

An Examination of State and Local Fire Protection Programs in the Wildland-Urban Interface ¹

Margaret Reams,² Terry Haines,³ Cheryl Renner³

Abstract

Recent years have brought dramatic expansion of residential development into the Wildland-Urban-Interface (WUI). This rapid development places property, natural assets and human life at risk from wildfire destruction. The U.S. National Fire Plan encourages communities to formulate and implement regulatory and outreach programs for pre-fire planning to mitigate the risk to area residents. During 2003, researchers 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 USDA Forest Service's National Wildfire Programs website and are concerned with vegetation management on private lands. Empirical analyses of the administrators' responses suggest several new insights about these sub-federal risk mitigation efforts concerning how they are organized and what they are trying to accomplish. First, certain types of program activities - public education, assistance to property owners, and conducting area-wide risk assessments - are highly related, suggesting a common "bundle" of services offered by many of these programs. Second, desirable management activities - including forging collaborative associations with other stakeholder groups and measuring progress toward program goals - are associated with more "comprehensive" programs, those conducting numerous public education activities and offering a variety of services to property owners. Third, many program managers are facing significant obstacles as they attempt to meet the goals and objectives of their programs. These tend to fall into three categories: shortcomings within the broader policy context, such as inadequate scientific knowledge about fire risk; negative attitudes among the public, including resistance from property owners toward vegetation removal; and budgetary constraints. Finally, respondents offer the activities they believe to be most effective along with "measurable changes" in risk conditions they expect to see as direct results of their efforts. This suggests potential indicators of program effectiveness that may be useful in future research, shedding light on which approaches and activities may work best in reducing risk to WUI communities from catastrophic wildfire.

Introduction

Recent years have brought dramatic expansion of residential development into the Wildland-Urban-Interface (WUI), placing property, natural assets and human life at risk from wildfire destruction. The U.S. National Fire Plan encourages communities to formulate and implement regulatory and outreach programs for pre-fire planning to mitigate the risk to area residents. These programs are important because to reduce wildfire threat requires well-designed, coordinated efforts among various levels of

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² Department of Environmental Studies, Louisiana State University, Baton Rouge, LA

³ USDA Forest Service, Southern Research Station, Forest Resource Law and Socio-Economics, New Orleans, LA.

government, stakeholder groups, and private property owners. Moreover, effective efforts will be those that can change the attitudes and behaviors of residents, encouraging them to create defensible space and practice smarter management of the vegetation on their properties. Thus, a systematic review of these efforts is needed to better understand the complexities of their missions, how they are being implemented, and, ultimately, how well they are working.

During 2003, researchers surveyed the administrators of regulatory and voluntary wildfire risk reduction programs in 25 U.S. states. These are listed on the USDA Forest Service's National Database of State and Local Wildfire Hazard Mitigation Programs website, www.wildfireprograms.usda.gov, and are concerned with encouraging vegetation management on private lands. The objectives of this research are to examine these sub-federal risk mitigation efforts to determine what they are trying to accomplish, the major obstacles they are facing and how these obstacles may work as constraints on the programs, and how managers are attempting to gauge the effectiveness of their efforts.

Public Attitudes and Wildfire Risk Mitigation

One of the major challenges facing decision makers as they formulate sub-federal 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 level of program theory, the strategies employed by risk reduction programs targeted to private property owners remain largely untested.

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 had no direct experience with the devastating effects of wildfire and, as a result, tended to underestimate the risk. Over a decade later, Winter and Fried (2000) found that focus groups in Michigan perceived wildfire 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, some expressed a negative view of direct regulations for vegetation management on private lands as a potential infringement on property rights.

Similarly, Smith and Rebori (2001) cited several persistent attitudes among residents that may discourage vegetation management. These include: property owners may not want to believe they are at risk (McCaffrey 1999); they may not believe that vegetation removal only on their land will not stop a wildfire in the community; or that it is simply not their responsibility to protect themselves from wildfire risk (Loehner 1985). Further, some 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 1995; Davis 1990).

