



Goals, obstacles and effective strategies of wildfire mitigation programs in the Wildland–Urban Interface

Margaret A. Reams^{a,*}, Terry K. Haines^{b,1}, Cheryl R. Renner^{c,2}, Michael W. Wascom^a,
Harish Kingre^a

^a*Department of Environmental Studies, 2107 Energy, Coast, and Environment Building; Louisiana State University,
Baton Rouge, LA 70803, United States*

^b*Southern Research Station, USDA Forest Service, 701 Loyola Avenue, Room 10034, New Orleans, LA 70113, United States*
^c*212 Pocosin Drive, Mandeville, LA 70471, United States*

Abstract

The dramatic expansion into the Wildland–Urban Interface (WUI) places property, natural assets, and human life at risk from wildfire destruction. The U.S. National Fire Plan encourages communities to implement laws and outreach programs for pre-fire planning to mitigate the risk to area residents. Starting in 2003, we surveyed the administrators of regulatory and voluntary wildfire risk reduction programs in 25 U.S. states. These state and local programs are listed on the United States Department of Agriculture (USDA) Forest Service's National Wildfire Programs Database website, www.wildfireprograms.usda.gov, and are concerned with vegetation management on private lands. Analyses of the administrators' responses suggest several new insights about these risk mitigation efforts, including 1) how they are organized, 2) what they are trying to accomplish, 3) what are the obstacles, and 4) how well they may be working.

In our study we describe the goals and objectives of these programs as well as the obstacles confronting managers. Further, we explore trends in these programs including participation in collaborative planning and use of program evaluation to measure progress toward goals. Additionally, we explore the program managers' perceptions of what are their most effective programs for creating defensible space.

© 2005 Published by Elsevier B.V.

Keywords: Wildfire risk reduction; Wildfire programs; Wildfire mitigation; Community planning

1. Introduction

Expansion into the Wildland–Urban Interface (WUI) has placed property, natural assets, and human life at risk from wildfire destruction. Wildfires in 2000 and 2002 were particularly devastating, with a total of more than 15 million acres burned

* Corresponding author. Tel.: +1 255 578 4299; fax: +1 225 578 4286.

E-mail addresses: mreams@lsu.edu (M.A. Reams),
Tkhforest@aol.com (T.K. Haines), Shoodancer@aol.com
(C.R. Renner).

¹ Tel.: +1 504 589 6652.

² Tel.: +1 985 845 7061.

and nearly 1700 homes destroyed (National Inter-agency Fire Center, 2004). Furthermore, California suffered its worst wildfire season in modern times in 2003 with more than 739,000 acres burned and 3600 homes lost (U.S. Department of Agriculture and Interior, 2004).

The U.S. National Fire Plan encourages communities to implement laws and outreach programs for pre-fire planning to mitigate the risk to area residents. Many of these risk mitigation programs are listed on the USDA Forest Service's National Wildfire Programs website, www.wildfireprograms.usda.gov, a catalog of state and local programs to reduce hazardous fuels in and around Wildland–Urban Interface (WUI) communities using vegetation management, primarily on private lands. Since many of these programs are relatively new, it is useful to examine their objectives and activities.

To date, there has been no systematic review of state, local and county efforts for wildfire risk mitigation in the WUI and whether or not they are effective. The question of overall program effectiveness is complex. Naturally occurring variations in wildfire risk and the unpredictability of human behaviors that often lead to wildfire, make it impossible simply to assume that those areas spared by catastrophic wildfire in recent years have more effective risk reduction programs. Insight into more effective strategies for risk reduction is important to public policy theorists, public decision makers, and community stakeholders.

Our research objectives are two-fold. First, we report on current state and local risk reduction programs, describing stated objectives, activities, and managers' perceived obstacles to program effectiveness. Second, we examine the trends in these programs toward two valuable and proactive management strategies—participation in collaborative planning and conducting regular program evaluations.

