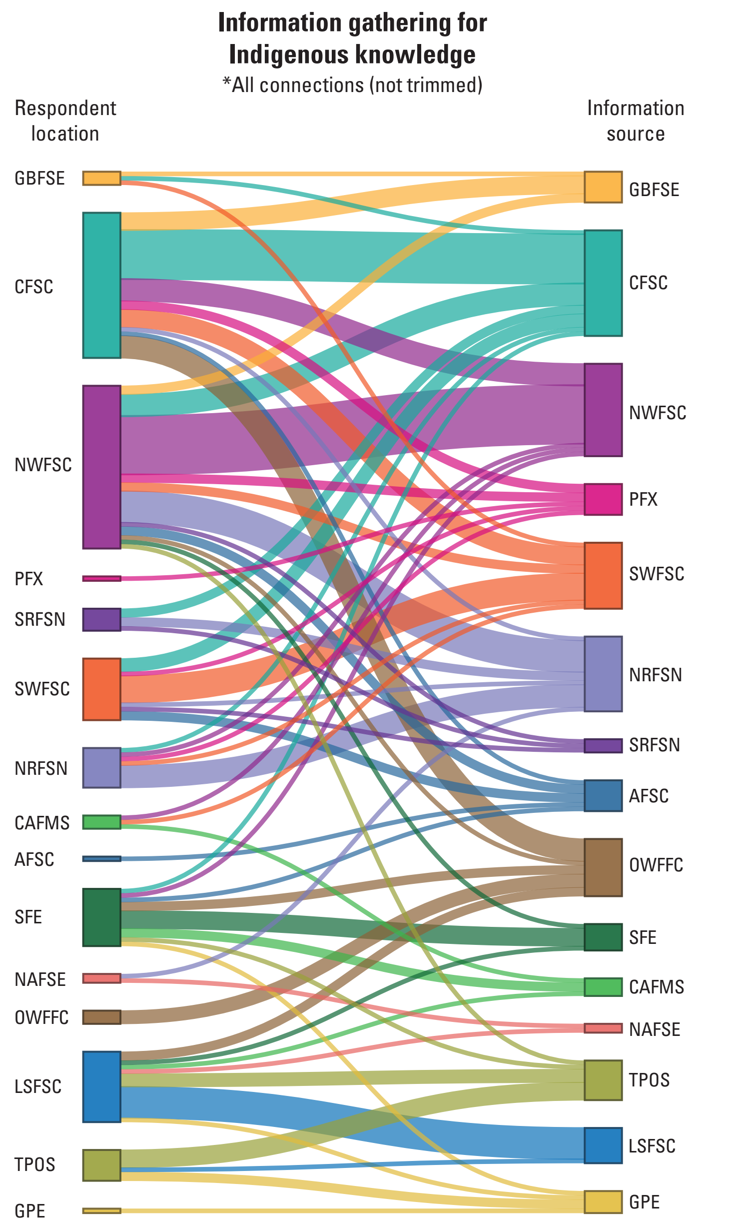



**Figure 55.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for Indigenous knowledge. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)


**Figure 56.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for fire behavior. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

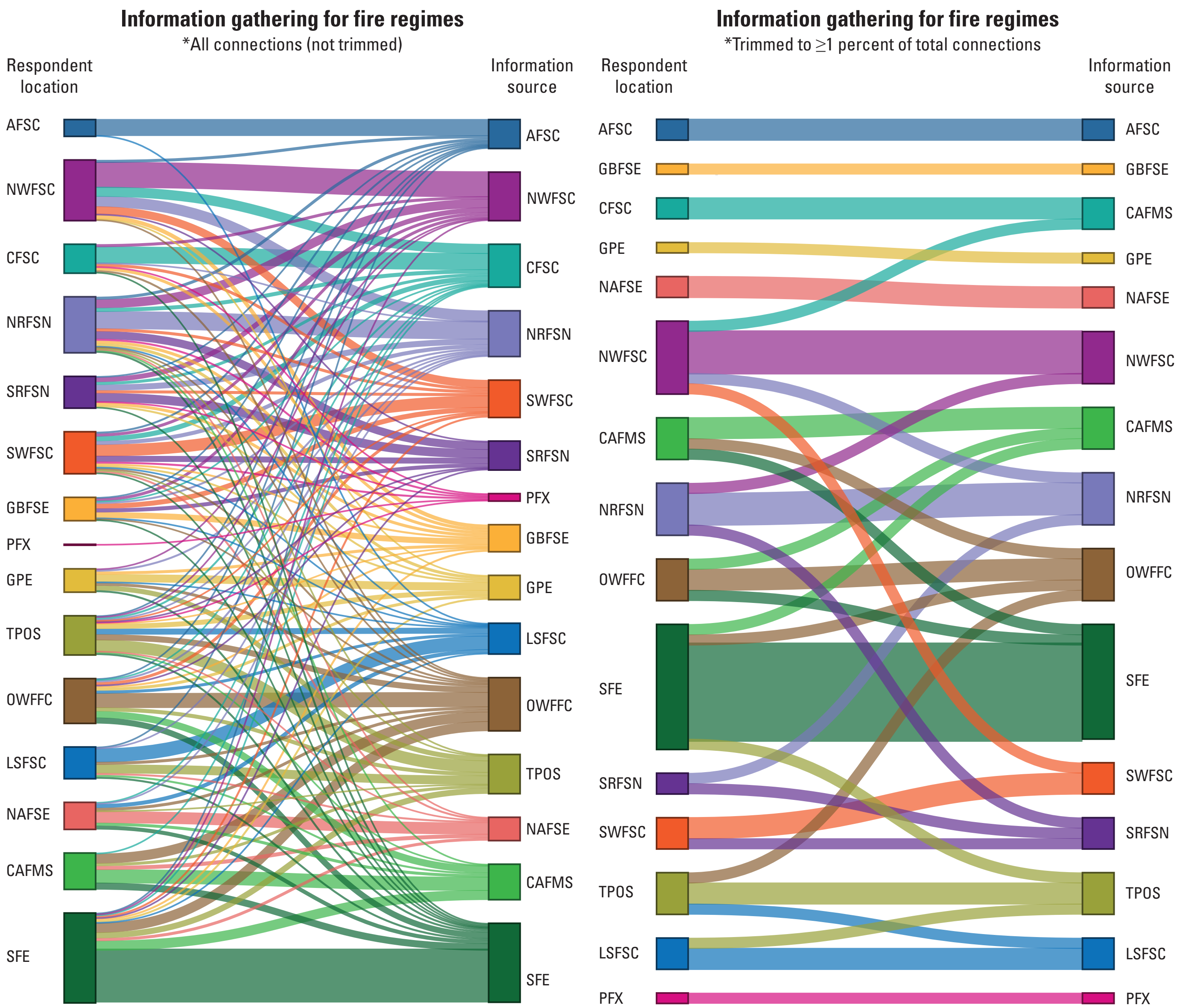



**Figure 57.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for fire regimes. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

For the fuels management science topic, respondents in Alaska, Lake States, and North Atlantic locations mostly gather from their corresponding regional exchanges. Exchanges in the West, especially California, are very active in gathering information for this topic. California respondents go to many other exchanges to gather information for fuels management, including the Great Basin, Northwest, Oak Woodlands, and Southwest exchanges, but only respondents from the Northwest location and California go to the California exchange for information on this topic. Northwest and Northern Rockies respondents go to each other's exchanges, as well as their own, for information on this topic. Similarly, Northern Rockies and Southern Rockies respondents gather information from each other’s exchanges. Southwest is a popular exchange for information on this topic, including for respondents from Northwest, Southern Rockies, and California locations, and respondents from the Southwest only gather information from their own corresponding exchange. Southern respondents only go to their corresponding regional exchange, but some respondents from Appalachians and some from Oak Woodlands also gather information from the Southern exchange. See figure 59.

For the topic of smoke, air quality, and health, respondents in Alaska, Great Basin, Northwest, Great Plains, Southwest, Lake States, Southern Rockies, Pacific, and North Atlantic locations all primarily gather information from their own corresponding regional exchanges. There are some unidirectional interactions. Tallgrass Prairie respondents go to the Lake States exchange, but not vice versa. Northern Rockies respondents gather information from the Northwest exchange, but not vice versa. Respondents from California and Southern locations gather information from the Southwest exchange, but respondents from the Southwest tend to only gather information on this topic from their own regional exchange.

The Southern location stands out for this topic in that its respondents go to many exchanges for information, bridging across both the eastern and western geographies. Southern respondents go to the Southwest, Appalachians, and Oak Woodlands exchanges for information on this topic. Southern respondents go to California, Northwest, and Great Plains exchanges for information on this topic. Respondents from only two locations, Oak Woodlands and Appalachians, go to the Southern exchange for information on this topic, and Southern respondents also gather information from the corresponding Oak Woodlands and Appalachians exchanges. On the other hand, Southern respondents go to California, Northwest, Great Plains, and Southwest exchanges for information gathering on this topic, but not vice versa. See figure 60.

For the WUI and infrastructure science topic, Alaska, Great Basin, Great Plains, North Atlantic, Pacific, Southwest), and Lake States respondents mostly gather information from their own corresponding regional exchanges. As seen for multiple science topics, Tallgrass Prairie respondents go to the Lake States exchange but not go to any other exchanges, other than their own corresponding regional exchange. California and Northwest respondents go to the Pacific exchange to gather information on this topic. California respondents go to many exchanges (that is, Great Basin, Pacific, Northwest, Oak Woodlands, and Southwest), but only Southern respondents go to the California exchange. Southern Rockies respondents go to the Southwest and California exchanges for information on WUI and infrastructure. California also has many responses for this topic.

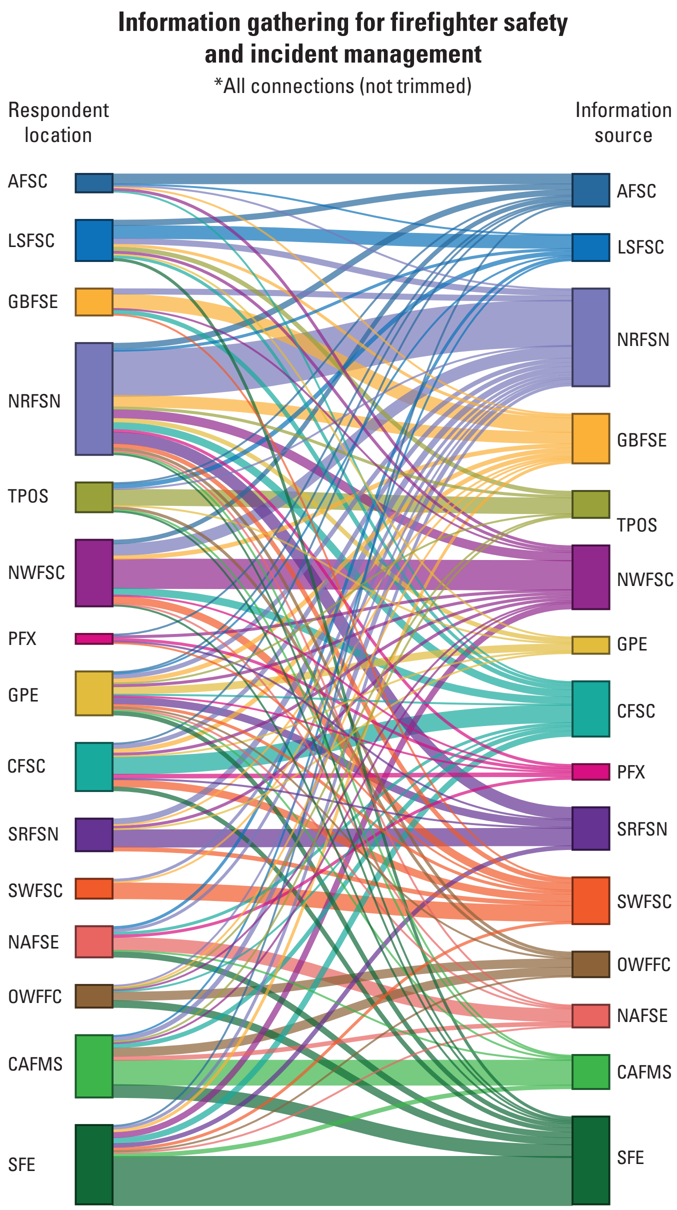
For this topic, there is a lot of information gathering that goes both ways. Northern Rockies and Northwest respondents gather information from each other’s exchanges, as well as their own. Respondents in Northern Rockies and Southern Rockies locations also gather from each other’s exchanges, as seen in other topics. Likewise, respondents in Appalachians and Southern locations gather information from each other’s exchanges, and Oak Woodlands and Southern respondents also gather information from each other’s exchanges. See figure 61.

Since there was a low overall response for the topic of economic impacts compared to other topics, the diagram was not trimmed and only one diagram is shown (fig. 62). The corresponding graphic demonstrates a richly woven network rather than exhibiting clearly dominant patterns. Respondents from Pacific and Tallgrass Prairie locations do not gather from other exchanges, but respondents from other locations gather information from these locations’ corresponding exchanges, including respondents from North Atlantic, California, Northwest, Southern, and Pacific locations gathering from Pacific and respondents from Great Plains and Tallgrass Prairie gathering from Tallgrass Prairie.

There is a lot of overlap in information gathering between the western exchanges of Northwest, California, Northern Rockies, Southern Rockies, and Southwest. Many respondents reported going to the Northwest exchange for information, and respondents from the Northwest location gather information on this topic from many other exchanges. Respondents from Southern and Northern Rockies locations gather information from the Southern Rockies exchange.

In the eastern region, Lake States, Great Basin, and Oak Woodlands respondents mostly gather information from their corresponding regional exchanges. At least one Southern respondent gathers information from nearly every other exchange, except for the Great Basin and Southwest exchanges. The main location for respondents to gather information from the Southern exchange is the Southern location itself. Numerous respondents from Great Plains gather information from the Tallgrass Prairie. See figure 62.

For the science topic of soil, no patterns of information gathering stand out clearly. That said, there is a lot of information gathering occurring in both the eastern and western regions. Respondents from Alaska, Lake States, North Atlantic, Northern Rockies, Southern, and Tallgrass Prairie locations mostly go to their own corresponding regional exchanges for information on this topic. Southern Rockies respondents go to many exchanges (that is, California, Great Basin, Northwest, Northern Rockies, Tallgrass Prairie, Southwest, and Southern Rockies itself) to gather information on this topic, but only respondents from Great Basin and Southwest go to the Southern Rockies exchange for information.



