Joint Fire Science Exchange Network

2015 Evaluation Report

A National Cluster Evaluation of the Fire Science Exchange Network's Processes and Impacts

University of Nevada Cooperative Extension
University of Nevada, Reno

Funded by a grant from the Joint Fire Science Program

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Fire Science Exchange Network
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A partnership of Nevada counties; University of Nevada, Reno; and U.S. Department of Agriculture

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Executive Summary

The National Evaluation of the Joint Fire Science Program (JFSP) aims to assess the processes and outcomes of regional Fire Science Exchanges (Exchanges) and Exchanges' programming at the aggregate national level. This ongoing evaluation includes four components: an online survey, targeting the fire science information-related experiences and opinions of fire managers/practitioners (Consumers), fire researchers/scientists (Producers), and members of the General Public; a webmetrics component including quantitative and qualitative elements; an evaluation resource guide designed to assist Exchanges in evaluating their regional activities; and a qualitative interview component exploring the perspectives and experiences of key Exchanges' personnel. The current report presents results obtained from the **fifth year (Wave 5)** of data collection from the online survey and webmetrics evaluation components. In addition, it provides the results of statistical significance tests conducted on combined survey data from the last five waves to examine progress on Exchange goals comparing results from Exchanges' early establishment to Exchanges in their fourth year of funding.

Five JFSP Exchanges participated in the online survey this year, actively recruiting participants between March 2015 and July 2015. A total of **369** individuals participated. Most participants were Consumers (70.9 percent) followed by Producers (20.8 percent) and members of the General Public (8.3 percent). The number of Wave 5 survey participants was substantially lower than the number of participants in Waves 1, 2, and 4. Exchanges should continue to expand their listserves to address survey fatigue and help increase response rates in future years; however, starting next year, the evaluation team has reduced the length of the online survey instrument and Exchanges will move to a three year administration schedule in order to increase stakeholder engagement in program evaluation.

Two events during this wave of data collection should be noted as they likely influenced Wave 5 online survey and webmetrics results. First, a new Exchange participated in the online survey for the first time. Secondly, many Exchanges were in the process of switching their websites to a new template. These influences are further discussed in the Implications section of the Executive Summary and in relevant sections of the report when interpreting results.

2015 Online Survey Results

As in prior years, results from Wave 5 targeted three main types of Exchange constituents: 1) *Consumers* (managers/practitioners), 2) *Producers* (fire researchers/scientists), and 3) *General Public* (all other Exchange associated respondents). Overall, respondents from all three categories reported positive opinions regarding fire science information and experiences with their regional Exchange. The following findings were particularly noteworthy:

- **Consumers** expressed the strongest agreement with the statement: *Using fire science information enhances my effectiveness on the job*, and were least likely to agree with the statement *Fire science information is easy to apply to my specific problems* indicating continued need for translated fire science research results and tools.

- Although still on the positive end of the scale, **Consumers** in Wave 5 reported slightly lower perceptions of **Producers,** perhaps highlighting a need to target increasing interactions between Consumers and Producers among participating Exchanges**.** Both Consumers and Producers expressed a desire to work with one another, but this desire was more strongly expressed among Producers.

- The majority of both **Consumers** and **Producers** had very favorable perceptions of their Exchange's impacts on fire science delivery. They were particularly likely to agree or strongly agree that their Exchange is needed to help coordinate sharing of fire science and that the Exchange has helped improve both the accessibility and the application of fire science in their region.

- The majority of both **Consumers** and **Producers** reported positive experiences with their Exchange's website, indicating that the websites were user-friendly and provided a wide variety of current fire science information. Many respondents also made mention of social media accounts that they accessed when connecting with Exchanges or looking for fire science community information.

- The majority of **General Public** respondents agreed or strongly agreed that their awareness of fire science/management issues had increased during the past year.

- **General Public** respondents cited communicating with fire management/extension professionals as well as Internet sources as the most useful and often accessed ways of obtaining fire science information.

Longitudinal Comparisons

In order to better assess outcomes and impact of Exchanges over time, data from all five survey waves were combined and a Principal Component Analysis (PCA) used to determine suitability for combining individual survey items into a smaller number of latent variables. Using PCA to create latent variables helps to decrease redundancy in the data by targeting shared variability; this helps to identify how different items work together to more fully explain the same phenomenon. For Consumers, four latent variables were constructed based on survey item groupings: 1) Experience with fire science; 2) Experience with fire science Producers, 3) Experience with Exchanges, and 4) Experience with websites. For Producers two latent variables were created: 1) Experience with Exchanges and 2) Experience with websites. These latent variables were compared with first or second year Exchange data and data obtained from respondents in Exchanges in their fourth year of establishment using difference in means significance tests.

Longitudinal Statistical Significance Results for Consumers

Over time, Consumer respondents' ratings increased ratings for:

- Experiences with fire science: Respondents were much more likely to report an improved experience using and trusting fire science in year four (M = 3.81, SD = 0.54) when compared to year one (M = 3.71, SD = 0.54); $t(1433) = 2.87$, $p = 0.004$.

- Experience with Producers: Respondents were significantly more likely to have positive ratings of fire science Producers in year four (M = 3.46, SD = 0.57) when compared to year one (M = 3.33, SD = 0.55); $t(1418) = 3.97$, $p < 0.001$.

- Experience with Exchanges: Respondents were significantly more likely to rate their Exchange as a valuable and necessary resource in the fire science community in year four (M = 3.83, SD = 0.58) when compared to year two (M = 3.60, SD = 0.57); $t(400) = 3.46$, $p = 0.001$.

- Experience with Exchange websites: Respondents were significantly more likely to rate their Exchange's website as having a wide variety of practical and up-to-date information in a user-friendly and convenient place in year four (M = 3.71, SD = 0.54) when compared to year two (M = 3.61, SD = 0.50); $t(659) = 2.56$, $p = 0.011$

Longitudinal Statistical Significance Results for Producers

Over time, Producer respondents' ratings increased ratings for:

- Experience with Exchanges: Respondents were much more likely to report an improved opinions about their Exchange's ability to impact fire science delivery in year four (M = 4.09, SD = 0.54) when compared to year two (M = 3.77, SD = 0.59); $t(114) = 2.86$, $p = 0.005$.

- Experience with Exchange websites: Respondents were significantly more likely to rate their Exchange's website as having a wide variety of practical and up-to-date information in a user-friendly and convenient place in year four (M = 3.73, SD = 0.62) when compared to year two (M = 3.51, SD = 0.62); $t(176) = 2.39$, $p = 0.018$.

Webmetrics Results

The webmetrics component of the national evaluation includes two elements. The quantitative component assesses the impacts of Exchange websites in terms of visitor recruitment and retention, the extent to which users engage with the websites, and the performance of specific website features or pages. The qualitative component examines the operation of the Exchange websites and social media accounts in more detail and solicits feedback from Exchange representatives regarding website and social media-related purpose, target audiences, and challenges. Data for the current Wave 5 of the national evaluation were collected when most Fire Exchanges were in the process of transitioning to a new website template. The transition process likely had some impact on the Google Analytics data and thus the quantitative webmetrics results for Wave 5 may be less reliable than those obtained from prior waves. Key findings from both elements are highlighted below:

- There was an increase in the overall number of both unique and repeat visitors to Exchange websites in Wave 5 when compared to Wave 3 and Wave 4.

- As in prior waves, returning website users tend to revisit websites 3 to 8 times within a month suggesting websites are meeting user needs.

- The most frequently visited page types across Exchanges were events and webinar pages. These page types were notably more popular for unique and returning users than maps and tool pages or publications and research pages.

- The transition to the new website template was the most commonly reported website-related challenge among Fire Exchange representatives; however, it is hoped that the redesign will ultimately decrease some of the website maintenance burden on Exchange personnel.

- All Exchanges reported maintaining social media accounts. Many Exchange representatives have begun using different social media accounts for outreach to different audiences. Exchanges should continue to link social media accounts together and with their websites for maximum impact of online efforts.

- Many Exchange representatives expressed a desire for increased help interpreting social media metrics and outreach to target audiences using social media.

Implications

The last 5 waves of the national evaluation online survey data indicate that the Exchanges have made significant progress toward their shared goals as evidenced by significant improvements between responses collected early in Exchange establishment with responses from Exchanges in their fourth year. **These results indicate that Exchanges are enhancing perceptions of fire science and its use, increasing interactions among fire science professionals, are being seen as valuable additions to the fire science community, and are providing valuable and easily obtained translated fire science through their websites, social media accounts, and events.**

Wave 5 of data collection, in particular, was unique in that this wave included participants from a newly established Exchange as well as collected data during a time when many Exchanges were engaging in a website redesign. For these reasons, Wave 5 data may be less reliable than other waves. In terms of the online survey, although many responses to items were slightly lower this wave than in Wave 4, responses still remained on the positive end of the scale. Slightly lower scores were expected as the new Exchange has not yet established comprehensive programming in its region. Encouragingly however, responses were higher in Wave 5 than responses in Wave 1 and Wave 2 (waves including respondents from newly established Exchanges), suggesting that the new Exchange has been able to capitalize on the previous and continued efforts of existing Exchanges in the network. Additionally, the website redesign created some expected and unexpected challenges during transition as some websites were temporarily offline. The redesign project however, should help with user navigation and Exchange website maintenance moving forward. Future data collection should more easily elucidate the continued impact of Exchanges as well as the effectiveness of their websites.

As Exchanges have consistently met their goals for short-term outcomes, moving forward the national evaluation team is preparing to track medium and long-term outcomes across the evaluation components. Additionally, to address survey fatigue in future years the online evaluation survey has been significantly shortened. This shorter survey should be quicker to complete as it captures current and future outcome goals. Also, the evaluation team can now collect Google Analytic data, reducing Exchange personnel time on this component; however, the evaluation team still strongly suggests Exchanges look at their individual data to guide efforts in identifying and sharing the most popular and relevant fire science content.

Introduction

During the past several years, there has been an increasing emphasis on federally funded program accountability. Programs must clearly demonstrate the impacts of their efforts in order to secure future funding and support. This is often best accomplished through theory-driven evaluations examining multiple facets of program activities and outcomes. To this end, the national cluster evaluation of the Joint Fire Science Program (JFSP) Fire Science Exchange Network (Exchanges) employs a mixed-method approach grounded in the Logic Model to assess the processes and outcomes of activities. Because each Exchange is diverse and in varying stages of development, the present evaluation is conducted at the aggregate level to track progress toward Exchanges' shared goals related to the enhancement of fire science delivery. Results are intended to: 1) assist the JFSP Board in determining how to improve and further support Exchanges' performance and success; 2) provide feedback to Exchanges concerning progress toward their goals to help maximize the impacts of outreach and educational activities; and 3) facilitate Exchanges' development of JFSP best practices toward reaching shared goals.

The national cluster evaluation of the JFSP Exchanges contains four components:

1. An online survey targeting fire managers/practitioners, fire researchers/scientists, and members of the general public;
2. A webmetrics component that includes quantitative and qualitative data to evaluate the Exchanges' websites;
3. An evaluation resource guide to help Exchanges build capacity to conduct regional-scale evaluations (which was newly updated and will be distributed in 2016); and
4. Interviews conducted with Exchange personnel to capture the successes and challenges encountered in increasing the accessibility and applicability of fire science information.

This report focuses on the findings from the **fifth wave (Wave 5)** spring 2015 online survey and webmetrics components of the evaluation of the JFSP Exchange Network.

The report begins with an overview of the online survey evaluation of the Exchanges, which focuses primarily on respondents' perceptions and behaviors regarding fire science information accessibility and applicability. Findings from the spring 2015 survey are presented, followed by a new Longitudinal Comparison section. This new section describes results obtained by combining all five waves of survey data from which latent variables of survey items were constructed. Significance tests between data from beginning survey waves were compared with survey data obtained from respondents associated with Exchanges in their fourth year in order to determine if Exchanges were meeting their goals over time. Additionally, the current report includes a summary of results obtained from the qualitative and quantitative webmetrics components of the JFSP evaluation.

Online Survey Component

As with other national evaluation components, the online survey aims to enhance continued understanding of Exchanges' processes and impacts while striving toward shared goals. To achieve this understanding, new survey data must be collected at regular intervals. All Exchanges have the opportunity to administer the online survey each spring and are required to do so at least once every three years. Survey administration requirements and recommendations for each Exchange depend upon their individual funding and renewal schedule. Thus, data collected during each annual wave of survey distribution reflects a slightly different group of participating Exchanges.

Despite annual variations in Exchanges' participation, the overarching objective of the survey is to assess JFSP progress toward their goals *as a whole*. This section first reports the comprehensive results obtained from the spring 2015 online survey, which was administered by five of the JFSP Exchanges, one of which was newly funded. This analysis summarizes Exchange constituents' most current opinions and experiences regarding fire science delivery. Additionally, data from the last five waves of survey collection were combined and latent variables were constructed from survey items. Significance tests then were conducted to compare responses from Exchanges first and second years of funding with Exchanges in their fourth year of funding (see the Longitudinal Comparisons section).

Three frames of the online survey were developed in order to capture the perspectives and experiences of distinct audiences. The first targets *Consumers* of fire science information, or fire managers/practitioners, whereas the second targets *Producers* of fire science information, or fire researchers/scientists. The third frame is intended for members of the *General Public* which are essentially all other respondents who may be exposed to Exchange outreach or educational activities but do not identify as fire science professionals. When possible, items in the Consumer and Producer survey were constructed to be complementary or parallel. The General Public frame in particular differs from the other two frames; it focuses more on basic experiences and preferences regarding fire science information. Thus, following a description of the survey method and participants, this section presents specific results for each frame separately.

Method

Five Exchanges actively recruited participants for Wave 5 of the online survey. Each participating Exchange launched the survey between March 2015 and July 2015, at a time deemed most appropriate depending on an Exchange's stage of development, location and fire season. For recruitment purposes, participating Exchanges used "contact lists" developed by compiling existing email lists, contacts from prior needs assessments, and registrants at websites and various educational activities. To reach as many participants as possible, a "snowball" sampling strategy was used, whereby existing contacts were encouraged to forward the survey invitation to any other qualified or interested participants. University of Nevada,

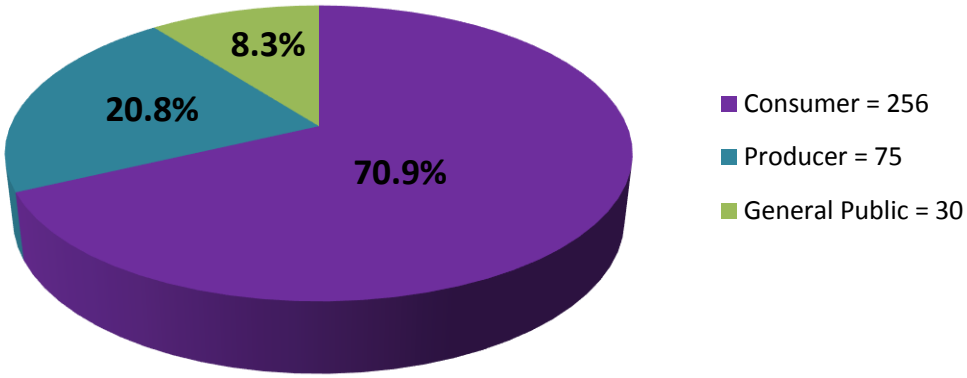
Reno Institutional Review Board certification was sought and obtained for all data collection activities described in this report.

Recruitment followed the Dillman method (Dillman, Smyth & Christian, 2009), which recommends that participants receive three separate invitations to participate in survey research: an initial recruitment notice, a follow-up reminder and a final reminder. All participating Exchanges forwarded these invitations via email (staggered across approximately six weeks, with two weeks between each distribution) to all those on their respective contact lists. Participants accessed the survey via the link included in all recruitment emails. Upon entering Survey Monkey (the online survey host site), participants were asked to select their primary identification (Consumers of fire science information, or managers/practitioners; Producers of fire science information, or researchers/scientists; or the General Public, encompassing landowners/community members not currently employed in a fire science profession). Based on these responses, participants were electronically directed to the appropriate survey frame. Participants subsequently responded to a variety of multiple choice items depending on survey frame. Upon completing the survey, participants were thanked and redirected to the JFSP website home page.

Participants

A total of 369 individuals accessed the spring 2015 online survey and agreed to participate, and 361 (97.8 percent) of these participants completed the entire survey.[1] Among those who began the survey, 70.9 percent (*N* = 256) identified themselves as Consumers of fire science information, 20.8 percent (*N* = 75) identified themselves as Producers of fire science information, and 8.3 percent (*N* = 30) identified themselves as the General Public/community members (see Figure 1).