Collaborative pre-fire planning among community stakeholders is encouraged by the National Fire Plan as an important mechanism to build public support and institutional capabilities for on-going vegetation management. Similarly, program evaluation is a useful activity that facilitates increased accountability and enables program managers to make adjustments in budget allocations and activities as they gain insight into which approaches and tools may be

working best to reduce wildfire risk. Our examination of program evaluation efforts includes reporting on performance indicators suggested by program managers as well as the most valuable risk reduction tools recommended by respondents. This information is relevant to eventual discussions of how well these state and local risk reduction programs may be working.

2. Motivating the public to reduce wildfire risk

One of the challenges facing decision makers as they formulate state and local risk mitigation programs is how to change the behaviors of private property owners regarding vegetation management. While there is substantial scientific research concerning components of wildfire risks, such as the relative influences of climate, topography, and fuel loadings, there is far less research concerning related human behavior and the types of programs most likely to lead to desirable changes in that behavior. At the program level, the strategies employed by risk reduction programs targeted to private property owners remain largely untested; however, a growing body of research suggests it is inherently difficult to change the behavior of property owners.

Public risk perceptions concerning wildfire appear to affect residents' support for policy alternatives to mitigate the risk. For example, Bradshaw (1987) and Loehner (1985) reported that many residents within WUI communities had no direct experience with the devastating effects of wildfire and, as a result, tended to underestimate the risk. Even those who have experienced a disaster in the past and have survived, often fail to recognize the risk of a future event (Halpern-Felsher et al., 2001). Working with focus groups in Michigan, Winter and Fried (2000) found that wildfire is perceived to be inherently uncontrollable, with random patterns of damage; a perception that tended to discourage individual property owners from engaging in unilateral removal of vegetation. Further, they found that regulations such as zoning and safety ordinances for vegetation management are viewed as unacceptable infringements on the rights of property owners. On the other hand, support for more restrictive government regulations seems to

increase after a community has experienced a wildfire (Abt et al., 1990).

Similarly, Mileti and Peek-Gottschlich (2001) found that perception of reduced risk is a function of cultural identity and values. Americans tend to put their faith in technology to protect them from hazards. At the same time, this faith is tempered by the American spirit of individualism which resents government interference in closely guarded personal rights (Mileti, 1999). This belief that technology, provided by some level of government, will ward off danger results in “blaming behavior” when a disaster is not averted. Kumagai et al. (2004) found that after the Butte Complex Fires of 1999, homeowners blamed California Department of Forestry and Fire Protection (CDF) for starting a backfire that burned their homes when no such backfire was documented.

In addition to perceptions of risk, values are important as an underlying obstacle to fuels reduction. Residents may not support vegetation management because they fear that removal of trees and shrubs will negatively affect the aesthetics and ecological functions of a natural landscape (Alan Bible Center for Applied Research, 1998; Hodgson, 1993; Davis, 1990). Winter and Cvetkovich (2003) found predictive success in the support of fuels management strategies by the Forest Service when values are shared by the agency and the public. Further research by Winter et al. (2004) in California, Michigan and Florida found that while agency trust varied geographically, trust to make decisions regarding defensible space ordinances was lower than trust to make decisions about prescribed burning or mechanical treatment at all three locations.

The Winter and Fried (2000) and Winter et al. (2004) findings suggest that public support may be weak for regulations, but stronger for educational and assistance programs that raise the awareness of the wildfire threat, teach specific methods for fuel reduction, and encourage a coordinated set of mitigation actions among community residents.

Given the various constraints on residents’ willingness to implement vegetation management strategies, a clear role exists for effective risk reduction programs. Existing efforts tend to take the form of direct regulations at the state, county or municipal levels or more voluntary, educational programs. This research is an initial step in gaining insight into: 1)

what these programs are attempting to accomplish, 2) how they are going about furthering their goals, 3) what obstacles their administrators are encountering, and 4) what program elements are the most effective in reducing risk to WUI communities from catastrophic wildfire.

