WILDFIRE RISK

Human Perceptions and Management Implications

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Addressing the Mitigation Paradox at the Community Level

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Continued population growth in the intermountain West coupled with decades of fire suppression policy places entire communities and their associated infrastructure at continued risk of wildland fire (Beebe and Omi 1993; GAO 1999). As a consequence, more people, property, and infrastructure are exposed to the risk of wildfire than at any time in recent history. Since 1970, more than 30,000 structures, including 10,000 homes, have been destroyed by wildfires throughout the United States (Firewise 2004). From 1988 to 1998, wildfires consumed over 20,000 square miles, destroyed some 6,500 structures, caused losses estimated in excess of $2.5 billion, and resulted in more than 40 deaths (Deyle et al. 1998).

In spite of these trends, mitigating the risk from wildfire is not high on the list of concerns of individual property owners. The perceived risk of wildfire destroying any one individual's home is very low, while the cumulative risk to the entire community of wildfire can be much higher. This creates a greater incentive for a community to mitigate the risk from wildfire than for any individual property owner. This problem is termed the *wildfire mitigation paradox*. This paradox is the result of a complex interaction of factors associated with an individual's willingness to accept, support, and comply with mitigation activity or risk reduction programs (Gregory 2002; Rohrmann 1998; Slovic 2000b), with a key factor being a trade-off between the perceived risks of wildfire and benefits of taking action. Once individuals have identified the full range of mitigation actions available to them, they engage in two types of evaluation: cost–benefit and their estimated return over time (Kates 1971). In general, relatively high levels of resources, such as money, expertise, and time, are needed for mitigation programs (Tierney 1993). Averting wildfire

risk and insuring against wildfire losses are costly, and households will undertake such actions only when subjective benefits exceed the costs of resources used (McKee et al. 2004). Residents in fire-prone areas are asked to bear costs, exert effort, and sacrifice aesthetic and other benefits in the immediate term in favor of uncertain increases in protection against low-probability, but potentially catastrophic, wildfires in the future (Daniel 2007). In other words, when an individual examines his or her own expected benefits relative to the costs of mitigation activities, the decision may be to forgo mitigation activities because the expected benefits to the individual are lower than the costs. But from the viewpoint of the community, which faces a higher total risk of wildfire than any one individual, the expected benefits may be higher than the costs. The wildfire mitigation paradox creates a very challenging situation for wildfire risk mitigation programs.

Empirical evidence supports these more theoretical arguments. Households in areas prone to a natural hazard risk consistently underinvest in protective measures (Fischhoff 1989; Kunreuther 1978; White 1974; Winter and Fried 2000b). Urban residents have a low initial awareness of fire severity, assign low probabilities to occurrences, and prefer policy strategies that shift the hazard management responsibility to public resource managers (Gardner et al. 1987). Cortner et al. (1990b) found that homeowners generally appeared reluctant to support programs for which they had to carry the burden. They wanted to avoid direct costs of fire hazard management. Further, options that limited choices of where a person could live, such as zoning and density regulations, were not strongly supported. People wanted to choose where they lived. Winter and Fried (2000b) found similar results when they surveyed homeowners in rural Michigan after a wildland fire. Safety ordinances and zoning measures were almost universally rejected as unworkable and infringing on private property rights. Some homeowners perceived the risk of wildland fire but did not attempt to reduce that risk. Cortner et al. (1990b) found that homeowners recognized the importance of brush clearing around homes, yet few actually implemented the practice. Homeowners surveyed by Winter and Fried (2000b) felt that mitigation strategies, such as clearing brush and creating a buffer space, were futile because of the unpredictable nature of the fires they witnessed. Historically, defensible-space ordinances have failed to generate appreciable risk reduction because of political opposition and lack of enforcement.

The conventional framing of mitigation action along risk–benefit lines suggests that individuals are unlikely to undertake mitigation activity (Daniel 2007). Yet in some places, individuals and communities are taking action to mitigate their threat of wildfire risk. In these situations, the communities are providing incentives or other programs to reduce the cost of mitigation activity for individual landowners. This chapter investigates two case studies to illustrate how the mitigation paradox has been addressed to facilitate mitigation measures. The purpose is to provide practitioners and scholars

alike with examples of community mitigation measures and how they alter the risk–benefit calculus.

Addressing the Mitigation Paradox

To address wildfire risks, the individual must believe that risks are real; that the mitigation actions are plausible, appropriate, and can be successfully accomplished; and that promised reductions in risk are reasonably certain to be obtained (Chilton et al. 2002; O'Connor et al. 1999). In other words, individuals must be *predisposed to take action* and have *feasible mitigation alternatives* available to them. This suggests the need to alter the predisposition for action while providing workable models for mitigation action.