Figure 1. Primary Identification of Survey Respondents



[1] The percentage of respondents who completed the entire survey is similar to that obtained in survey years 2011, 2012 and 2013. There were no noticeable patterns regarding attrition, with individuals discontinuing participation at various points throughout the survey. All responses up to the point of discontinuing the survey were included in analyses.

Five Exchanges actively recruited participants for the spring 2015 survey: Great Basin, North Atlantic, Northwest, Oak Woodlands, and Southern Rockies. Yet, many participants affiliated with other Exchanges responded to the survey due to the snowball sampling procedure and regional geographic overlap across Exchanges. As a result, all Exchanges had at least one member that participated in the 2015 online survey.

In the spring 2015 survey, participants were asked to identify the primary Exchange in which they worked or lived. Table 1 displays the frequencies of survey respondents per frame who self-identified with an Exchange affiliation. Consumer and Producer participants also were asked to identify any other Exchanges in which they worked. Approximately 18 percent of Consumer respondents and 60 percent of Producer respondents indicated that they worked in more than one Exchange.

Table 1. Number of Online Survey Respondents by Fire Science Exchange

Fire Exchanges	Consumer *N*	Producer *N*	Public *N*	Total *N*
Alaska	0	0	1	**1**
Appalachians	16	1	0	**17**
California	3	2	0	**5**
Great Basin	19	11	3	**33**
Great Plains	5	3	0	**8**
Lake States	0	4	0	**4**
North Atlantic	54	13	10	**77**
Northern Rockies	4	0	1	**5**
Northwest	23	9	5	**37**
Oak Woodlands	38	9	0	**47**
Pacific	1	0	0	**1**
Southern	4	3	1	**8**
Southern Rockies	20	5	3	**28**
Southwest	1	0	0	**1**
Tallgrass	4	1	1	**6**
National Level	1	4	0	**5**
Other	8	1	2	**11**

Note. These figures reflect the number of participants who completed the entire survey and explicitly identified their primary fire Exchange via a multiple choice survey item.

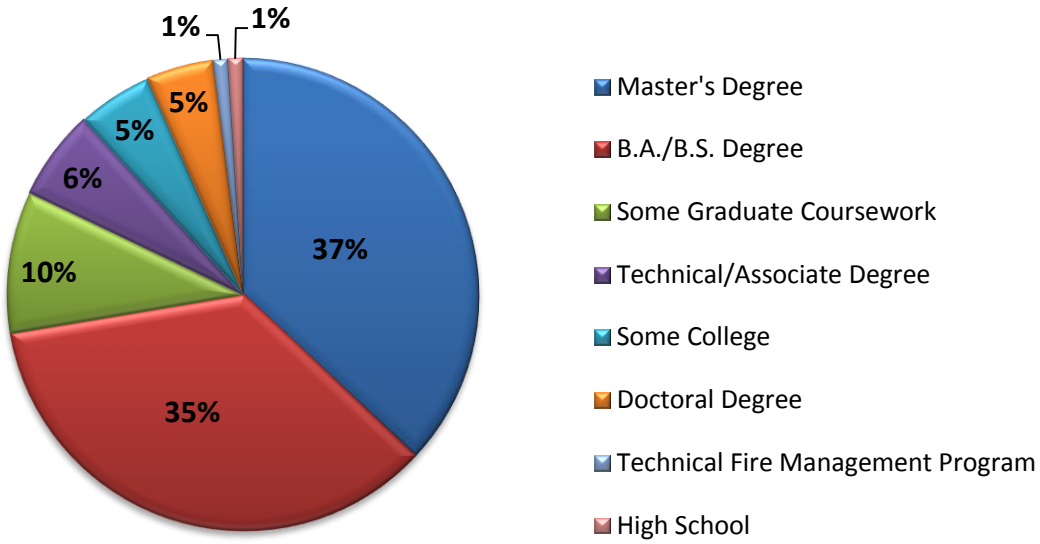
Consumer Survey Results

More than two-thirds (71 percent, *N* = 256) of total survey respondents identified as Consumers of fire science information, working as fire managers, practitioners or technical specialists. As with the other survey frames, Consumer question items targeted perceptions of Exchanges' progress toward shared goals as identified in the JFSP Logic Model (changes in awareness, knowledge, attitudes, motivations, behaviors and policy/practices).

Consumer Demographics

Consumer survey respondents were primarily male (69.4 percent) and Caucasian (93.6 percent). Additional reported ethnicities included "Other" (3.2 percent), Multi-Ethnic (1.6 percent), Hispanic/Latino (1.1 percent), and Asian/Pacific Islander (0.5 percent). The mean age of Consumer survey respondents was 46.2 years. Consumer respondents were experienced and well educated. Average reported length of time working as a fire practitioner/manager was 19.1 years, and the majority had earned a bachelor's or post-baccalaureate degree (see Figure 2).

Figure 2. Consumers' Educational Background



Similar to previous years, the majority of respondents described themselves as either natural resource specialists (40.5 percent) or fire managers/practitioners (28.7 percent) or "Other" (21.0 percent; see Figure 3). "Other" roles included a variety of managers, weather specialists, foresters, ecologists, biologists and other diverse specialists (including fuel, public relations, etc.). Most Consumers were affiliated with federal organizations (35.9 percent) or state agency/organizations (34.9 percent; see Figure 4).

Figure 3. Primary Role of Consumers

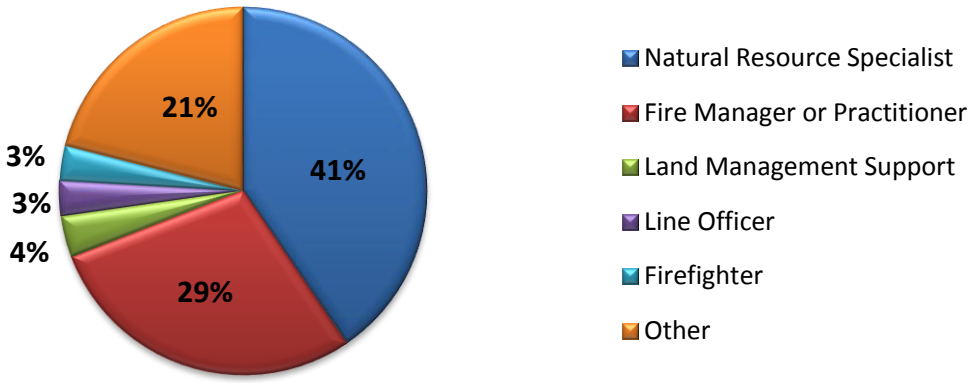
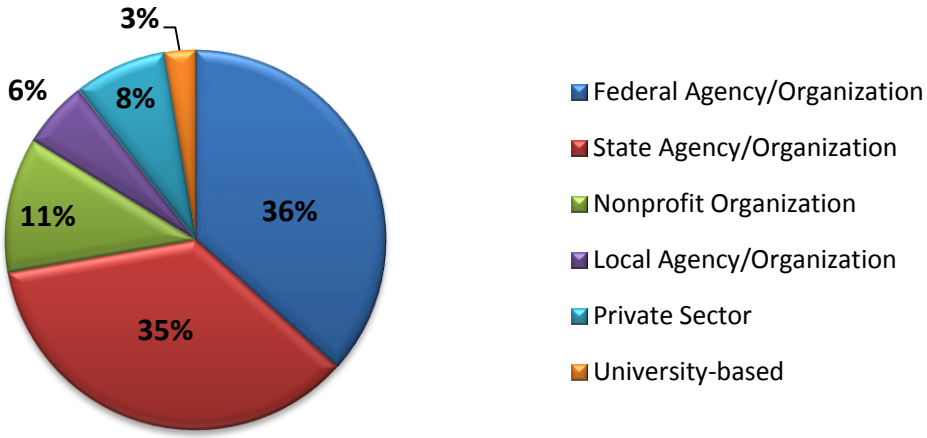


Figure 4. Affiliation of Consumers



Experiences with Fire Science Information and Information Producers

The first section of the Consumer survey instructed participants to indicate their level of agreement with 13 statements targeting their perceptions and experiences concerning fire science information and fire science Producers. In addition, this section included two categorical response items regarding collaboration between fire science Consumers and Producers.

Table 2 displays Consumers' mean responses to items targeting their basic experiences and opinions concerning fire science information. All mean responses occurred at the positive end of the scale, indicating relatively favorable evaluations of fire science information accessibility and applicability. Similar to previous years, Consumers expressed the strongest agreement with the statement, *Using fire science information enhances my effectiveness on the job*, and were least likely to agree with the statement *Fire science information is easy to apply to my specific*

problems, (although mean responses to this item still fell on the positive end of the scale). This is consistent with key issues highlighted by Exchange personnel in their needs assessments and funding proposals; namely, that Consumers face challenges in accessing fire science research results and tools relevant to their work and/or in translating and adapting extant fire science information for their own use.

Table 2. Consumer Perceptions and Experiences Regarding Fire Science Information Accessibility and Applicability

Item	Mean (SD)
Using fire science information enhances my effectiveness on the job	**4.11** (0.60)
Fire science information should be shared more frequently within my agency/organization	**4.06** (0.70)
I trust fire science research findings	**3.89** (0.66)
I often draw upon fire science research when making work-related decisions	**3.71** (0.81)
During the past year, I have changed at least one thing in my work based on what I've learned about fire science	**3.58** (0.82)
Fire science information is easy to find	**3.53** (0.80)
Fire science information is easy to understand	**3.47** (0.76)
Fire science information is easy to apply to my specific problems	**3.26** (0.83)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree.

Table 3 displays Consumers' mean responses to items targeting their perceptions and experiences concerning Producers of fire science information (fire science researchers/scientists). All responses to these items were at the positive end of the scale (with the exception of the negatively framed items), suggesting that Consumers have relatively favorable opinions of fire science information Producers and their work. All positively framed items in this section, however, were slightly lower than in previous survey waves. The negatively framed item, *Fire science researchers/scientists are reluctant to study problems and issues suggested by local managers/practitioners,* was slightly higher. These results highlight for participating Exchanges a need to target increasing interactions among Consumers and Producers, and may reflect the inclusion of data from a newly established Exchange not yet impacting the region.

Table 3. Consumer Perceptions and Experiences Regarding Producers

Item	Mean (SD)
Fire science researchers/scientists are easy to approach	**3.50** (0.77)
Fire science researchers/scientists value my knowledge and experience as a field professional	**3.39** (0.80)
Fire science researchers/scientists are willing to directly work with me if I have questions about research or how to apply fire science at my job	**3.39** (0.74)
Fire science researchers/scientists are reluctant to study problems and issues suggested by local managers/practitioners*	**2.76** (0.85)
Fire science researchers/scientists rarely provide information that helps me address the management problems I face*	**2.52** (0.84)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree. *Indicates the items were negatively framed (thus lower mean values on these items indicate more positive perceptions and experiences regarding fire science information producers).

Table 4 displays the frequency of responses to the two categorical items regarding Consumers and Producers working together. Less than half of all Consumer respondents (42.5 percent) reported that they had worked with fire researchers/scientists on a research or management project, and most Consumers (73.3 percent) said they would like to work with or continue working with Producers.

Table 4. Consumer Perceptions and Experiences Regarding Working with Producers

Item	Yes	No	Unsure
Have you worked jointly with fire researchers/scientists on a research or management project?	**42.5%**	**54.8%**	**N/A**
Would you like to work/continue to work with fire researchers/scientists on a research or management project?	**73.3%**	**1.4%**	**25.3%**

Items Regarding Fire Science Exchange Efforts

Due to the varying developmental stages of the Exchanges, it was expected that some respondents would be unfamiliar with their Exchange and its regional fire science activities and outreach efforts. Thus, prior to receiving any survey items explicitly referencing Exchanges, respondents were asked whether they were aware of a fire science and delivery Exchange in their region supported by the Joint Fire Science Program. Most were aware of their regional

Exchange (85.3 percent) and were subsequently asked to respond to seven items regarding their opinions and experiences about their Exchange. The remaining 14.7 percent of respondents who indicated that they were unaware of their regional Exchange skipped these items and continued on to the next portion of the survey. This is the same percentage of respondents who skipped these items in Wave 4.

As shown in Table 5, all mean responses fell at the positive end of the scale. As with previous waves, respondents indicated the highest level of agreement with the statement that *The Exchange is needed to help coordinate sharing of fire science information in my region*. Additionally, respondents were least likely to agree with the statement, *The Fire Exchange has helped improve policy regarding fire management in my region*. Thus, data indicate that Exchanges are meeting their short term outcomes of increasing awareness and knowledge of fire science as outlined by the overarching national JFSP Logic Model. As Exchanges continue to mature and exert influence, however, they may focus efforts on medium to long term outcomes to achieve translational fire science objectives in their regions, potentially resulting in policy shifts and visible changes on the ground.

Table 5. Consumer Opinions and Experiences Regarding their Regional Exchange

Item	Mean (SD)
The Fire Exchange is needed to help coordinate sharing of fire science information in my region	**4.30** (0.71)
I would recommend Fire Exchange involvement to my co-workers.	**4.09** (0.70)
The Fire Exchange has helped improve the accessibility of fire science information in my region	**4.07** (0.76)
The Fire Exchange has helped improve the use and application of fire science information in my region	**3.79** (0.80)
The Fire Exchange has helped improve communication among fire managers/practitioners and fire researchers/scientists in my region	**3.62** (0.80)
The Fire Exchange has made it easier for my agency/organization to accomplish its goals	**3.29** (0.73)
The Fire Exchange has helped improve policy regarding fire management in my region	**3.15** (0.73)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree.

Evaluation of Fire Science Exchange Websites

A review of initial and renewal funded proposals reveals that all JFSP Exchanges aim to establish and continuously improve their individual websites. The purposes and effectiveness of the Exchange websites are further discussed in the Webmetrics section of this report. As these websites are integral to enhancing fire science delivery, Consumers' experiences and opinions regarding their Exchange websites is assessed using six multiple choice items and one open-ended response item in the online survey.

Prior to receiving any website-related items, Consumers were asked if they had visited their Exchange's website. Almost three-quarters (74.6 percent) indicated that they had visited the website; only these respondents were questioned further about the website. The remaining 25.4 percent of respondents did not receive any other items about the Exchange website and were electronically redirected to the next portion of the survey.

Respondents indicating that they had visited their Exchange's website were next asked to respond to five question items. Mean responses to these items indicate that users were satisfied with website content, with most agreeing that their website provided a variety of current and practical information (see Table 6).

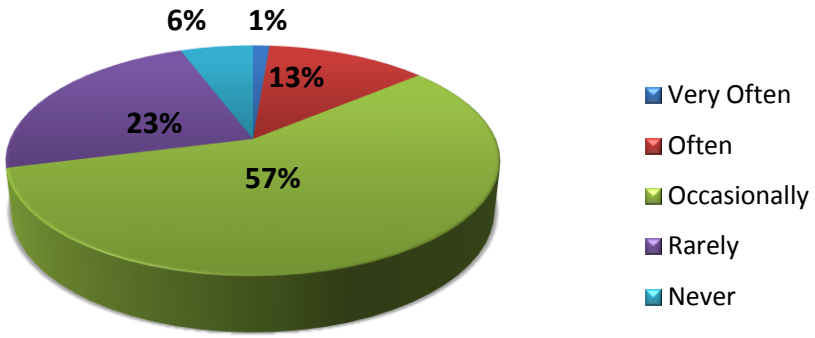
Table 6. Consumer Responses Regarding their Exchange's Website

Item	Mean (SD)
My Exchange's website provides information that is current and up-to-date	**3.90** (0.65)
My Exchange's website provides a wide variety of fire science information	**3.81** (0.66)
My Exchange's website is user-friendly	**3.78** (0.64)
My Exchange's website provides practical information I can use in my job	**3.77** (0.67)
My Exchange's website organizes the information I need in one convenient place	**3.55** (0.75)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree

Users also were asked to indicate how often they used information obtained from their Exchange's website in their job during the past year. Results suggest that most respondents applied such information on the job *Occasionally* (*M* = 2.81, *SD* = .78; see Figure 5 for response frequencies). These data, however, may have been influenced by the website redesign project that put some websites offline or in a limited capacity state during reconstruction this past year. It is expected that ratings to this questions will increase after all websites have been fully established.

Figure 5. Frequency of Exchange Website Information Use by Consumers on the Job



Qualitative Consumer Responses Concerning Exchange Websites

After responding to the closed-ended items about their Exchange's website, Consumers had the opportunity to provide suggestions, thoughts about website features or organization, or other experiences with the website. A total of 34 Consumers responded.[2] Overall, comments reflected the various stages of Exchanges' website development/redesign. A sample of respondents direct quotes are listed below:

- **Positive Comments.** Some respondents expressed an appreciation for their Exchange's website.