3. Data and methods

The research consists of two distinct parts. First we developed the National Wildfire Programs Database website, cataloging state and local wildfire risk reduction programs. The purpose of the database website, www.wildfireprograms.usda.gov is to facilitate the broad dissemination of ideas among fire protection officials, community leaders, policy makers, planners, educators, and homeowners by describing the wildfire mitigation programs that state and local governments across the country have implemented.

As of the summer of 2003 we had investigated 150 programs in 25 states, and were continuing to build the database. The website information gave us an overview of program structure and type, and allowed us to move to the second phase of research. We developed a survey designed to elicit information on the scope of programs, administrative difficulties, and to begin to investigate the question of program effectiveness.

The survey is an attempt to gather detailed information about the objectives, activities and experiences of managers of state, county, and local risk mitigation efforts. We sent surveys via email to administrators or officials of the risk reduction programs listed on the National Wildfire Programs Database website. We did not attempt to construct a sample of the programs listed on the website; our intent was to gather information about the entire group of programs. The survey was concise and respondents could simply fill in their answers and send the completed survey by reply email.

We were aware of potential problems involved in conducting a survey through email and took steps to minimize them. Researchers have identified several limitations of email surveys including respondents’ technical difficulties with recording answers and returning the questionnaire via email, variations in

question display according to screen size, as well as questions of validity and reliability that accompany all types of questionnaires (Dillman, 2000; Dillman et al., 1998). To make the display of questions as uniform as possible, we avoided graphics and used a text-style presentation. We sent the survey as an RTF attachment to our introductory email message. We encouraged recipients to contact us by phone or email if they had any difficulty opening the attached survey. Only two recipients had difficulty either opening the attachment or returning the completed survey to us by email.

Our initial contact with many of the program managers was during the preliminary research phase where we located contacts, gathered information about the programs, and constructed the National Wildfire Programs Database. Website entries include information about the purpose, features, and accomplishments of wildfire hazard mitigation efforts, as well as links to pertinent websites and program managers' contact information. We notified program managers in advance that the survey would be sent soon, and we asked them to participate in the research. We emailed 100 surveys and received completed surveys from 56 program managers.

In some cases, the same individual had responsibility for several initiatives described as separate programs on the website, and combined his or her thoughts into one questionnaire. In other cases, managers of programs did not respond, even after 2 follow-up email contacts. We compared the list of non-responders with the managers who did respond in an effort to determine possible bias in the responses. The non-responders were evenly distributed among the various types of risk reduction programs, indicating no significant response bias in the survey.

We based survey questions on program characteristics we identified in our prior research. We found that the objectives of the existing state and local wildfire mitigation programs generally fell into four broad categories: education, hazard assessments and mapping, homeowner assistance, and implementation of regulations. We also used information from the website program descriptions to identify specific activities that were conducted to meet the broad objectives. We constructed a spreadsheet to determine the frequencies of a wide-range of wildfire mitigation activities categorized under the four broad program objectives in the survey. For example, the educational

objective listed 14 activities that were found in the website database such as community meetings, workshops for officials and firefighters, websites dedicated to wildfire information, and classroom education.

We used this information to construct a list of likely activities managers would be involved in to further the stated goals of their programs. These questions were presented as a "check all that apply" list of activities under each of the four broad program goals of education, homeowner assistance, area-wide risk assessment, and implementation of regulations. Each of these questions concerning activities to further goals allowed managers to enter additional activities not identified in the question.

In addition to questions designed to obtain basic information about the key objectives and specific activities being conducted, the survey posed questions about the obstacles managers believed were limiting the effectiveness of their efforts. We used information gleaned from our prior work in creating the program summaries for the website to inform our questions about potential program obstacles. We presented the survey recipients with a list of potential impediments and asked them to indicate on a scale of 0–5, the extent to which the issue is an obstacle to their program achieving its goals.

We asked simple open-ended questions as to whether they conduct systematic evaluation of their programs, and if so, the purposes for that evaluation and the indicators used to measure effectiveness. Similarly, respondents were asked to respond to open-ended questions concerning their most effective program tools or activities for risk reduction, whether they participate in collaborative planning, and, if so, the number of partner groups they work with.

