Many ecosystems in North America depend on fire, but management use of fire cannot succeed without public consent. Furthermore, hazard reduction and increased safety in the wildland-urban interface require widespread understanding and active participation by the public. This article describes the effectiveness of an outreach program that used informal workshops and hands-on activities to help the adult public learn about fire behavior, ecology, and management. The research questions were:

- Does a workshop with hands-on activities contribute to increased knowledge about wildland fire among adult members of the public?
- Does this approach contribute to more positive attitudes and beliefs about fire management in adults?

**Fire Policy, Fire Messages**

Since the early 20th century, the dominant wildland fire policy in the United States has been to suppress all wildland fires. Natural resource professionals have been reasonably successful at excluding fire from many landscapes. As a result, however, some fire-dependent forest communities have been altered. Species composition has changed, forest density has increased, and the likelihood of severe fire has increased in some forest types (Agee

---

**Keywords:** communication; education; policy; public perceptions

---

**ABSTRACT**

This study evaluated workshops for the adult public featuring experiential learning about wildland fire. Participants used hands-on activities to investigate fire behavior and ecology and to assess hazards in the wildland-urban interface. Effectiveness was examined using a pretest, a posttest following the program, and another posttest 30 days later. Participants’ knowledge increased following the program, and their attitudes and beliefs became more supportive of fire management. These changes were still evident a month later. Hands-on activities can help adults become better informed about wildland fire and more positive about fire management.

---

**Hands-on Learning**

Its Effectiveness in Teaching the Public about Wildland Fire

---

Above: The “matchstick forests” activity, used in public workshops, shows the effect of slope on fire spread.
Resource managers believed they were doing the right thing because excluding fire protected property and lives, but they underestimated fire’s critical ecological role in forest development. To remedy this problem, fire “inclusion,” through prescribed fire and wildland fire, has been part of wildland fire policy for the past quarter century (USDI and USDA 1995). An intensive, successful information campaign accompanied the policy of fire exclusion from public lands. Smokey Bear, one of the most recognized faces worldwide with his famous slogan “Only you can prevent forest fires,” contributed to a public perception that all wildland fires are bad and should be extinguished. Resource managers recognize Smokey Bear’s effectiveness in preventing human-caused wildfires, but they find now that they need to increase public acceptance of the role of natural fire and prescribed fire in achieving healthy, sustainable forest ecosystems.

The challenge of changing people’s perceptions about wildland fire has been recognized for at least 40 years (Davis 1959 as cited by Mutch 1976). Mutch voiced a need for imaginative educational materials to tell the public about fire’s ecological role. However, conservation education was often viewed as merely “a nice thing to do” or was initiated only after a severe, destructive fire (USDA-FS 1998). Educational programs did not take precedence over other public land management responsibilities; therefore, programs were implemented only in addition to managers’ existing duties.

In one of the earliest studies to examine adult knowledge, attitudes, and beliefs about wildland fire, Stankey (1976) recommended that managers educate and involve the public, make gradual changes in policy, and provide communications programs aimed at many different audiences. These recommendations continue to be supported by more recent studies (Mastrofrodo et al. 1990). Public messages about fire should include the ecological role of fire plus all aspects of fire management: fire prevention, suppression, prescribed burning, and wildland fire for resource benefit (Gardner et al. 1985). Stenberg (1982) found a correlation between knowledge of fire effects and support for or opposition to various fire policy statements. Taylor and Daniel (1984) indicated that fire education programs do not need to be extremely intensive nor expensive to be beneficial.

In 1995, the US Departments of Agriculture (USDA) and Interior (USDI) recommended that “a clear message about the important role of fire as a natural process and an understanding of policies concerning wildland fire and the urban interface” be communicated to the general public (USDI and USDA 1995, p. 12). Most of the materials and programs developed in response to this recommendation target students. Our research investigated the effectiveness of adapting one of these programs, called FireWorks, for use with adult audiences.