    1. General positive comments:

        - "The website is well designed, easy to read, and provides well-organized information and resources."

        - "The website is fantastic. A great look, always up-to-date, easy to navigate, lots of useful information and data, educational videos, and a well-curated Twitter feed."

- **Website Improvement Suggestions**. Some respondents requested specific types of information be added whereas others expressed a desire for organizational or content changes.

[2] A thorough analysis of all commentary provided is beyond the scope of this report; however, a complete text of all open-ended comments offered here and elsewhere in the report is available upon request.

1. Examples of specific information requests:

    - "While I know we do have a ton of WUI there are a lot of other facets of our roles as fire/fuels managers that I find myself going to other region websites to search for info on. While there are similarities in the regions there are also significant differences and applying data from one veg type to another can lead to faulty inferences."

    - "It seems that a lot of the information shared within my region is for more southern areas, where my area is a bit different than what the conditions described in most studies. I would like to see more studies on reducing grass dominance with fire timing in the summer or fall, nearly everything is about the trees."

2. Improving communication between groups:

    - "There isn't a lot of research in Fire science and fire behavior or at least in Canada … Fire behavior needs to be more documented, and there needs to be a greater exchange between countries...I have no knowledge of the Fire behavior system used in the USA and I should. I think your group is an important step in the right direction in re-developing and experimenting with fire behavior documentation and making sure it is talked about with a wider range of un-experienced public."

    - "Connect with the land managers and fire folks that are doing real field implantation ask want they are doing and think… not just text books."

    - "More interaction between JFSP and the state prescribed fire council, perhaps even an ex-officio member on the steering committees, etc."

3. Website content recommendations:

    - "Would like to have a ftp site [a document sharing and storage site] in order to share [data between organizations and scientists] for research: cost, fire, weather data, human resources, etc..."

    - "[I would appreciate] a quick reliable, clear way of asking a question that keys in specific keywords that directs me to relevant research to help with management questions pertaining to fire behavior, fire management, and fire ecology."

4. Webinar specific:

    - "I wish [Exchange] websites would list webinars from all relevant sources. Or maybe this would be better for the main JFSP website. But still, unless I put

all the webinars on my own calendar, I can't easily find webinar announcements from all the great efforts (Exchange, IAWF, etc.)."

- "In the past few months they have repeatedly posted links for webinars, etc. and then changed them without notifying users. They seem to mostly recycle other content and not have too much original work."

- "I have tried to share webinar links with others, but then the site changes the links and they do not work. It is nice to have a site, but once you put out a link for a webinar, do not change it!"

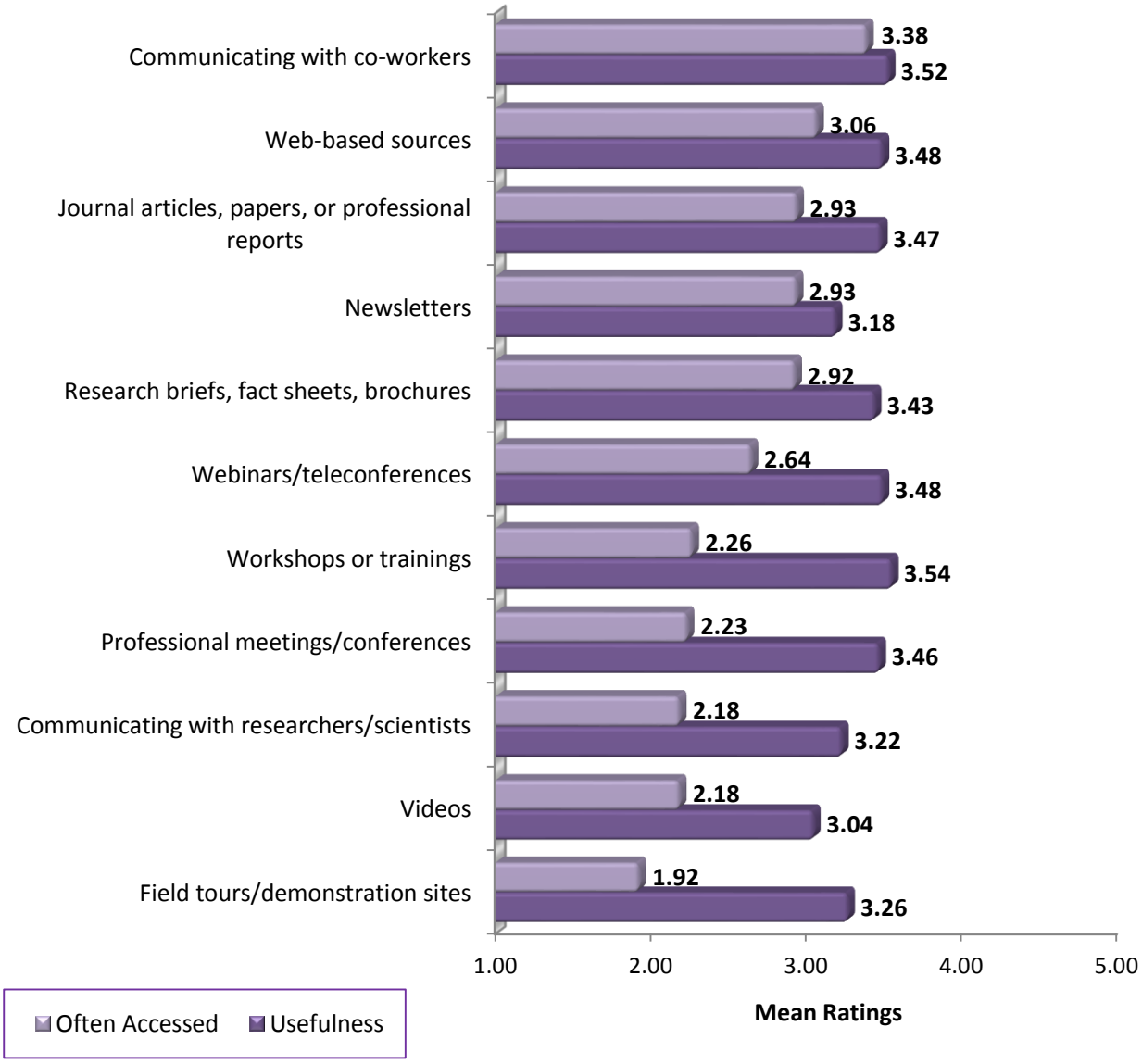
Although comments come from a limited sample and may or may not represent majority views, common themes nonetheless indicate areas for Exchanges' consideration.

Experiences with Fire Science Information Communication Sources

The JFSP Exchanges have proposed and implemented many strategies for disseminating current and practical fire science information to Consumers. Accordingly, the online survey examined Consumers' basic experiences with 11 common communication sources of fire science information. Consumers were first asked to indicate how often they had *accessed* information from each source during the last year. Next, Consumers were asked to rate the *usefulness* of the information they had accessed from each source. Because participants had not access all sources, sample sizes for usefulness varied, ranging from 145 (*field tours and demonstration sites*) to 187 (*research briefs, fact sheets and brochures*). Responses may help focus Exchanges' efforts toward disseminating fire science information via preferred (useful and accessed) communication sources.

Figure 6 displays Consumers' mean responses to items assessing perceived usefulness of fire science information obtained from common communication sources and the frequency with which respondents accessed information via these sources, ranking responses by how often each is accessed. The top two most frequently reported accessed communication sources were *communicating with co-workers* and *web-based sources*. Whereas, the top rated useful communication sources were *workshops or trainings* and *communicating with co-workers*. Some communication sources varied in terms of their perceived usefulness versus how often they were actually accessed. For example, newsletters were rated as often accessed but they were not rated very high for usefulness (second to last).

Figure 6. Fire Science Information Communication Sources: Mean Ratings of How Often Accessed and Usefuleness



Note. A 5-point Likert scale was used. Often Accessed scale rated responses where 1 = Never and 5 = Very Often. Usefulness scale rated responses where 1 = Not Useful and 5 = Very Useful. Because some Consumers had little or no experience with some of these information sources (had never accessed during the past year), not all respondents provided usefulness ratings.

Consumer Perceptions of Obstacles to Accessing and Applying Fire Science Information

In the final section of the Consumer survey, respondents were asked about their perceptions of obstacles to the accessibility and application of fire science information in their region. Responses to the obstacles items were more neutral than responses to any other item set in the survey and do not indicate any strong deficiencies in programming (see Table 8). This wave, consumers rated *Lack of communication between agencies and organizations in my region decreases the accessibility of fire science information* and *I have few opportunities to communicate with fire scientists/researchers* as the top obstacles to accessing and applying fire science information.

Table 8. Obstacles Consumers Face in Accessing Relevant Fire Science Information

Obstacle	Mean (SD)
Lack of communication *between* agencies and organizations in my region decreases the accessibility of fire science information	**3.18** (1.05)
I have few opportunities to communicate with fire scientists/researchers	**3.10** (1.05)
Lack of communication *within* agencies and organizations in my region decreases the accessibility of fire science information	**3.07** (1.02)
Fire science information is not available in one convenient place	**2.94** (0.94)
Available fire science information and/or research results are difficult to apply in the field	**2.90** (0.93)
Available fire science information and/or research results are not presented in a way that managers/practitioners can easily digest and understand	**2.82** (0.92)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree.

Producer Survey Results

A total of 75 respondents (20.8 percent of the entire sample) self-identified as fire science researchers/scientists. The Producer survey frame is shorter than the Consumer survey frame, primarily targeting perspectives and behaviors regarding the dissemination of fire science research results as well as attitudes toward Consumers.

Producer Demographics

Producer respondents were mostly male (76.2 percent) and Caucasian (96.8 percent), followed by Asian/Pacific Islander (3.2 percent). The mean age of Producers was 44.6 years and they had worked as researchers/scientists for an average of 16.2 years.

All respondents completing the Producer survey had earned a college degree. Over half (57.6 percent) held a doctoral or professional degree, and almost one-third (31.8 percent) held a master's degree (see Figure 7). Though most Producers strictly identified themselves as fire science researcher/scientists (75.8 percent), some were student scientists/researchers (12.1 percent), natural resource managers/specialists (6.1 percent), or indicated more specialized roles including weather, educator, and research land management support; 6.0 percent; see Figure 8). Producers most commonly worked for a university-based organization (50.0 percent), followed by a federal agency/organization (33.3 percent; see Figure 9).

Figure 7. Educational Background of Producers

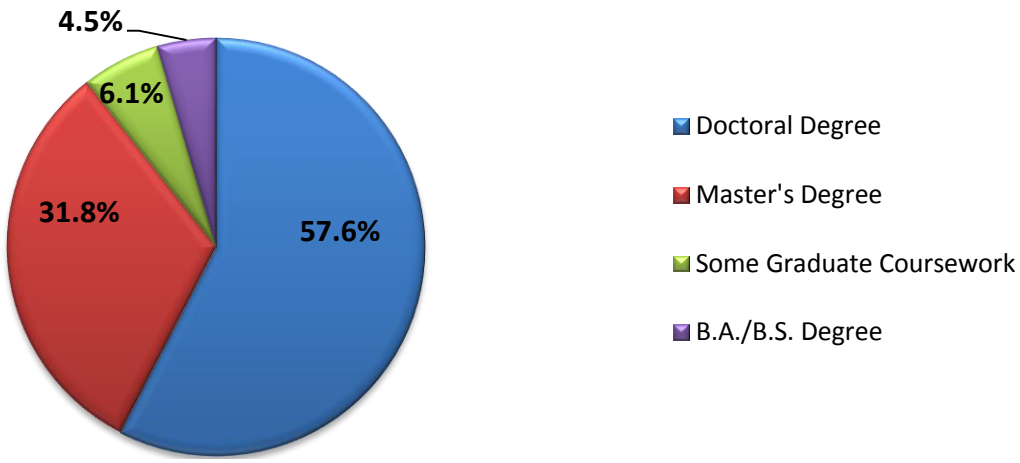


Figure 8. Primary Role of Producers

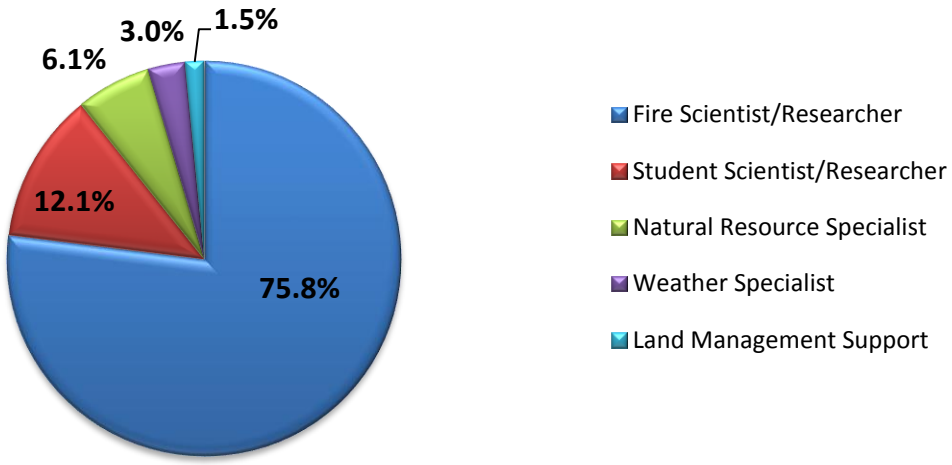
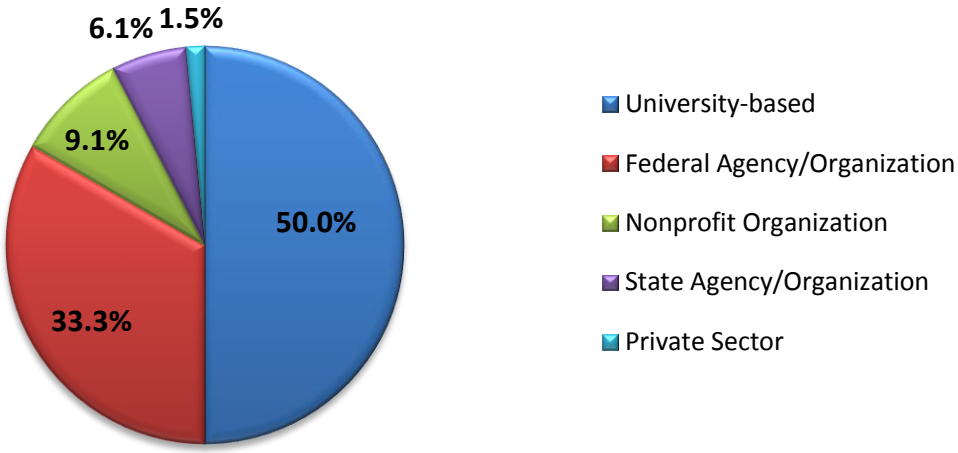


Figure 9. Affiliations of Producers



Producers Research Practices and Experiences with Consumers

Producers were first asked to complete a series of 11 items concerning their experiences with fire science information and Consumers of fire science information. Mean responses to the first nine items are displayed in Table 9. Overall, Producers expressed favorable attitudes toward fire managers/practitioners and research endeavors targeting this population; similar to previous years, most Producers strongly agreed that, *Interacting with managers/practitioners enhances my effectiveness on the job* (57.4 percent). They also strongly preferred applied research over theoretical research.

Present results indicate that both Producers and Consumers have favorable perceptions of one another. There were some slight differences, however, between Producer and Consumer responses to parallel survey items. For instance, Producers' agreement with the statement,

Managers/practitioners value my knowledge and experience as a fire scientist (*M* = 3.90, *SD* = .66.) was slightly higher than Consumers' agreement with the statement, *Researchers/scientists value my knowledge and experience as a field professional* (*M* = 3.39, *SD* = .80). Though Consumers considered Producers to be approachable (*M* = 3.50, *SD* = .77), Producers rated *themselves* as even more approachable (*M* = 4.29, *SD* = .60). Less than half (42.5 percent) of Consumers reported working with a researcher/scientist on a research or management project, whereas the majority of Producers (85.5 percent) reported working with managers/practitioners on such a project (see Table 10). The discrepancy between Producers working with Consumers versus Consumers working with Producers may be driving these findings. It is possible that Producers become involved with JFSP Exchanges because of their interest in translating research into practical application. Most Consumers are involved with JFSP Exchanges for translated fire science for practical application but not necessarily to engage the research process. Although data do not clarify the reason for differences between Consumer and Producer ratings, they do indicate a continued need for Exchanges to facilitate interactions between Consumers and Producers. Exchanges may want to continue to engage Consumers in helping to define and direct research topics that can be communicated to Producers.

