EASTERN WILDFIRES: PERCEPTIONS AND PUBLIC EDUCATION APPROACHES

A Thesis in
Forest Resources

by
Laurie Schoonhoven

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The thesis of Laurie Schoonhoven was reviewed and approved* by the following:

James C. Finley
Professor, Forest Resources
Thesis Advisor

A. E. Luloff
Professor of Rural Sociology

Margot W. Kaye
Assistant Professor of Forest Ecology

Sanford S. Smith
Senior Lecturer Forest Resources & Agricultural Extension

Michael G. Messina
Professor of Forest Resources
Director of the School of Forest Resources

*Signatures are on file in the Graduate School
ABSTRACT

In the northeastern United States, forests are under development pressure. Individual homes and residential communities are increasingly built in forests. While many consider northeastern forests “fireproof,” the mix of homes and the build-up of fuels such as leaves, branches, and dead trees on the forest floor have raised concerns about wildfire, either natural or human caused. In Pennsylvania irresponsible recreational forest activities, debris burning, and arson contributed to wildfire risk. Increasing use of controlled burns as a management tool by federal, state, and private organizations have reduced fire risk. These factors have created a landscape with higher and lower wildfire risks.

To gain a baseline understanding of people’s perceptions and awareness of wildfire risk as well as prevention activities and programs, key decision makers were interviewed in three wildfire prone communities identified by the Pennsylvania Bureau of Forestry. These key informants conveyed that constituents did not perceive wildfire as a threat. As well, informants were unaware of the risk, wildfire frequency in their communities, or measures to reduce personal property loss due to wildfire. To change behaviors and attitudes, participants viewed youth education as the best approach. As a result, middle school teachers were recruited in the three wildfire prone communities to assist with developing wildfire lesson plans and prevention activities targeted at fifth through eighth grade students. The lessons and resource materials developed in this project addressed teacher’s needs including easy to use, engage students, adaptive to diverse cognitive styles and reading levels, and meet state environmental education standards.
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Chapter 1

Introduction

Fire, both natural and human created, has had a long history in Pennsylvania. Native Americans and European settlers used it to clear forests for agriculture and hunting (DeCoster, 1995; Pyne, 1997). As Europeans and other immigrants settled the state, human-caused fires as well as human interaction with the environment continued to alter the landscape (DeCoster, 1995).

Currently, 58 percent of Pennsylvania is forested (DCNR, 2004) and these forests are under various levels of development pressure from people moving from urban to suburban and rural areas. The area where structures and human development intermingle with undeveloped landscapes (Communities Committee et al. 2004) is called the wildland-urban interface (WUI). As people settle in the WUI, they are exposed to the potential risk of wildfire (Jacobson, Monroe, and Marynowski, 2001) attributed to irresponsible recreation activities, debris burning, and arson.

Thus, the WUI has a primary focus for programs on wildfire protection, suppression, and education (Cortner and Field, 2007). The Firewise program was developed in 1996 through a partnership of federal and state natural resource and emergency agencies to address wildfire issues in the WUI. The program works with communities, elected officials, builders, and emergency personnel to reduce the loss of properties and resources through risk assessment, fuel reduction, and public education.

A great deal of research and literature exists on Western wildfires and public perceptions; however, there is limited research on Northeastern forest fires and especially with regard to perceptions of wildfires. Since Eastern and more specifically Pennsylvania forests and wildfires differ greatly from Western forests and wildfires, it was difficult to apply Western public
perceptions to Eastern wildfire issues. In particular, Northeastern wildfires tend to be low intensity, ground fires quickly extinguished by firefighters. To effectively address growing wildfire risks in Pennsylvania and the Northeast, it was necessary to understand public perception of wildfire risk. To craft successful wildfire management and risk reduction strategies it is necessary to have public involvement.

**Historical View of Wildfires**

Native Americans greatly altered the landscape by using fire to manage plants and wildlife, replace soil nutrients, clear land for agriculture, and protect villages from hostile forces (DeCoster, 1995; Pyne, 1997). However, scholars differ on what happened after North America’s discovery by Europeans. Some proposed Native American populations were decimated between 1492 and 1630 prior to permanent European settlement (Mann, 2005) by disease introduced by early explorers. During those intervening years forests covered pre-Columbian activities. DeCoster (1995) suggested Europeans found forests with openings created by Native American burning practices and natural disturbance. These modified forests and landscape would have inadvertently assisted European immigration into areas vacated by Native American. Settlers quickly adopted Native American slash and burn techniques to clear land for agriculture and hunting (Pyne, 1997).