FireWorks (Smith and McMurray 2000) was developed by the USDA Forest Service Rocky Mountain Research Station, with support from the Northern Region and the Bitterroot Ecosystem Management Research Project. The program targets students in grades 1 through 10. FireWorks has two objectives: to increase understanding of wildland fire and to increase skill in science, mathematics, and critical thinking. The 36 activities in FireWorks use interdisciplinary, hands-on investigations to introduce students to principles of combustion in wildland fires.
fuels, characteristics that enable plant and animal populations to survive fire, historic fire regimes in different kinds of forest, change in forest communities over time, and people's influences on forests and wildland fire. To convey the diversity of fire regimes within a geographic area, FireWorks focuses on three kinds of forest that occur in the Rocky Mountains and Intermountain area: ponderosa pine, lodgepole pine, and whitebark pine.

The objectives of FireWorks are consistent with the goals, management direction, and messages of the interagency National Wildfire Coordinating Group (NWCG 1999) and follow the recommendations of the Conservation Education Task Force (USDA-FS 1998). Hundreds of teachers have attended FireWorks workshops, and the program has been used by thousands of students—mainly in the northern Rocky Mountains, Intermountain Region, and Alaska. Thomas and others (2000) found that use of FireWorks increased knowledge about wildland fire in seventh-graders and improved student attitudes toward their teachers and learning environment. This project assesses the effectiveness of workshops using hands-on activities from FireWorks to help adults learn about fire behavior, ecology, and management.

“Teaching” Adults

An informed, motivated citizenry is essential in public decisionmaking processes affecting the environment (Stankey 1976). The National Environmental Policy Act (NEPA) requires public involvement for fuel treatment and forest restoration projects and development of fire management plans. Effective public involvement relies on understanding and trust from members of the public. To gain public trust regarding fire management, it is important to narrow the knowledge gap between scientists, managers, and the public (Yankelovich 1991). Furthermore, increased adult understanding of wildland fire is needed to raise awareness and begin the process of “working through” available information, so that decisions will not be dominated by impulsive or emotional first responses (Yankelovich 1991).

Table 1 (continued). Items used to measure workshop participants’ knowledge, attitudes, and beliefs about fire ecology and management on the pretest, posttest 1, and posttest 2.

<table>
<thead>
<tr>
<th>Attitude items</th>
<th>Pretest</th>
<th>Posttest 1</th>
<th>Posttest 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A real estate agent shows you a newer home (2–3 years old) on 3 acres of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Forest fires have beneficial effects on the natural environment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Severe fires are less likely to occur in pine forests that have experienced</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The agency managing the ponderosa pine forests around your community wants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. If you knew that there was a 2,000-acre prescribed fire within a mile of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Increasing use of prescribed burns in an area: ponderosa pine, lodgepole</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Growing space for ponderosa pines would increase.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. The potential for future large wildland fires would be reduced in that</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Roots growing within the duff layer would be protected from the heat.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Belief items

1. I believe suppressing forest fires increases the chances of a very large fire occurring. |            |            |
2. I believe periodic forest fires would have beneficial effects on habitat for animals such as elk and woodpeckers. |            |            |
3. If a surface fire burned through a forest with underbrush, fallen needles, and tree seedlings, indicate your predictions. |            |            |

There is no single, universal definition that describes adult learners. Adults typically take on learning as a secondary role after fulfilling primary roles of parent, spouse, employee, or community leader (Polson 1993). They have a rich experience base to draw on as well as different developmental changes and tasks. Their lives are complex and diversified, with many variables affecting learning processes (Knowles 1980; Smith and Pourchot 1998).

An effective adult educator considers these characteristics when planning outreach and educational programs. The learning environment should make people feel comfortable both physically and mentally, and everyone must be respected, accepted, and supported. The information presented should be accessible, using clear language and avoiding jargon (Knowles 1980), and it should be relevant and applicable to real situations (Jackson 1980).
1. Connect the learner’s existing knowledge, experiences, beliefs, and attitudes with a new set of knowledge, experiences, beliefs, and attitudes.