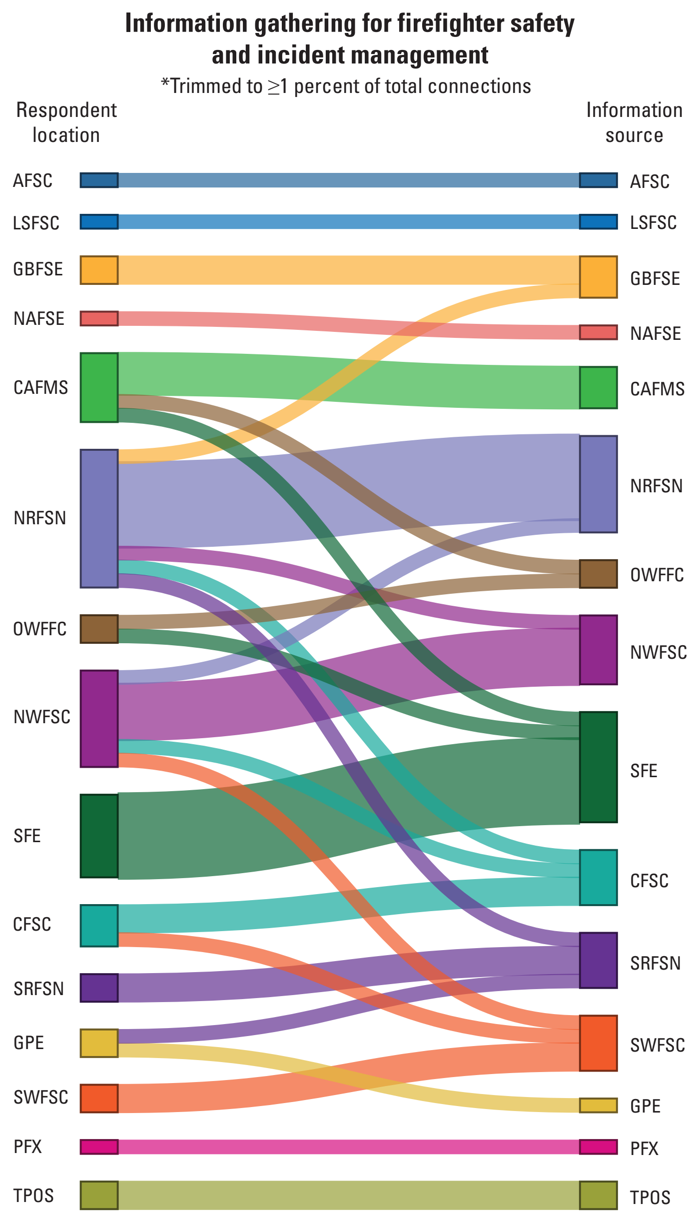




**Figure 58.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges, including themselves (right) for firefighter safety and incident management. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

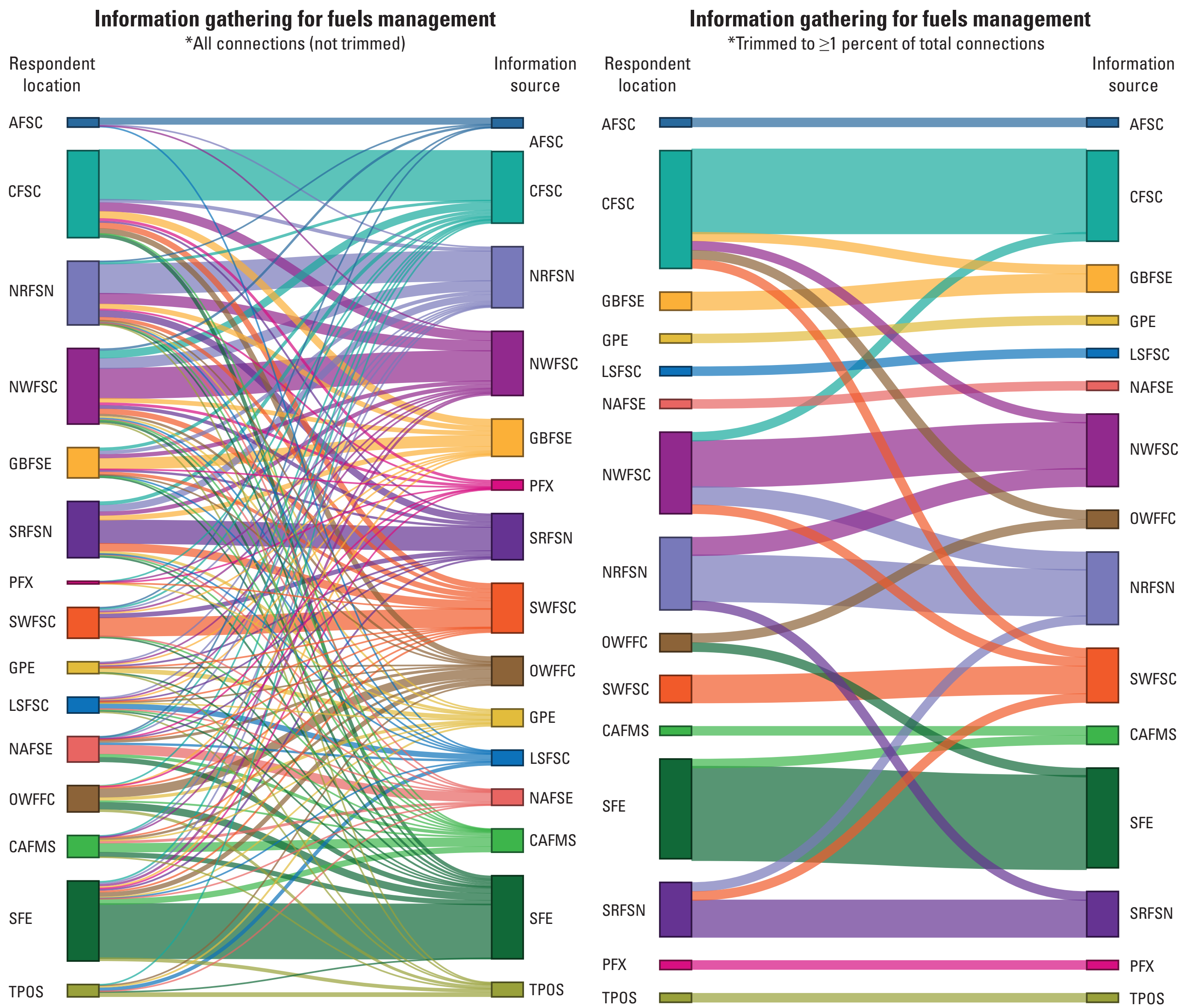



**Figure 59.** Flow of information gathering from respondent location (left) to all 15 exchanges (right) for fuels management. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

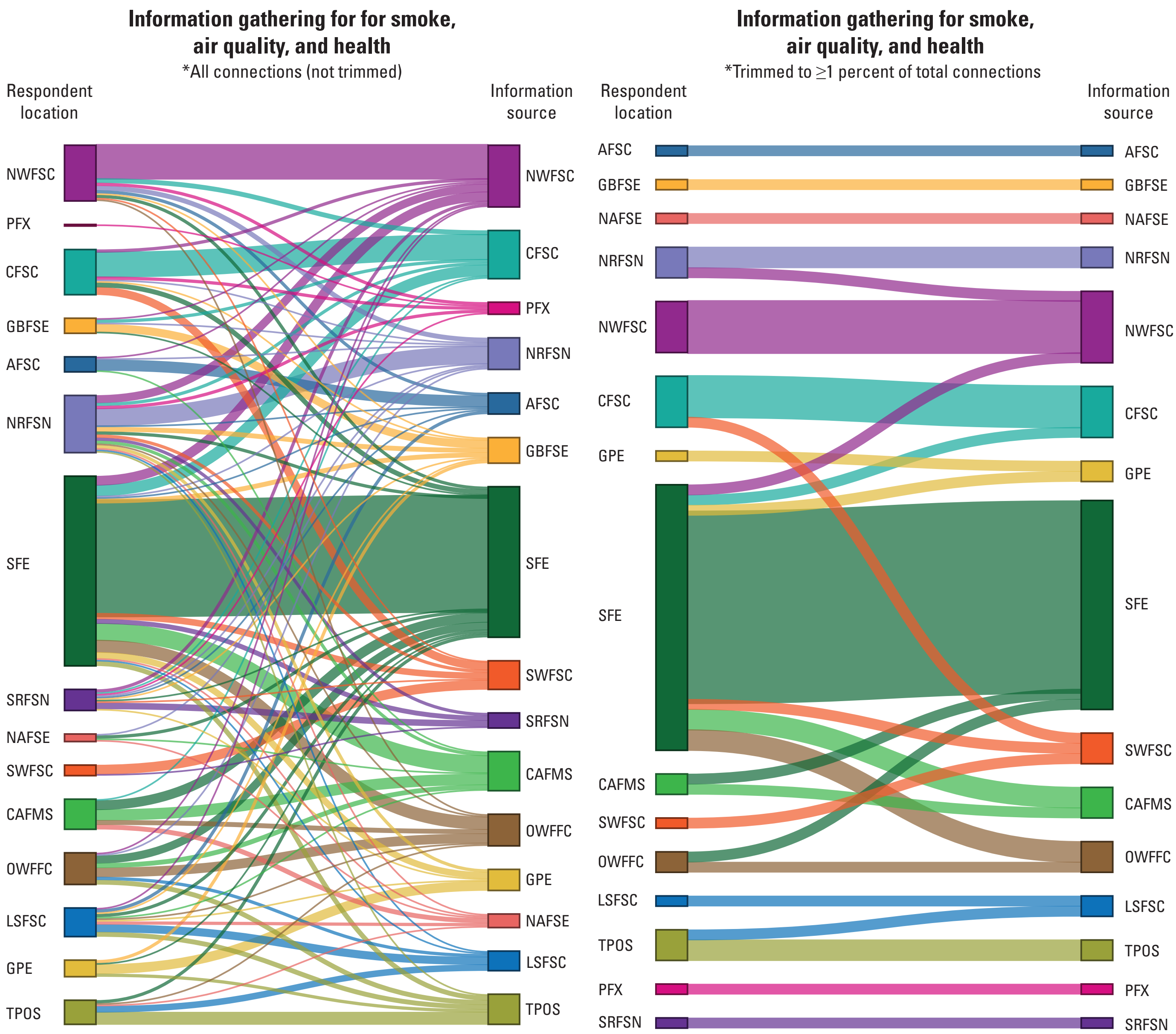



**Figure 60.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for smoke, air quality, and health. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only.)AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

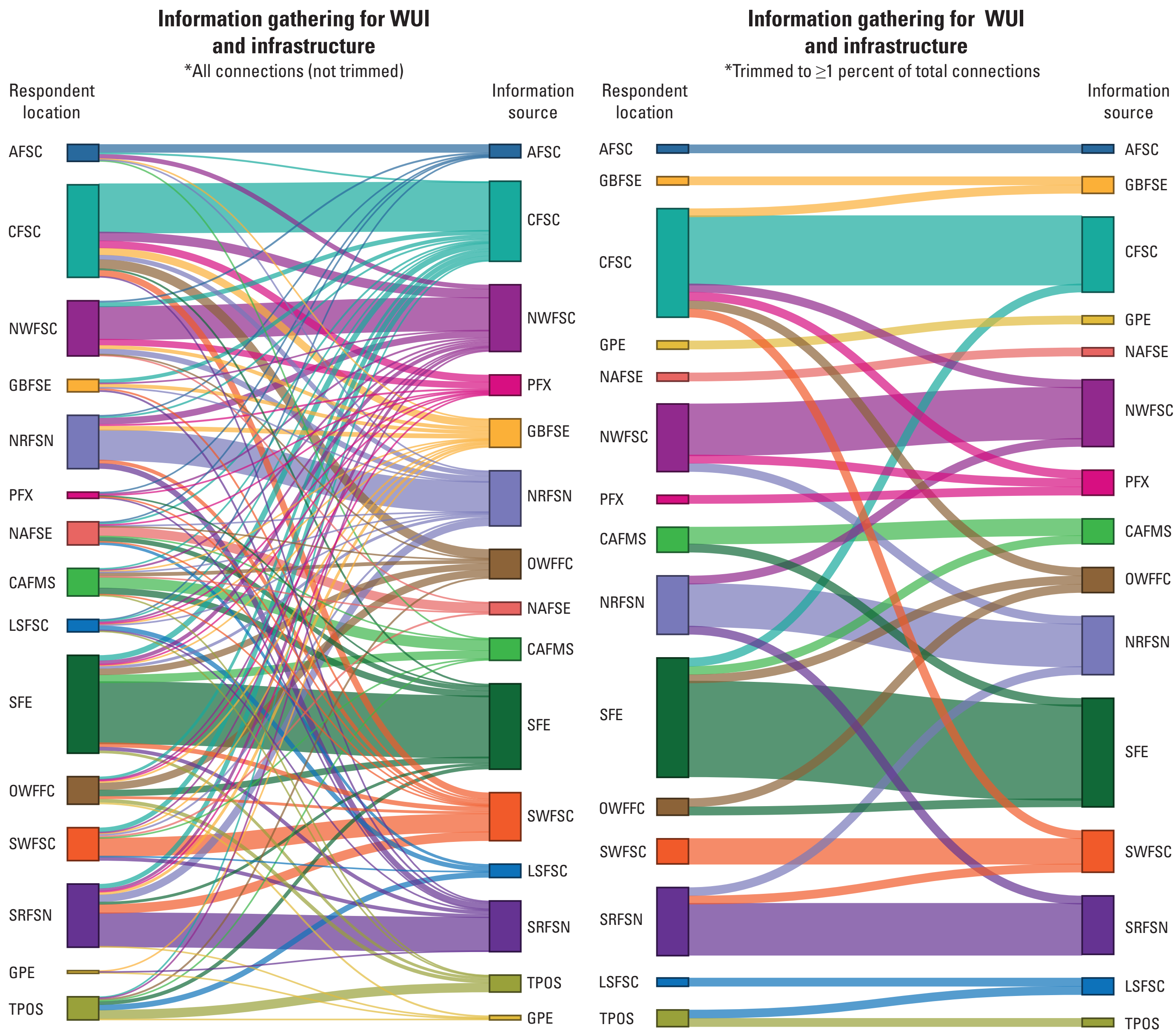



**Figure 61.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for wildland urban interface and infrastructure. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

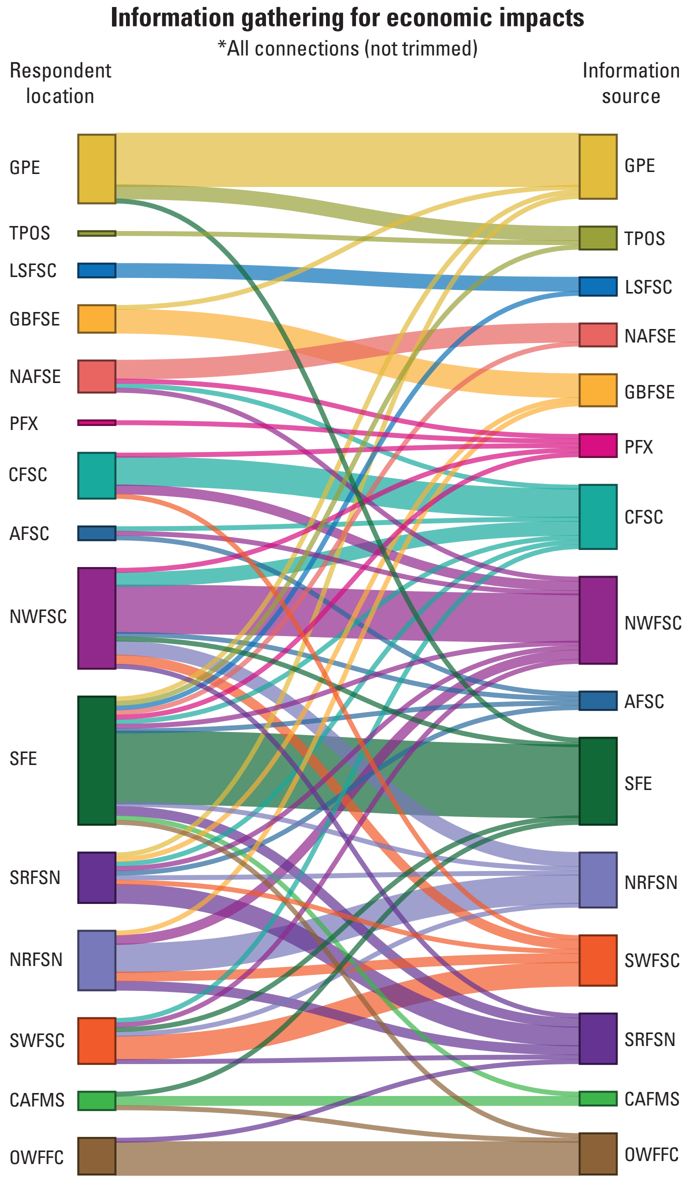



**Figure 62.** Flow of information gathering from respondent location (left) to all 15 regional fire science regional exchanges (right) for economic impacts. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

Some unidirectional relationships exist. Respondents from Southern and Great Plains locations go to the Tallgrass Prairie exchange for information, but not vice versa. Southwest respondents go to the Southern Rockies exchange for information, but not vice versa. Southern respondents go only to their own regional exchange for information on soil, whereas respondents from Appalachians, Oak Woodlands, and Great Plains go to the Southern exchange for information on soil. Similarly, respondents from Tallgrass Prairie only go to their corresponding regional exchange for information on soil, whereas Southern Rockies and Great Plains respondents also go to the Tallgrass Prairie exchange for information on soil. Oak Woodlands respondents go to Appalachians and Great Plains exchanges for information, whereas Appalachians and California respondents gather information from the Oak Woodlands exchange. California respondents mainly go to their corresponding regional exchange to gather information for this topic, but some go to the Oak Woodlands exchange. Appalachians is the only location that goes to the Lake States exchange for this topic; respondents from the Appalachians also gather information from Oak Woodlands and Southern exchanges. Northwest and Southern respondents go to the Great Basin exchange for information on soil. See figure 63.

Figure 64 is a similar box-and-whisker to figure 46 but was generated from the results from the question "what exchange(s) do you go to for information," with the respondent's own regional exchange excluded from their response. As a result, instead of focusing on the reliance of respondents on their corresponding regional exchanges, this graphic reflects the reliance of respondents on other exchanges. Percentages are equal to the number of respondents who get information about topic X from exchange Y, out of all who answered questions about topic X but are not from exchange Y; for example, out of all who focus on wildlife, how many not from the Alaska location go to the Alaska exchange for information about wildlife?

By this metric, Alaska, North Atlantic, and Pacific seldom provide information to respondents from other exchanges. Appalachians, Great Plains and Lake States are not frequently the exchanges that others go to for information. On the other hand, Oak Woodlands, Southern, Northwest, and Northern Rockies exchanges are more often relied on by respondents from other locations. Overall, the percentages for this question are much lower than for the previous box-and-whisker plot focused on respondent location reliance, but the metrics are not directly comparable.