Winter and Fried (2000) findings suggest that public support may be strongest for educational-type programs that raise the awareness of the wildfire threat, teach

specific methods for fuel reduction, and encourage a more 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, public-outreach type programs. This research is an initial step in gaining insight into what these programs are attempting to accomplish, how they are going about furthering their goals, and the obstacles their administrators are encountering as they attempt to reduce risk to WUI communities from catastrophic wildfire.

Data and Methods

Researchers developed and administered a survey of program administrators in an effort to gather additional information about the wildfire risk reduction programs listed on the U.S. Forest Service website, "National Database of State and Local Wildfire Hazard Mitigation Programs" at www.wildfireprograms.usda.gov. The survey represents a first attempt at gathering detailed information about the objectives, activities and experiences of managers of state, county, and local risk mitigation efforts. Throughout the summer of 2003, researchers sent surveys via email to administrators or officials of as many of the risk reduction programs as possible. In some cases, such as a state statute or local ordinance, there were no apparent "contact" individuals to answer questions about the implementation of the law. We sent surveys to 100 administrators and received 56 completed responses. The researchers are continuing to add programs to the national data base weekly, as this phase of the project focused on wildfire risk reduction programs in only 25 U.S. states. Researchers used descriptive statistics, a series of bi-variate correlation and factor analyses in SPSS version 11.0 to answer the research questions.

Major Themes of Wildfire Risk Mitigation Efforts

Survey respondents were asked to indicate the major goals and objectives of their programs. Fifty-five are working toward "public education and outreach"; 46 are involved in assessing the wildfire risk at the community level; 44 are offering assistance to property owners for vegetation removal; and 26 of the programs in the survey are implementing legal standards and regulations.

Since many programs are pursuing more than one of these objectives, to what extent are these program objectives associated with each other? For example, are most of the programs that are actively pursuing "education" as a stated objective also implementing numerous "area-wide risk assessment" activities? And, are programs that oversee the implementation of regulations also involved in helping property owners clear dangerous vegetation from their land? To answer these questions, we constructed several variables from the survey responses. These are the reported total number of activities undertaken for: 1) public outreach and education (such as websites, demonstration projects, and workshops); 2) assessing general risk levels for the community (for example, creating GIS hazard maps and using fire behavior models); 3) assisting homeowners with hazard reduction (through individual property evaluations, treatment, chipping, and slash disposal), and; 4) the number of regulations or guidelines implemented by each program (such as requirements for new developments and/or existing residences). These four quantitative variables

indicate the level of program activity in the pursuit of the four distinct goals or objectives. We used a Pearson's correlation matrix to estimate the associations between these four quantitative variables.

We found that programs with more activities for public outreach and education also are more likely to be using multiple tools in conducting area-wide risk assessments, including GIS and technical risk assessment models (Pearson's $r = .382$; $p = .004$; $n = 56$). Also, more active public education programs tend to offer more services to help residents clear dangerous vegetation from their properties (Pearson $r = .589$; $p < .001$; $n = 56$). Similarly, programs that are more active in conducting risk assessments for the surrounding area tend to offer more assistance to property owners (Pearson $r = .400$; $p = .002$; $n = 56$). Finally, we found that programs implementing more regulations were also likely to be offering more activities to assist private property owners (Pearson $r = .388$; $p = .003$; $n = 56$). We found no significant associations between implementing more regulations and investing in more educational services or being more active in assessing general levels of wildfire risk within a community or county.

These findings suggest that several of the four program goals appear to be significantly associated, suggesting a tendency among program decision makers to offer a similar "bundle" of services to WUI residents that may transcend, to some extent, geographic location. The similarities among the programs in this survey suggest that efforts of national and regional organizations such as the Firewise Program and California's Fire Safe Council are effective in encouraging risk-reduction programs at the local levels.

Pre-fire Collaborative Planning

In addition to examining program objectives and activities, the researchers 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. These responses led to two variables measuring participation in collaborative planning and a rough estimation of the size or extent of their collaborations. Fifty of the respondents indicated that they are participating in pre-fire collaborative planning with other stakeholder agencies or organizations. The median number of partners in these collaboration is 4 and 43 of these managers expect to see tangible reductions in risk as a result of collaborative planning. The most widely expected results include the creation of more effective risk reduction plans and an increase in public support for defensible space and vegetation management.