Factors That Influence Predisposition for Action

Three factors inform risk valuation and management, and therefore predisposition against taking action: institutional arrangements, information, and public versus private risk exposure (Winter and Fried 2000b). Institutional arrangements such as government laws, regulations, programs, and community norms for action can foster or inhibit incentive to take action. Likewise, individuals may be informed about the risks to their own homes or property, which may be very low, thereby justifying inaction. They may be less well informed, however, about the collective risk to the entire community. Providing information about risks to the community and how to mitigate these risks may predispose some individuals to take action. Finally, the interjurisdictional nature of the wildfire threat means that private property owners and public agencies need to comprehensively address the problem. For instance, if public agencies do not take action to reduce the risk on the lands they manage, then private homeowners adjoining these lands may be less predisposed to reduce hazardous fuels on their own property and vice versa. As these three factors suggest, informational efforts, appropriately structured institutional arrangements, and developing a shared sense of responsibility toward risk exposure may lead to a greater disposition for action.

Action Alternatives

Successful wildfire mitigation requires changes in individual and community-level behavior (McCaffrey 2004a), and the challenge is in finding the appropriate mix of actions that will actually effect change. Numerous alternatives exist to address wildfire risk, including financial incentives, zoning, prescribed burning, altering building codes, educating homeowners on risk reduction activities, mechanical vegetative thinning, installing fireproof roofs and building materials, and using cost sharing, cooperative behavior, and private insurance

programs to mitigate risk. Communities predisposed to action tend to combine various alternatives. Because risk perception is subjective and each community faces unique threats, no one set of action alternatives will be appropriate for all communities. The three categories of factors that influence predisposition for action—institutional arrangements, informational efforts, and shared responsibility—provide a framework for more systematically understanding mitigation responses at the community level. The remainder of this chapter examines the mitigation approaches taken in Flagstaff, Arizona, and Ruidoso, New Mexico, using this framework. The purpose is to illustrate two different kinds of mitigation responses to demonstrate that they are possible, can be implemented, and provide risk reduction in specific places. These cases are not meant to be definitive examples, but rather illustrate possible models for adaptation in other locales. Different cultural, social, economic, political, geographic, meteorological, and vegetative conditions in each community suggest that different approaches will be needed in different locales. This means it is important for communities to decide for themselves what combination of actions is most appropriate to address their own risks.

Methods

The cases presented in this chapter were chosen based on community-level responses to wildfire in Arizona and New Mexico in fiscal years 2001 and 2002. A state-level analysis of wildfire risk to communities adjoining USDA Forest Service lands and their responses was conducted to select the most responsive community in each state. For the purposes of the project, the total funds secured through the National Fire Plan (NFP) Community Assistance Programs[1] in fiscal years 2001 and 2002 were used as a proxy to assess the degree of responsiveness in the communities in Arizona and New Mexico. Ruidoso was notable in securing the largest total amount of funding in New Mexico, while Flagstaff received the most money in Arizona.

A variety of data-collection techniques were employed, including archival document collection, in-person interviews, site visits, and telephone and email interviews prior to and following site visits to each community. Site visits to Ruidoso occurred September 23–26, 2002, and to Flagstaff, December 8–12, 2003. The archival documents, interview transcripts, and additional material are all on file with the author.

Wildfire Mitigation in Flagstaff, Arizona

Flagstaff sits at the base of the San Francisco Peaks, in the midst of the largest continuous ponderosa pine forest in the world. The Coconino National Forest surrounds the entire city, and the Flagstaff wildland-urban interface (WUI)

covers about 140,000 acres of national forest, state forest, military, national park, Flagstaff city, and privately owned lands (Summerfelt 2003). Flagstaff covers approximately 40,000 acres at high risk of a WUI wildfire: 11,400 acres of private land, 8,600 acres of state property, and 20,000 acres of federal land (Arizona State Land Division 2000). According to the 2000 census, the population of Flagstaff was 52,894, with a median household income of $48,427. The median home value was $161,000, with almost 47 percent of the homes seasonally occupied (U.S Census Bureau 2003).

Changing attitudes about reducing hazardous fuels, supporting prescribed fire, and creating defensible spaces within the community have been some of Flagstaff's real successes. The Flagstaff Fire Department's fuel manager, Paul Summerfelt, reflected in 2003: "Prior to 1996, it was wrong to cut a tree, and who in their right mind would set a fire? Well, next spring within the city, we will cut our one millionth tree. We now light more fires than we put out." As of 2004, cutting trees and setting prescribed fires had become so common in Flagstaff that people no longer question either practice, and from 1996 to 2003, 4,840 acres were thinned and 3,026 acres were prescribed burned (Summerfelt 2003).