Similar to figure 47, figure 65 displays the individual statistics summarized in the box-and-whisker plot of figure 64 for each exchange. The purpose of this figure is to give an overview of how respondents rated their reliance on other exchanges (excluding their respondent location) across the 16 science topics. An additional figure that separates this chart by science topic can be found in appendix 1 (fig. 1.2). For each exchange, figure 65 depicts the percentage of respondents from locations outside of that exchange's location that selected that exchange as a source of information for each science topic. As in figure 64, the denominator for the percentage corresponds to all respondents who answered questions about topic X but are not located in exchange Y.

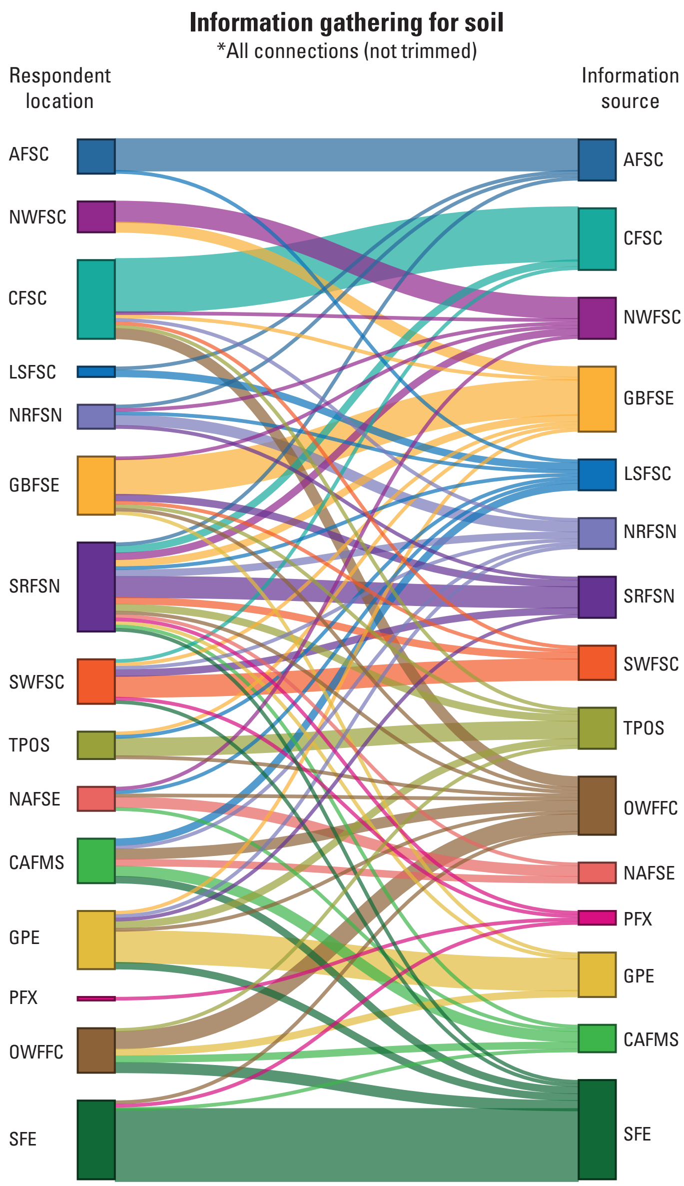
California, Northern Rockies, Northwest, Oak Woodlands, Southern, Southwest, and Tallgrass Prairie exchanges are all relied on relatively frequently by outsiders, whereas North Atlantic stands out as relatively seldom relied on by others. Figure 65 shows which topics each exchange is a popular source of information for respondents from other locations. As shown, California is popular for Indigenous knowledge, Oak Woodlands for vegetation, and Southern for prescribed fire and smoke, air quality, and health.

When looking at the reliance on non-respondent locations by science topic, a few patterns emerge. For wildlife, invasive plants, and vegetation, Oak Woodlands, Southern, and Tallgrass Prairie appear to be the preferred exchanges for information. For watershed processes, respondents more often go to Northern Rockies, Northwest, and Southern Rockies exchanges. For the postfire science topic, all the western exchanges are popular. For fire behavior, fire regimes, and prescribed fire science topics, Oak Woodlands and Southern are popular exchanges. For fuels management, the preferred exchanges include Northern Rockies, Northwest, Southern, and Southwest. Southern is the preferred exchange for smoke. California and Northwest are popular exchanges for WUI and infrastructure. There is high reliance on Northern Rockies and Southern for the firefighter safety and incident management topic. For social science and human dimensions, respondents tend to turn to California and Northern Rockies exchanges. Lastly, California is the preferred exchange for Indigenous knowledge. Economic impacts and soil did not have a standout exchange that was heavily relied upon by non-respondent locations. See figure 65.

## Prioritization of Fire Science Exchange Network Objectives

Respondents were asked to allocate points indicating how they would prioritize the FSEN objectives (JFSP, 2022) to best meet their needs. They were provided a list in which the six original JFSP objectives were divided into nine individual concepts. The nine objectives directly corresponded to the six original JFSP objectives (three of the six original objectives were subdivided into two statements). Respondents were asked to allocate 90 points among these nine statements, with more points meaning greater value and importance to the respondents.

Overall, respondents ranked "sharing information" and "building relationships" highest, meaning that the first JFSP objective, "share information and build relationships" was the highest priority for respondents. Objective four, "demonstrate research on the ground" followed as the next most-important objective to respondents. On the other end of the spectrum, respondents ranked "assessing the applicability of research"



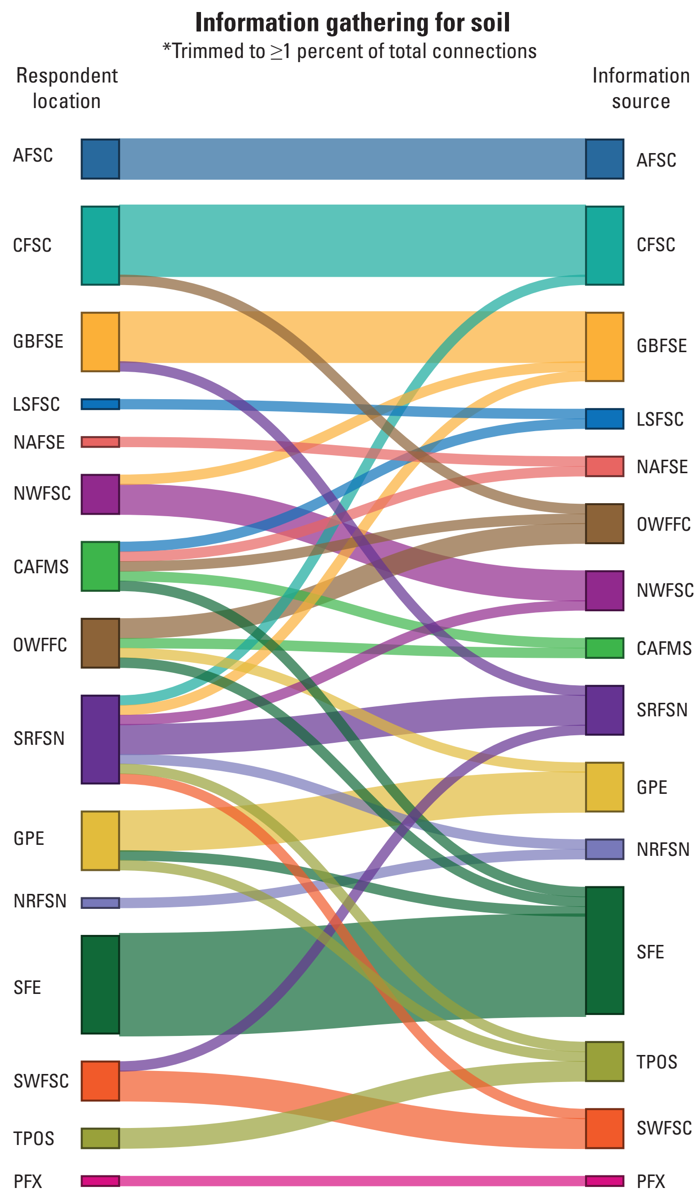




**Figure 63.** Flow of information gathering from respondent location (left) to all 15 regional fire science exchanges (right) for soil. Left diagram shows all connections and right diagram is the same information trimmed to show stronger connections only. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

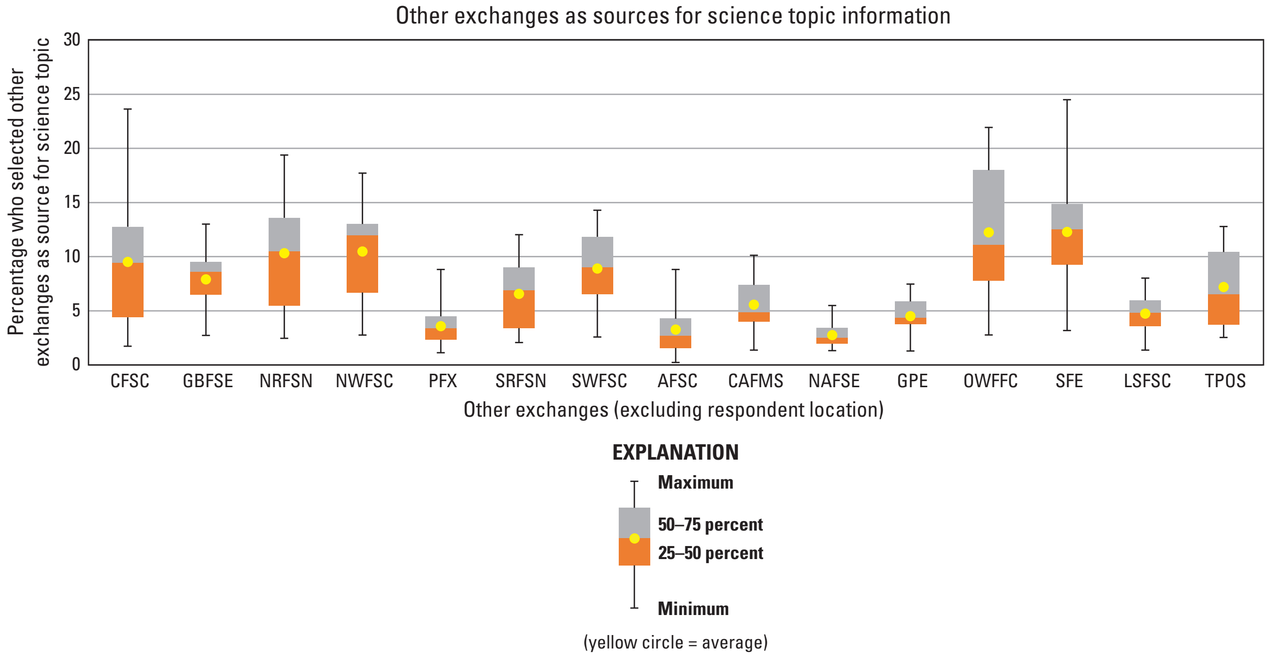



**Figure 64.** The average reliance of survey respondents on “other” exchanges in the Fire Science Exchange Network (that is, excluding the regional exchange that corresponds to their respondent location) across all 16 science topics. The spacing between the top and bottom of each box indicates the degree of spread in the data, and the whiskers indicate the variability outside of the upper (gray) and lower (orange) quartiles. The line separating the orange and gray sections is the median, and the yellow dot is the average. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

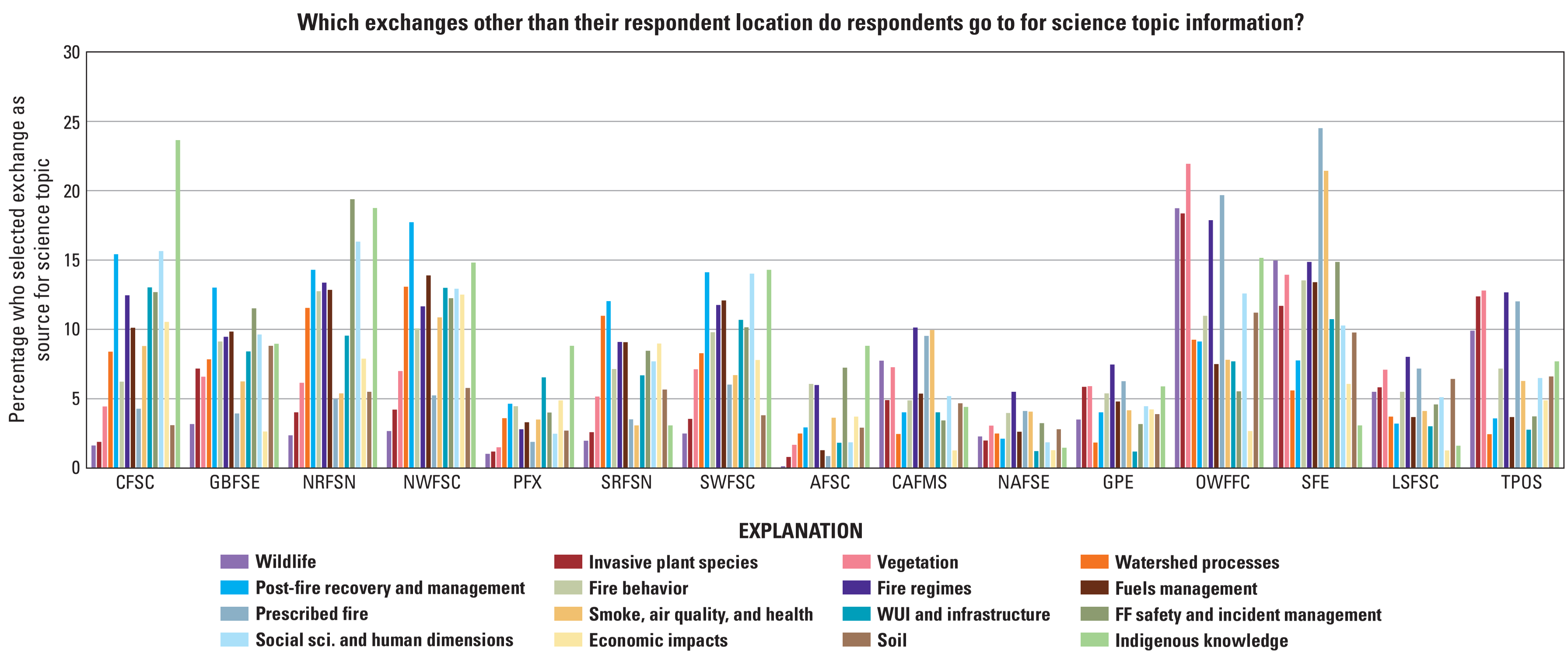



**Figure 65.** Reliance of survey respondents on other exchanges in the Fire Science Exchange Network (that is, exchanges other than that corresponding to their location) across the 16 science topics. (AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; GPE; Great Plains Fire Science Exchange; LSFSC, Lake States Fire Science Consortium; NAFSE, North Atlantic Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; OWFFC, Oak Woodlands and Forests Fire Consortium; PFX, Pacific Fire Exchange; SFE, Southern Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium; sci., science; WUI, wildland urban interface; FF, firefighter)

and “assessing the quality of research” lowest, both of which make up objective three “identify and develop methods to assess the quality and applicability of research.” Another objective rated as a relatively low priority was objective six, “identify new research, synthesis, and validation needs.” The two components of objective two, “synthesis of information” and “list and describing information,” were as average priority for respondents. Lastly, the fifth JFSP objective, “support adaptive management” ranked close to the middle with a moderate priority compared to the other objectives. See figure 66.

The descriptive statistics for the objectives show that at least one respondent allocated no points for each objective, indicating that none of the objectives were of high importance for all respondents (table 33). Conversely, at least one respondent gave each objective the maximum 90-point allocation, except for “assessing the applicability of research,” which received a maximum of 71 points from any respondent. Median values for the objectives ranged from 5 to 14 points. Since the standard deviation is high for all the objectives, it appears that respondents frequently allocated a high number of points to a select few objectives, and zero to others rather than allocating their 90 points more evenly. The standard deviation for building relationship is the highest (14.19) and the standard deviation for assessing the quality of research is the lowest (6.76) indicating there was more agreement in respondents for assessing the quality of research.