By the late nineteenth century much of the nation’s forest had been cleared for agriculture (Pyne, 1997). In some cases, settlers’ fires had catastrophic effects when they burned out of control, destroyed homes and caused loss of life. While some of the land was burned for agricultural development, debris burning, railroads, and arson also caused wildfires. Concomitantly, lightning caused natural wildfires.
National and state agencies began to emerge in the late nineteenth century to address deforestation and wildfires (DeCoster, 1995; Pyne, 1997). Agencies used fire suppression as well as fire prevention programs to reduce wildfires. Recognizing the success of fire prevention programs targeting children, in 1944 the US Forest Service launched the Smokey Bear campaign to teach children and adults about wildfire prevention. The campaign was successful; people adopted fire safety techniques as well as fire suppression policies (Pyne, 1997; MacGregor, Finucane and Gonzalez-Caban, 2008).

Pennsylvania’s wildfire history somewhat parallels national trends. At the time of European settlement, estimates were that 95 percent of Pennsylvania was forested (DCNR, 2004). As the nation developed, timber harvesting to supply raw materials for settlement and development reduced Pennsylvania’s forestland to 30 percent of the land area by 1907 (DCNR, 2004). Fire still occurred, in 1880 an estimated 250,000 acres of land burned in Pennsylvania (DeCoster, 1995; Pyne, 1997). Fire suppression combined with public education programs instituted in the late nineteenth century and early twentieth century reduced most fires to ten acres or less, and these were often extinguished in less than three hours (DeCoster, 1995).

**Wildland Urban Interface**

Early twentieth century fire suppression efforts reduced wildfire frequency. Fire exclusion in the 1930s was thought to promote ecological stability (NIFC, 2001); however, scientists and forest managers by the late 1960s understood fire suppression combined with people living in fire-dependent ecosystems had exacerbated wildfire risks (Pyne, 2001; Cohen, 2008). In 1985, catastrophic wildfires destroyed 1,400 homes nationwide (Cohen, 2000). The multi-agency National Wildland Urban Interface Fire Protection Program was organized in 1986
to develop strategies for reducing wildfire risk to life, homes, and resources (Cohen, 2000; Cohen, 2008).

The National Wildland Urban Interface Fire Protection Program initially targeted firefighters and owners with safety information (Firewise, 2011). In 1997 the program created Firewise USA program (Firewise, 2011) to facilitate federal, state, and emergency agency efforts with WUI communities to reduce the risk life and property loss due to wildfires. Firewise programs worked with communities and homeowners to assess risks, develop wildfire prevention plans, and implement fire retardant landscaping and home construction. At the about the same time, Pennsylvania through the Department of Conservation and Natural Resources created a statewide Firewise program to work with builders, elected officials, and homeowners in WUI communities to develop wildfire protection plans.

Pennsylvania has thirty-four Firewise communities and efforts to expand the program have met with limited success. To improve Firewise marketing, Tara Claghorn, a former graduate student with Pennsylvania State University School of Forest Resources, conducted a series of focus groups in three Pennsylvania communities which had recently experienced a wildfire. These focus groups were conducted to understand public perception of Firewise, wildfire awareness, and best approaches to educating the public about reducing wildfire risk in their community. Focus group results indicated adults had full schedules and did not have time to attend public education programs. Focus group participants recommended youth education. See Appendix A for complete focus group results. Seventy percent of focus groups participants were firefighters and forestry personnel.
Creating the Fire Prevention Message

The lack of educational material addressing Northeastern wildfire risk, interest in Firewise, and the findings from Claghorn’s focus groups coupled with a Pennsylvania wide interest in using prescribed fire in forest management set the stage for developing additional outreach and educational materials. Current wildfire educational materials are heavily focused on Western wildfires, but Northeastern wildfires are quite different. Specifically, Northeastern deciduous forests are relatively fire resistant with a few fire adapted tree species such as scrub oak (*Quercus ilicifolia* Wangenh), table mountain pine (*Pinus pungens* Lamb.) and pitch pine (*Pinus rigida* P. Mill.). The Northeastern fire season occurs in the spring and fall, when deciduous trees are leafless, which allows sun and wind to dry leaf litter and small woody debris on the forest floor. In addition, snowmelt and precipitation influence leaf litter and woody debris moisture content and flammability. When deciduous trees leaf out, the closed canopy creates a cool, damp forest where the fuel has higher moister which reduces fire risk. Northeastern wildfires also tend to be ground fires caused debris burning, the leading cause of wildfires (DCNR, 2011).