Risk Reduction Programs and Systematic Evaluations

The second management activity the researchers were interested in 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 in that it indicates the extent to which evaluation of the effectiveness of risk reduction efforts may already be taking place. Further, it identifies performance indicators that may be useful in more formal evaluations of the effectiveness of these risk mitigation programs. The

number of respondents reporting that they attempt some type of systematic review of “progress toward stated program objectives” is 44 out of the 56 total respondents.

How do the Program Managers Measure the Effectiveness of Risk Reduction Programs?

We asked respondents to list the performance indicators they have assembled for the purpose of estimating progress toward program objectives. Their responses were:

- 1) Increase in number of properties where fuel reduction is achieved (24)
- 2) Compare results to goals (20)
- 3) Number of meetings or participants (17)
- 4) Make regular progress reports (13)
- 5) Number of communities participating (9)
- 6) Number of signups for programs (5)
- 7) Interviews with homeowners (4)

Most of the respondents attempt to measure progress toward reducing wildfire risk by keeping records of the number of treated properties within their community during a specified period of time.

Major Obstacles to Effective Risk Reduction Programs

We were interested in the obstacles faced by program managers as they attempt to meet their programs’ goals and objectives. Respondents examined a list of potential obstacles such as budgetary constraints, inadequate cooperation among relevant public and/or private agencies, and public apathy and 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 leave a blank space beside the potential impediment or put a “0” in the blank. The obstacles receiving the highest mean scores, indicating more significant problems are: budgetary constraints, public apathy, owner resistance to vegetation management, and a lack of qualified staff (Table 1).

Factor Analysis of Reported Program Obstacles

The researchers conducted a factor analysis of these responses and found that the obstacles cluster into three “dimensions” or types of problems. These are: 1) problems occurring mostly beyond the managers’ control and external to the program, within the larger “policy context”; 2) negative public attitudes, and; 3) inadequate funding for the program itself. For these 3 types of obstacles, a factor score was constructed for each case to indicate the extent to which administrators perceive them to be impediments to program effectiveness.

Table 1—What Obstacles Are Program Managers Facing in Meeting Program Goals?

	N	Minimum	Maximum	Mean	Std. Deviation
budget is obstacle	56	.00	5.00	3.3214	1.44105
lack of qualified staff	56	.00	5.00	2.4643	1.68377
need technical help	56	.00	5.00	1.8393	1.46196
public apathy	56	.00	10.00	3.1429	1.71017
owners resist veg. mgt.	56	.00	10.00	2.8393	1.55828
unclear program goals	56	.00	5.00	1.5357	1.26440
scientific uncertainty of risk	56	.00	4.00	1.5714	1.23373
inadequate com. risk assess.	56	.00	5.00	1.8036	1.49447
inadequate help for owners	56	.00	12.00	1.8929	1.94168
inad. enforcement of regs.	56	.00	5.00	1.7679	1.62918
inad. cooperation among stakeholders	56	.00	5.00	1.7321	1.47082
inad. public input into fire policy	56	.00	5.00	1.3929	1.43563
other obstacles to program success	56	.00	5.00	.8393	1.77638
Valid N (listwise)	56				

Note: Responses could range from “0” (not an obstacle) to “5” (a very significant obstacle).

Dimension 1 – Obstacles Relating to the Broader “Policy Context”:

- 1) Lack of qualified staff
- 2) Need for technical help
- 3) Unclear program goals
- 4) Scientific uncertainty of risk
- 5) Inadequate community risk assessments
- 6) Inadequate help for property owners
- 7) Inadequate enforcement of regulations
- 8) Inadequate cooperation among stakeholders
- 9) Inadequate public input into wildfire policy

Dimension 2 – Obstacles Relating to Public Attitudes:

- 1) Public apathy
- 2) Property owners resist vegetation management

Dimension 3 – Obstacle Relating to Program Funding:

- 1) Inadequate program budget

Do These Obstacles Limit Managers' Choices?

Several research questions can be answered by determining whether a statistical association exists between various program components, management activities and the reported obstacles facing program administrators. These questions are presented below:

1) Is there an association between reported budgetary constraints and the number of program objectives implemented by administrators?