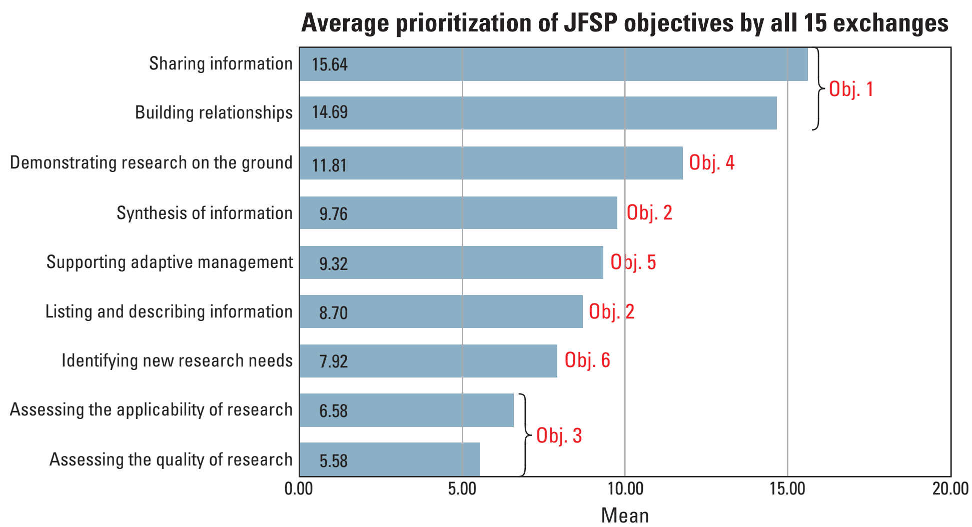



**Figure 66.** The prioritization of the six Joint Fire Science Program objectives divided into nine subobjectives and ranked by respondents out of 90 points. Text in red indicates the original Joint Fire Science Program objective that each statement corresponds with: Objective 1, share information and build relationships; Objective 2, list and describe existing research and synthesis information; Objective 3, Identify and develop methods to asses the quality and applicability of research; Objective 4, demonstrate research on the ground; objective 5, support adaptive management; and Objective 6, identify new research, synthesis, and validation needs. The mean values sum to 90. (JFSP, Joint Fire Exchange Program; Obj., objective)

**Table 33.** Descriptive statistics pertaining to the prioritization of the Joint Fire Science Program objectives.

[JFSP, Joint Fire Science Program]

| Statistics for prioritization of JFSP objectives for 15 exchanges | | | | | | |
|---|---|---|---|---|---|---|
| **Objective** | **Mean** | **Median** | **Std. Deviation** | **Minimum** | **Maximum** | **Sum** |
| Sharing information | 15.64 | 14.00 | 11.96 | 0 | 90 | 33,573 |
| Building relationships | 14.69 | 10.00 | 14.19 | 0 | 90 | 31,520 |
| Demonstrating research on the ground | 11.81 | 10.00 | 11.21 | 0 | 90 | 25,336 |
| Synthesis of information | 9.76 | 9.00 | 10.05 | 0 | 90 | 20,950 |
| Supporting adaptive management | 9.32 | 8.00 | 9.87 | 0 | 90 | 20,004 |
| Listing and describing information | 8.70 | 6.00 | 9.69 | 0 | 90 | 18,666 |
| Identifying new research needs | 7.92 | 6.00 | 9.382 | 0 | 90 | 16,991 |
| Assessing the applicability of research | 6.58 | 5.00 | 7.36 | 0 | 71 | 14,125 |
| Assessing the quality of research | 5.58 | 5.00 | 6.76 | 0 | 190 | 11,975 |

## Prioritization of Objectives by Respondent Location

Overall, the spread in point allocation across the 15 respondent locations mirrors that of the average point allocations, meaning that respondents in the different locations prioritized the nine objectives similarly (fig. 67). In the following section, each of the nine objectives is isolated to see patterns in the prioritization of objectives according to respondent location.

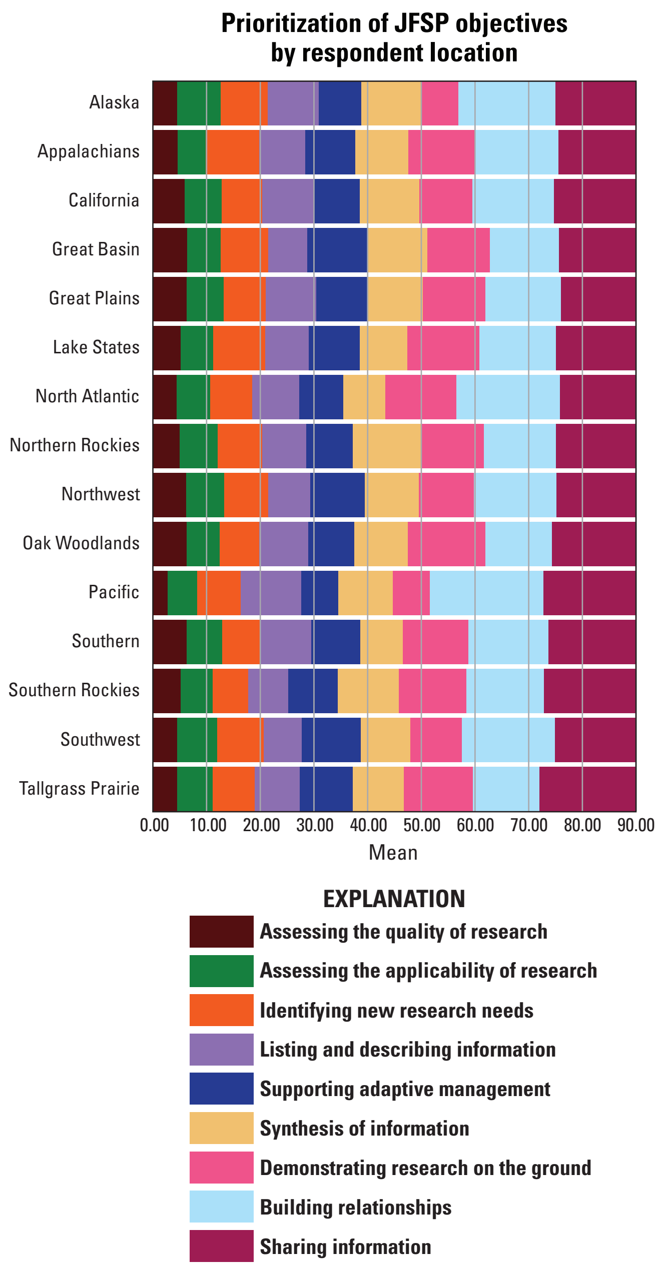



**Figure 67.** Stacked graph of the prioritization of the six Joint Fire Science Program objectives divided into nine subobjectives by the 15 regional fire science exchange respondent locations.

"Sharing information" and "building relationships" ranked either first or second priority on average for respondents from all 15 locations. Tallgrass Prairie respondents gave the "sharing information" objective the most points on average (19.78 points) among respondents, and Alaska respondents gave it the least points (15.98 points) among respondents (fig. 68). Sharing information was the highest ranked objective for respondents from Tallgrass Prairie, Southern, Southern Rockies, Oak Woodlands, and Great Basin, followed by "building relationships."

Pacific respondents gave the "building relationships" objective the most points compared to respondents from other locations, with an average of 23 points, and Oak Woodlands respondents gave it the least number of points compared to respondents from other locations, at 14.93 points (fig. 69). Alaska, North Atlantic, Pacific, Southwest, California, and Appalachians respondents all ranked this as their highest priority objective. Northwest, Northern Rockies, Lake States,

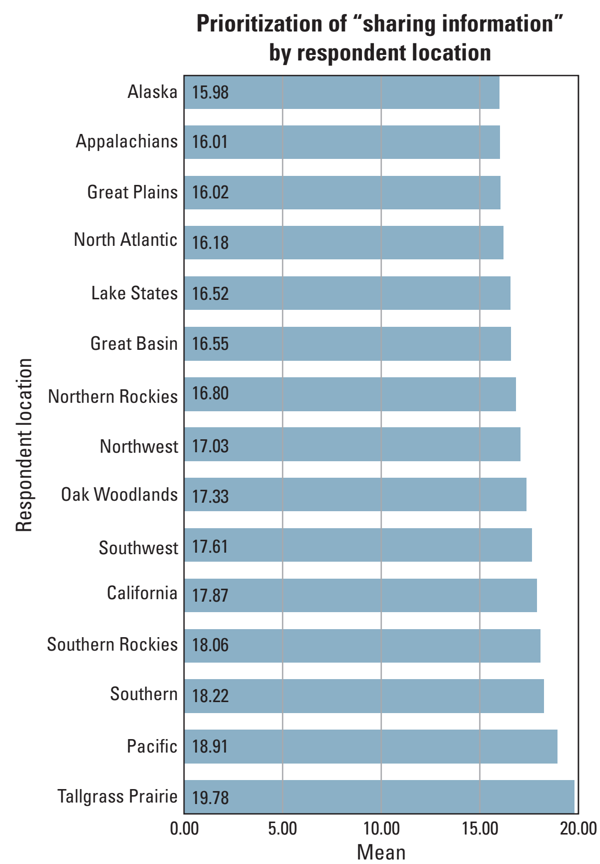



**Figure 68.** The prioritization of the "sharing information" objective according to Fire Science Exchange Network respondent location.

and Great Plains respondents also ranked this objective as their most important, but the averages ranged from 17.19 to 16.12 respectively for "sharing information."

Most exchanges ranked "demonstrating research on the ground" or "synthesis of information" as their third or fourth highest ranked objective, with some nuances for Alaska, Pacific, Southern, and North Atlantic. "Demonstrating research on the ground" was ranked as the third priority objective for respondents in about half of the locations, including Great Basin, Tallgrass Prairie, Great Plains, Lake States, Appalachians, Oak Woodlands, North Atlantic, and Southern. Compared to respondents from other locations, North Atlantic respondents gave "demonstrating research on the ground" the most points at 17.95, and Pacific respondents gave it the least points at 10.38. Alaska respondents also ranked this objective relatively lower at 10.42 points. Oak Woodlands, Tallgrass Prairie, Lake States, Southern, Appalachians, Great Plains, and Southern Rockies respondents all ranked this objective 15 points or higher on average. California, Northern Rockies, Great Basin, Northwest, and Southwest respondents all ranked this objective between 14.41 and 12.68 points (fig. 70).

For respondents in the other half of locations, including Northern Rockies, Southern Rockies, California, Alaska, Pacific, Northwest, and Southwest, "synthesis of information" was ranked third. Compared to respondents from other locations, North Atlantic respondents gave "demonstrating research on the ground" the most points at 17.95, and Pacific respondents gave it the least points at 10.38. Alaska respondents also ranked this objective lower at 10.42 points. Oak Woodlands, Tallgrass Prairie, Lake States, Southern, Appalachians, Great Plains, and Southern Rockies respondents all ranked this objective 15 points or higher on average. California, Northern Rockies, Great Basin, Northwest, and Southwest respondents all ranked this objective between 14.41 and 12.68 points (fig. 70). Northern Rockies respondents ranked "synthesis of information" at 15.93 whereas Southern respondents ranked it at 11.31 points. Southern Rockies

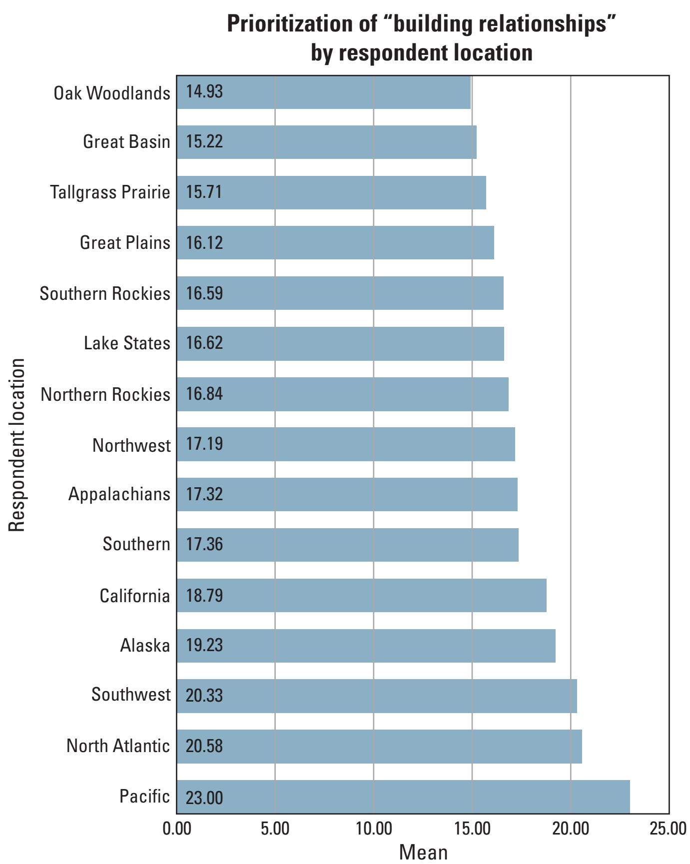



**Figure 69.** The prioritization of the "building relationships" objective according to Fire Science Exchange Network respondent location.

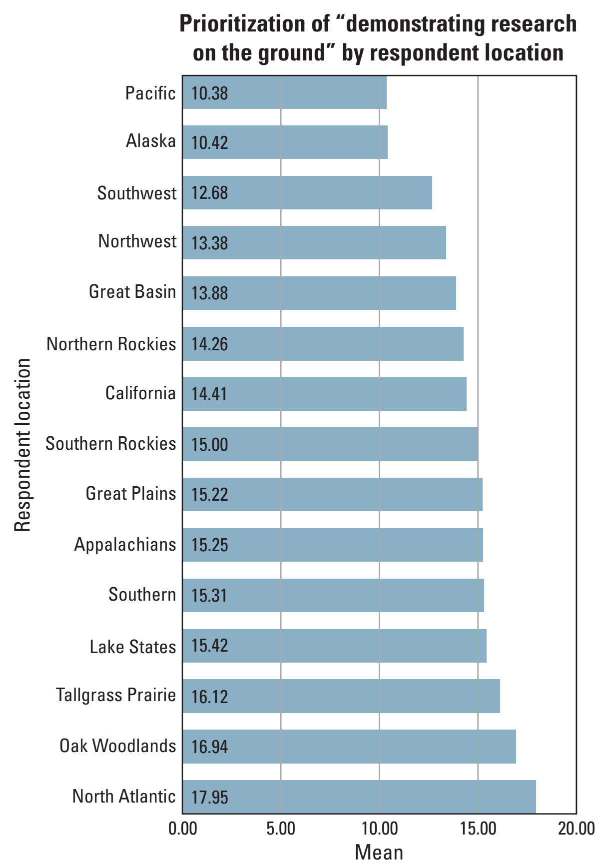



**Figure 70.** The prioritization of the "demonstrating research on the ground" objective according to Fire Science Exchange Network respondent location.

and California respondents fell closely behind Northern Rockies respondents with averages of 15 points or higher. Great Basin, Alaska, Tallgrass Prairie, Pacific, Northwest, Great Plains, and Lake States respondents all ranked this objective around 13 points. Appalachians, Oak Woodlands, Southwest, and North Atlantic respondents ranked it between 12.89 and 11.92 points, in descending order (fig. 71).

In general, the average point allocations for "supporting adaptive management" (fig. 72), "listing and describing information" (fig. 73), and "identifying new research needs" (fig. 74) fell similarly in the middle; respondents ranked these objectives similarly to each other. For many locations, "supporting adaptive management" was allocated more points out of these three objectives, meaning that respondents from these locations generally ranked "supporting adaptive management" above "listing and describing information" and "identifying new research needs." This is the case for Great Basin, Southwest, Tallgrass Prairie, Great Plains, Northwest, Southern, Appalachians, North Atlantic, Southern Rockies, and Lake States respondents. Great Basin respondents gave "supporting adaptive management" the most points compared to the other locations, at 14.10. This is followed by Southwest, Tallgrass Prairie, Great Plains, California, Northwest, Southern, Appalachians, North Atlantic, and Southern Rockies respondents ranking the objective between 13.96 and 12.39 points. Lake States, Northern Rockies, Oak Woodlands, Pacific, and Alaska respondents fell on the lower end ranking the objective between 11.98 and 9.90 points on average.

For other locations, respondents ranked "listing and describing information" above "supporting adaptive management" and "identifying new research needs." This is the case for respondents from Northern Rockies, California, Oak Woodlands, Pacific, and Alaska. California respondents ranked "listing and describing information" relatively the highest compared to respondents from other locations, at 13.63 and Southern Rockies and Great

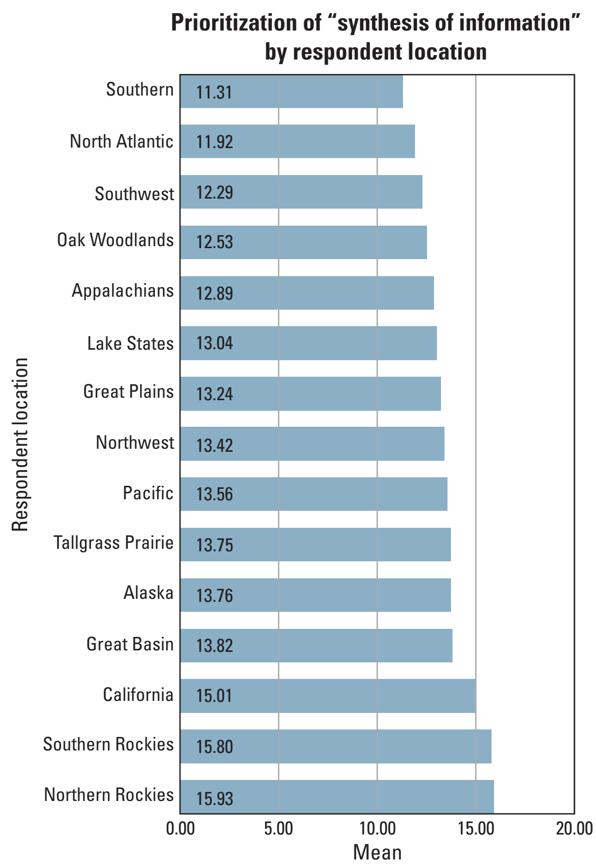



**Figure 71.** The prioritization of the "synthesis of information" objective according to Fire Science Exchange Network respondent location.