Table 9. Producer Research Practices and Experiences with Consumers

Item	Mean (SD)
Interacting with managers/practitioners enhances my effectiveness on the job	**4.56** (0.53)
Through my role as a researcher/scientist, I hope to improve how managers/practitioners make work-related decisions	**4.52** (0.58)
I make an effort to present information to managers/practitioners in a way that is easy to understand	**4.49** (0.69)
I consider myself approachable to managers/practitioners	**4.29** (0.60)
I often present or publish fire science information for manager/practitioner audiences	**3.91** (0.86)
Managers/practitioners value my knowledge and experience as a fire scientist	**3.90** (0.66)
I believe that managers/practitioners trust fire science research findings	**3.62** (0.73)
I am sometimes hesitant to study problems and issues suggested by local managers/practitioners*	**2.23** (0.83)
I prefer that my research be focused on theoretical issues, rather than on applied management problems*	**1.94** (0.66)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree. *Indicates items were negatively framed (thus lower mean values on these items indicate more positive perceptions and experiences regarding fire science information consumers).

Table 10. Producer Perceptions and Experiences Regarding Working with Consumers

Item	Yes	No	Unsure
Have you worked jointly with fire managers/practitioners on a research or management project?	**85.5%**	**14.5%**	**N/A**
Would you like to work/continue working with fire managers/practitioners on a research or management project?	**94.2%**	**0%**	**5.8%**

Items Regarding Fire Science Exchange Efforts

As with Consumers, it was anticipated that some Producers would be unfamiliar with their regional Exchange at the time of survey distribution, and thus not equipped to respond to fire Exchange-specific items. Accordingly, Producers were first asked if they were aware of a fire science and delivery Exchange supported by the JFSP in their region prior to receiving any items referencing the JFSP Exchanges. Twelve respondents (17.6 percent) indicated that they were *not* aware of their regional Exchange; these respondents were electronically redirected to the next portion of the survey. The remaining respondents (82.4 percent) then were asked to respond to seven questions regarding their Exchange's efforts.

The Exchange-specific items included in the Producer frame were identical to those in the Consumer frame. Mean responses were relatively positive and very similar to those obtained from Consumers. The majority of Producers agreed that the Exchange was needed and would recommend involvement to their co-workers, but were less certain regarding the effects of their Exchange's activities on regional fire management policy (see Table 11).

Table 11. Producer Responses Regarding their Regional Exchange

Item	Mean (SD)
I would recommend Exchange involvement to my co-workers	**4.30** (0.71)
The Exchange is needed to help coordinate sharing of fire science information in my region	**4.27** (0.70)
The Exchange has helped improve the accessibility of fire science information	**4.11** (0.78)
The Exchange has helped improve communication among fire managers/practitioners and fire researchers/scientists in my region	**3.88** (0.79)
The Exchange has helped improve the use and application of fire science in my region	**3.77** (0.83)
The Exchange has made it easier for my agency/organization to accomplish its goals	**3.65** (0.89)
The Exchange has helped improve policy regarding fire management in my region	**3.09** (0.72)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree

Perceptions of Fire Science Exchange Websites

Producers (81.8 percent) indicated that they had visited their Exchange's website. Some of the items Producers received were identical to those included in the Consumer survey frame (My Exchange's website is user-friendly), whereas some differed according to the specific needs of Producers (My Exchange's website helps keep me informed of current research findings and My Exchange's website provides a way for me to share my research products or fire science delivery activities).

Producers' mean responses to these website-specific items are displayed in Table 12. Reported opinions and experiences regarding Exchange websites were positive, with Producers particularly likely to agree that their Exchange's website is user friendly and provides a wide variety of fire science information.

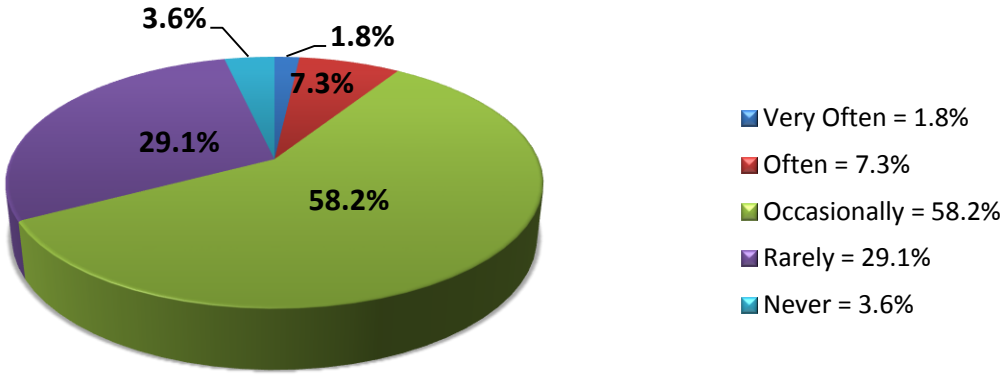
Table 12. Producers' Opinions and Experiences Regarding their Exchange's Website

Item	Mean (SD)
My Exchange's website provides a wide variety of fire science information	**3.77** (0.78)
My Exchange's website is user-friendly	**3.70** (0.75)
My Exchange's website helps keep me informed of current research findings	**3.61** (0.83)
My Exchange's website provides a way for me to share my research products or fire science delivery activities	**3.66** (0.85)
My Exchange's website organizes fire science information and other useful tools in one convenient place	**3.58** (0.80)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree.

The majority of Producers reported that they *Occasionally* (58.2 percent) used information obtained from their Exchange's website in their job during the past year (see Figure 10). Less than 10 percent reported using information obtained from their Exchanges' website *Often* or *Very Often* on the job.

Figure 10. Frequency of Website Information Use by Producers on the Job



Qualitative Producer Responses Concerning Exchange Websites

After responding to the closed-ended items about their Exchange's website, Producers had the opportunity to provide suggestions, thoughts about website features or organization, or other experiences with the website. A total of 9 Producers responded.[3] Their comments primarily offered suggestions for website improvements.

[3] A thorough analysis of all commentary provided is beyond the scope of this report; however, a complete text of all open-ended comments offered here and elsewhere in the report is available upon request.

- **Direct Quotes.**

    1. General approval of Exchange websites:

        - "Good updates on conferences and webinars."
        - "It's great."

    2. Suggestions for website improvements:

        - "Need more contributors to the site in order to participate in an active exchange of ideas."
        - "More primary content - there are several briefs (and similar documents), but less current research. Other Exchanges [sic] push new research..."
        - "Difficult to navigate to some of the tools."
        - "In my opinion, promotion of this resource is minimal and it rarely reaches target outside the choir."

Producer Perceptions of Obstacles to Fire Science Information Dissemination and Application

Producer items regarding obstacles were similar to those included in the Consumer survey, with the exception of *Managers/practitioners seem unreceptive or disinterested in current fire science research and information* (see Table 13 for Producer mean responses). Both Producers and Consumers identified the same top obstacle: *lack of communication between agencies/organizations*. Consumers, however, rated *I have few opportunities to communicate with fire scientists/researchers* as their second highest rated obstacle, whereas Producers rated the corresponding item *Fire scientists/researchers have few opportunities to communicate with managers/practitioners* second to last. This finding highlights discrepancies between perspectives of Consumers and Producers in terms of cross-communication opportunities. The comparatively larger number of Consumers than Producers in the fire science community may drive this finding. Although Exchanges cannot impact the imbalance of different types of fire science professionals, Exchanges may want to strategize ways to increase opportunities for Consumers to have more direct access to Producers via professional meetings/conferences, workshops, or through interactive website/social media platforms.

Producers were more likely to rate the question, *Available fire science information and/or research results are not presented in a way that managers/practitioners can easily digest and understand* (M = 3.33, SD =.77) as an obstacle than Consumers who rated this as the lowest obstacle (M = 2.82, SD =.92). This finding may indicate that Producers are underestimating Consumers' understanding of fire science information and that other factors such as perceived relevance of research may be contributing to Consumers' willingness to incorporate fire science research on the job. Exchanges should look at conducting regional evaluations to disentangle to what extent Consumers feel their research needs are being addressed by Producers.

Table 13. Producer Perceptions of Obstacles to the Dissemination or Application of Fire Science Information

Obstacle	Mean (SD)
Lack of communication *between* agencies and organizations in my region decreases the accessibility of fire science information	**3.29** (.95)
Lack of communication *within* agencies and organizations in my region decreases the accessibility of fire science information	**3.17** (0.89)
Available fire science information and/or research results are not presented in a way that managers/practitioners can easily digest and understand	**3.33** (0.77)
Fire science information is not available in one convenient place	**3.29** (1.09)
Available fire science information and/or research results are difficult to apply in the field	**2.88** (0.90)
Fire scientists/researchers have few opportunities to communicate with managers/practitioners	**2.70** (0.91)
Managers/practitioners seem unreceptive or disinterested in current fire science research and information	**2.56** (0.98)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree.

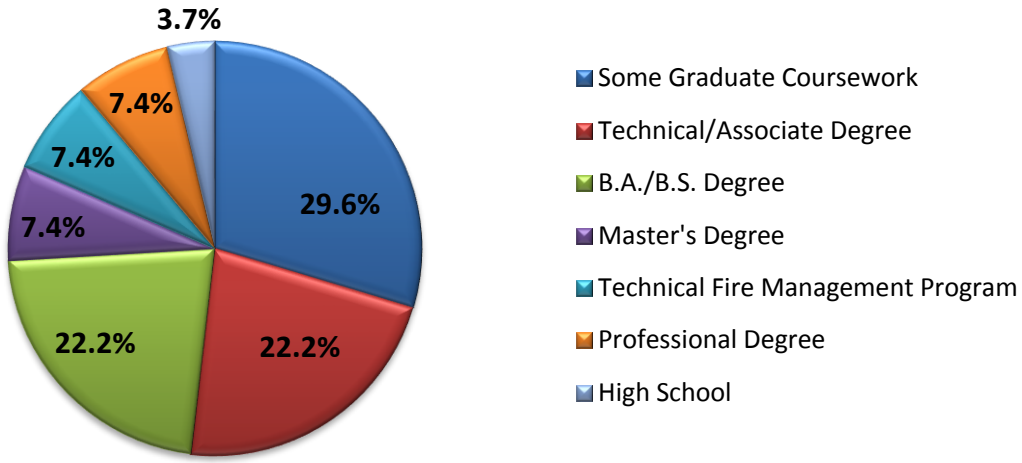
General Public Survey Results

Only a few Exchanges target the General Public as an audience for increasing fire science information accessibility and applicability. Consequently, the General Public survey is the smallest of the three frames, both in number of respondents (*N* = 30) and in scope. The General Public survey frame contains two main item sections: one focusing on experiences with fire science information, and the other assessing perceptions and experiences concerning various sources of fire science information.

General Public Demographics

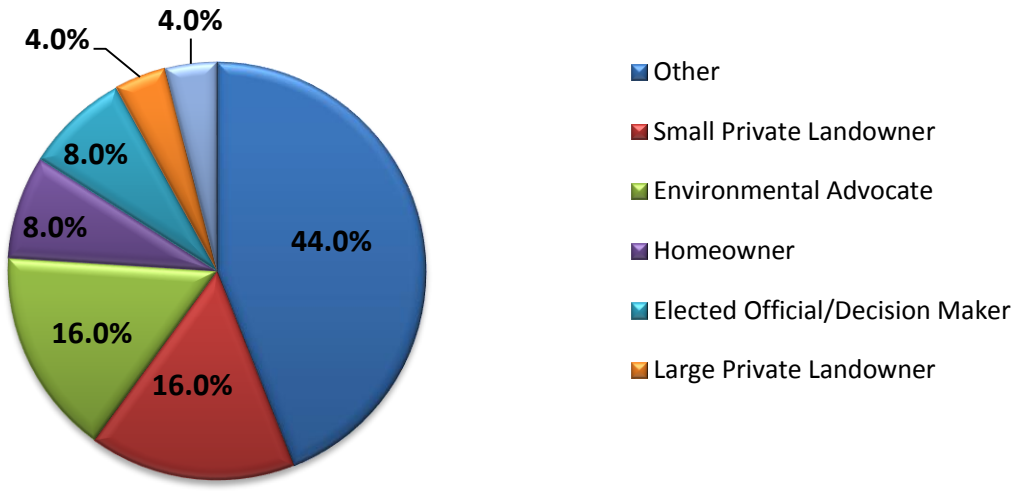
More than a half (69.2 percent) of General Public respondents were male. The average age of respondents in this frame was 58.26 years. Most were Caucasian (92.6 percent), followed by Multi-ethnic (3.7 percent) or "Other" (3.7 percent). A little more than one-fourth (29.6 percent) had completed some graduate coursework, 22.2 percent held a bachelor's degree, and 22.2 percent held a technical/associates degree (see Figure 11).

Figure 11. Educational Background of General Public



Respondents indicated a wide variety of roles, demonstrating the diverse nature of the General Public survey sample (see Figure 12). The most common role indicated was "Other" (44.0 percent), followed by small private landowner (16.0 percent) and environmental advocate (16.0 percent). Those indicating "Other" identified themselves as consultants, community organizers, Land Trust managers, students, or retired from a fire science-related field. All respondents generally indicated significant involvement with fire science-related issues.

Figure 12. Primary Role of General Public



General Public Experiences with Fire Science Information

General Public respondents were first asked to respond to a series of 13 items concerning their experiences with fire science information, which targeted beliefs, opinions, and behaviors regarding fire science information at a broad level. Mean responses to the first series of items are displayed in Table 14. Current findings indicate increasing awareness of fire science/management issues and that General Public respondents are discussing and sharing fire science with others. Also, General Public respondents were likely to report finding fire science useful and trustworthy, as well as indicate an interested in learning about fire science and fire management issues.

General Public respondents were least likely to endorse the statement, *Fire science information is easy to find* (though mean responses still fell at the positive end of the scale). This suggests that Exchanges should continue efforts to increase awareness of convenient methods of obtaining fire science information among targeted General Public groups (such as private landowners). Continued development and promotion of the Exchange websites should help enhance the General Public's access to fire science information, particularly if the websites are user-friendly. Exchanges targeting members of the General Public without web access may need to consider alternate strategies to facilitate ease of accessing fire science information.

Table 14. General Public Experiences with Fire Science Information and Fire Management Issues

Item	Mean (SD)
My awareness of fire science/fire management issues has increased during the past year	**4.15** (0.72)
I have shared or discussed information that I have learned about fire science with others	**4.11** (0.57)
Overall, the fire science information available to me has been useful	**4.04** (0.81)
The fire science information I have received seems trustworthy and credible	**4.00** (0.48)
I am interested in learning more about fire science/fire management issues	**4.00** (1.07)
I plan to use what I've learned about fire science to protect my home/land/community	**3.96** (1.01)
I have changed one or more of my behaviors as a result of what I have learned about fire science	**3.93** (0.87)
Fire science information is relevant to my needs	**3.92** (0.85)
I am concerned about fire danger in my community	**3.81** (1.27)
I am concerned about the effects of fire on my environment	**3.63** (1.39)
Educational materials about fire science (fact sheets, videos and web-based) are easy to understand	**3.63** (0.79)
Fire science information is easy to find	**3.38** (0.90)
I'm unsure of where to go or who to contact if I have questions about fire science or fire management issues*	**2.22** (1.01)

Note. A 5-point Likert scale was used where 1 = Strongly Disagree and 5 = Strongly Agree. *Indicates the item was negatively framed (thus lower mean values indicate *more* certainty about where to go/who to contact regarding fire science/management issues).

General Public Experiences with Fire Science Information Communication Sources

Like Consumers, General Public respondents completed a series of items about their experiences with a variety of fire science information communication sources. Specifically, they were asked to indicate the frequency with which they accessed information from seven different communication sources during the past year. In addition, they were asked to rate the usefulness of information they had received from each communication source.