Yes, a bivariate Pearson Correlation analysis revealed that the more severe the budgetary constraints, the fewer program goals and objectives were being attempted (Pearson $r = -.295$; $p=.029$; $n = 55$). Conversely, managers of those programs attempting to achieve more objectives are less likely to report budgetary constraints. Thus, more highly developed, more comprehensive risk reduction programs appear to benefit from adequate and stable levels of funding. However, we found no evidence that programs that attempted certain objectives or “bundles” of objectives were more or less likely to experience funding constraints. For example, programs implementing regulations reported no fewer budgetary problems than those with public outreach and education as their primary objectives.

2) Are more serious reported problems within the broader “policy context” of wildfire risk reduction associated with certain management choices?

Yes, researchers found that more serious perceived problems beyond the control of program managers, such as scientific uncertainty pertaining to risk levels and a program’s need for technical help, are associated with a disinclination to measure progress toward program goals (Pearson $r = -.272$; $p=.043$; $n=56$). Interestingly, the other types of obstacles – budget constraints and negative public attitudes – do not appear to be associated with willingness to evaluate the effectiveness of the risk reduction program. Apparently, significant problems within the broader policy context, outside the control of program administrators, may serve to undercut faith in the program’s ability to gain “traction” and affect meaningful reduction in risk.

3) What other factors may affect managers’ decisions to attempt to measure progress toward stated goals and objectives?

Researchers found a significant correlation between those programs that offer more types of activities in the service of either educating the public, assessing the risk within the community, assisting property owners with vegetation management, or implementing specific standards or regulations -- and a tendency to conduct systematic evaluations of program effectiveness (Pearson $r = .282$; $p=.035$; $n=56$). Thus, managers and administrators who are implementing more specific activities to further program goals are also more likely to try and measure the effectiveness of their efforts.

4) What factors may influence managers' decisions whether to participate in collaborative pre-fire planning with public and private stakeholder groups?

Researchers found a significant association between greater reported problems with public apathy and resistance from property owners concerning vegetation removal and a reluctance to enter into collaborative partnerships and associations ((Pearson $r = -.249$; $p = .052$, one-tailed; $n = 56$) It appears that program officials facing a more hostile or, even, merely an uninformed group of property owners within their community are less likely to participate in pre-fire planning for risk reduction. Managers of programs in areas with a more supportive group of residents appear to be more likely to forge relationships for collaborative planning. This is logical given that stakeholder groups – likely partners in collaborative planning -- may not be well-organized in areas where property owners do not perceived wildfire risks to be of high importance. However, other factors may influence the degree of collaboration including the severity of wildfire risk, population density, and the proximity and availability of agencies and organizations to work with.

What Measurable Changes Can Program Managers Expect to See As They Progress Toward Specific Objectives?

The following is a list of measurable changes in risk conditions that program managers report they would expect to see if specific program objectives are met. These tangible improvements are useful as potential indicators of program success.

1) Expected Effects of Education and Public Outreach: For the program goal “Education and Public Outreach”, the most offered potential indicator of effectiveness is a measurable “increase in general public awareness of Fire Wise concept.” Such a change in public awareness could be determined through a regular survey of the property owners within communities.

2) Expected Effects of Conducting Area-Wide Risk Assessments: For the program goal “conducting area-wide risk assessments”, the potential indicators most often mentioned are “targeting high risk areas” and “prioritizing projects”. Also, “increasing defensible space” was suggested. Each of these measures could be developed into performance indicators if records of program activities are maintained carefully.

3) Expected Effects of Assistance to Property Owners: For the program goal “assistance to property owners”, more respondents suggested simply keeping records of the number of properties treated during a designated period of time.

4) Expected Effects of Implementing Regulations: For the program goal “implementing regulations”, the potential indicator most often suggested is similar to the outcome expected after offering assistance to property owners – an increase in treated lands. Again, keeping records regarding these activities is a logical step toward developing these suggestions into indicators of program effectiveness.

Most Effective Program Activities for Creation of Defensible Space

The program managers were asked to list the specific activity they believed to be most effective in encouraging private property owners within their communities to

engage in vegetation management and implement defensible space on their properties (Table 2).