We used descriptive statistics in SPSS version 11.5 to analyze some of the responses to the survey. For open-ended questions, we summarized the information from the respondents and then placed responses in categories for the purposes of reporting.

4. Survey results

4.1. Education

We found that a component for education was nearly universal in that 55 of the 56 managers reported

education and public outreach as program objectives. Respondents indicated using a number of methods to educate the public about the dangers of living in wildfire-prone areas, and the importance of creating defensible space around their homes. Publications that promote hazard reduction, fire protection and safety, as well as landscaping and defensible space guidelines specific to the geographic area have been developed and distributed through mailings, public events, and on websites. Lists of recommended fire-resistant plant species have been developed and disseminated, particularly in new residential developments, and demonstration homes and gardens have been created. Publicity in newspapers, on radio, television and through videos which discuss wildfire protection, hazard reduction planning, and thinning projects are another way residents are being informed. Classroom resources and teacher education are part of the overall education component in many of the jurisdictions. In several states, a fire science component has been added to the science curriculum. Software and media firms have been contracted to create the curricula for educating students about wildfire ecology, safety, and protection. The curricula often include the use of interactive cd-roms and videos.

Fire protection officials have developed their own classroom programs in many areas. These efforts have included hands on defensible space and fire safety programs for grade school students. Those targeting high school students have involved fuel removal around schools and field exercises, such as assessment and mapping of high fire-risk areas in the community.

Fire officials are also conducting community and neighborhood meetings. In these meetings a dialogue between residents and fire officials is established and issues related to wildfire protection measures for the area are explored. In addition, wildfire management officials are also promoting firewise workshops for volunteer and career firefighters, planners, developers, and policy makers. The workshops generally focus on developing a wildfire risk management plan for the town/community. While education programs varied from ones that simply distribute firewise vegetation and construction information to fully developed programs with all of the elements described above, the median number of program elements in all education programs was 8.

4.2. Wildfire risk assessments and mapping

State and local wildfire risk assessments and mapping projects were underway, or had been completed, in 46 of the 56 survey responses. Designation of high-risk areas is accomplished by assessing the interaction of individual risk factors such as fuel loading, topography, fire history, climate, housing density, and infrastructure for fire fighting. Inspections by trained personnel using a wildfire hazard severity rating system to determine risk for individual homes and subdivisions were being used in 44 localities. Hazard severity rating systems used are often based on a model developed by the National Fire Protection Association in NFPA 299. This model was adapted for individual states by several state fire protection organizations. The model assigns a rating for individual components of wildfire risk related to vegetation, home construction materials, road design and access, water availability, signage, and other factors. From these ratings, a composite hazard severity score is assigned (NFPA, 1997).

4.3. Homeowner assistance

Direct assistance to homeowners was reported as a program objective by 47 of the managers surveyed. Those jurisdictions offering homeowner assistance usually provided a combination of services, such as home inspections, free prescriptions, and cost-share or free clearing and chipping or disposal of debris. Despite the high cost of land treatment for homeowners, 18 jurisdictions provide free defensible space clearing assistance to homeowners, and 28 of respondents offer assistance on a cost-sharing basis. Other popular assistance activities include free chipping of debris in 27 jurisdictions, and free slash disposal in 19 jurisdictions. Many jurisdictions have instituted regular curbside pickup and/or established community disposal sites. The median number of homeowner assistance activities per jurisdiction is 3.

4.4. Implementing regulations

Twenty-six program managers indicated that their wildfire mitigation program includes a regulatory

component. Managers reported that the focus of their regulatory programs includes mandatory defensible space standards and/or wildfire hazard review processes for new developments. Types of regulations include comprehensive wildfire mitigation regulations or fire codes based on NFPA 299 or the Urban–Wildland Interface Code (International Code Council, Inc., 2003), subdivision regulations and/or development plan standards, and zoning overlay districts. Of the 26 jurisdictions with regulations, 22 implemented standards applying only to new construction, and 15 apply to both new and existing structures. Real estate disclosure of location within a wildfire hazard zone was required by law in 9 jurisdictions, and insurance incentives for creating and maintaining defensible space apply in 7 jurisdictions.