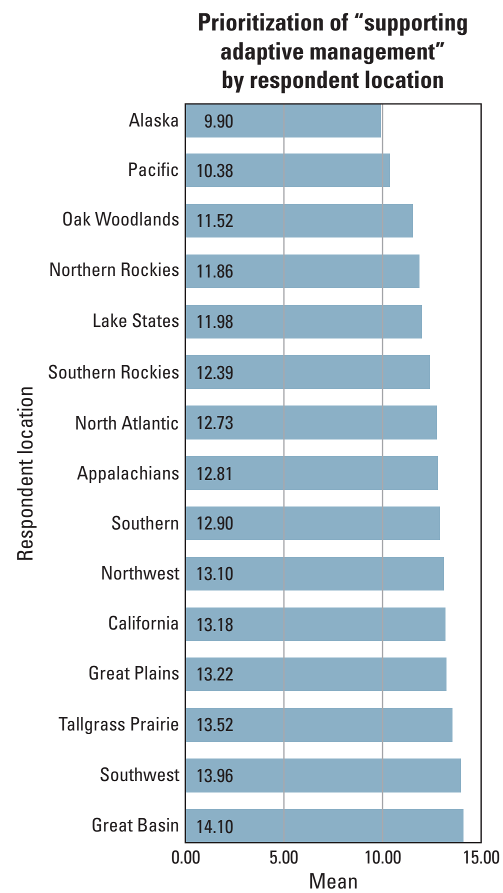



**Figure 72.** The prioritization of the "supporting adaptive management" objective according to Fire Science Exchange Network respondent location.

Basin respondents ranked it relatively the lowest, both at 10.23. Respondents from the rest of the locations ranked this objective between 13.50 and 10.74 points; in descending order they are Pacific, North Atlantic, Northern Rockies, Tallgrass Prairie, Southern, Oak Woodlands, Great Plains, Alaska, Appalachians, Lake States, Northwest, and Southwest.

A different ranking emerged for other locations whereby Appalachians, Lake States, Northwest, and Southwest respondents ranked "identifying new research needs" higher than "listing and describing information," but below "supporting adaptive management." "Identifying new research needs" had the highest mean allocation compared to respondents from other locations, with 12.78 points from Appalachians respondents and 12.72 points from Lake States respondents. The lowest allocations compared to respondents from other locations were 9.70 points from Pacific respondents, 9.66 points from Oak Woodlands respondents, and 9.50 points from Southern Rockies respondents. The rest of the locations fell between 12.14 and 10.30 points. In descending order, they are North Atlantic, Northwest, Southwest, California, Great Basin, Northern Rockies, Alaska, Tallgrass Prairie, Great Plains, and Southern.

"Assessing the applicability of research" ranked eighth in the list of objectives for all locations, except for Alaska and Tallgrass Prairie, where this objective was rated seventh instead of eighth. Compared to respondents from other locations, Alaska respondents allocated this objective the most points, at 11.54 points and Appalachians respondents allocated it the lowest points at 8.28. Respondents from the rest of the locations allocated it on average between 10.94 and 8.79 points. In descending order, they are Tallgrass Prairie, California, Southwest, Northern Rockies, Northwest, Southern, Great Plains, Great Basin, North Atlantic, Pacific, Oak Woodlands, Southern Rockies, and Lake States (see fig. 75).

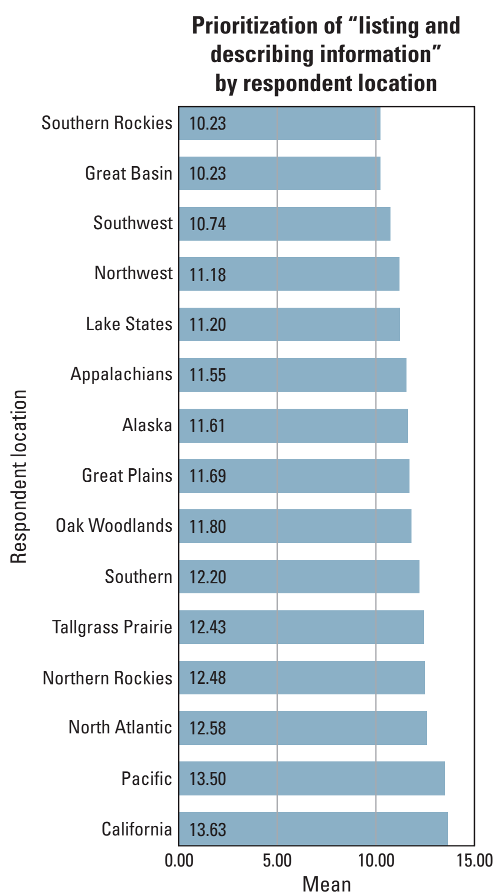



**Figure 73.** The prioritization of the "listing and describing information" objective according to Fire Science Exchange Network respondent location.

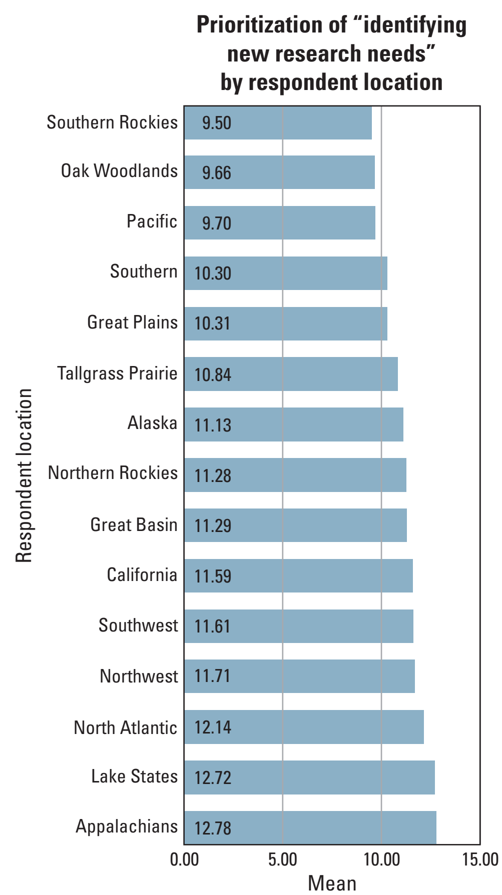



**Figure 74.** The prioritization of the "identifying new research needs" objective according to Fire Science Exchange Network respondent location.

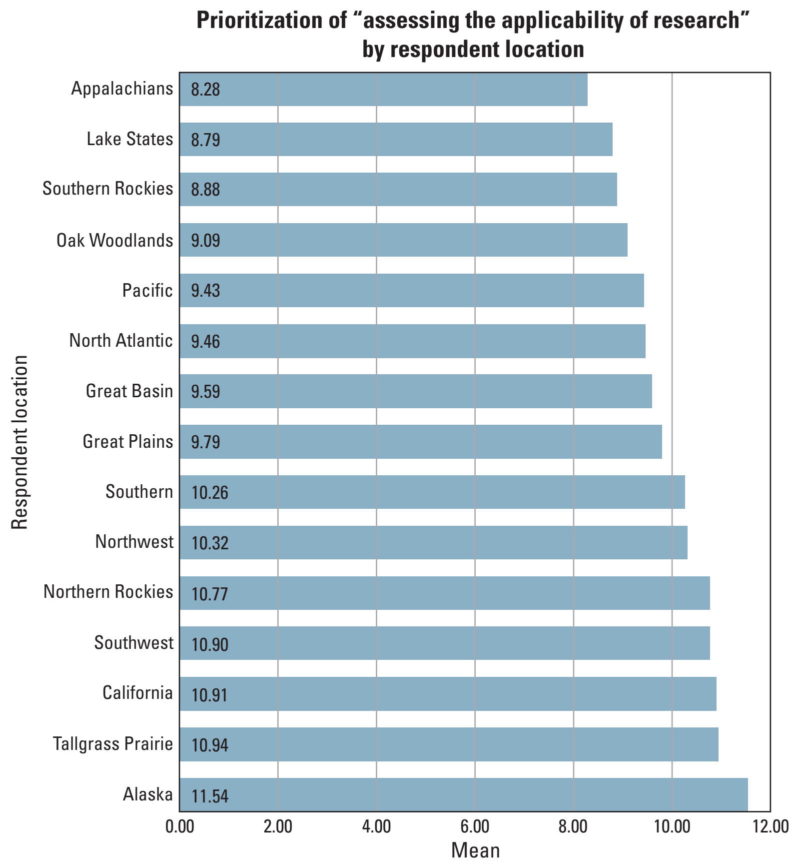



**Figure 75.** The prioritization of the "assessing the applicability of research" objective according to Fire Science Exchange Network respondent location.

"Assessing the quality of research" ranked lowest for all 15 locations with an average point allocation between 9.97 and 6.60 points. In descending order, California, Southern, Northwest, Great Basin, and Northern Rockies respondents all ranked this objective close to 9 points. Oak Woodlands, Southern Rockies, Great Plains, Tallgrass Prairie, and Southwest respondents all ranked this objective in decimals of 8 points. North Atlantic, Lake States, Appalachians, and Alaska respondents all ranked it in decimals of 7 points. Lastly, Pacific respondents ranked the objective the lowest at 6.60 points (see fig. 76).

# Summary

In this study, Fire Science Exchange Network (FSEN) users were asked about their perspectives on the relative importance of the six FSEN objectives (JFSP, 2022); the importance, delivery of scientific resources, and information flow for key wildfire science topics; and the relative reliance of exchange users on different information sources. Survey respondents were primarily from federal and state organizations, had moderate to high experience with wildfire science and management, and worked locally and in land management. Nearly 65 percent of respondents stated they participate solely in one exchange; up to 18 percent of respondents in some locations stated they do not subscribe to their corresponding regional exchange. Respondents across the exchange network rated sharing information and building relationships as the highest priority objective of the FSEN. For the exchange network in general, respondents rated both the importance and performance for all science topics, except for Indigenous knowledge, as moderate to high. Respondents indicated that Indigenous knowledge was both less important to their work and has less sufficient scientific resources available than the other topics. This could suggest that more focus is needed to develop this topic. It should be noted that only 2 percent of respondents self-identified with Tribal organizations. This suggests an opportunity for the Joint Fire Science Program (JFSP) to direct attention toward outreach within existing nontribal wildfire communities on this topic to contribute additional content on this subject matter and see opportunities to facilitate incorporation of Indigenous knowledge in decision making, or engage more individuals who are part of Indigenous communities.

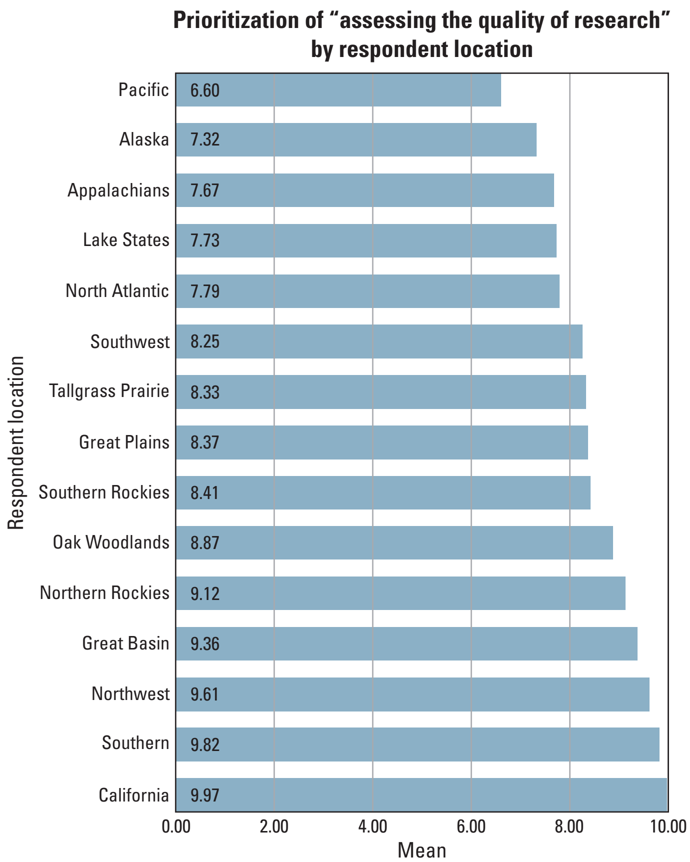



**Figure 76.** The prioritization of the "assessing the quality of research" objective according to Fire Science Exchange Network respondent location.

## Groupings of Exchanges

Across the different analyses in this study, three groups emerged among the exchange network: the western exchanges (California, Northwest, Northern Rockies, Southern Rockies, Southwest, and Great Basin); the eastern exchanges (Oak Woodlands, Southern, Tallgrass Prairie, Appalachians, Great Plains, and Lake States); and the remaining exchanges (Alaska, Pacific, and North Atlantic), coined "independents," that consistently did not belong to either geographic group. The discussion is organized according to these three groups with an integration of key findings across the science topics, including their Important-Performance Analysis (IPA) ratings, reliance, and information gathering.

### Western Exchanges

Exchanges in the western grouping consist of California, Northern Rockies, Southern Rockies, Southwest and for some topics, Great Basin. Great Basin was not found to be consistently part of this group, but sometimes it was involved, such as for the topics of soil and fuels management and invasive plant species, where it had the most responses out of any of the western exchanges for this topic. Within the grouping of the western exchanges, there was a frequent subgroup between Northern Rockies, Southern Rockies, and Northwest where there was often mutual interaction and information gathering among respondents. Northwest and Northern Rockies additionally stood out as go-to exchanges for information because there were higher percentages of respondents that went to these exchanges for information on average compared to the other exchanges. For this group, most of the respondents had moderate reliance on their own corresponding exchange; more specifically, only 26 to 30 percent of respondents relied heavily on their respondent location. Southern Rockies respondents had relatively higher reliance on their own exchange across all science topics, where 30 percent of respondents relied heavily on the exchange on average.

The exchanges in the western group stood out as information sources for the topics of watershed processes, postfire recovery and management, Indigenous knowledge, social science, and fuels management, illustrated by the multiple connections seen in the Sankey diagrams (for example, see fig. 53 postfire recovery and management). For watershed processes respondents from Northern Rockies, Northwest, and Southern Rockies were doing the most information gathering and had the most respondents going to their corresponding exchanges for information. When looking at the IPA chart for watershed processes, the western exchanges were mostly in the Good Work quadrant (except for California, which fell in the Gap quadrant), whereas the eastern exchanges were not in the Good Work quadrant. For postfire recovery and management, the western exchanges had many people going to these exchanges for information; Northwest was the go-to exchange for respondents from other locations to gather information from. For Indigenous knowledge, California and Northwest stood out as popular information hubs, with California as the most popular exchange for respondents from other locations to go to for this topic. For social science, California and Northern Rockies were popular exchanges, and lastly for fuels, Northern Rockies, Northwest, and Southwest stood out as popular exchanges.

There are also topics for which respondents in the western exchanges did not stand out as much but were still active in information gathering and were relied on by other locations. This was the case for the topics of firefighter safety and incident management, fire behavior, wildland urban interface (WUI) and infrastructure, and economic impacts. For firefighter safety and incident management, Northern Rockies stood out as a frequent source for information. For fire behavior, Northern Rockies and California were stand-out exchanges, and for WUI and infrastructure, California, and Northwest were frequent exchanges for respondents to gather information from. The western exchanges generally rated the economic impacts topic as more important than the eastern exchanges did, but with lower performance; in fact, respondents from all the western locations placed this topic into the Gap quadrant. Respondents from other locations relied on the Northwest exchange for information on economic impacts more frequently than on other exchanges.