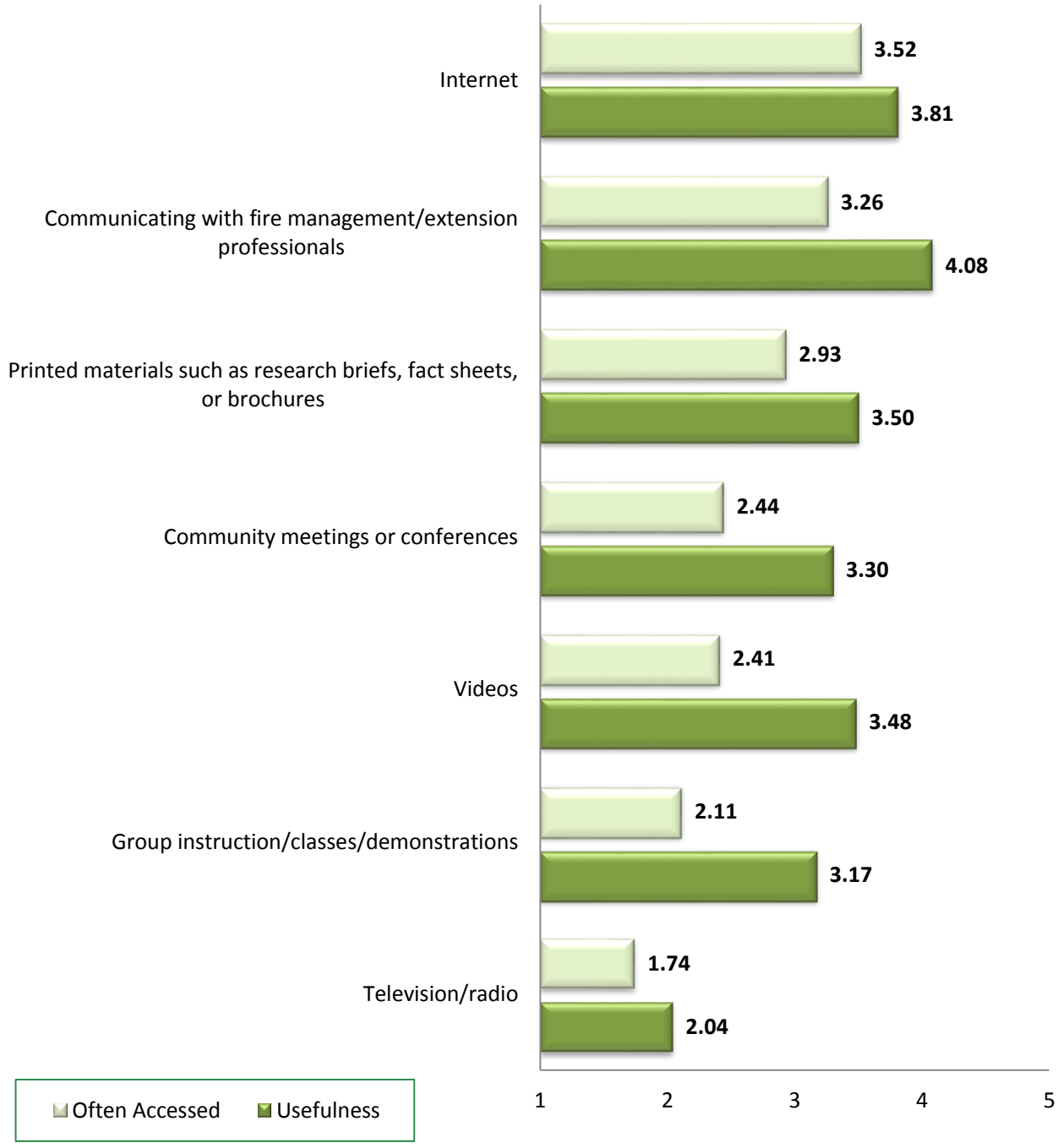
General Public mean responses to these items are depicted in Figure 13. The sources rated as most useful were often, but not always, among the most frequently accessed. For instance, the General Public respondents rated *Communicating with fire management/extension professionals* as the most useful source of fire science information but most often accessed the

Internet. Thus, like Consumers and Producers, it appears that the General Public respondents benefit from interacting with fire science professionals.

The *Internet* was the most frequently accessed source, and was rated as the second most useful source of fire science information. A follow-up survey question asked General Public respondents whether the fire science information they received from web-based sources was current and up to date. Most respondents agreed (66.7 percent) or strongly agreed (14.8 percent) that the information accessed from web-based sources was current; only 3.7 percent indicated they had not accessed fire science information from a web-based source.

Taken together, these findings highlight the importance of Exchange websites in enhancing fire science delivery among members of this diverse group. As the vast majority of General Public respondents reported using the internet to obtain fire science information, promoting websites (and, for those Exchanges targeting the General Public, offering relevant information and resources) are conducive to increasing fire science information accessibility and application. Exchanges also should consider additional ways to include the General Public in Exchange events to improve communication and connection with fire science professionals.

Figure 13. Fire Science Information Communication Sources: Mean Rating of How Often Accessed and Usefulness



Note. A 5-point Likert scale was used. Often Accessed scale rated responses where 1 = Never and 5 = Very Often. Usefulness scale rated responses where 1 = Not Useful and 5 = Very Useful. Because some Consumers had little or no experience with some of these information sources (had never accessed during the past year), not all respondents provided usefulness ratings.

Longitudinal Comparisons

The following section presents analyses conducted to explore Exchange impacts on fire science information and delivery, over time. Online survey data from all waves of the survey were first aggregated and then categorized in order to differentiate responses from respondents affiliated with Exchanges in their *first year*, respondents affiliated with Exchanges in their *second year*, and respondents affiliated with Exchanges in their *fourth year*. This categorization of responses accounted for the significant time lapse between the establishment of the eight "original" JFSP Exchanges and the subsequently funded six Exchanges. As North Atlantic (the newest Exchange) has administered the online survey only once, respondents from this Exchange were excluded from analyses. Additionally, as many new items were added to the survey in the second year, some comparisons had to be conducted between respondents from Exchanges in their second year with respondents from Exchanges in their fourth year of establishment.

Before responses to items from different years of Exchange establishment could be compared however, Principal Components Analyses (PCA) were run on individual items from all years to determine if they met criteria to be combined into latent variables. In PCA, all sources of variability (unique, shared, and error variability) are analyzed for each observed item and is the preferred method of exploring the underlying structure of a set of items (Mertler & Vannatta, 2010). Using PCA to create latent variables helps to decrease redundancy in the data as well as identify how different items work together to more fully explain the same phenomenon. Most items within the same subsection in the online survey met the criteria to be combined into latent variables based on that subsection. Once latent variables were formed, significance of means tests were conducted to determine if responses significantly changed between early Exchange establishment (e.g., year one or year two) and Exchanges at year four.

Consumer Results

Four latent variables were formed based on Consumer responses. Two of these latent variables were compared between year one and year four. Two latent variables formed from items available after year two and were compared between year two and year four. The details of latent variable construction and results of comparison of means tests are outlined below.

Latent Variable Creation: Principal Components Analysis

Items from each of the four subsections of the Consumer section of the online survey were run together and separate in a series of Principal Component Analyses to determine suitability for combining into latent variables. Items in the same subsection were most likely to be suitable for combining. This resulted in four latent variables based on item subsections: **1) Experience with Fire Science; 2) Experience with Fire Science Producers; 3) Experience with Exchanges, and 4) Experience with Exchange Websites**. Table 15 displays all items added to each latent variable with the component loading that was used to determine suitability for combination. A general rule of thumb is that items that have a component loading greater than 0.60 are representing he same underlying construct. Items that did not share common variance with two or more other items were simply removed from analyses; this included four items.

Table 15. Component Loadings of Items for each Consumer Latent Variable

Items	Component Loading
Experience with Fire Science: Latent Variable 1	
Using fire science information enhances my effectiveness on the job	**0.80**
I often draw upon fire science research when making work-related decisions	**0.77**
During the past year, I have changed at least one thing in my work based on what I've learned about fire science	**0.68**
I trust fire science research findings	**0.61**
Experience with Fire Science Producers: Latent Variable 2	
Fire science researchers/scientists are willing to directly work with me if I have questions about research or how to apply fire science at my job	**0.76**
Fire science researchers/scientists are easy to approach	**0.75**
Fire science researchers/scientists value my knowledge and experience as a field professional	**0.68**
Fire science researchers/scientists are reluctant to study problems and issues suggested by local managers/practitioners*	**0.62**
Fire science researchers/scientists rarely provide information that helps me address the management problems I face*	**0.60**
Experience with Exchanges: Latent Variable 3	
The Fire Exchange has helped improve the accessibility of fire science information in my region	**0.83**
The Fire Exchange has helped improve the use and application of fire science information in my region	**0.85**
I would recommend Fire Exchange involvement to my co-workers.	**0.78**
The Fire Exchange has helped improve communication among fire managers/practitioners and fire researchers/scientists in my region	**0.75**
The Fire Exchange has made it easier for my agency/organization to accomplish its goals	**0.71**
The Fire Exchange is needed to help coordinate sharing of fire science information in my region	**0.70**
The Fire Exchange has helped improve policy regarding fire management in my region	**0.64**
Experience with Exchange Websites: Latent Variable 4	
My Exchange's website provides a wide variety of fire science information	**0.85**
My Exchange's website provides practical information I can use in my job	**0.84**
My Exchange's website provides information that is current and up-to-date	**0.83**
My Exchange's website organizes the information I need in one convenient place	**0.79**
My Exchange's website is user-friendly	**0.73**

*Indicates the item was negatively framed and reverse coding was used

Longitudinal Comparisons of Means for Latent Variables

Mean responses of latent variables were compared by Exchange establishment year to determine if changes were significant. All latent variables met the assumption of homogeneity of variance. For each latent variable, responses significantly improved in year four. Specifically, when looking at respondents' experiences with fire science, respondents were much more likely to report an improved experience trusting and using fire science in year four (M = 3.81, SD = 0.54) when compared to year one (M = 3.71, SD = 0.54); $t(1433) = 2.87$, $p = 0.004$. Similarly, respondents were significantly more likely to have positive ratings of fire science Producers in year four (M = 3.46, SD = 0.57) when compared to year one (M = 3.33, SD = 0.55); $t(1418) = 3.97$, $p < 0.001$. As many items looking at experience with Exchanges and Exchange websites were not added until the second year of the online survey, year two and year four comparisons were conducted for those latent variables. Again, respondents were significantly more likely to rate their Exchange as a valuable resource in the fire science community in year four (M = 3.83, SD = 0.58) when compared to year two (M = 3.60, SD = 0.57); $t(400) = 3.46$, $p = 0.001$. Also, respondents were significantly more likely to rate their Exchange's website positively in year four (M = 3.71, SD = 0.54) when compared to year two (M = 3.61, SD = 0.50); $t(659) = 2.56$, $p = 0.011$ (see Table 16). As latent variables are more accurate representations of underlying constructs than individual items, significant improvements across time points indicates strong support for Exchanges' impact on fire science perceptions, interactions with Producers, and website experiences.

Table 16. Consumer JFSP Attitudes: Year 1 vs. Year 4 and Year 2 vs. Year 4

JFSP Consumer Attitude Variables	**Year 1** Mean (SD)	n	**Year 4** Mean (SD)	n	***p* value**
Experience with Fire Science	**3.71** (0.57)	1,078	**3.81** (0.54)	357	0.004
Experience with Fire Science Producers	**3.33** (0.55)	1,062	**3.46** (0.57)	359	< 0.001
Attitude Variables	**Year 2** Mean (SD)	n	**Year 4** Mean (SD)	n	***p* value**
Experience with Exchanges	**3.60** (0.57)	104	**3.83** (0.58)	298	0.001
Experience with Exchange Websites	**3.61** (0.50)	384	**3.71** (0.54)	277	0.011

Producer Trends

Two latent variables were formed based on Producer responses and were significant when comparing means over time. The details of latent variable construction and results of comparison of means tests are outlined below.

Latent Variable Creation: Principal Component Analysis

Items from each of the three subsections of the Producer section of the online survey were run together and separate in a series of Principal Component Analyses to determine suitability for combining into latent variables. One subsection concerning Producers' experiences with Consumers had poor component loadings across items (at or below 0.60) and was subsequently removed from analyses. The additional items resulted in two latent variables that included all items from their respective subsections: **1) Experience with Exchanges and 2) Experience with Exchange Websites.** Table 17 displays all items added to each latent variable with the component loading that was used to determine suitability for combination. Items that have a component loading greater than 0.60 are representing the same underlying construct and are suitable to combine into a latent variable.

Table 17. Component Loadings of Items for each Producer Latent Variable

Items	Component Loading
Experience with Exchanges: Latent Variable 1	
The Exchange has helped improve the accessibility of fire science information	**0.86**
The Exchange has helped improve the use and application of fire science information in my region	**0.81**
I would recommend Exchange involvement to my co-workers	**0.79**
The Exchange is needed to coordinate sharing of fire science information in my region	**0.78**
The Exchange has helped improve communication among fire managers/practitioners and fire researchers/scientists in my region	**0.72**
The Exchange has made it easier for my agency/organization to accomplish its goals	**0.65**
Experience with Exchange Websites: Latent Variable 2	
My Exchange's website provides a wide variety of fire science information	**0.86**
My Exchange's website organizes fire science information and other useful tools in one convenient place	**0.85**
My Exchange's website helps keep me informed of current research findings	**0.83**
My Exchange's website is user-friendly	**0.77**
My Exchange's website provides a way for me to share my research products or fire science delivery activities	**0.73**

Comparisons of Means for Latent Variables

Mean responses of latent variables were compared by year an Exchange was established to determine if changes in means were significant.

For the two latent variables (experience with Exchanges and Exchange websites), responses significantly improved in year four. Specifically, when looking at Producer respondents' experiences with fire science Exchanges, respondents were much more likely to report an improved opinion about their Exchange's ability to impact fire science delivery in year four (M = 4.09, SD = 0.54) when compared to year two (M = 3.77, SD = 0.59); $t(114) = 2.86$, $p = 0.005$. Similarly, respondents were significantly more likely to positively rate their Exchange's website in year four (M = 3.73, SD = 0.62) when compared to year two (M = 3.51, SD = 0.62); $t(176) = 2.39$, $p = 0.018$ (see Table 18). These results strongly suggest that Producers perceive Exchanges and their websites as improving fire science delivery.

Table 18. Producer JFSP Attitudes: Year 2 vs. Year 4

JFSP Producer Attitude Variables	Year 2 Mean (SD)	Year 2 n	Year 4 Mean (SD)	Year 4 n	*p* value
Experience with Exchanges	**3.77** (0.59)	38	**4.09** (0.54)	78	0.005
Experience with Exchange Websites	**3.51** (0.62)	104	**3.73** (0.62)	74	0.018

Implications

Findings indicate that Exchanges are positively impacting the fire science community over time. For Consumers in particular, this impact can be seen in improvements at all levels of Exchange efforts (e.g., attitudes and use of fire science, attitudes concerning Producers, attitudes toward Exchanges as valuable sources of fire science, and attitudes concerning Exchange websites). Similarly for Producers, improvements have been made over time in attitudes concerning Exchanges' impacts in their regions as well as Exchange websites. The only Producer subsection that did not coalesce into a latent variable were items concerning experiences with Consumers. One reason for poor component loadings may be because these items span a range of content from research motivations and practices, perceptions of Consumers, and Consumer outreach. Another reason may be that there are meaningful differences between Producers not captured in the current aggregate analyses. Overall, however, scores on items concerning Producers' experiences with Consumers have remained high across all survey waves. An alternate approach like interviews is likely needed to assess in greater detail the impact of Exchanges on Producer interactions with Consumers.

Webmetrics Component

Exchange websites are a primary means of increasing fire science information accessibility and applicability among Consumers, Producers and the General Public. These websites serve as a hub for practical fire science information by providing a variety of translated fire science products as well as notifying users of learning and funding opportunities.

The webmetrics component of the current evaluation includes quantitative and qualitative assessments. The quantitative element involves collection and analysis of common website analytics or indicators regarding website visits and utilization. Quantitative webmetrics data included in the following section were collected from October 2014 to September 2015. During this time some Exchange websites switched to a new template platform and this change may have created irregularities as reflected by current data. The qualitative element focuses on the operation and purpose of Exchange websites and Exchange social media accounts from the perspective of those most responsible for their Exchange's website. The qualitative webmetrics data were collected via an online survey in August 2015.

Quantitative Webmetrics Component

All JFSP Exchange websites embed an appropriate analytics package (such as Google Analytics) to collect monthly data pertaining to patterns of utilization. All fifteen Exchanges shared webmetrics data with the evaluation team. Data from two Exchanges, however, were excluded from the aggregate analysis.[4] Thus, thirteen Exchanges with established websites are represented in Wave 5. Limited findings from previous waves will be cited for comparative purposes or to highlight this year's irregularities, when appropriate.