All but three managers with regulatory program components indicated that regulatory strategies are a component of broader, comprehensive programs that also include education and public outreach efforts, homeowner assistance, and wildfire hazard assessment and mapping. The median number of regulations per jurisdiction was 1.

Table 1
Descriptive statistics of perceived obstacles to program effectiveness

	N	Range*	Mean	Standard deviation
Inadequate program budget	56	0–5	3.3214	1.44105
Lack of qualified staff	56	0–5	2.4643	1.68377
Need more technical help	56	0–5	1.8393	1.46196
Public apathy	56	0–5	3.0536	1.45752
Residents resist vegetation management	56	0–5	2.7500	1.25408
Unclear program goals	56	0–5	1.5357	1.26440
Scientific uncertainty of risk	56	0–4	1.5714	1.23373
Inadequate community risk assessments	56	0–5	1.8036	1.49447
Not enough help for property owners	56	0–5	1.7679	1.43958
Low enforcement of regulations	56	0–5	1.7679	1.62918
Little cooperation among stakeholders	56	0–5	1.7321	1.47082
Inadequate public input into fire policy	56	0–5	1.3929	1.43563
Other obstacles to program success	56	0–5	.8393	1.77638
Valid N (list wise)	56			

*Responses ranged from “0” (not an obstacle) to “5” (a very significant obstacle).

4.5. Identifying the major obstacles facing managers of risk reduction programs

Respondents were asked to indicate the major obstacles they face in meeting the goals and objectives of their programs. Respondents examined a list of potential obstacles such as budgetary constraints, inadequate cooperation among relevant public and/or private agencies, and public apathy. Respondents were asked to indicate on a scale of 1–5, the extent to which the item is an obstacle. If an item is not an obstacle at all, the respondents were asked to put a “0” in the blank.

Respondents indicated that the most serious obstacles to the success of their programs have to do with limitations of resources and negative attitudes on the part of residents (Table 1). Specifically, the perceived obstacles scoring the highest ratings are budget limitations, public apathy, shortages of technical staff, and resistance by property owners to removal of dangerous fuel buildup and ongoing vegetation management.

5. Proactive management trends

5.1. Participation in collaborative planning

We were interested in the extent to which program managers are engaging in collaborative pre-fire planning with other stakeholder groups. The managers were asked whether they participate in such collaboration and, if so, how many partner groups they work with. Fifty of the 56 respondents reported that they are involved in collaborative planning to some extent. The number of reported partners ranged from 1–22, with a median of 4.

What results did respondents expect to see as a result of collaborative planning? The most often-mentioned result was simply “more effective plans”, with 35 managers voicing this expectation. Twenty-three respondents indicated that a significant increase in public support for vegetation removal would result from participation in pre-fire collaborative planning. Many believed that the increased public support would follow from the publicity that such collaboration would garner in the local news media.

5.2. Program evaluation efforts

The second proactive management element of interest was whether administrators attempt to measure progress toward stated goals and objectives in some systematic manner. In addition, the managers were asked to indicate how they measure progress and for what purposes. This is important information for the building of an evaluation framework for these programs. It indicates the extent to which program evaluations are taking place, the supporting data being collected, and what types of performance indicators may be relevant or useful in future evaluations of the effectiveness of these risk mitigation programs. Forty-four of the 56 respondents report that they are attempting some type of systematic review of progress toward stated program objectives. They undertake these evaluations for a variety of reasons ranging from internal budgetary decisions to compliance with guidelines for grants and other types of financial support received.

The specific indicators of program effectiveness used by these respondents include both direct and indirect measures of progress. The more direct measures of risk reduction include increases in number of properties where fuel reduction is achieved, as reported by 24 of the 44 respondents. More indirect measures include number of participating property owners or community groups, as well as the number of educational meetings and workshops conducted during a designated period of time. These measures were reported by 42 of the 44 respondents who conduct regular program evaluations. Most of the respondents who favored direct indicators also suggested including the more indirect measures in evaluations in order to estimate both the level of effort put forward by the program as well as the ultimate impact of that effort.