## Eastern Exchanges

Exchanges designated as the eastern grouping consist of Oak Woodlands, Southern, Tallgrass Prairie, Appalachians, and to a lesser extent, Great Plains. Great Plains was often grouped with these exchanges, but for some topics, respondents from Great Plains only gathered information from their own exchange, such as for fire behavior, fire regimes, fuels management, and WUI and infrastructure. Oak Woodlands and Southern were information hubs in this region because on average they had higher percentages of respondents that go to these exchanges for information across the science topics. The eastern exchange grouping had strong information gathering for the topics of wildlife, vegetation, invasive plants, and prescribed fire. For wildlife, invasive plants, vegetation, fire behavior, fire regimes, and prescribed fire Oak Woodlands, Southern and Tallgrass Prairie were common sources for information. In the eastern region, Southern was the most frequent exchange to go to for information about smoke, air quality, and health; firefighter safety and incident management; and fuels management. Respondents from other locations came to the Southern exchange substantially for information on prescribed fire and smoke. For the topics of wildlife; invasive plants; vegetation; prescribed fire; smoke, air quality, and health; WUI and infrastructure; and social science and human dimensions, respondents from the Tallgrass Prairie location went to the Lake States exchange for information. Respondents from Tallgrass Prairie and Lake States locations gathered information from each other's exchanges for fire behavior, fire regimes, and Indigenous knowledge. Lake States had many respondents that reported information gathering for Indigenous knowledge, whereas the other exchanges in this group did not, meaning that respondents from Lake States more often selected Indigenous knowledge as one of the top topics relevant to their work.

Looking at the extent to which respondents relied strongly on their respondent location for information, Oak Woodlands and Southern respondents had relatively high reliance on their corresponding regional exchanges across all science topics. On the other hand, Appalachians, Great Plains, Lake States, and Tallgrass Prairie respondents relied relatively less on their corresponding exchanges across the science topics. In fact, results indicated that survey respondents did not rely heavily on Appalachians, Great Plains or Lake States for information. There are a few exceptions in terms of reliance ratings on different information sources. The general trend was that external sources were relied upon more heavily than sources from the exchange network; however, in some cases respondents own regional exchange were most heavily relied upon. For example, Tallgrass Prairie respondents relied most strongly on their own exchange for information about watershed processes, and Oak Woodlands respondents relied most strongly on their own exchange for information about fire regimes.

Lastly, there are a couple of topics for which the information gathering and IPA ratings by respondents were varied across the exchange network, but respondents relied more on eastern exchanges for information. This was the case for fire regimes and soil. Respondents from western exchanges rated the science topic of fire regimes as more important than respondents from eastern exchanges, but respondents from both regions rated the performance of scientific resources for the topic between a value of 2 and 3. Respondents from other exchanges relied more on Oak Woodlands and Southern for information about fire regimes than the other exchanges. Soil was a topic where exchanges dispersed across the Good Work and Gap quadrants, but mostly western exchanges (Northwest, Northern Rockies, Southwest, and Great Basin) were in the Good Work quadrant with a few eastern exchanges (Oak Woodlands and Tallgrass Prairie). California and Southern Rockies were western exchanges that plotted in the Gap quadrant. However, reliance ratings were mixed across the network, with more respondents reliant on Oak Woodlands than the other exchanges.

## Other (Independent) Exchanges

Alaska, Pacific, and North Atlantic exchanges stood out from the rest of the exchange network since they are all relatively isolated geographically and in terms of the rate of their interaction with other exchanges. Throughout the analysis, it became clear that respondents in these three locations relied strongly on their own corresponding regional exchanges for information, whereas respondents from other locations did not rely heavily on the exchanges representing these locations for information. In fact, for some science topics, up to 100 percent of respondents relied strongly on their own regional exchange for information. In addition, all three exchanges fell in the Gap quadrant of the IPA chart for watershed processes, Indigenous knowledge, and social science and human dimensions.

Alaska respondents mostly gathered information from the Alaska exchange. The various Sankey diagrams demonstrating information gathering showed that the Alaska respondents gathered information only from their respondent location for every science topic. When considering the extent of respondent reliance on their own regional exchange, 100 percent of Alaska respondents relied heavily on the Alaska exchange for information on fire regimes and economic impacts. Alaska was also a frequent anomaly for the reliance charts. Whereas respondents from many other locations relied strongest on external sources, Alaska respondents relied more on their regional exchange for several topics, including economic impacts; postfire recovery and management; fuels management; fire regimes; smoke, air quality, and health; and WUI and infrastructure. For prescribed fire, Alaska respondents stated they rely more on other exchanges than own regional exchange or external sources, which matches the IPA ratings where Alaska respondents rated the availability of scientific resources to be very low for their own exchange compared to other exchanges. Alaska respondents also rated the importance and performance for invasive plants lower than respondents from other locations.

Pacific respondents relied less on their corresponding regional exchange across the science topics than respondents from the other two locations in this group. However, for fire regimes, 100 percent of Pacific respondents relied strongly on their own regional exchange. The Pacific exchange was unique because although respondents tended to exclusively gather information from the Pacific exchange, respondents from multiple western locations went to the Pacific exchange for information about specific science topics. For example, Northwest respondents went to the Pacific exchange for information on social science and human dimensions, WUI and infrastructure, and post-fire recovery and management. California respondents went to the Pacific exchange for information on WUI and infrastructure and watershed processes. For economic impacts, at least one respondent from Northwest, Southern, North Atlantic, and California locations went to the Pacific exchange for information. For Indigenous knowledge, respondents from California and Northwest, and at least one respondent from Southwest and Northern Rockies gathered information from the Pacific exchange. These results suggest that the types or quality of information provided about these topics by the Pacific exchange was valuable for respondents from other locations.

In terms of reliance, Pacific broke from the pattern where respondents from most locations relied most strongly on external sources, for the topics of fire regimes and fuels management, for which respondents from the Pacific location relied more on their own regional exchange. Respondents from exchanges in the western group, as well as the Southern location, went to Pacific and Alaska exchanges for information about Indigenous knowledge and economic impacts, even though respondents in these exchanges rated the availability of scientific resources for these topics as low. In fact, Pacific fell in the Gap quadrant for soil and vegetation. Pacific was also an outlier in the IPA chart for vegetation, where all the other exchanges plotted in the Good Work quadrant, whereas Pacific fell into the Gap quadrant. Compared to how respondents from other locations rated their corresponding locations on the topic of soil, Pacific also stands out because respondents rated the topic as higher importance but lower performance.

Lastly, North Atlantic, though less geographically isolated than Alaska or Pacific, appeared isolated in terms of its lack of interaction and participation with other exchanges. In the information gathering charts, respondents from North Atlantic only gathered information from the North Atlantic exchange, except for some respondents who gathered information from the Pacific exchange for information about economic impacts, and a few that went to the Southern exchange for information about watershed processes. There are also a few instances where respondents from other locations gathered information from the North Atlantic exchange, though these are not common. For example, Appalachians respondents gathered from the North Atlantic exchange for the topic of soil, Southern respondents gathered from the North Atlantic exchange for the topic of economic impacts, and Lake States respondents gathered information from the North Atlantic exchange for the topic of Indigenous knowledge. North Atlantic respondents participated in questions for the topics of fire regimes and economic impacts relatively more frequently than for other topics, indicating that these topics were relevant to the work of respondents in this location. In the IPA charts, North Atlantic respondents rated the scientific resources available for many topics to be in Good Work, like the groupings for the rest of the network. However, it was an outlier in the Gap quadrant for fuels management and fire regimes. North Atlantic, along with Alaska, had the lowest performance ratings for economic impacts out of the entire network.

# Conclusions, Limitations, and Future Work

This report summarizes results from an evaluation of the Joint Fire Science Program's (JFSP) Fire Science Exchange Network (FSEN) by the U.S Geological Survey. A secondary literature review was conducted that informed the development of four research objectives for which an online survey was developed and sent to exchange users. For the first research objective, the scope of the JFSP FSEN mission, respondents were asked their perspectives on the relative importance of the six FSEN objectives (JFSP, 2022) and their subcomponents. Sharing information and building relationships were valued over the other objectives by respondents.

For the second research objective, the number and configuration of exchanges, respondents evaluated the importance, delivery, and information flow across exchanges for 16 key fire science topics. The Importance-Performance Analysis framework provides a highly transparent and replicable method to identify agency strengths, weaknesses, and areas for resource prioritization and appropriation. By looking at patterns in the Importance-Performance Analysis charts, strengths and gaps emerged for topics. For example, for a few topics, such as fire behavior, respondents across all locations rated the importance and performance to be in the Good Work quadrant, indicating strengths across the network for this topic. There were also several topics where deficiencies were highlighted for a few exchanges that plotted in the Gap quadrant, whereas all other exchanges fell into the Good Work quadrant. For example, Southwest was the only location in the Gap quadrant for smoke, air quality, and health. There was less cohesion in groupings for the topics of soil, watershed processes, economic impacts, social science and human dimensions, and Indigenous knowledge. The importance-performance results were spread across quadrants for these topics with less discernable groupings of exchanges.

For the third research objective, distribution of resources, the evaluation of the performance of individual exchanges on the current criteria was beyond the scope of this evaluation. However, looking at the science information needs identified for respondents in each location can help reevaluate the criteria themselves. For instance, increased breadth and complexity presumably necessitate greater resources. To develop a more complete understanding of the breadth, complexity, and overlap of science information needs for any given exchange, respondents were asked to evaluate the importance and delivery of scientific resources for key wildfire science topics that are important to its network users that were then linked to locations by their self-identified regional exchange. Some science topics appeared stronger than others; for example, prescribed fire was both a popular topic and was highly rated for delivery of scientific resources, whereas Indigenous knowledge was considered less important by respondents and with fewer scientific resources available. Some exchanges appeared to be "hubs" for specific topics; for example, California was a hub for information on Indigenous knowledge, Southern was a hub for information on prescribed fire, and Oak Woodlands was a hub for information on vegetation. A potential pathway is to identify which exchanges serve as hubs for specific topics and to have the exchange focus on continuing to deliver quality information for those topics.

For the fourth and final research objective, centralization of the network, respondents were asked about their relative reliance on different information sources and patterns in information gathering across exchange networks. Results revealed that respondents greatly relied on external sources outside of the exchange network for information on most topics. When gathering information from the exchange network, exchange respondents tended to participate in the exchanges that border or are geographically closer to their respondent location. Thus, the exchanges seemed to operate in two geographic groupings, the western exchanges and eastern exchanges, with the remaining exchanges operating mostly independent of the others, at least in terms of the data collected from this survey. Although Pacific respondents typically went to the Pacific exchange for information, respondents from many other locations went to the Pacific exchange for information on several topics. This may suggest that despite its smaller size and geographic distance from the rest of the network, the Pacific exchange provided valuable information to other exchanges on various topics.

Overall, according to respondents, it appears that the network is fulfilling its intended purpose as all exchanges had a constituency that strongly relies on them for certain science topics. It is true that the study would have benefited from a higher response rate and has limitations. It is important to keep in mind that some exchanges had a higher survey response rate than others; for example, the Pacific exchange had a very low response rate relative to the other exchanges. Also, the results in this report are specific to FSEN users who responded to the survey and are not necessarily representative of all the FSEN users. No attempt was made to survey members of the wildfire science and management community who do not currently subscribe to any of the exchanges.

Follow-up research on certain items revealed in this study, but that were outside of the scope, would be valuable. For example, a future study could investigate what external sources exchange respondents are using for information on key science topics. This follow-up study could help discern if there are potential partnerships for exchanges to make with external organizations to deliver this information or how exchanges should focus their data delivery depending on whether certain topics are already adequately covered by other information sources. In addition, up to 18 percent of respondents do not subscribe to the exchange they indicated was their respondent location. Further studies could investigate why that might be; for example, certain respondents do not believe their respondent location adequately addresses their needs. Lastly, another valuable area for future work could be collaborating directly with exchanges to identify opportunities for engaging user groups who are underrepresented (for example, individuals affiliated with Tribal organizations).

## References Cited


Alberty, S., and Mihalik, B.J., 1989, The use of importance-performance analysis as an evaluative technique in adult education: Evaluation Review, v. 13, no. 1, p. 33–44, accessed March 17, 2022, at https://doi.org/10.1177/0193841X8901300103.

Bodin, O., and Crona, B.I., 2009, The role of social networks in natural resource governance—What relational patterns make a difference?: Global Environmental Change, v. 19, no. 3, p. 366–374, accessed March 17, 2022, at https://doi.org/10.1016/j.gloenvcha.2009.05.002.

Borgatti, S.P., Everett, M.G., and Johnson, J.C., 2018, Analyzing social networks (2nd ed.): London, Sage Publications Ltd., 384 p.

Colavito, M.M., 2017, Utilising scientific information to support resilient forest and fire management: International Journal of Wildland Fire, v. 26, no. 5, p. 375–383, accessed March 17, 2022, at https://doi.org/10.1071/WF16158.

Colavito, M.M., Trainor, S.F., Kettle, N.P., and York, A., 2019, Making the transition from science delivery to knowledge coproduction in boundary spanning—A case study of the Alaska Fire Science Consortium: Weather, Climate, and Society, v. 11, no. 4, p. 917–934, accessed March 17, 2022, at https://doi.org/10.1175/WCAS-D-19-0009.1.

Dillman, D.A., 2007, Mail and Internet surveys—The tailored design method (2nd ed.): Hoboken, N.J., Wiley, 523 p.

Dolinsky, A.L., and Caputo, R.K., 1991, Adding a competitive dimension to importance-performance analysis—An application to traditional health care systems: Health Marketing Quarterly, v. 8, no. 3–4, p. 61–79, accessed March 17, 2022, at https://doi.org/10.1300/J026v08n03_03.

EnviroIssues, 2017. Science/Policy work group final report—Mechanisms for integrating fire science and policy: Joint Fire Science Program, prepared by EnviroIssues, 50 p. [Also available at https://www.firescience.gov/documents/10_JFSP_Science_Policy_Work_Group_Final_Report_Mar2017_final.pdf.]

EnviroIssues, 2018a, Fire Science Exchange Network assessment interviews—Summary report: Joint Fire Science Program, prepared by EnviroIssues, 18 p.

EnviroIssues, 2018b, Joint Fire Science Program—Integrating fire science with policy—Action plan for mechanism implementation: Joint Fire Science Program, prepared by EnviroIssues, 17 p.

Freeman, L.C., 2004, The development of social network analysis—A study in the sociology of science: Vancouver, Empirical Press, 205 p.

Gerlak, A.K., and Heikkila, T., 2011, Building a theory of learning in collaboratives—Evidence from the Everglades restoration program: Journal of Public Administration: Research and Theory, v. 21, no. 4, p. 619–644, accessed March 17, 2022, at https://doi.org/10.1093/jopart/muq089.

Go, F., and Zhang, W., 1997, Applying importance-performance analysis to Beijing as an international meeting destination: Journal of Travel Research, v. 35, no. 4, p. 42–49, accessed March 17, 2022, at https://doi.org/10.1177/004728759703500407.

Hayman, S., and Thomson, A., 2016, Joint Fire Science Program—Connecting science and policy: Joint Fire Science Program, prepared by EnviroIssues, 24 p. [Also available at https://www.firescience.gov/Publications/2016_0609_AssessmentReport_Final.pdf.]

Holland-Bartels, L., and Pierce, B., eds., 2011, An evaluation of the science needs to inform decisions on Outer Continental Shelf energy development in the Chukchi and Beaufort Seas, Alaska: U.S. Geological Survey Circular 1370, 278 p., accessed March 17, 2022, at https://doi.org/10.3133/cir1370.

Holling, C.S., 1978, Adaptive environmental assessment and management: New York, Wiley, 377 p.

Hammitt, W.E., Bixler, R.D., and Noe, F.P., 1996, Going beyond importance-performance analysis to analyze the observance-influence of park impacts: Journal of Park and Recreation Administration, v. 14, no. 1, p. 45–62. [Also available at https://js.sagamorepub.com/jpra/article/view/1720.]

Hunter, M.E., 2016, Outcomes of fire research—Is science used?: International Journal of Wildland Fire, v. 25, no. 5, p. 495–504. [Also available at https://doi.org/10.1071/WF15202.]

IBM Corp., 2020, IBM SPSS Statistics for Windows, version 27.0: Armonk, NY, IBM Corp. software release.

Joint Fire Science Program [JFSP], 2022, Fire Science Exchange Network web page, accessed May 12, 2022, at https://www.firescience.gov/JFSP_exchanges.cfm.

Kocher, S.D., Toman, E., Trainor, S.F., Wright, V., Briggs, J.S., Goebel, C.P., MontBlanc, E.M., Oxarart, A., Pepin, D.L., Steelman, T.A., Thode, A., and Waldrop, T.A., 2012, How can we span the boundaries between wildland fire science and management in the United States?: Journal of Forestry, v. 110, no. 8, p. 421–428, accessed March 17, 2022, at https://doi.org/10.5849/jof.11-085.

Lemieux, C.J., Thompson, J.L., Dawson, J., and Schuster, R.M., 2013, Natural resource manager perceptions of agency performance on climate change: Journal of Environmental Management, v. 114, p. 178–189. [Also available at https://doi.org/10.1016/j.jenvman.2012.09.014.]