The Flagstaff area experiences nearly 400 wildland fires each year, of which approximately 60 percent are caused by lightning (GFFP n.d.). In June 1996, lightning ignited the Hochderffer fire, which burned 16,115 acres. This was the largest fire on record in the Coconino National Forest. During the same time period, the Horseshoe fire burned 8,650 acres. The fires coincided with the arrival of a new fire chief and served as the turning point in the community for addressing wildfire risk. According to Assistant Fire Chief Jim Wheeler, "Having fires on the edge of the city and fires within the city limits, the community was essentially panic-stricken" (Wheeler 2003). These events set into motion changes in institutional arrangements, education and outreach, and collaboration between public and private efforts to address wildfire risk.

Improving Institutional Arrangements

Beginning in 1996, Flagstaff realized the need to improve the institutions that influence wildfire mitigation activity. Since then, the city has aligned its fire department, building codes, planning efforts, and cost-share funding for hazardous fuel reduction activities to encourage greater mitigation work.

Flagstaff Fire Department Fuel Management Division. The City of Flagstaff is unique in that it has its own Fuel Management Division within the Fire Department. This division works with homeowners to reduce hazardous fuels on their property and has been engaged in an active fuel reduction program that began in 1996. Since that time, they have created institutional infrastructure to support a variety of wildfire mitigation activities, including hiring a fuel management officer in 1997, a seasonal fuel reduction crew in 1999, an

assistant fuel management officer in 2000, a fire crew boss in 2001, and two fire technicians in 2002. To cultivate interest for these new institutional arrangements in the broader community, the Fuel Management Division began an intern program in 1999 and a volunteer program in 2002. The Fire Department has an annual budget of $8 million. The Fuel Management Division started with an annual budget of $100,000 in 1997 and as of 2003 was allocated $300,000 annually (Wheeler 2003). The division has supplemented this annual allocation with a diverse set of grants that amounted to a total of $345,750 in 2001 and 2002 alone.[2]

Building Codes. New rules and regulations can create incentives to mitigate against wildfire risk. Flagstaff has instituted a variety of code changes to encourage property owners to protect against wildfire. In 1996, Flagstaff's roof construction ordinance was changed to a limited combustible roof (GFFP n.d.; Wheeler 2003). In 1997 and 1998, the Fire Department incorporated Firewise construction elements into the development process. All new subdivisions must meet Firewise construction guidelines, including limited combustible siding, closed eaves and soffits, wire mesh screen all over venting, fire-resistant roofing, and thinned vegetation (Wheeler 2003). In 2000, Flagstaff adopted the 1997 version of the Uniform Fire Code, and it uses this code to support mitigation efforts in such areas as hazardous vegetation, roofing materials, driveway access, and other aspects related to wildland fire concerns. Codes are implemented and enforced through the permit and building process. The Fire Department signs off on specific items for the permits and occupancy-of-site permission (Summerfelt 2003). The building codes have been well received, according to Assistant Fire Chief Jim Wheeler: "No one to whom we've applied these conditions has ever complained, much less appealed. We have an appeals process. No appeals, none. Not even a complaint" (Wheeler 2003).

Stewardship Plans. The Flagstaff Planning and Fuel Management Divisions have an administrative program that requires a forest stewardship plan to be prepared and implemented for new developments or new building permits (Summerfelt 2003). The Fuel Management Division also completes stewardship plans for existing homes or properties at no charge. A stewardship plan gives an assessment of the conditions on the property and recommendations to improve forest health, address insect disease, and mitigate fire risk. The division will create the plan working in conjunction with the homeowner and mark trees for thinning, but the owner is responsible for hiring a contractor to do the actual thinning. Funding for the development of stewardship plans comes from Northern Arizona University and the Ecological Restoration Institute, city appropriations, and the National Fire Plan. In 2001, stewardship plans were developed for 1,950 acres, and 470 acres were marked for thinning. In 2002, stewardship plans were developed for 614 acres, and 605 acres were

marked. In 2003, stewardship plans were developed for 1,472 acres, and 765 acres were marked (Summerfelt 2004).

Cost-Share Programs. In 2004, the Greater Flagstaff Forest Partnership launched a 50–50 cost-share program to assist private homeowners with hazardous fuel reduction on their property (Summerfelt 2003). This program is funded using State Fire Assistance money. Additionally, the Arizona State Land Department has a 25–75 cost-share program through the Forest Land Enhancement Program, which provides educational, technical, and financial services to nonindustrial private forest owners (Southwest Area Forest, Fire and Community Grants 2003). The use of cost-share programs was limited at the time this research was conducted; nonetheless, the existence of the programs provides an incentive for private landowners to take action by defraying the cost of reducing hazardous fuels on their land.