2. Place the responsibility of what is learned on the learner and accentuate self-directed learning.

3. Encourage learners to transfer learning from the instructional context (e.g., workshop environment) to an application context (e.g., applying fuel breaks around the house).

Methods

The target population for this research was rural communities of the northern Rocky Mountains and Intermountain area. We contacted leaders of existing community organizations (e.g., workshop environment) to an application context (e.g., applying fuel breaks around the house).

Four activities from the FireWorks program (Smith and McMurray 2000) were selected for the workshops, based on their importance for understanding wildfire behavior and fuels to assess the safety of homes in the wildland-urban interface.

Participants apply what they know about fire behavior and fuels to assess the safety of homes in the wildland-urban interface.

Activities Used in Public Workshops

“Will It Burn?”

Participants ignite three kinds if wildland fuels—conifer needles, buds, and roots—and compare their burning properties. They explain their observations in terms of the Fire Triangle (oxygen, heat, and fuel).

“Fire Triangle in Wildlands”

Participants view a three-minute video titled Three Kinds of Fire, which displays properties of surface, crown, and ground fires. Matrices of matches are constructed as physical models of forests with different densities and arrangements of trees, then burned to investigate the effects of slope and tree density/arrangement on crown fire spread.

“Forest Communities”

Participants examine cross sections from three tree species (ponderosa, lodgepole, and white-bark pines). They use their observations to describe fire history in each forest type and characteristics that enable some species to survive wildland fire.

“People in Fire’s Homeland”

Participants apply what they know about fire behavior and fuels to assess the safety of homes in the wildland-urban interface.

Participants ignite three kinds of wildland fuels—conifer needles, buds, and roots—and compare their burning properties. They explain their observations in terms of the Fire Triangle (oxygen, heat, and fuel).

“Fire Triangle in Wildlands”

Participants view a three-minute video titled Three Kinds of Fire, which displays properties of surface, crown, and ground fires. Matrices of matches are constructed as physical models of forests with different densities and arrangements of trees, then burned to investigate the effects of slope and tree density/arrangement on crown fire spread.

“Forest Communities”

Participants examine cross sections from three tree species (ponderosa, lodgepole, and white-bark pines). They use their observations to describe fire history in each forest type and characteristics that enable some species to survive wildland fire.

“People in Fire’s Homeland”

Participants apply what they know about fire behavior and fuels to assess the safety of homes in the wildland-urban interface.
33 men. Their ages ranged from 18 through 68 years, averaging 45. All participants had completed high school; 65 percent had attended at least some college. Length of residence in the community ranged from one year to 55 years, averaging 20 years.

Mann-Whitney U and Wilcoxon Rank Sum tests (Zar 1984) were used to determine if knowledge, attitudes, and beliefs varied significantly with age, education, or gender. No statistically significant effects were found (for all demographic descriptors p > 0.05), so surveys were not stratified by demographic characteristics.

Survey responses to “knowledge” questions were marked as “correct” or “incorrect,” and the number of correct answers was recorded. Responses to questions about attitudes and beliefs were evaluated as “supportive” or “not supportive” of fire management and the number of supportive responses was recorded. Data were analyzed using Friedman tests (Statistical Package for Social Science Software 10.1 for Windows), which provided mean rank values for the pretest, posttest 1, and posttest 2. Significant differences were further analyzed using a Multiple Comparison Analysis (Hochberg and Tamhane 1987). Differences between mean ranks were considered statistically significant at p < 0.05.

Participants demonstrated significantly greater knowledge about wildland fire on posttest 1 than on the pretest, and they retained a majority of this information 30 days after the program (fig. 1). At the end of the program and 30 days afterward, participants’ attitudes were significantly more supportive of fire management than they were at the beginning of the workshop. Participants’ beliefs about fire management were also significantly more supportive at the end of the program; the strength of this support declined significantly in the following month but remained significantly greater than at the start of the workshop.