Manfreda, K.L., Bosnjak, M., Berzelak, J., Haas, I., and Vehovar, V., 2008, Web surveys versus other survey modes—A meta-analysis comparing response rates: International Journal of Market Research, v. 50, no. 1, p. 79–104, accessed March 17, 2022, at https://doi.org/10.1177/147078530805000107.

Maletsky, L.D., Evans, W.P., Singletary, L., and Sicafuse, L.L., 2018, Joint Fire Science Program (JFSP) Fire Science Exchange Network—A national evaluation of initiative impacts: Journal of Forestry, v. 116, no. 4, p. 328–335. [Also available at https://doi.org/10.1093/jofore/fvy009.]

Martilla, J.A., and James, J.C., 1977, Importance-Performance Analysis: Journal of Marketing, v. 41, no. 1, p. 77–79, accessed March 17, 2022, at https://doi.org/10.1177/002224297704100112.

Moreno, J.L., 1934, Who Shall Survive?—A new approach to the problem of human interrelations: Washington, D.C., Nervous and Mental Disease Publishing Company, 440 p. [Also available at https://doi.org/10.1037/10648-000.]

National Science and Technology Council, 2012, Deepwater Horizon oil spill principal investigator workshop—St. Petersburg, Fla., October 25–26, 2011, Final Report: Washington, D.C., National Science and Technology Council, Subcommittee on Ocean Science and Technology, 91 p. [Also available at https://obamawhitehouse.archives.gov/administration/eop/ostp/nstc/docsreports.]

Oh, H., 2001, Revisiting importance-performance analysis: Tourism Management, v. 22, no. 6, p. 617–627. [Also available at https://doi.org/10.1016/S0261-5177(01)00036-X.]

O'Neill, M.A., and Palmer, A., 2004, Importance-performance analysis—A useful tool for directing continuous quality improvement in higher education: Quality Assurance in Education, v. 12, no. 1, p. 39–52, accessed March 17, 2022, at https://doi.org/10.1108/09684880410517423.

Perry, B.L., Pescosolido, B.A., and Borgatti, S.P., 2018, Egocentric network analysis—Foundations, methods, and models: Cambridge, U.K., Cambridge University Press, 350 p. [Also available at https://doi.org/10.1017/9781316443255.]

R Core Team, 2021, R—A language and environment for statistical computing, version 4.1.0 (Camp Pontanezen): R Foundation for Statistical Computing software release, accessed March 17, 2022, at https://www.r-project.org/.

Sandström, A., and Rova, C., 2010, Adaptive co-management networks—A comparative analysis of two fishery conservation areas in Sweden: Ecology and Society, v. 15, no. 3, 23 p., accessed March 17, 2022, at https://doi.org/10.5751/ES-03531-150314.

Schmidt, M., 2008, The Sankey diagram in energy and material flow management—Part I, history: Journal of Industrial Ecology, v. 12, no. 1, p. 82–94, accessed March 17, 2022, at https://doi.org/10.1111/j.1530-9290.2008.00004.x.

Sheehan, K.B., 2001, E-mail survey response rates—A review: Journal of Computer-Mediated Communication, v. 6, no. 2, article JCMC621, [variously paged], accessed March 17, 2022, at https://doi.org/10.1111/j.1083-6101.2001.tb00117.x.

Shih, T.-H., and Fan, X., 2008, Comparing response rates from web and mail surveys—A meta-analysis: Field Methods, v. 20, no. 3, p. 249–271, accessed March 17, 2022. https://doi.org/10.1177/1525822X08317085.

Sicafuse, L., Evans, W., Singletary, L., and Maletsky, L., 2013, Interviews with JFSP consortia leadership and staff: Joint Fire Science Program, 34 p. [Also available at https://www.firescience.gov/documents/JFSP_Consortia_Interviews_report.pdf.]

Steblein, P.F., Loehman, R.A., Miller, M.P., Holomuzki, J.R., Soileau, S.C., Brooks, M.L., Drane-Maury, M., Hamilton, H.M., Kean, J.W., Keeley, J.E., Mason, R.R., Jr., McKerrow, A., Meldrum, J.R., Molder, E.B., Murphy, S.F., Peterson, B., Plumlee, G.S., Shinneman, D.J., van Mantgem, P.J., and York, A., 2021, U.S. Geological Survey wildland fire science strategic plan, 2021–26: U.S. Geological Survey Circular 1471, 30 p., accessed March 17, 2022, at https://doi.org/10.3133/cir1471.

Tonge, J., and Moore, S.A., 2007, Importance-satisfaction analysis for marine-park hinterlands—A Western Australian case study: Tourism Management, v. 28, no. 3, p. 768–776, accessed March 17, 2022. https://doi.org/10.1016/j.tourman.2006.05.007.

Vaske, J.J., Beaman, J., Stanley, R., and Grenier, M., 1996, Importance-Performance and Segmentation—Where do we go from here?: Journal of Travel & Tourism Marketing, v. 5, no. 3, p. 225–240. [Also available at https://doi.org/10.1300/J073v05n03_04.]

Wade, D.J., and Eagles, P.F.J., 2003, The use of importance-performance analysis and market segmentation for tourism management in parks and protected areas—An application to Tanzania's national parks: Journal of Ecotourism, v. 2, no. 3, p. 196–212. [Also available at https://doi.org/10.1080/14724040308668144.]

Ziegler, J., Dearden, P., and Rollins, R., 2012, But are tourists satisfied? Importance-performance analysis of the whale shark tourism industry on Isla Holbox, Mexico: Tourism Management, v. 33, no. 3, p. 692–701. [Also available at https://doi.org/10.1016/j.tourman.2011.08.004.]

# Appendix 1

Appendix 1 provides access to the complete FSEN online survey as originally sent to respondents. Summary figures are also provided that show the respondents' reliance on their location (fig. 1.1) and on other exchanges (fig. 1.2). Definitions were taken and modified according to those in the directory of firescience.gov. For more information see https://www.firescience.gov/JFSP_findings_search.cfm.

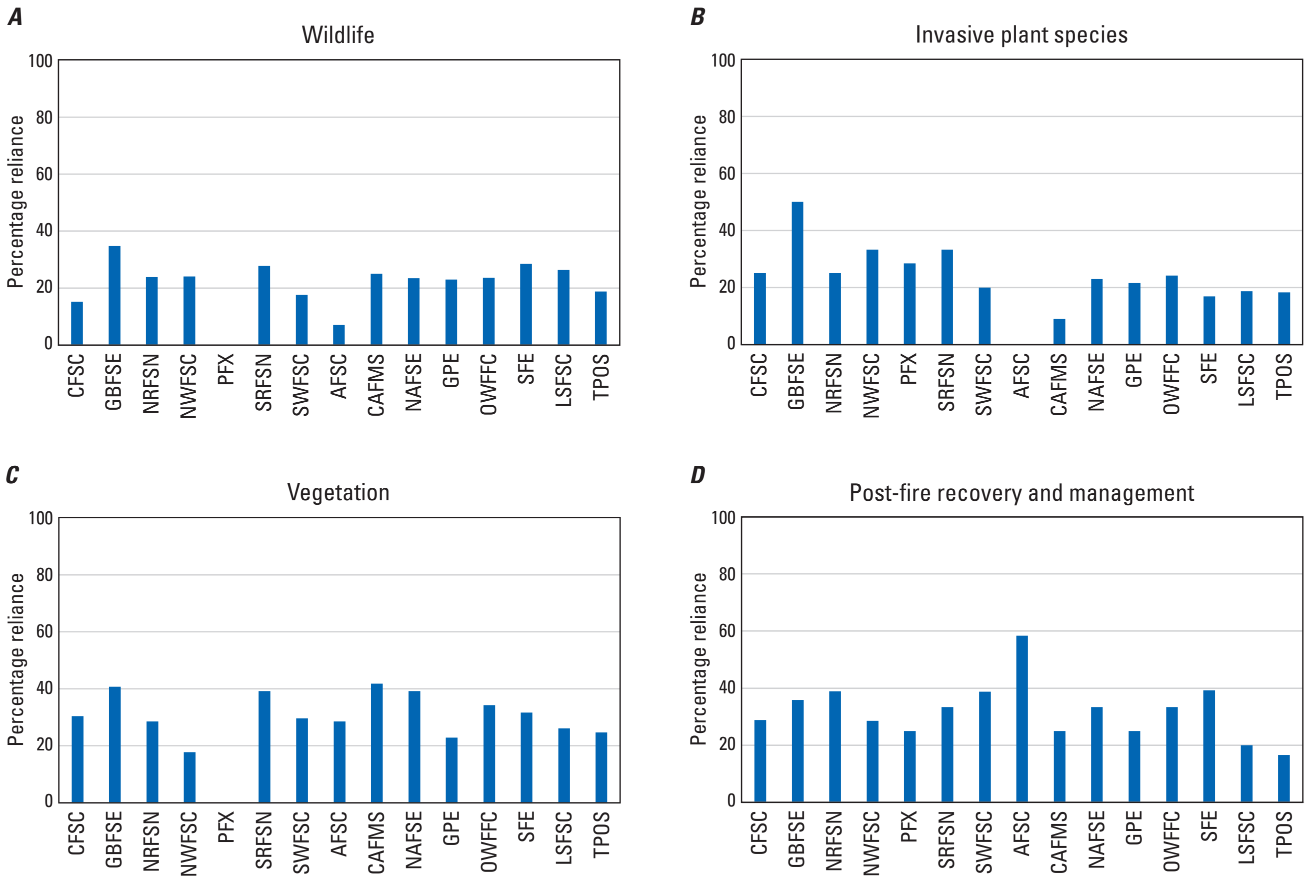



**Figure 1.1.** Respondents' reliance on their location for *A,* wildlife; *B,* invasive plant species; *C,* vegetation; *D,* post-fire recovery and management; *E,* fire behavior; *F,* fire regimes; *G,* prescribed fire; *H,* smoke, air quality, and health; *I,* wildland urban interface (WUI) and infrastructure; *J,* social science and human dimensions; *K,* economic impacts; *L,* soil; *M,* watershed processes; *N,* fuels management; *O,* firefighter (FF) safety and incident management; and *P,* Indigenous knowledge. (CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; PFX, Pacific Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; NAFSE, North Atlantic Fire Science Exchange; GPE, Great Plains Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; LSFSC, Lake States Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

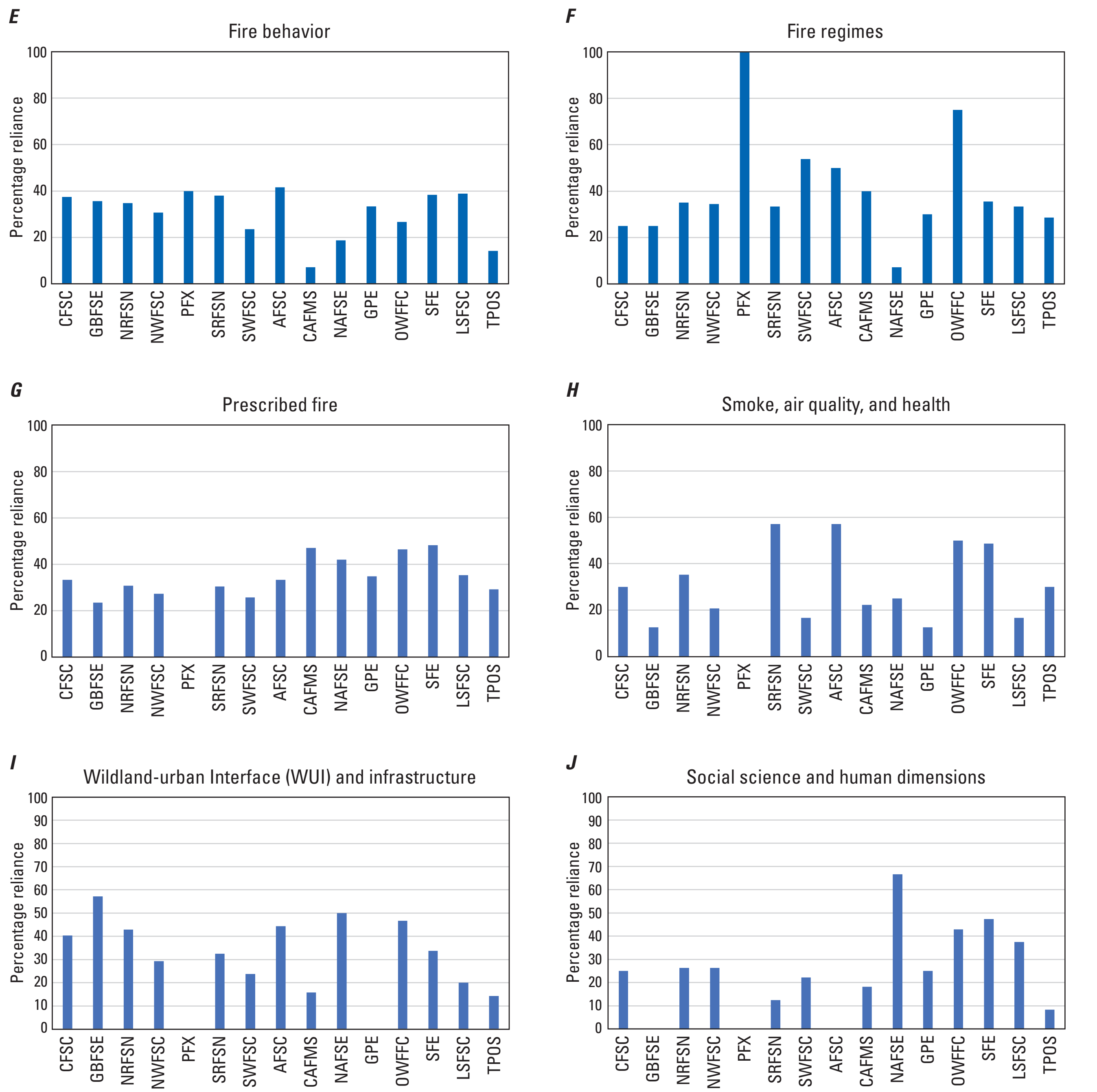



**Figure 1.1.** (Continued) Respondents' reliance on their location for *A,* wildlife; *B,* invasive plant species; *C,* vegetation; *D,* post-fire recovery and management; *E,* fire behavior; *F,* fire regimes; *G,* prescribed fire; *H,* smoke, air quality, and health; *I,* wildland urban interface (WUI) and infrastructure; *J,* social science and human dimensions; *K,* economic impacts; *L,* soil; *M,* watershed processes; *N,* fuels management; *O,* firefighter (FF) safety and incident management; and *P,* Indigenous knowledge. (CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; PFX, Pacific Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; NAFSE, North Atlantic Fire Science Exchange; GPE, Great Plains Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; LSFSC, Lake States Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