Informational Efforts

Providing information to property owners about the risks to the community can reshape how wildfire risks are perceived. Flagstaff has engaged in demonstration projects, multifaceted general outreach, and targeted home assessments to inform its various communities about threats of wildfire and provide alternatives for action.

Demonstration Projects. Demonstration projects provide working examples of hazardous fuel mitigation efforts. In 1996, the Flagstaff Fuel Management Division started its first demonstration project behind one of the fire stations in the middle of the city. A one-acre plot was initially treated so that people could see the difference between 120 stems per acre in the demo area and 350 stems per acre on the surrounding untreated land (Wheeler 2003). This first demonstration project cost about $30,000 because of extensive preparation and scrutiny by the public (Summerfelt 2003).[3] The City Council made a number of visits to the site. Trees were marked multiple times. Community members watched every tree come down. When the demo area was prescribed burned, the entire Fire Department was present. Paul Summerfelt credits Flagstaff's continued success in mitigating fire risk to the initial investment of time and money: "It was money very well spent, because everybody got their say, everybody watched, everybody had an input" (Summerfelt 2003).

General Outreach and Education. In 1999, Flagstaff and the surrounding Coconino County encouraged homeowners to assist in the prevention of loss from wildfire. The Flagstaff Fire Department launched the Be Prepared Program, which educated residents about safety and homeowner responsibility for wildfire prevention. In 2002, Flagstaff followed up with a Firewise program to recognize communities and neighborhoods throughout the city that were

doing significant work. The Flagstaff Fire Department created a website funded by a State Farm Insurance grant to inform the public of risks and options for addressing them in the community. Wal-Mart also donated money to create outdoor bulletin boards for each of Flagstaff's fire stations (Summerfelt 2003).

Targeted Educational Campaigns. In 2003, the Flagstaff Fire Department created a public education plan that identified specific at-risk groups and areas and began a home assessment campaign for 900 homes in especially vulnerable areas. In the spring and summer of that year, the Fuel Management Division visited neighborhoods to evaluate defensible space around homes. It followed up with property owners that had identifiable risks, and about one-third of the properties needed work. By the end of the year, 350 out of the 900 targeted assessments were completed (Summerfelt 2003). In 2004, the Flagstaff Fire Department identified new groups to target with an educational CD. Developers, real estate agents, and insurance representatives were mailed an interactive CD with video clips, still photos, and the basics for protecting houses and subdivisions from wildfire risk (Summerfelt 2004).

Shared Responsibility

Two collaborative groups provide opportunities for shared understanding of the various public and private efforts to mitigate wildfire in Flagstaff. The Ponderosa Fire Advisory Council facilitates interagency cooperation on prescribed burning and thinning projects, and the Greater Flagstaff Forests Partnership assists in the interaction among a variety of research, nonprofit, and public agencies concerned about restoring ponderosa pine ecosystems surrounding Flagstaff. These collaborative groups underscore the interjurisdictional nature of the wildfire problem facing Flagstaff and work to inform the many people involved in mitigation response efforts.

Ponderosa Fire Advisory Council. The Ponderosa Fire Advisory Council (PFAC) was formed in 1989 as a consortium of local fire agencies, fire districts, municipal fire personnel, the USDA Forest Service, Arizona State Land Department, and National Park Service. It is a 16-member group that includes all fire agencies within the greater Flagstaff area, along with Coconino County, Northern Arizona University, and the National Weather Service (Wheeler 2003). Through PFAC and other partnerships, there is good interagency cooperation (Summerfelt 2003). For instance, the Fuels Management Division collaborates closely with the Forest Service, trading personnel on prescribed burns and working together on joint burns and thinning contracts.

Greater Flagstaff Forests Partnership. The Greater Flagstaff Forests Partnership (GFFP) is an alliance of 25 academic, environmental, business, and governmental organizations dedicated to testing and adapting new approaches

to restoring ecosystem health in the forests surrounding Flagstaff. Its three primary goals are to restore natural ecosystem structure, function, and composition; manage forest fuels to reduce the risk of catastrophic wildfire; and research, test, develop, and demonstrate key ecological, economic, and social elements of restoration efforts. The GFFP, formally recognized through a cooperative agreement signed on March 31, 1998, is a partnership between the Forest Service (Coconino National Forest, Rocky Mountain Research Station, USDA Forest Products Lab) and the nonprofit Greater Flagstaff Forests Partnership, Inc. (GFFP 2003a). The partnership seeks to analyze 100,000 acres of WUI around Flagstaff in 10,000-acre blocks per year and implement forest health and fire reduction projects. By 2003, as part of the GFFP, the City of Flagstaff and Arizona State Land Department had restored a total of 6,680 acres, with 4,230 acres thinned and 2,450 acres broadcast burned on their properties. Additional restoration work includes wildlife cover deferrals, road closures, meadow restoration and cleanup, and designation of camping spots. More than 70 different research studies were under way in 2003 (GFFP 2003b).