Basic Website User Data

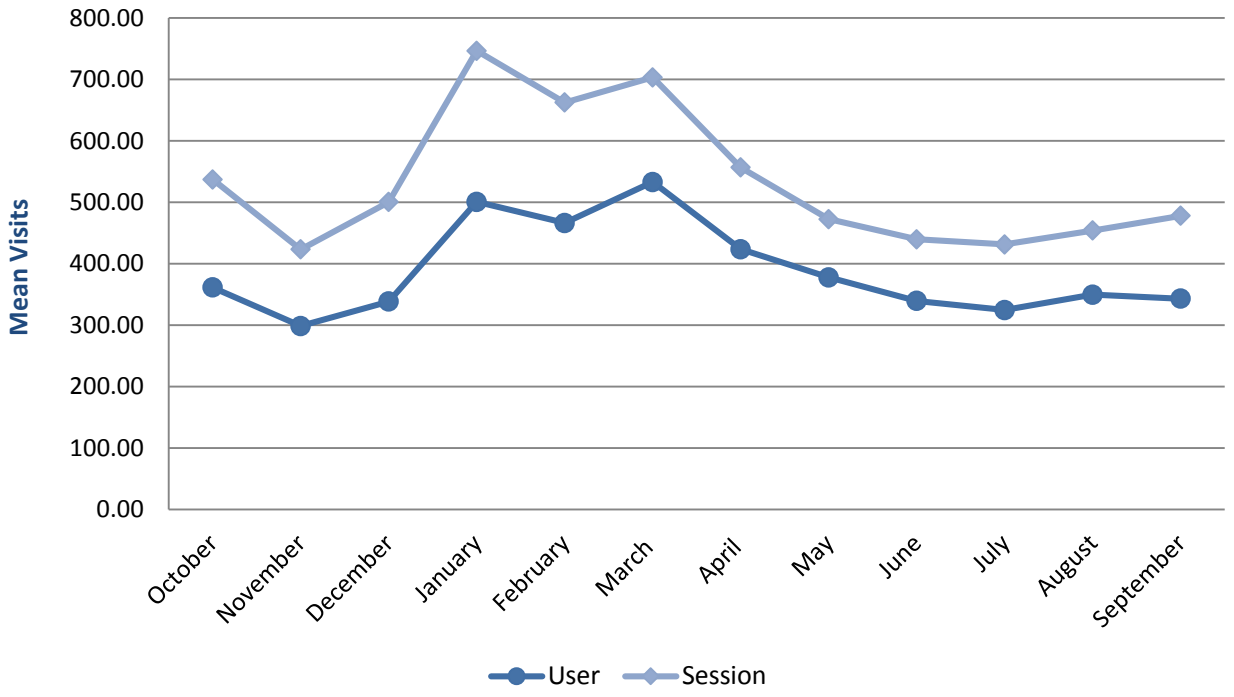
This section reports the number of website *sessions* and *users,* the average duration of time visitors spent on websites, the average number of pages visitors viewed in one session, and the *bounce rate* (percentage of visitors who landed on the website and then immediately left the website) from October 2014 to September 2015.

Total number of sessions provides a raw count of instances in which the website was accessed during a one-month period, whereas the number of users provides a count of unduplicated website visitors. Total number of sessions indicates the general frequency with which the websites are being accessed, whereas the number of users indicates the extent to which the Exchange websites are attracting different visitors. The mean session and user visits to Exchange websites from October 2014 to September 2015 are depicted in Figure 14. Standard deviations of

[4] The evaluation team excluded data from two of the Exchanges because these data were highly irregular and unreliable, to the extent that they would have had a significant impact on the aggregate results. The unreliability of the excluded data was due to factors beyond the Exchange's control (i.e., website hacked, significant shifts in personnel).

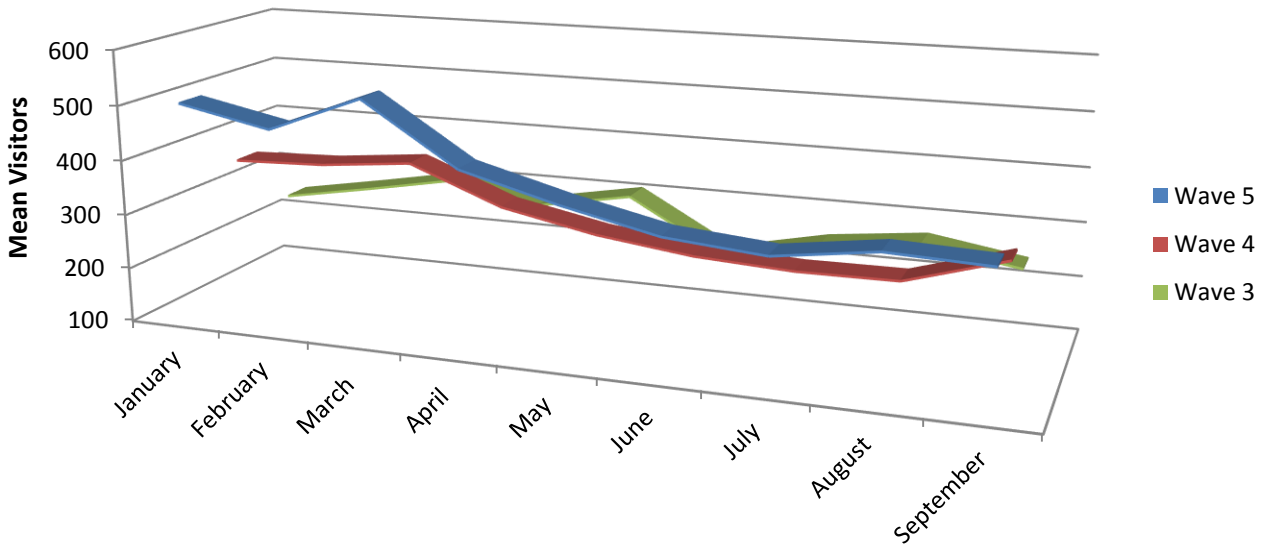
the mean ranged from 184 to 589 for sessions visits and 146 to 381 for user visits for all months. Although these ranges are quite large, this is expected considering the diversity of Exchanges in terms of website development and regional users' needs.

Figure 14. Mean Session and User Visits per Month, October 2014 to September 2015



Wave 5 data revealed similar patterns of mean user visits as seen in Wave 4 and Wave 3, with increases in visits overall (see Figure 15). Specifically, in Wave 5 user visits peaked in winter months and decreased through warmer months as seen in previous waves. Overall, increases in visits may indicate that Exchange websites are improving their website outreach efforts. The consistency in trend data over time indicates true patterns of visitation for Exchange website users. Exchanges may want to note the timing of traffic increases when planning targeted highlights or modifications of website content.

Figure 15. Mean User Visits for Wave 3 to Wave 5



Exchanges were asked to report the average duration of time visitors spent on Exchange websites as well as the number of pages visited. Similar to previous waves, visitors spent approximately three minutes on websites, with the average amount of time spent on websites remaining fairly consistently between October 2014 and September 2015. On average, visitors clicked onto 2 to 3 pages within the website during one session. Further discussion of top webpages across all websites can be found under Top Website Content in this section.

Exchanges also were asked to report monthly *bounce rates*, which indicate the percentage of website visitors who did not further explore the website upon accessing the home page. Higher bounce rates may indicate that website content and features are not relevant to users, the website design is confusing and difficult to navigate, or that users expected to arrive at a different site.

For Wave 5, the mean bounce rate aggregated across the months of October 2014 to September 2015 was 54.10 percent (*SD* = 16.04, *n* = 12). The bounce rate in Wave 5 was higher than the mean bounce rate in Wave 4 of 46.96 percent (*SD* = 20.35, *n* = 13), and in Wave 3 of 43.51 percent (*SD* = 22.97, *n* = 12). The higher bounce rate in Wave 5 may be reflective of website construction issues due to the adoption of the new website template. Future data collection is needed to determine if bounce rates continue to increase over time.

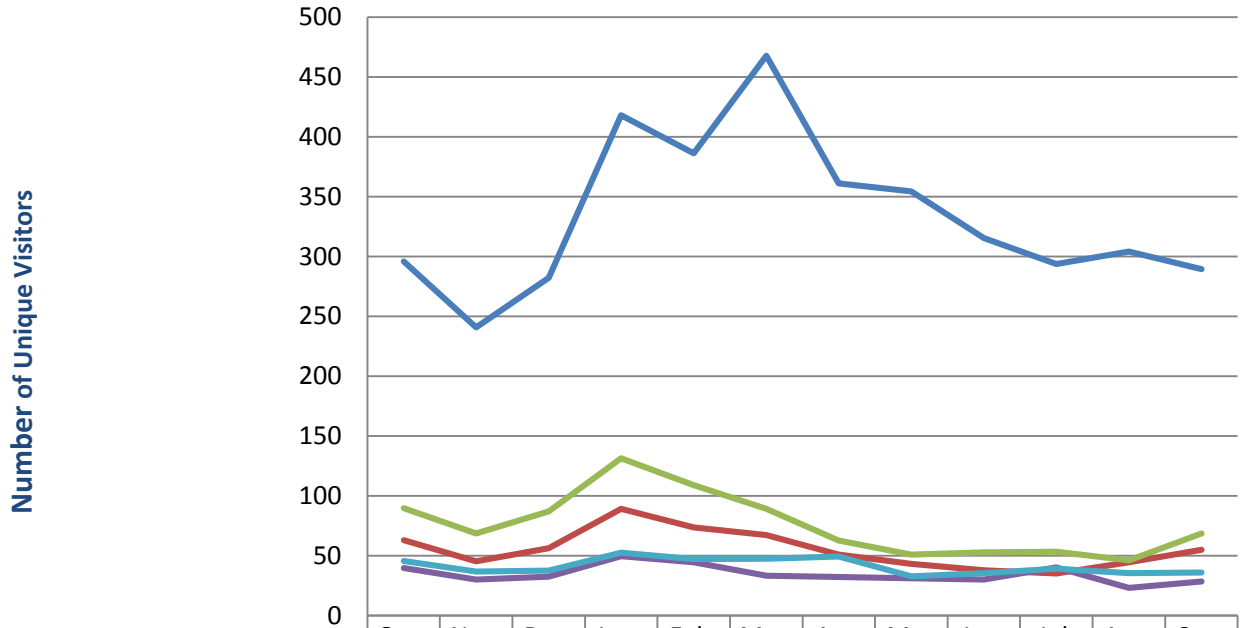
Visitor Loyalty

Visitor loyalty is a measure of user retention. The extent of visitor loyalty is determined by the number of times that the same user accessed a website over a specified time period. High visitor

loyalty (increased number of subsequent visits) indicates that users are engaged and satisfied with website content.

Figure 16 displays the aggregate mean scores for visitor loyalty for the months of October 2014 to September 2015. As with previous waves, most unique users visited Exchange websites only once. The peak in visits across visiting categories occurring more than once was in the month of January. For reoccurring users within a single month, most revisited their Exchange's website three to eight times. Given that most returning users are accessing websites several times within a month suggests that these websites are meeting the needs of fire science professionals.

Figure 16. Visitor Loyalty Means for October 2014 to September 2015

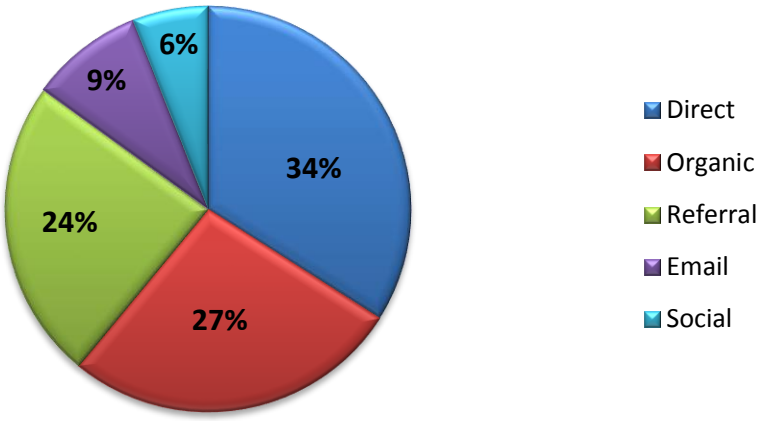


	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
Visited Once	296	241	282	418	386	468	361	354	315	294	304	289
Visited Twice	63	45	56	89	74	67	51	43	38	35	45	55
Three to Eight Visits	90	69	87	132	109	89	63	51	53	53	46	69
Nine to Twenty-Five Visits	40	30	33	50	45	34	32	31	30	40	23	29
Twenty-Six or More Visits	46	37	38	53	47	48	49	33	36	39	36	36

Traffic Sources

To better understand how users encountered their Exchange website, data were collected regarding the top website traffic sources resulting in Exchange website visits. *Traffic sources* refer to the specific web-based mechanisms that subsequently directed visitors to the Exchange websites. Figure 17 displays the breakdown of percentages for five general traffic sources that resulted in Exchange website visits. *Direct* refers to the percentage of users who accessed Exchange websites by directly typing the website's address into their Web browser (or accessed the website address via browser history). *Organic* refers to the percentage of visitors who used unpaid links (non-advertisement links) found through search engines (like Google, Yahoo, Bing, etc.) to reach Exchange websites. *Referral* encompasses all other websites and domains with a link that ultimately directed the user to the particular Exchange website. *Email* refers to specific traffic from emailed links (like MailChimp) and *Social* refers to specific traffic from a specified social media site. In Wave 5, visitors were most likely to directly access websites indicating the majority of website traffic is coming from those familiar with the website. Exchanges should continue outreach to new audiences through increasing website links with other fire science websites, optimizing content and key words for search engines, and well as integrating efforts with social media platforms. The fact that 51% of traffic is coming from organic searches and referrals, however, indicates that Exchanges are making progress in outreach efforts.

Figure 17. Traffic Sources



Exchanges also were asked to indicate their top three *specific* traffic sources for each month. These data were entered as text (web addresses and phrases), so numeric analyses were not conducted in this category. A basic review of these data illuminates the most common types of general traffic sources used to access the websites. Those arriving at Exchange websites using searches overwhelmingly used the Google search engine. The majority of referrals originated from the JFSP home website (firescience.gov) and FRAMES, though cross-Exchange links and university-based links also generated web traffic. Finally, links embedded in MailChimp announcements, listserv emails and social networking sites often appeared among the top three specific traffic sources.

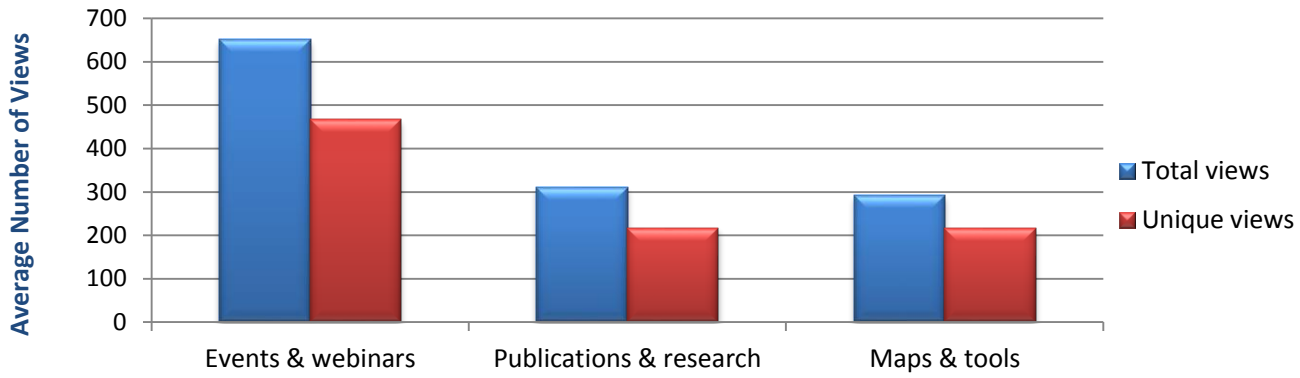
Top Website Content

One objective of the quantitative webmetrics component is to examine the popularity of website content in order to assess the degree to which specific website features and content are meeting users' needs. This information may inform further website development, modification and expansion. Yet, as stated in all previous reports, the differential organization of each individual Exchange website has created real challenges to reliably identifying top website content.

In 2014 JFSP funded efforts to standardize website organization across all Exchanges. The new website template contains three main organizing frames to describe top content: 1) Events and webinars, 2) Publications and research, and 3) Maps and tools. The events and webinars section contains information on field tours, conferences, and webinars. The publication and research section contains a wide range of information from fact sheets, white papers, online courses, newsletters, lessons learned materials, book chapters, academic posters and dissertations. Finally, the maps and tools section contains management and planning documents (like contact information and Exchange goals), as well as models and technology information for direct application. This organizing framework should allow each Exchange to customize content, while allowing evaluators to more accurately assess use of website features and improve users' navigation across multiple websites.