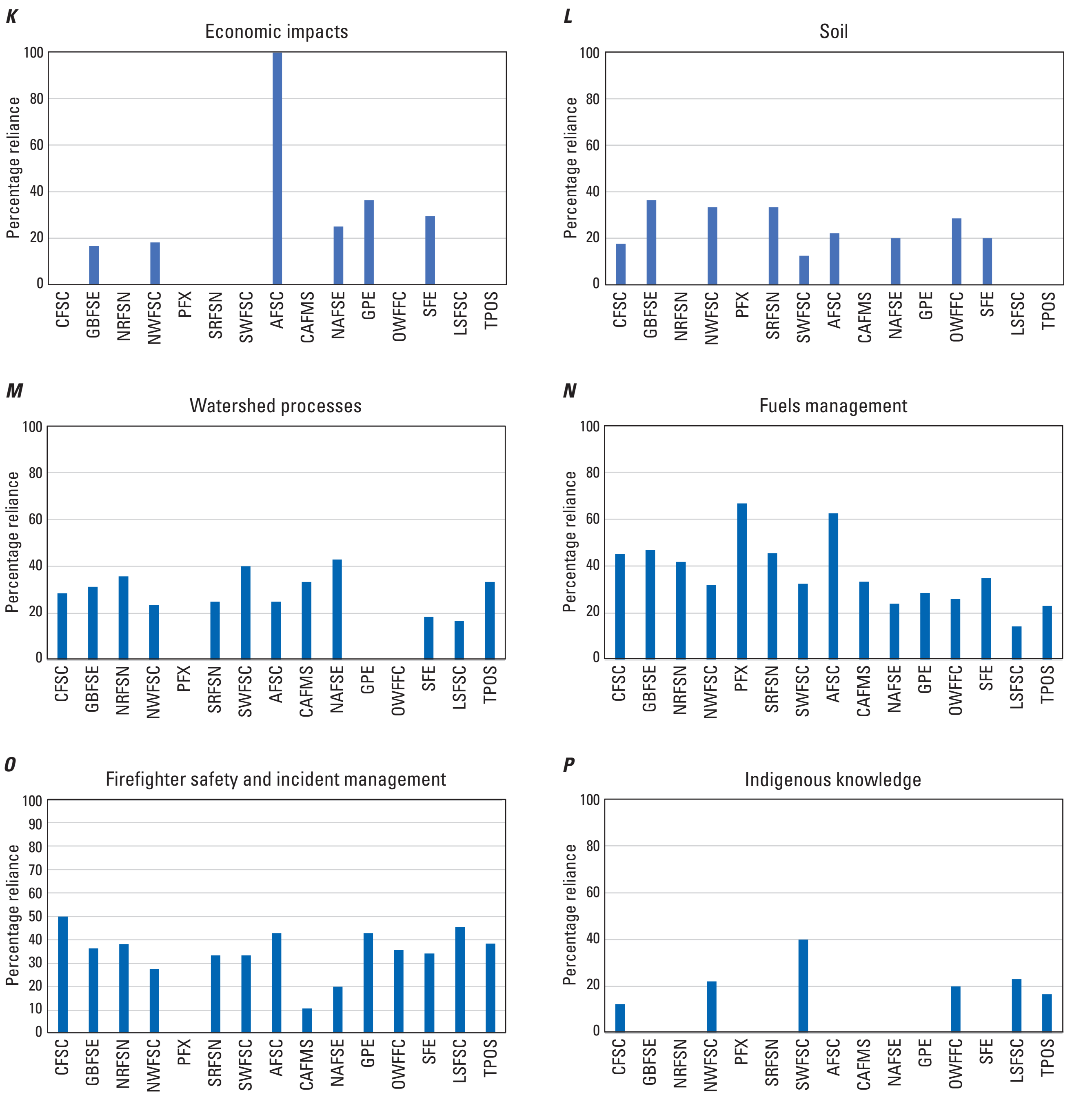



**Figure 1.1.** (Continued) Respondents' reliance on their location for *A,* wildlife; *B,* invasive plant species; *C,* vegetation; *D,* post-fire recovery and management; *E,* fire behavior; *F,* fire regimes; *G,* prescribed fire; *H,* smoke, air quality, and health; *I,* wildland urban interface (WUI) and infrastructure; *J,* social science and human dimensions; *K,* economic impacts; *L,* soil; *M,* watershed processes; *N,* fuels management; *O,* firefighter (FF) safety and incident management; and *P,* Indigenous knowledge. (CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; PFX, Pacific Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; NAFSE, North Atlantic Fire Science Exchange; GPE, Great Plains Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; LSFSC, Lake States Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

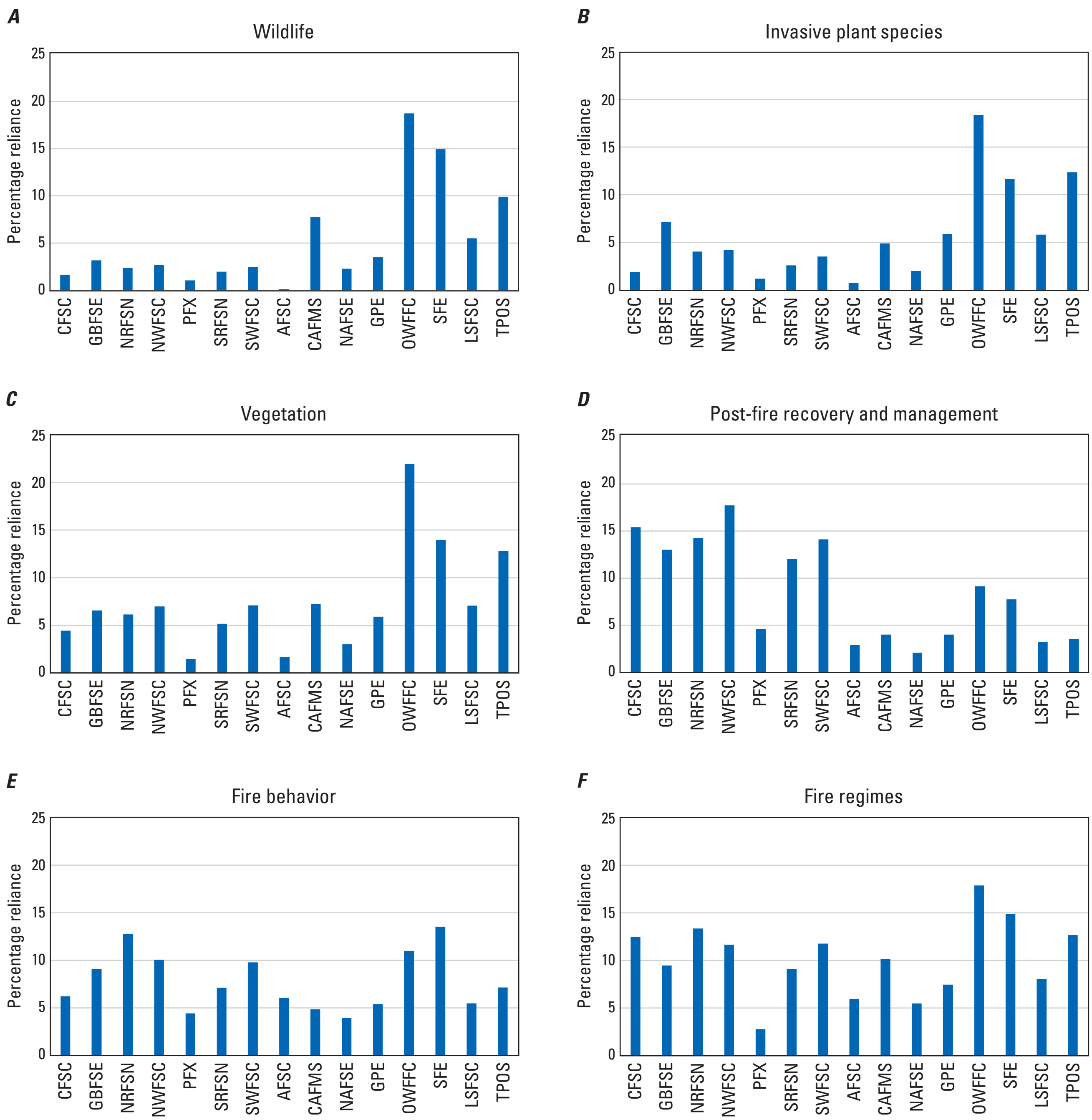



**Figure 1.2.** Respondents’ reliance on other exchanges for *A,* wildlife; *B,* invasive plant species; *C,* vegetation; *D,* post-fire recovery and management; *E,* fire behavior; *F,* fire regimes; *G,* prescribed fire; *H,* smoke, air quality, and health; *I,* wildland urban interface (WUI) and infrastructure; *J,* social science and human dimensions; *K,* economic impacts; *L,* soil; *M,* watershed processes; *N,* fuels management; *O,* firefighter (FF) safety and incident management; and *P,* Indigenous knowledge. (CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; PFX, Pacific Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; NAFSE, North Atlantic Fire Science Exchange; GPE, Great Plains Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; LSFSC, Lake States Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

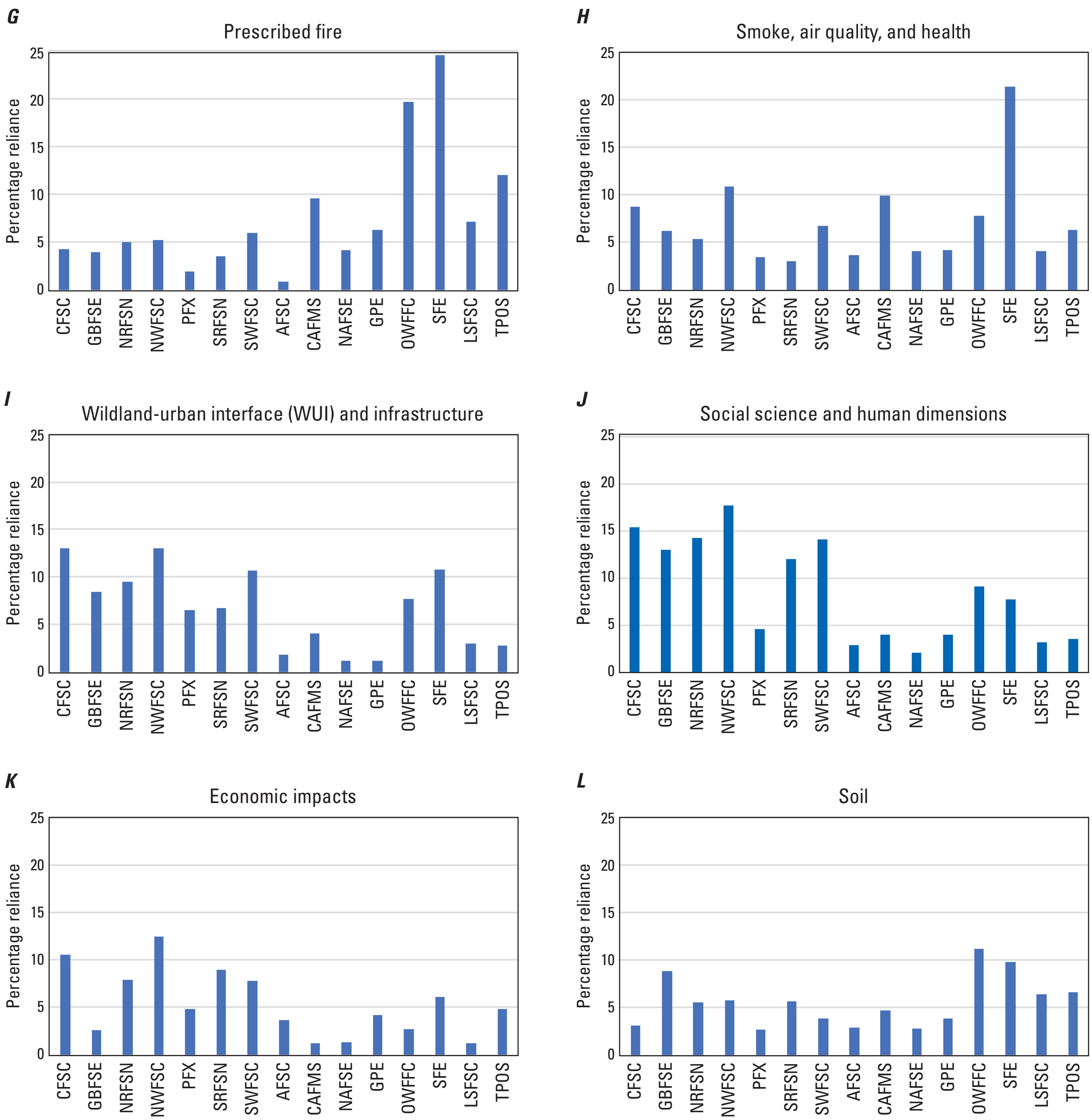



**Figure 1.2.** (Continued) Respondents' reliance on other exchanges for *A,* wildlife; *B,* invasive plant species; *C,* vegetation; *D,* post-fire recovery and management; *E,* fire behavior; *F,* fire regimes; *G,* prescribed fire; *H,* smoke, air quality, and health; *I,* wildland urban interface (WUI) and infrastructure; *J,* social science and human dimensions; *K,* economic impacts; *L,* soil; *M,* watershed processes; *N,* fuels management; *O,* firefighter (FF) safety and incident management; and *P,* Indigenous knowledge. (CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; PFX, Pacific Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; NAFSE, North Atlantic Fire Science Exchange; GPE, Great Plains Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; LSFSC, Lake States Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

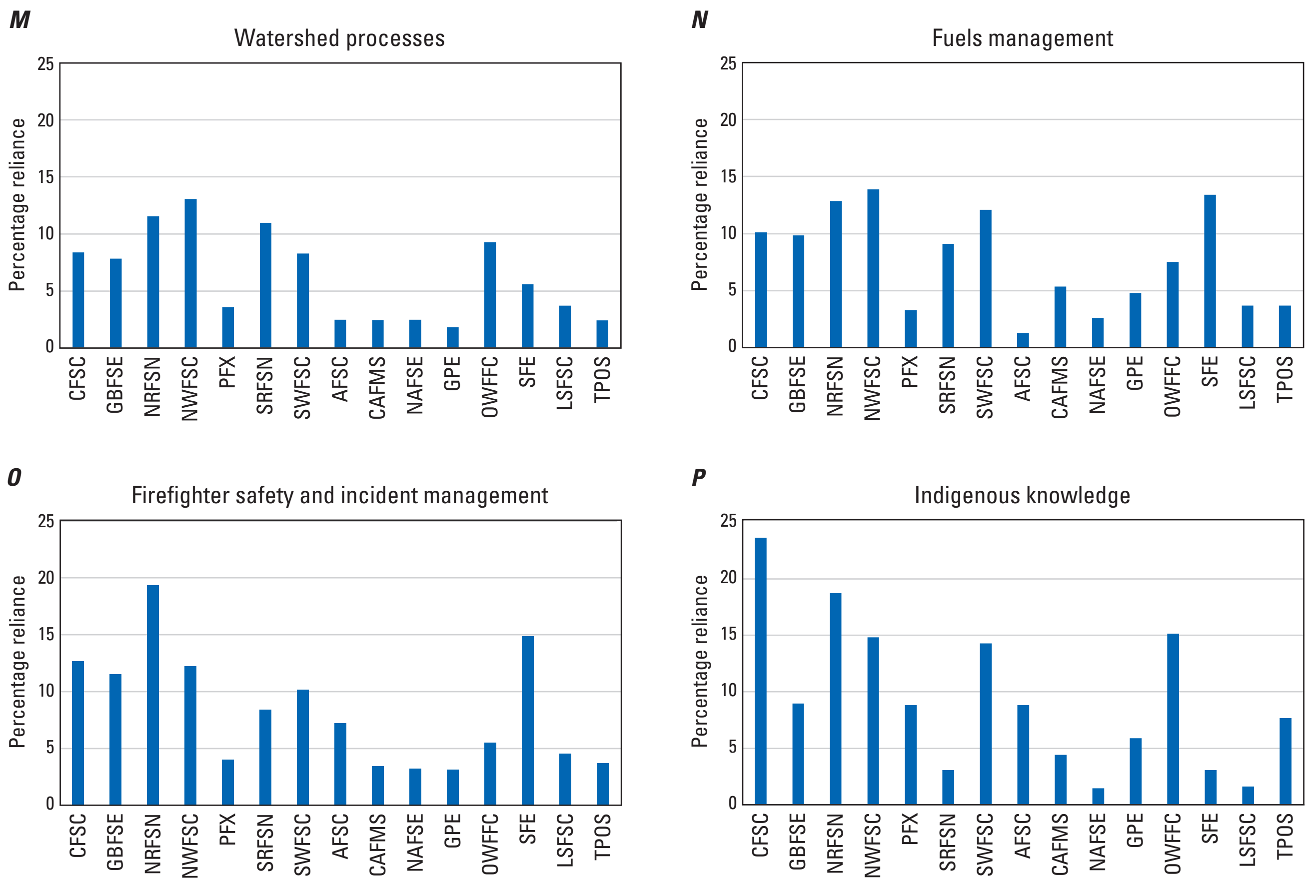



**Figure 1.2.** (Continued) Respondents' reliance on other exchanges for *A,* wildlife; *B,* invasive plant species; *C,* vegetation; *D,* post-fire recovery and management; *E,* fire behavior; *F,* fire regimes; *G,* prescribed fire; *H,* smoke, air quality, and health; *I,* wildland urban interface (WUI) and infrastructure; *J,* social science and human dimensions; *K,* economic impacts; *L,* soil; *M,* watershed processes; *N,* fuels management; *O,* firefighter (FF) safety and incident management; and *P,* Indigenous knowledge. (CFSC, California Fire Science Consortium; GBFSE, Great Basin Fire Science Exchange; NRFSN, Northern Rockies Fire Science Network; NWFSC, Northwest Fire Science Consortium; PFX, Pacific Fire Exchange; SRFSN, Southern Rockies Fire Science Network; SWFSC, Southwest Fire Science Consortium; AFSC, Alaska Fire Science Consortium; CAFMS, Consortium of Appalachians Fire Managers and Scientists; NAFSE, North Atlantic Fire Science Exchange; GPE, Great Plains Fire Science Exchange; OWFFC, Oak Woodlands and Forests Fire Consortium; SFE, Southern Fire Exchange; LSFSC, Lake States Fire Science Consortium; TPOS, Tallgrass Prairie and Oak Savanna Fire Science Consortium)

Publishing support provided by the Science Publishing Network,
Denver Publishing Service Center

For more information concerning the research in this report, contact the
Center Director, USGS Fort Collins Science Center
2150 Centre Ave., Bldg. C
Fort Collins, CO 80526-8118
(970) 226-9398

Or visit the Fort Collins Science Center website at
https://www.fort.usgs.gov

Collins and others—**2021 Assessment of the Joint Fire Science Program's Fire Science Exchange Network**—SIR 2022–5052, Version 1.1

ISSN 2328-0328 (online)
https://doi.org/10.3133/sir20225052