USDA Forest Service. USDA Forest Service staff in the Coconino National Forest had six projects under way in 2003, all of which were part of the coordinated efforts of the GFFP. The projects involved a total of 24,000 acres, with 11,000 acres targeted for ecological restoration treatments. Appeals and litigation delayed implementation of the projects until early 2001. By 2003, 1,100 acres had been thinned on Forest Service lands, and another 900 acres were under contract to be thinned. Approximately 750 acres had been broadcast burned, with additional slash-pile burning (GFFP 2003b).

Wildfire Mitigation in Ruidoso, New Mexico

A cool vacation haven at 6,900 feet in elevation, Ruidoso has a population of 50,000 in the summer, which falls to about 10,000 in the off-season. It is increasingly seen as a retirement destination. In 2001, Ruidoso was ranked as the second most vulnerable community at risk for wildfire in the nation by the Forest Service, surpassed only by Lake Tahoe in California (Delaco 2002). Approximately 164,000 acres are at risk in the greater Ruidoso area and surrounding communities (Delaco 2005). Small vacation cottages, rustic cabins, and grandiose homes pepper the steep, winding, heavily wooded canyons that place the community at risk. According to the 2000 census, more than 43 percent of the homes in Ruidoso were seasonally occupied. The average household income was $35,626, and the average home value was $106,544 (U.S. Census Bureau 2002). Ponderosa pine, with an understory of piñon, juniper, and Gambel and shrub oaks, is the typical vegetative cover. Prevailing winds from the southwest make Ruidoso especially vulnerable to wildfire.

Aesthetic issues and preserving densely forested landscapes were of foremost concern to Ruidoso until the 1990s, when the risk of wildfire grew. As recalled by one resident: "In 1996, Ruidoso was ranked as having a great fire hazard. A USFS team came to Ruidoso to evaluate the risk and found that there were not adequate escape routes, no emergency planning, and poor communication" (Morton 2002). As Ruidoso became more aware of its risk, it also began experiencing WUI fires. In May 2000, the Cree fire burned 6,500 acres, destroyed three homes, and forced hundreds of residents on Ruidoso's east side to evacuate their homes (Duemling 2002; Luna 2002). During June 2001, the Trap and Skeet fire burned 463 acres on Ruidoso's west side (DeIaco 2002). Then in March 2002, the Kokopelli fire burned almost 1,000 acres and overran a subdivision, destroying 29 structures (DeIaco 2002; Duemling 2002; Luna 2002).

Acute awareness of their risk stimulated many within Ruidoso to action. The Ruidoso Wildland Urban Interface Group formed in 2001 to provide a more comprehensive response to the threat the area faces. As part of these wide-ranging efforts, Ruidoso has treated nearly 16,000 acres on public land and 1,500 acres on private land as of February 2005 (DeIaco 2005).

Improving Institutional Arrangements

The biggest institutional accomplishment for Ruidoso has been its own municipal program, which was created over a period of years beginning in 2000. Ruidoso had the political support and foresight to hire an urban forester, who coordinates and conducts a citywide hazardous fuel reduction program; create a department of forestry; pass ordinances to support widespread hazardous fuel reduction; impose building codes to reduce future wildfire risk; and create a municipal slash disposal system to assist property owners willing to thin their land. A cost-share program helps support homeowner efforts under the municipal program.

Urban Forester and Department of Forestry. At the urging of an organized group of concerned citizens, Ruidoso hired a full-time urban forester in 2000. The position was created to address the challenges of current forest health issues and to protect the community values at risk from the hazards of wildfire. The urban forester was initially placed within the Planning and Zoning Department, but a Forestry Department was created in 2003. Since that time, a full-time secretary and two forestry technicians have been hired to help with the increasing workload (DeIaco 2005).