5.3. What program activities are seen as most effective?

The last question of the survey was an open-ended question, "Please describe your most effective program activity for creating defensible space." The results are interesting in that 30 of the 46 respondents to this question chose more than one program element, despite the phrasing of the question, which asked for only one element (Table 2).

Table 2
Number of program elements reported to be "most effective"

No. of program elements	All Programs no. of responses (<i>n</i> = 46)	Complex programs no. of responses (<i>n</i> = 23)
1	16	9
2	11	7
3	11	3
4	7	4
5	0	
6	1	

In Table 2, the first column shows responses by all program managers, and the second column shows responses by managers of complex programs. Complex programs include all four objectives: education, risk assessment, homeowner assistance, and regulations. This will control for any bias due to programs that do not offer all the program areas. The fact that the majority of program managers resisted identifying only one single most effective activity suggests that these activities tend to be mutually supportive. The managers see fuel reduction like a puzzle, with many elements fitting together to solve the problem.

The number and frequency of the six most effective program elements most often selected by respondents are given in Table 3. Again, we look separately at all responses and responses by managers of complex programs. If a program offers only public education, its program manager would by necessity choose education as his or her most effective program element. By looking at both columns we are controlling for bias, while reporting the preferences of all respondents.

We see that the percentage of respondents choosing education as the most effective program drops significantly in the complex programs column compared to the larger group: 17% as opposed to 30%. However, the top six program elements remain the same, albeit in a different order. Public education and regulations reverse places, with regulations tying with risk assessment for the third selection and education dropping to sixth.

We can draw several insights from the preferences of program managers, themselves grappling with how best to invest their time and resources. First, their responses indicate confidence in hands-on, practical assistance to private property owners. Thus, those programs that are more active in offering this type of

Table 3
Program elements reported to be “most effective”

Program element	All programs no. of responses (<i>n</i> = 46)	Complex programs no. of responses (<i>n</i> = 23)
Cost-share or free treatment	21	10
Disposal or chipping of slash	17	9
Public education	14	4
Risk assessment and mapping	13	7
Prescriptions	10	5
Regulations	10	7

aid to homeowners are using some of the most effective methods to reduce risk. Second, many program managers, particularly those who implement legal requirements, believe regulations are an effective tool, thus, should be part of a multi-faceted program to reduce hazardous fuels on private land. These responses suggest that it is a combination of program elements that has the greatest effect on changing the behavior of residents of WUI communities to reduce hazardous fuels on their properties.

6. Conclusion

With the increasing development in the WUI a major challenge to fire managers will be to develop effective programs to reduce the risk from catastrophic wildfire. We have taken a first step toward a more systematic examination of current state and local efforts.

First, we have clarified the stated objectives of these programs. Those objectives may be categorized as: 1) education, 2) assessment of area-wide risks, 3) assistance to private property owners, and 4) implementation of regulations and standards. Identification of goals allows for creation of an organizational typology whereby programs with similar goals and objectives may be placed into similar categories. This is a useful step, given that eventual discussions of program effectiveness should reflect progress toward specific program goals. Second, we have identified the types and relative severity of challenges managers are grappling with to further their programs' goals and objectives. The most significant obstacles

reported deal with inadequate program funding and negative public attitudes. Third, we have examined trends among these programs toward two important, proactive management activities—collaborative planning and program evaluation. Finally, we report managers' recommendations for appropriate indicators of program effectiveness as well as those program tools they believe to be most effective in reducing wildfire risk.

Examination of these programs is a new area of inquiry. This survey of program officials has yielded insights into state and local risk mitigation efforts that should aid program planners and researchers as they consider the effectiveness of these important efforts.