Although each website is unique, events and webinars pages were by far the most common type of page included on Exchange websites. Maps and tool pages, followed by publications and research pages, were the second and third most common page types. In addition to events and webinars being the most common type of pages, they also were the most commonly viewed as a category (see Figure 18a). Figure 18a displays *Total views* and *Unique views* for the months of (October 2014 to September 2015) for each type of page. Total views are the count of all page views, while unique views only count a user once, regardless of multiple pages re-visited within a month. Distinguishing between the two is particularly important because a small subset of users may be utilizing specific pages multiple times. Although publications and research encompass a diverse range of materials, these pages did not receive as many unique or total views as events and webinar pages. The finding that users are still less likely to directly access academic work strengthens the need for Exchanges to continue to translate fire science into more applied formats such as webinars and interactive events.

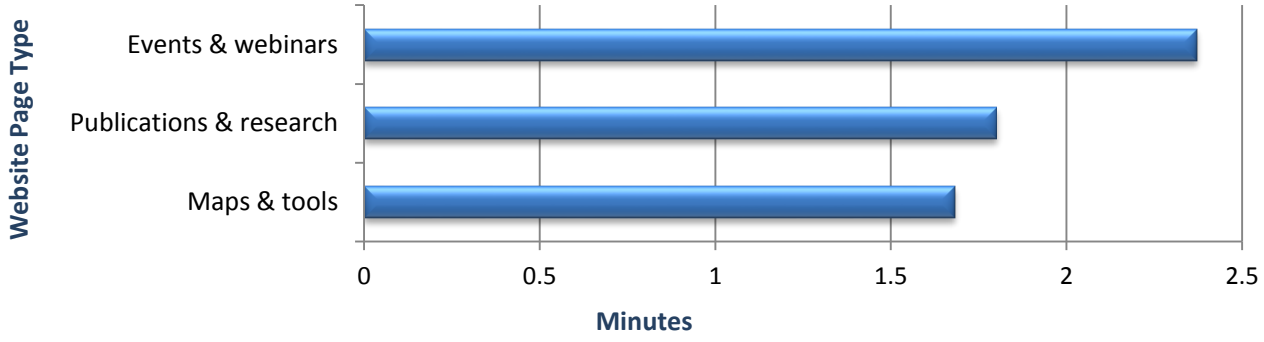
Figure 18a. Aggregated Total Views and Unique Views for Top Website Pages



The duration or time spent on a page indicates viewer engagement. Determining which pages are attracting initial and returning users, as well as the length of time users spend on each page type, can guide Exchanges in either altering websites to provide only the most engaging pages or improve important pages (pages with Exchange priority information) with popular features included on more frequented pages.

Events and webinar pages had the longest average duration of time spent, followed by publication and research, and finally maps and tools (see Figure 18b). This finding suggests that Exchanges are engaging users with their interactive events, fulfilling their role of bringing fire science professionals together. Another explanation for less time spent on other page types may be due to individuals downloading research and Exchange products for extended use; this would not be captured by website analytics. Further research would be needed to determine if materials on other page types are being utilized in this fashion.

Figure 18b. Average Duration in Minutes Spent on Top Website Pages



Qualitative Webmetrics Component

The qualitative webmetrics component was designed to obtain a more comprehensive understanding of Exchange websites' operation and the successes and challenges Exchange personnel have experienced with respect to their websites. Findings may help provide additional context for quantitative findings and illuminate the *reasons* behind various aspects of website performance. Qualitative data regarding Exchange websites are collected annually using an online survey completed by Exchange principal investigators and coordinators, webmasters, or other Exchange personnel who are highly familiar with their Exchange website. Within the past two years, Exchanges have been strongly encouraged to use social media as a means of increasing awareness and comprehension of current fire science information. Thus, recent waves of the qualitative webmetrics survey have incorporated items exploring Exchange's use of social media. Results are first presented for the items pertaining to Exchange websites, followed by those pertaining to Exchange social media accounts.

Fire Science Exchange Websites

The current findings (Wave 5) include Exchange staff responses from all 15 JFSP Exchanges. Although all JFSP Exchanges have successfully launched their websites, when interpreting webmetrics results, it is still important to recognize that Exchange websites are in varying developmental stages. In addition, the Exchanges vary in terms of resources and personnel allocated to website development and maintenance.

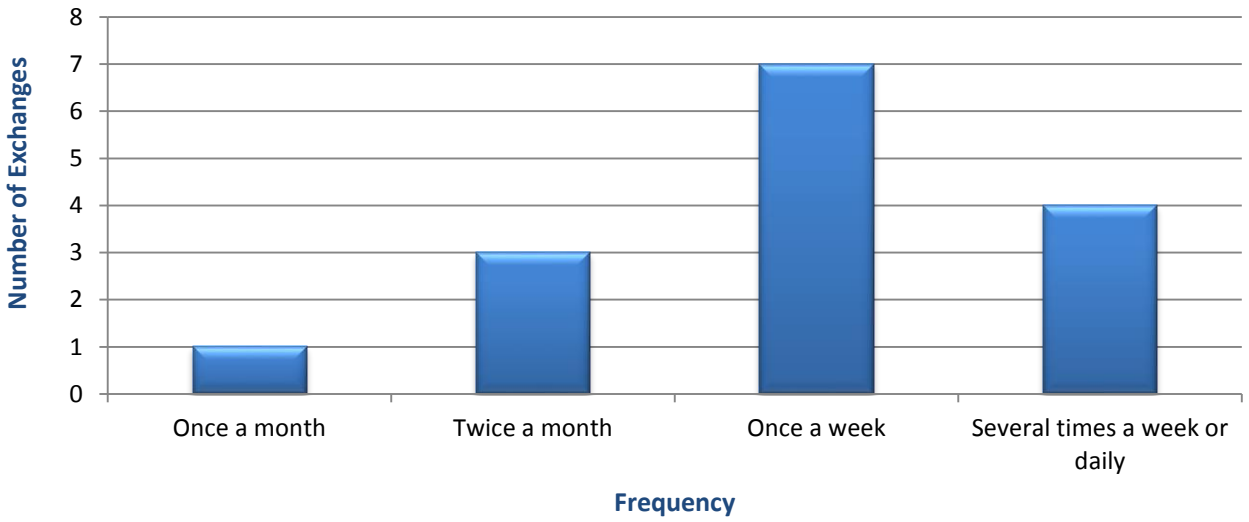
Website Design, Operation, and Maintenance

As in prior waves, the majority of Wave 5 qualitative webmetrics survey respondents (n = 10; 66.7%) indicated that the Fire Exchange Coordinator is primarily responsible for maintaining the Exchange website. Only one Exchange has a dedicated webmaster. The amount of time spent on website maintenance varies across Exchanges, but overall did not substantially differ from the reported time spent in previous waves. Almost half (n = 6) of Exchange representatives reported spending less than five hours a week on maintenance. Five Exchange representatives reported spending an average of five to ten hours a week on maintenance. One Exchange representative said that s/he spent anywhere from two to fifteen hours, depending on Exchange activities throughout the year. Finally, one Exchange representative indicated that 30 hours per week was spent to maintain their website.

The reported frequency with which Exchange websites were updated was slightly higher in Wave 5 when compared to prior waves. Most (n = 11) Exchange representatives reported updating websites at least once a week, with four of these Exchanges reporting they update websites daily or several times a day (see Figure 19). Frequent updates to the Exchange websites are necessary to keep users informed of current learning opportunities, fire science news and/or perspectives, and research findings. Not only can frequent updates help attract and engage loyal site users, but

they also can influence the perceived credibility of an Exchange[5] Not surprisingly, Exchanges spending more time maintaining their websites also tended to report more frequent website updates.

Figure 19. How Often Websites are Updated



In late 2014, Exchanges were given the option to implement a website redesign through a contract with external consultants. The redesign featured a common template intended to make the websites more visually appealing, organized, and easier to navigate. In addition, the redesign was expected to make website maintenance easier for Exchange personnel. Most Exchanges (n = 11) elected to adopt the redesign. At the time of qualitative webmetrics data collection (August 2015 - September 2015), only two Exchanges had officially adopted and implemented the website redesign.

Survey respondents were asked to list the three features of their Exchanges' website that take the most time or resources to maintain. Events pages were most commonly cited as requiring more time and resources to maintain, followed by archiving webinars and other educational tools and materials. The increased time spent on updating events and ensuring that users have timely access to recorded presentations and other materials is worthwhile for several reasons: frequent updates to events pages and calendars are needed to reach and engage constituents face-to-face and promote interactive learning opportunities (which constituents rate as the most valued fire science information source); frequent updates to events and calendar pages lend credibility to Exchanges as active brokers of fire science information. Support for the value of these pages also is echoed in Google Analytics visitor data.

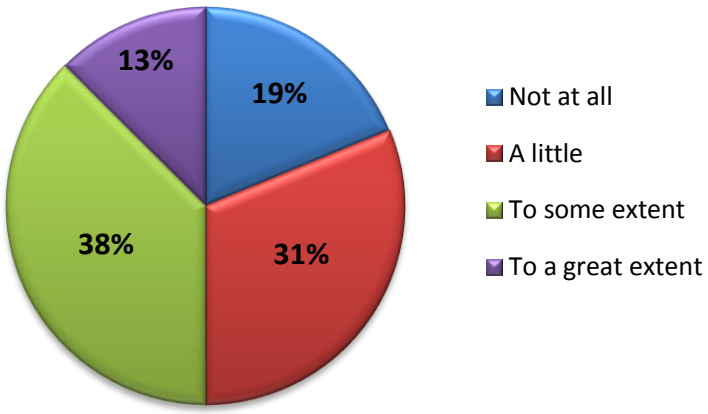
[5] Continually updating events calendars or events pages (informing users of events as soon as possible and a means of registering for/participating in the event), archived and planned webinars, and other website content should reflect positively on the Exchanges. Conversely, failure to update the site- particularly failure to promptly post new events and post/fill in event calendars may cause some site users to perceive the Exchange as less organized and/or credible.

Finally, exchange representatives were asked to respond to two items regarding the balance between maintaining their websites and obtaining website content. First, they were asked, *Thinking about the past year, which has taken more of your professional time: website logistics and maintenance, or searching for and developing new website content?* Responses occurred on a 7-point scale, with 1 = Most of my time has been spent on logistics/maintenance and 7 = Most of my time has been spent on searching for/developing new content. Representatives mostly indicated that their time had been evenly split between maintenance and content-related work, though some tended to spend more time on maintenance (*M* = 3.44, *SD* = 1.33). Next, respondents were asked to think about the next upcoming year and anticipate the amount of time they expect to spend on website logistics/maintenance versus searching for/developing website content. The mean response to this question increased slightly to 3.90 (*SD* = 1.66), suggesting that some Exchanges expected to achieve a better balance between maintenance and content-related work during the upcoming year.

Website Audience

Analyses of qualitative webmetrics survey responses in all prior evaluation waves consistently indicated that all Exchange websites primarily target fire managers/practitioners, followed by researchers/scientists. Wave 5 explored the extent to which Exchanges' websites are targeting the General Public. As Figure 20 shows, half (50.0%) of Exchange representatives reported that their websites are targeting community members/members of the general public either to some extent or to a great extent. Only three Exchanges (18.8) are not currently aiming to reach the General Public through their websites.

Figure 20. Reported Extent to Which Exchange Websites Target the General Public

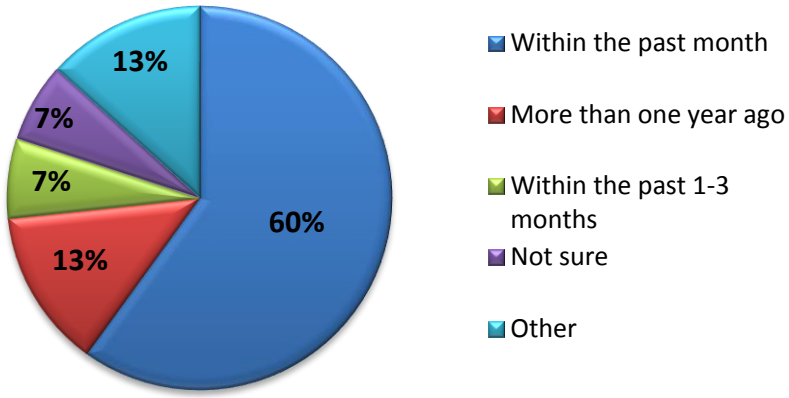


Fire Exchange Constituent Listserves

All Fire Exchanges maintain an electronic constituent correspondence list, or email listserve. Exchanges distribute announcements through the listserve regarding upcoming events, trainings, and continued educational opportunities; funding or collaboration opportunities; Exchange newsletters and blogs; other new Exchange products (e.g., field guides, fact sheets, literature reviews) and current fire science news. The listserve emails and announcements often link or

direct constituents to their Exchange's website. In addition, Exchanges distribute invitations to participate in the National JFSP Evaluation Online Survey through their listserves. As these listserves are a main source of outreach, it is critical that Exchanges make continued efforts to grow their listserves and ensure that constituents' contact information is current. To this end, qualitative webmetrics survey participants were asked to approximate the last time (as of August-September 2015, the quantitative webmetrics data collection period) their Exchanges' listserve was updated. As shown in Figure 21, most participants (60%) reported that their Exchanges' liststserve had been updated within the past month; only two Exchanges (13.33%) indicated that their listserve hadn't been updated since at least one year ago.

Figure 21. Frequency of Exchange Updates to Constituent Listserves



Exchange representatives were subsequently asked to describe any efforts that have been made to add individuals to their Exchanges' listserve. Several respondents said that a listserve sign-up sheet was made available at all in-person Exchange events, and a few others cited electronic means of growing the listserves (e.g., through email, website, and social media announcements). When asked how their Exchange keeps listserves current, respondents often indicated that this was accomplished through listserve maintenance features on MailChimp which identify outdated addresses and encourage subscribers to update their contact information. It is important that Exchanges continue their efforts to update and grow their listserves, and to share strategies for doing so with one another.

Regional Website Evaluations

The current national evaluation examines JFSP Exchanges' processes and impacts at the aggregate level. Each Exchange, however, is responsible for evaluating their programming impacts at the regional level.[6] Exchanges can evaluate their websites through several different

[6] The Evaluation Resource Guide for JFSP Fire Exchanges (2016) provides tools and references to assist Exchanges in evaluating their regional educational and outreach activities. To request a copy of this guide, please email Lorie Sicafuse at lsicafuse@unr.edu.

methods, such as conducting focus groups, interviewing current and potential website users, or including a brief "pop-up" evaluation survey on their actual website.

The majority of Exchanges (*n* = 14) have not conducted a regional level evaluation of their website within the past year. Two Exchange representatives reported conducting focus groups or interviews within the past year to obtain end user feedback regarding website organization, usability, and content. When respondents were asked about barriers to conducting regional evaluations, three themes emerged: 1) survey fatigue; 2) evaluation design; and 3) time.

Many Exchange representatives indicated that they would benefit from technical assistance (TA) and support in efforts to evaluate their websites. Specifically, over half of respondents said they would benefit from TA regarding methods to conduct website evaluations and strategies for recruiting evaluation participants. Six respondents (43%) further indicated that they would like information and TA on understanding and interpreting Google Analytics data. Building Exchanges' capacity to evaluate their own websites is becoming increasingly important as many Exchanges adopted the new website design or are working to reach and recruit users outside of the traditional manager/scientist groups. The national evaluation team can provide a variety of information, support, and technical assistance tailored to Exchanges' evaluation needs. This can include webinars on the most commonly requested topics, referrals to written and electronic resources, and individual consultations with Exchange personnel.

Website-Related Challenges

In prior iterations of the qualitative webmetrics survey, Exchange representatives tended to identify organization/visual appeal and keeping websites updated as their top website-related challenges. Because most Exchanges opted to implement the redesign, organization was no longer cited as a challenge in Wave 5. More than half of the Exchange representatives (*n* = 9), however, identified the transition to the new redesigned website template as their top website-related challenge. Several Exchanges reported encountering unexpected difficulties with the transition, such as broken links, problems with search functions, and navigation issues.