Homeowner Assessments. Ruidoso instituted a program of municipal homeowner assessments in which the urban forester meets with residents interested in mitigating wildfire risk around their homes. The urban forester poses three alternative visions for mitigation, depending on the values a property owner

wishes to emphasize in his or her landscape. These include fire protection and hazard reduction, landscape opportunities, and forest health. The goal of the municipal program is to treat 13,000 acres within Ruidoso to a ground-fire standard, which is designed to reduce the risk of a wildfire spreading into the trees. Treatment of the entire acreage is expected to be completed between 2008 and 2010 (Delaco 2002). As of February 2005, 1,500 acres, or 75 percent of the 454 lots in the first five subdivisions targeted, have been treated. In November 2004, letters were sent to additional subdivisions, for a total of 972 lots planned to be targeted in the next phase (Delaco 2005).

Wildfire Mitigation Ordinances. In the spring of 1996, a group of concerned citizens called the Forest Health Coalition organized to change Ruidoso's tree-cutting ordinance. The original ordinance stated that a permit and a $5 fee were needed to cut down any tree larger than five inches in diameter (Duemling 2002; Luna 2002). In the 1990s, wildfire risk increased, and residents wanted to reduce hazardous fuels to make their property safer but were prohibited by the process and expense imposed by the ordinance. The coalition lobbied effectively, and the ordinance was changed to allow thinning if the property owner maintained 40 square feet of basal area, unless disease or insect problems were present. Permits still were required to cut trees over 10 inches in diameter (Delaco 2002; Luna 2002).

In June 2002, the City Council passed a universal homeowner treatment ordinance requiring treatment of 13,000 acres within Ruidoso to a ground-fire standard. A community-led group called the Forest Task Force initially brought the idea before the Planning and Zoning Commission, which then recommended it to the City Council. The night the task force brought the ordinance before City Council for a vote, smoke from the 425,000-acre Rodeo-Chediski fire 300 miles away in Arizona was blowing through town, which helped get the ordinance passed (Delaco 2002; Morton 2002).

Cost-Share Program. A cost-share program is available for property owners throughout Ruidoso and the surrounding Lincoln County to create defensible space on their land. The New Mexico State Forestry Homeowner Cost-Share Program is funded with National Fire Plan moneys, which are passed through the state to cities, towns, and counties to help defray costs of creating defensible space around homes. Ruidoso was awarded $485,000 through this program in fiscal years 2001 and 2002. Another $360,000 was awarded in 2003 (Delaco 2005). Homeowners can be reimbursed up to 70 percent of the costs. State program standards are designed to prevent a crown fire from spreading and are stricter than those of the municipal program. With these moneys, New Mexico State Forestry, in conjunction with property owners, has treated lands that abut Forest Service property within Ruidoso and that adjoin the neighboring Mescalero Reservation (Duemling 2002; Luna 2002). Because the cost-share program is meant for all of Lincoln County, Ruidoso receives only

a portion of the money for its residents. In 2001 to 2004, about 50 people per year took advantage of the program. With the addition of new forestry technicians in the Department of Forestry, the urban forester anticipates being able to serve 150 people per year in the future (DeIaco 2005).

Slash and Debris Removal. An additional consideration for mitigating wildfire threat in Ruidoso has been slash and debris removal. To create incentives for property owners to thin their land, Ruidoso needed to develop a comprehensive disposal system for slash. In 1998, the Forest Health Coalition initially proposed a process to pick up limbs and needles. The next year, Ruidoso officials purchased a grappling truck to facilitate the removal of debris (Morton 2002). To accelerate debris removal in conjunction with the passage of the universal homeowner treatment ordinance and municipal home assessment program in 2002, Ruidoso purchased three additional grappling trucks. "We didn't want to be in a position where we had people thinning their property and no way to pick it up. This gave them an excuse to delay" (DeIaco 2002). Coordinated through the Ruidoso Solid Waste Department, the trucks make rounds to neighborhoods on a scheduled basis to remove debris cut by residents. The presence of a coordinated slash-removal program allows enforcement of the ordinances.

Informational Efforts

Traditional Firewise workshops were held in the spring of 2001 and 2002 to reach full-time residents, but other outreach activities have targeted vacationing visitors and seasonal homeowners, which constitute about half of the population—one of the biggest challenges Ruidoso faces. Different information and outreach strategies are necessary for these groups.

Education of Part-Time Residents and Visitors. In 1999, Ruidoso received a Federal Emergency Management Agency (FEMA) grant of $300,000 for fire mitigation. With this money, the Ruidoso Office of Emergency Management (OEM) developed several strategies for informing and educating part-time residents and visitors. The OEM posted signs throughout the community identifying all evacuation routes. In addition, in the summer, when visitors are most prevalent, it ran an educational article in the newspaper and broadcast a public-service announcement video about evacuation and fire awareness on television. The OEM also designed a brochure that was sent to every residence along with the electric bill.