Acknowledgments

This research is supported by a cooperative agreement between the USDA Forest Service, Southern Research Station, Evaluation of Legal, Tax, and Economic Influences on Forest Resource Management (4802) and Louisiana State University. The authors thank James E. Granskog, Project Leader, for his valuable suggestions and input.

References

- Abt, R., Kuypers, M., Whitson, J., 1990. Perception of fire danger and wildland/urban policies after wildfire. In: Novdin, S., Waldrop, T. (Eds.), *Proceedings of an International Symposium, Fire and the Environment: Ecological and Cultural Perspectives*. USDA Forest Service, Southeastern Forest Experiment Station, Knoxville, TN, pp. 257–259.
- Alan Bible Center for Applied Research, 1998. Report of the Living with Fire Survey Results. Under Contract to Nevada Cooperative Extension. University of Nevada, Reno. Unpublished.
- Bradshaw, W.G., 1987. The Urban/wildland interface fire problem. Can social science play a role? In: Gole, R.D., Cortner, H.J. (Eds.), *People and Fire at the Wildland/Urban Interface (A Source Book)*. USDA Forest Service, Washington, D.C.
- Davis, James B., 1990. The wildland–urban interface: paradise or battleground? *Journal of Forestry* 88 (1), 26–31.
- Dillman, D.A., 2000. *Mail and Internet Surveys: The Tailored Design Method*. Wiley, New York.
- Dillman, D.A., Tortora, R.D., Bowker, D., 1998. Principles for constructing web surveys: an initial statement. Technical Report 98-50, Social and Economic Sciences Research Center. Washington State University, Pullman, WA.

- Halpern-Felsher, B.L., Millstein, S.G., Ellen, J.M., Adler, N.E., Tschann, J.M., Fiehl, M., 2001. The role of behavioral experience in judging risks. *Health Psychology* 20 (2), 120–126.
- Hodgson, Ronald W., 1993. Perceptions of Defensible Space (Perceived Characteristics that Influence Wildland–Urban Inter-mix Residents to Accept or Reject Fire Safe Landscaping). Department of Recreation and Parks Management, California State University, Chico, CA. March.
- International Code Council, Inc., 2003. International Urban–Wild-land Interface Code 2003. International Code Council, Country Club Hills, IL. 48 pp.
- Kumagai, Y., Carroll, S.C., Cohn, P., 2004. Coping with interface wildfire as a human event: lessons from the disaster/hazards literature. *Journal of Forestry* 102 (6), 28–32.
- Loeber, L.L., 1985. Fire hazard: the dimension of resident’s attitude: 51–55. In: Radtke, K. (Ed.), *Conference Proceedings Living in the Chaparral of Southern California*.
- Mileti, D.S., 1999. *Disasters by Design: A Reassessment of Natural Hazards in the United States*. Joseph Henry Press, Washington, DC.
- Mileti, D.S., Peek-Gottschlich, L., 2001. Hazards and sustainable development in the United States. *Risk Management: an International Journal* 3 (1), 61–70.
- National Interagency Fire Center, 2004. National fire news. <http://www.nifc.gov/fireinfo/nfn.html>.
- NFPA, 1997. NFPA 299 Standard for Protection of Life and Property from Wildfire. NFPA, Quincy, MA. 14 pp.
- U.S. Department of Agriculture and Interior, 2004. Implementation of the healthy forest initiative. Fact Sheet, 1–3 (www.fs.fed.us/r6/colville/hfi/more/fact-sheet.shtml).
- Winter, G., Fried, J.S., 2000. Homeowner perspectives on fire hazard, responsibility, and management strategies at the wild-land urban interface. *Society and Natural Resources* 13, 33–49.
- Winter, P.L., Cvetkovich, G.T., 2003. A Study Of Southwesterners’ Opinions on the Management of Wildland and Wilderness Fires—Fire Management Version. Pacific Southwest Research Station, USDA Forest Service, Riverside, CA.
- Winter, G., Vogt, C.A., McCaffery, S., 2004. Examining social trust in fuels management strategies. *Journal of Forestry* 102 (6), 8–15.