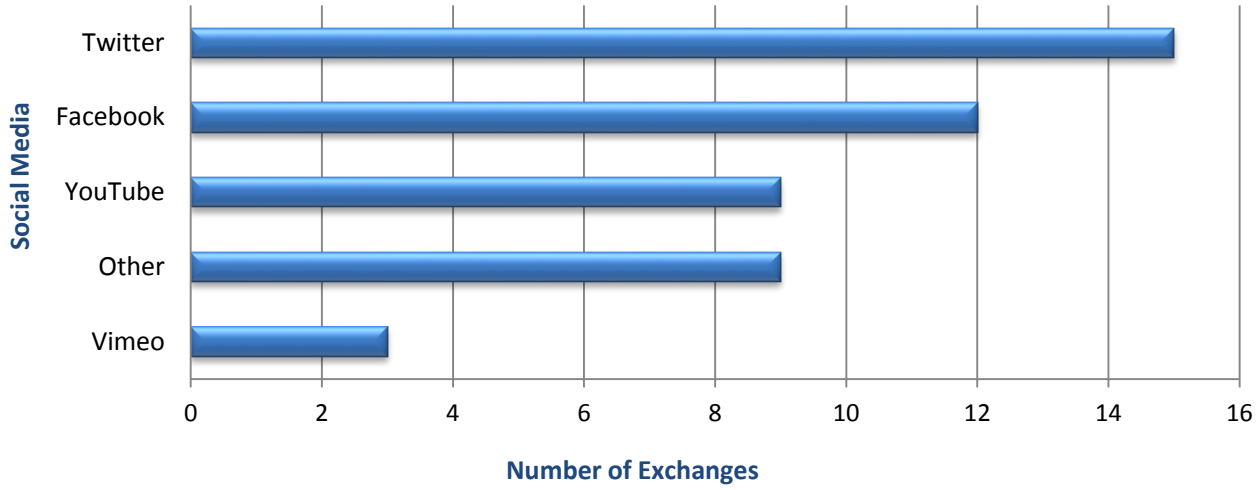
Social Media

The goal of social media use by Exchanges is to increase awareness of Exchanges as well as drive traffic to Exchange events and products. Social media items on the qualitative survey were used to obtain a basic understanding of Exchanges' efforts expended on social media accounts, social media target audiences, and how Exchanges track the reach and impacts of their accounts.

Operation of Fire Science Exchange Social Media Accounts

The number of social media accounts Exchanges operate increased slightly from Wave 4 to Wave 5. As of Wave 5, all Exchanges were operating Twitter accounts (see Figure 22). Most also had established Facebook (*n* = 12) and YouTube (*n* = 9) accounts, but only a few (*n* = 3) had a Vimeo account. Over half of all Exchanges (*n* = 9) reported using other types of social media, such as Tumblr, LinkedIn, and Instagram.

Figure 22. Number of Exchanges with Social Media Accounts



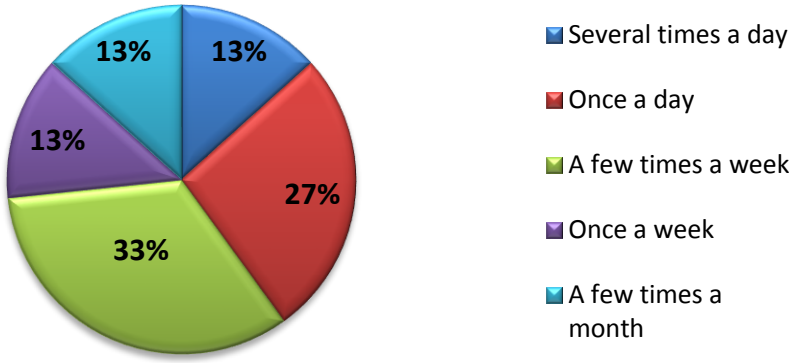
Over half of respondents (*n* = 8) identified the Exchange Coordinator as the primary person maintaining their Exchange's social media accounts. Two Exchanges employ part-time specialists specifically in charge of social media. The remaining five Exchange representatives said that either the responsibility for the Exchange social media accounts was shared between the Coordinator and other staff, or primarily the responsibility of outreach staff (such as Extension Associate or Science Communication Director).

Respondents reported that out of the various social media accounts maintained, the most time is spent on updating Twitter and Facebook. Four respondents said Twitter took the most time to maintain, another four said Facebook took the most time to maintain, and five said that an equal amount of time was spent on Twitter and Facebook.

In addition, respondents were asked 1) How many hours a week were spent updating social media accounts; and 2) How frequently the accounts are updated. Six respondents reported that two hours or less were devoted to social media account updates a week, and five reported that between 3-5 hours per week were spent on Exchange social media accounts. Three respondents said that more than five hours were dedicated each week to updating the social media accounts, with one of these respondents indicating that staff spent at least 15 hours working on Exchange social media.

Overall, there was a small decrease in the reported frequency of updates to social media accounts between Waves 4 and 5 of the national evaluation. As Figure 23 shows, survey respondents said that less than half (*n* = 6) of Exchanges update their social media account(s) on a daily basis. Five respondents said that their Exchange's accounts were updated several times per week, whereas four others said that the accounts were updated once per week or less than once per week.

Figure 23. Frequency of Updates to Exchange Social Media Accounts



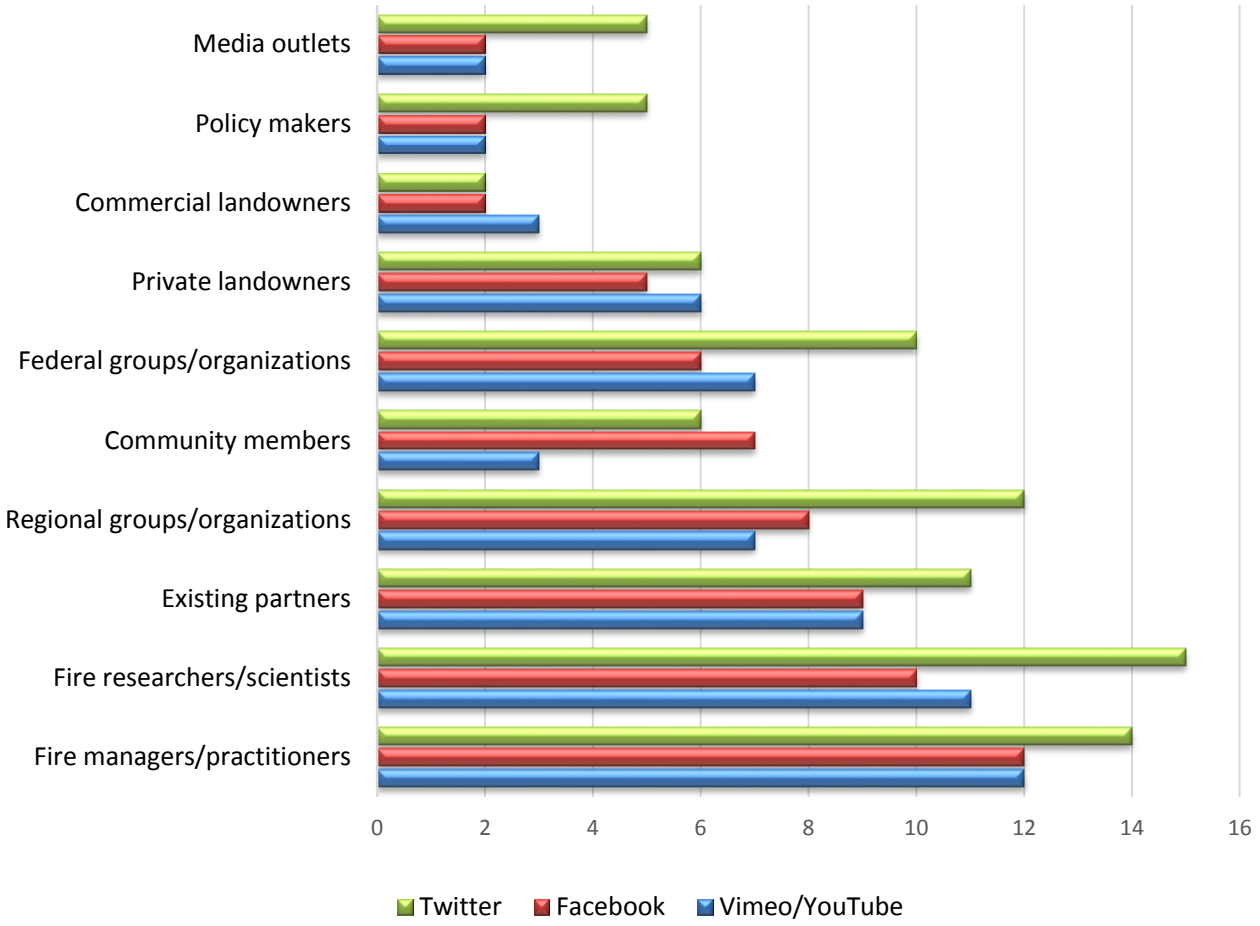
Respondents also were asked if their Exchange social media accounts were integrated or linked to their website via a social media management tool such as HootSuite or another mechanism. Establishing such cross-linkages is important, as these linkages can help draw Exchange social media followers to Exchange websites and vice versa. Almost one half of respondents (*n* = 7) indicated that their Exchange websites and social media accounts were linked in this manner, with four others reporting that such links had not been established but that there were plans to do so in the near future.

Social Media Target Audiences

As Figure 23 shows, the Exchanges' target audiences for their social media accounts are much broader than those for their websites. After fire managers/practitioners and researchers/scientists, respondents most frequently identified other groups and organizations (existing partners, regional and national organizations) as part of their social media target audience. Slightly less than half (*n* = 7) of respondents reported that community members were a target audience of their Exchange's Facebook account, with six and three respondents indicating that community members were part of the target audience for their Twitter and YouTube/Vimeo accounts, respectively. Some Exchanges may want to increase efforts to reach community members via social media, given that 51% are actively using their websites to target the general public and an additional 31% are targeting the general public "a little."

Only one-third (*n* = 5) of representatives said that their Exchange's Twitter account targeted media outlets and policy makers; Exchanges were even less likely to use other types of social media to target these audiences. Yet, these may be important audiences to target in order to increase awareness of the Exchanges, which is one of the primary purposes of Exchange social media use.

Figure 23. Number of Exchanges Identifying Target Audiences of Social Media Accounts



Social Media Metrics

The JFSP Board recommended that all Exchanges develop and implement a means of tracking the extent to which social media accounts are reaching targeted audiences. Nearly all (*n* = 13) Exchange representatives indicated that they were collecting quantitative social media data; however, the use of these data varied across exchanges. Seven respondents indicated that their Exchange primarily used social media metrics to meet JFSP reporting requirements or to simply determine the number of followers. A few respondents reported more in-depth uses of social media metrics. For instance, four respondents described using the metrics to determine the popularity of specific types of social media posts and user engagement with posts. This information was then used to help increase the relevancy and popularly of future posts.

Respondents were asked to indicate what types of support (if any) would be helpful in examining the utility and impacts of their Exchange's social media accounts. The majority of respondents (*n* = 10) said that their Exchange would benefit from receiving help with developing strategies to obtain feedback on social media accounts and activity from target audiences. In addition, over

half (*n* = 8) said that their Exchange could use more information on how to interpret social media metrics.

Two main sources of technical assistance are readily available to Exchanges interested in learning more about how to use social media metrics. First, there are a few Exchanges that are using social media metrics to specifically target user interests and needs. Personnel from these Exchanges (who are engaged in social media activity and assessment) can provide technical assistance to personnel with other Exchanges less familiar with social media metrics. If some Exchanges express interest, the national evaluation team can host a webinar or provide technical support through other means on basic collection, interpretation, and application of social media metrics. In addition, the national evaluation team could partner with some Exchange staff in presenting a technical assistance webinar, with the Exchange staff showing how they used social media metrics to inform future social media posts, operations, or other programming.

Social Media-Related Challenges

Participants were asked to briefly describe the single biggest social media-related challenge facing their Fire Exchange. Three main themes emerged in responses to this question. First, several Exchanges are struggling with how to collect, analyze, and interpret data from their social media accounts. Second, Exchanges reportedly often have difficulty in identifying content to share that would be most interesting or relevant to their target audiences; in fact, some Exchanges are uncertain if social media is an effective means of reaching their target audiences. Third, some Exchange representatives expressed concern about a lack of time and/or resources to keep their social media accounts current.

Webmetrics Component: Summary and Future Directions

Data for the current wave of the national evaluation were collected when most Fire Exchanges were in the process of transitioning to a new website template. The transition process likely had some impact on the Google Analytics data collected during April 2015 – September 2015, and thus the quantitative webmetrics results for Wave 5 may be less reliable than those obtained from prior waves. Despite this, the aggregate results for Wave 5 do suggest that Fire Exchanges are increasingly attracting new users to their websites; moreover, they are continuing to engage prior users by providing material relevant to the fire science and management-related issues that their constituents face.

Overall, there were few differences in Exchange representatives' responses about the operation and maintenance of their websites and social media accounts from Wave 4 to Wave 5. There was a slight increase in the extent to which websites were updated and in the average time spent on social media accounts. The reported time spent on maintaining/updating websites and social media accounts, however, significantly varied across Exchanges. The reported time spent on websites per week ranged from one hour to 40 hours; the reported time spent on social media accounts per week ranged from 30 minutes to 15 hours. Although the national evaluation team does not compare Exchanges or report Fire Exchange data at the individual level, it may be worthwhile for individual Exchanges to explore relationships between time spent and frequency of updates with website and social media metrics. This may help Exchanges determine the amount of time and resources needed to achieve their website and social media-related goals.

The transition to the new website template was the most commonly reported website-related challenge among Exchange representatives. Several representatives reported navigating unexpected issues, and that the redesign was not what they had anticipated. Going forward, it will be important for the Exchanges that have adopted the redesign to note changes in website maintenance, operation, and user metrics. Although this transition period may be challenging, it is expected that the redesign will ultimately decrease some of the website maintenance burden on Exchange personnel. It also is expected that adoption of the new template/redesign will help the national evaluation team obtain a more comprehensive understanding of quantitative webmetrics results and Exchange website processes and impacts. For instance, similar website organization and design should increase the validity and reliability of metrics regarding bounce rates, top page content, page depth, and time spent on the site.

Current webmetrics findings illuminate some actions that Exchanges may consider to increase awareness and knowledge via websites and social media. First, all Exchanges should link their websites, social media accounts, and related postings through a common mechanism (social media management tool). Second, Exchanges should use the website and social media metrics that are available to them to guide their efforts in identifying and sharing the most popular and relevant fire science and management-related content. Although the national evaluation team has assumed responsibility for collecting the Google Analytics data for the qualitative webmetrics evaluation component, it is important that Exchanges continue to examine these data on their own, and on a regular basis. Third, in addition to examining webmetrics data, Exchanges also

should evaluate their websites at the individual level using other methods such as surveys, focus groups, or interviews. Information gathered from these evaluations can help Exchanges continually improve their sites, and should be particularly useful given that many Exchanges have adopted a new website design.

Exchanges will benefit from drawing on the knowledge and experiences of personnel from other Exchanges. As previously mentioned, some Exchange personnel are more experienced than others in using social media metrics and finding content that resonates with their target audiences. The national evaluation team also is a source of assistance and support. Our team can help Exchanges learn more about website and social media metrics by providing tailored assistance to Exchanges or by collaborating with Exchange personnel to develop presentations and materials (such as webinars or basic guides). The national evaluation team also is prepared to provide technical assistance and support to help the Exchanges conduct regional-level evaluations of their website using a variety of methods. It is expected that the Fire Exchanges will make significant progress towards their website and social media-related goals in 2016 as they apply what they have learned from their fellow Exchanges and other sources.

Limitations

As with any evaluation project, the national cluster evaluation of the JFSP Exchange Network has limitations that should be noted. First, Exchanges themselves differ greatly on timing of their start dates, development, size, as well as regional environmental and political considerations. Therefore, the uniqueness and individual growth of each Exchange may confound data interpretation within and across waves. In addition, when Exchanges have participated in the national survey, some Exchanges have recruited more survey participants than other Exchanges; thus, some Exchanges are overrepresented in the data. An example of overrepresentation in the data can be seen in the General Public frame as some Exchanges make the General Public a target audience and thus have more General Public respondents. The three survey frames themselves also have different sample sizes that can be problematic for comparisons. For example, although the Producer and Consumer frames share related questions, fewer numbers of Producer respondents means that fewer responses are necessary to create a majority response; thus caution is required when directly comparing results across frames. Finally, every year the national survey taps the same participant pools, meaning that each wave of the survey may have the same repeating participants. Thus, it should be noted that our final yearly samples likely represent a mix of repeating and new respondents. Again, all Exchanges should strive to expand their listserves so that each wave of the national survey includes a diverse, representative sample of participants that reflect each Exchange's dynamic and unique set of stakeholders and constituents.

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