Traveling Booth. To reach more people, the OEM devised an event-driven strategy. In 2002, the OEM was awarded a Department of the Interior grant of $14,000 for fire prevention, which enabled it to design outreach activities targeting vacationers in Ruidoso who attend popular events. The OEM created a

booth that is taken to various events where large crowds of people gather, such as races, museum exhibitions, and cook-offs.

Neighborhood Fire Watch. A Neighborhood Fire Watch also was developed in 2002. The OEM identified block captains and other interested parties to coordinate with neighbors and do outreach in neighborhoods. This was designed as a one-on-one outreach intervention at the grassroots level to target locals and work through neighbor-to-neighbor peer pressure. Through the Neighborhood Fire Watch, they planned to try to coordinate the grapple truck to pick up after the neighborhood had organized a larger clean-up effort.

Middle and High School Outreach. The OEM also is working on wildfire education programs in the local schools. Middle school students are being educated in fire dynamics and fire ecology. A vocational forestry program allows high school students to engage in a community-service component that ties into the land assessments and fuel reduction project within the municipality. The students help people who cannot create their own defensible space because of physical or financial constraints. Wal-Mart donated equipment to facilitate the program.

Shared Responsibility

Ruidoso has been working in concert with the Forest Service to create a fuel break on the southwest side of the community. It coordinates all its fire mitigation efforts through the Ruidoso Wildland Urban Interface Group.

Ruidoso and Forest Service Projects. Ruidoso has reduced fuels on 1,500 acres of community property. It has thinned municipal lands that abut Forest Service land using the same management prescription to create a uniform fuel reduction (Delaco 2002). The Forest Service has treated 16,000 acres and created a 13-mile fuel break around Ruidoso (Delaco 2005).

Ruidoso Wildland Urban Interface Group. The Ruidoso Wildland Urban Interface Group (RWUIG) is the main coordinating entity to address the community's wildfire risk. Composed of members from federal, state, and local entities in the public and private sectors, the group prioritizes areas for treatment and coordinates the efforts of the various entities. It also serves as a forum for sharing perspectives and provides a regular point of multilateral contact among diverse members who otherwise might interact only on an ad hoc or bilateral basis. Coordinated by Ruidoso's urban forester and director of forestry, the group has the goal of protecting community values at risk, including life, property, vistas, history, and wildlife. The RWUIG is in the process of creating a jointly informed geographical information system (GIS) program consistent with those of other Ruidoso departments, the Forest Service, and

New Mexico State Forestry. The program will facilitate a more fluid exchange of information within Ruidoso and the RWUIG while yielding consistent and accurate data about acres treated (DeIaco 2005).

Conclusions

This chapter explored the mitigation paradox that faces communities. Framing mitigation action in terms of risk–benefit calculations suggests that individuals are unlikely to undertake mitigation activity, even though significant numbers of people and amounts of property remain at risk from wildfire threats (Daniel 2007). Nonetheless, in some places, communities and individuals are engaging in mitigation measures. Predisposition to mitigate against wildfire risk can be negatively influenced by lack of information, poor institutional arrangements, and inequitable public and private risk exposure (Winter and Fried 2000b). Table 4-1 illustrates how the communities of Flagstaff, Arizona, and Ruidoso, New Mexico, have informed their communities, improved their institutional arrangements, and shared responsibility for mitigation activity to protect against their specific wildfire risks.

These three categories of activities may alter the calculus of risk–benefit ratios when it comes to engaging in mitigation action. If perceived risks of

TABLE 4-1. Summary of Mitigation Action in Flagstaff, Arizona, and Ruidoso, New Mexico

	Flagstaff	*Ruidoso*
Improving institutional arrangements	Flagstaff Fire Department Fuel Management Division	Urban forester/Forestry Department
	Building codes	Homeowner assessments
	Stewardship plans	Mitigation ordinances
	Cost-share programs	Slash and debris removal
		Cost-share programs
Informing the community	Demonstration projects	Education of part-time residents and visitors
	General outreach and education	Traveling booth
	Targeted educational campaigns	Neighborhood fire watch
		Middle and high school outreach
Sharing responsibility	Ponderosa Fire Advisory Council	Ruidoso municipal projects
	Greater Flagstaff Forests Partnership	USDA Forest Service projects
	USDA Forest Service	Ruidoso Wildland Interface Group