Responses to the questions about the program format and activities show that people enjoyed the workshops. Many responded that they “enjoyed the hands-on applications.” Several positive comments pertained to specific demonstrations and materials used in the activities. Participants appreciated that the workshops were participatory and provided information pertinent to community issues. They agreed unanimously that the facilitators were helpful in the learning process, and many indicated that they would participate in similar workshops in the future.

Discussion

This study demonstrated that hands-on learning is an effective method for reaching adult audiences with information on wildland fire. Participants were more knowledgeable about fire behavior, ecology, and management—as well as more supportive of fire management—after the program. Hands-on learning techniques can help adults better understand wildland fire ecology and management issues. If these learning opportunities are available prior to public participation activities where alternative actions are being considered and management decisions are made, the public will be better informed and thus public involvement processes may be more successful and public support for management actions may increase. Although this research focused on fire, the techniques of hands-on learning in a workshop format may improve communications with the public in regard to many natural resource ecology and management issues; numerous educational “trunks” are available to environmental educators (see, for example, the list of trunks in Montana at www.thenaturecenter.org/trunkguide.htm) and could be adapted for workshops with adults.

Although knowledge gain was associated with more positive attitudes and beliefs about fire management in this study, it does not necessarily follow that the knowledge gain caused the changes in attitudes and beliefs. Previous environmental education research indicates that increased knowledge does not consistently promote positive attitudes, although the two are sometimes strongly associated (e.g., Bradley et al. 1999; Kuhlemeier et al. 1999). Many authors warn that successful dialogue with the public requires much more than information (e.g., Weber and Word 2001); it requires an environment of respect and trust, where all participants can speak and be heard. The informal structure and hands-on activities used in this study provided such an environment and also gave participants the experience of observing, questioning, discussing, and solving problems together—good practice.
for the more complex issues that arise in fire and land management planning.

Limitations

The workshops for this study were held during a challenging summer for fire management in the western United States. The Cerro Grande fire in Los Alamos, New Mexico, occurred in early May 2000, when we were beginning the workshops. Posttest 2 was sent out during July and August, when large fires were burning in Montana and Idaho. Media coverage about the summer's fires may have affected participants' knowledge, attitudes, and beliefs about fire management.

The research goals of our study and the surveys themselves may have affected the reliability of our results. The introduction to the workshops included a brief description of the project supporters and workshop facilitators, informing participants that their responses would be used for research. This may have caused some individuals to respond differently than they would in a purely informational workshop. The survey questions were taken from previous surveys and the FireWorks curriculum. We assumed the questions measured what they were intended to measure: knowledge, attitudes, and beliefs.

Recommendations

As fire managers reach out to the public, they need tools that will help them communicate fundamental concepts about fire behavior, fire's role within ecosystems, and fire management. Hands-on learning from the FireWorks program is one such tool that can be used to reach adult audiences in small, rural communities. Agencies conducting fire management should support educational outreach for adults with programs that would complement established prevention programs. We recommend small programs for workshops with adults, 30 to 45 minutes long. This length would allow one activity to be presented effectively. Many community groups that meet weekly or monthly for 1 to 2 hours seek this kind of short program for members. Hands-on workshops could also be presented in public campgrounds throughout the summer and could be provided in partnership with extension foresters and volunteer fire departments (urban and rural), through continuing education programs and through outfitter and guide associations.

Future research should evaluate retention of information and changes in attitudes and beliefs over a time greater than one month. Such evaluation should be conducted at a time of year when the media are not covering the topic daily.

Literature Cited


Stenberg, K.J. 1982. The knowledge and attitudes of forest users towards the effects of forest fires and fire management policies. Master's thesis, University of California, Riverside.