Table 2— *Most Effective Program Activities as Reported by Managers*

Program Activities as Reported by Managers	Frequency (Total Response)
Public Education (Including K-12 and Teacher Training)	14
Mapping of Risk Areas (GIS)	1
Individual Risk Assessments	13
Prescriptions for Defensible Space for Individual Properties	10
Free Vegetation Removal and/or Treatment	8
Cost/Share Vegetation Removal and/or Treatment	14
Free Disposal of Slash Material (Plant Debris)	11
Chipping Service for Slash Material (Plant Debris)	10
Scheduled Community Clean-up Days	3
Law Requiring Vegetation Removal and Management	10
Distributing “How-To” Guides for Property Owners	2
Demonstration Properties	4

Note: The question was open-ended, respondents were not selecting from a list of “suggested” most effective program activities. Most respondents gave only one answer. In cases where more than one answer was given, both responses were recorded.

The respondents indicated a general preference for “hands-on”, practical assistance to private property owners. While many respondents listed “public education – including K-12 student and teacher outreach” as valuable, even more voiced support for the pragmatic type of assistance that encourages residents to get out into their yards and make the changes that will reduce the wildfire risks to their communities. Thus, those programs that are more active in offering these types of aid to home owners are engaged in some of the most effective methods to reduce risk, according to program managers – themselves, grappling with how best to invest their time and resources.

Conclusions

The examination of sub-federal wildfire risk mitigation programs is a recent area of inquiry and this survey of program officials is a first step toward a systematic review of these efforts. First, we clarified the stated objectives of the programs, important because future estimations of how well these programs are working must be based on progress toward specific program goals. Further, identification of goals allows for an organizational typology whereby programs with similar goals and objectives may be placed into similar categories. Then, managers of programs within each category may choose from a common pool of potential indicators of program effectiveness. Second, these findings shed light on the types of impediments that managers believe are hindering progress toward program objectives. We discovered that these obstacles tend to fall into 3 distinct categories: 1) problems associated with the broader “policy context”; 2) negative public attitudes, and; 3) budgetary constraints. Further, these obstacles appear to affect the choices made by program managers, as

suggested by the finding that problems within the broader policy context of the programs, including scientific uncertainty as to actual risk levels and risk components, may discourage program managers from attempting to evaluate the effectiveness of their efforts. Similarly, participation in collaborative pre-fire planning becomes less likely in the face of apathy or resistance from community residents. Finally, using input from managers, we assembled a list of potential indicators of program effectiveness that may be applied to programs with similar goals to help administrators plan more systematic reviews of their activities. This information should be useful to decision makers, community stakeholders, and researchers as they begin to consider the effectiveness of these important sub-federal wildfire risk mitigation efforts.

References

- 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?** People and Fire at the Wildland/Urban Interface (A Source Book). USDA Forest Service, Washington, D.C. ed: R.D. Gole and H.J.Cortner.
- Davis, I. B. 1990. **The wildland/urban interface. Paradise or battleground?** Journal of Forestry, January: 26-31.
- Hodgson, R.W. 1996. **Community programs.** In: R. Slaughter, ed., California's I-zone urban/wildland fire prevention and mitigation. California Department of Forestry and Fire Protection, Sacramento, CA: 242-258
- Loeher, L.L. 1985. Fire hazard: **The dimension of resident's attitude.** In: K. Radtke (ed.), Conference Proceedings Living in the Chaparral of Southern California. National Foundation for Environmental Safety and USDI National Park Service. Santa Monica, CA; 51-55.
- McCaffrey, S. 1999. **Preliminary results: Incline village fire survey.** University of California, Berkeley. (Unpublished)
- Smith, Ed; Rebori, Marlene. 2001. **Factors affecting property owner decisions about defensible space.** Assisting Forest Owner, Farmer and Stakeholder Decision-Making, International Union of Forestry Research, Proceedings of the Extension Working Party (S6.06-03) Symposium 2001.
- Winter, Greg; Fried, Jeremy. S. 2000. **Homeowner perspectives on fire hazard, responsibility, and management strategies at the wildland urban interface.** Society and Natural Resources 13(1); 33-49.