wildfire are low and benefits of risk reduction activities are considered costly, then there is little incentive for action. Consequently, efforts to raise perceptions of wildfire risk and reduce the cost of risk reduction activities can influence predisposition for action. Some institutional arrangements, such as building codes and ordinances, make it more costly for individuals to avoid taking risk reduction actions, because they are penalized financially or prohibited from occupying new residences. Other institutional arrangements, such as cost-share and slash-removal programs, effectively lower the costs associated with mitigation action. Stewardship plans and homeowner assessments assist in the creation of new institutional norms that encourage mitigation action. Providing property owners with individualized plans of action may allow them to evaluate their own risks and benefits within the context of communitywide hazards. Finally, institutional arrangements like Flagstaff's Fuel Management Division and Planning Department and Ruidoso's Forestry Department and Office of Emergency Management provide not only a physical presence of government offices and people, but also ongoing encouragement for the development and enforcement of a mitigation culture. The Fuel Management Division and Forestry Department oversee or work in conjunction with many of the other institutional arrangements in their communities to create incentives for taking action and disincentives for not doing so.

Informing the community about the risks they face and the options available to them also can alter the risk–benefit calculus. Demonstration projects can demystify the processes and outcomes that may prohibit some property owners from engaging in fuel-reduction work. In doing so, demonstration projects may lower the perceptions of costs and increase the perceptions of benefits. Although general outreach and education are needed, campaigns targeted to specific subpopulations, such as part-time residents, high school students, developers, and real estate agents, may provide more detailed information in terms of the risks and benefits most relevant to these groups. For example, part-time residents might be more interested in preserving aesthetic values because these are what make their vacation properties special to them. Outreach that acknowledges the importance of these values and incorporates them into mitigation strategies might more successfully alter the risk–benefit calculus in favor of action. Programs like Neighborhood Fire Watch use peer pressure to underscore the joint nature of risk and raise awareness about lowering risk and reaping the benefits of collective action. Residents also can learn from one another as they see hazardous fuel reduction being done on neighboring property, thereby increasing their perceptions of benefits and showing them more realistically what the costs are.

The interjurisdictional characteristics of wildfire risk create both opportunities and obstacles in terms of predisposition for mitigation action. Perceiving that a neighbor or agency is unwilling to tackle mitigation work may dampen others' enthusiasm to undertake such work. Conversely, activity by a neighbor or agency may stimulate additional interest in mitigation activity. Both

Flagstaff and Ruidoso have multiple public agencies addressing their wildfire threat and active programs promoting activity by individuals. Discrepancies between societal and individual perceptions of risk can lead to inaction. People who are more involved with their community hold more convergent societal and personal risk judgments (Park et al. 2001). Active community groups in Flagstaff and Ruidoso may contribute to aligning individual perceptions of risk with societal perceptions, thereby reducing incentives to shirk or free ride on the actions of others.

This chapter suggests that to overcome the mitigation paradox, individuals and communities must be predisposed to take action and have feasible mitigation alternatives available to them. Flagstaff and Ruidoso are predisposed to take mitigation action, and they provide workable models for other communities interested in learning about mitigation responses and adapting them to their own purposes. Ruidoso's model for action is top-down, in that it mandates vegetative treatment of fuel within the municipality, whereas Flagstaff's program is voluntary. These mitigation programs take into account the personal beliefs, societal norms, culture, and mores of their respective communities, as well as how the programs fit with environmental considerations and available technical capacity. As with most complex social problems, there are no silver bullets that can solve the wildfire mitigation paradox once and for all. Every community faces different obstacles and can capitalize on different opportunities at its disposal. Diffusing experience from successful examples allows other communities to harvest ideas as appropriate for their own contexts to meet the ultimate goal of self-sustaining community mitigation responses.

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Notes

1. NFP Community Assistance Programs provide incentives for communities to address their wildfire threat through four grant programs: State Fire Assistance, which funds statewide grant programs for education and hazardous fuel reduction; Economic Action Programs, which develop economic opportunities related to traditionally underutilized wood products; Volunteer/Rural Fire Assistance, which improves firefighting capabilities

of volunteer and rural fire departments; and Four Corners Sustainable Forest Partnership, which promotes community development through forest restoration. An additional source of funding was included in the New Mexico calculation: the Collaborative Forest Restoration Grants, which support projects to restore forests on public lands.

2. Flagstaff had extensively used NFP grants for 2001 and 2002. State Fire Assistance Grants funded projects to treat private property in Flagstaff, providing $183,684 in FY2001 and $709,856 in FY2002, for a total of $893,540. Of this money, $345,750 went to the Flagstaff Fire Department and Fuel Management Division to make personnel available to homeowners to create stewardship plans and mark trees (Summerfelt 2003).
3. In contrast, it cost on average $300 per acre in 2004 for thinning and prescribed fire, depending on the landscape and vegetative conditions (GFFP n.d.).