In 2009 the Pennsylvania legislature passed the Pennsylvania Prescribed Burning Practices Act (The General Assembly of Pennsylvania, 2009), which limits liability for agencies and organizations conducting prescribed burns also known as controlled burns. Controlled burns are used for hazardous fuel reduction and the increasingly used to encourage oak regeneration and restoration in Northeastern forests. More specifically, Pennsylvania state agencies and organizations burned approximately 2,700 acres in 2010 to promote forest regeneration and reduce fuel loads (Breininger, 2011). Although wildland fires are not extensive in Pennsylvania, controlled burns are considered an important part of any proposed education programs.
Building on Claghorn’s wildfire study and to better understand public perceptions of controlled burns, the qualitative study described in this thesis was conducted with key decision makers in fire prone municipalities. Because, controlled burns are increasingly used as a forest management tool and wildfires do occur in the WUI, there was an obvious need to prepare education programs and materials for directly and indirectly affected WUI municipalities. Education and safety programs are key to more efficient fire prevention and mitigation, risk reduction, hazardous fuel reduction, and the ecological regeneration and restoration of the Northeastern forests. Ultimately a resurging interest in and acceptance of fire as a management tool will depend on understanding and addressing real and perceived social constraints. This will require the combined effort of Pennsylvania's forest fire community – those who have the training, education, and desire to become active partners for the future of our forests and our communities – to work with a broad set of stakeholders.

Claghorn’s focus groups elucidated firefighters’ perspectives, this second study used key informant interviews to understand community stakeholder perspectives on wildfires and controlled burns. The interviews were conducted in three sites identified by the Pennsylvania Bureau of Forestry as fire prone. Interview data indicated people were interested in public education, especially youth education. Students and parents have reciprocal learning relationships where youth frequently teach their parents the latest concepts. Therefore, teacher focus groups were organized in schools near the fire prone sites and teachers were asked to help develop and evaluate wildfire and controlled burn lesson plans. Teachers recommended developing lesson plans that met state educational standards and were easily adaptable for middle school age children with diverse cognitive levels and learning styles.

The following chapters address public perceptions of wildfires and controlled burns as well as the process used to develop wildfire prevention curriculum. Chapter Two reviews literature that formed the foundation for this study. The study draws from four areas of research:
risk perception literature, place literature, parent and child literature, and environmental education literature. Chapter Three describes the research methods and data collection techniques. Key informant interviews and focus groups from three Pennsylvania study sites are examined. Chapter Four presents results and analysis of the key informant interviews and focus groups. Based on qualitative data results, three lesson plans were developed. The lesson plans are described and linked to the qualitative data results. Chapter Five outlines implications for natural resource managers and community decision-makers and shares research considerations relative to this project and future work in this area.
Chapter 2

Literature Review

This chapter begins with an exploration of perceptions of wildfire to elucidate approaches to educating youth and communities about the role of fire as a natural disturbance in forest ecosystems. As forest management methods and policies shift from a century of fire suppression to using fire to restore ecological health, the mixed messages of suppression versus controlled burn has confused stakeholders. Individual and community attitudes towards both controlled burn and wildfire determine their receptiveness to fire as a management tool as well as their actions to reduce wildfire risk. Literature on perception of wildfire, sense of place, and place-based education provide insights into current risk awareness and methods for educating people about wildfire prevention.

Public Perceptions of Wildfire and Controlled Burns

Public perception of wildfire gained relevance when fire policy recognized people were both part of the wildfire problem and its solution. Effective wildfire prevention programs begin with understanding social values, demographic trends, socioeconomic factors, fuel loads, structural issues, and wildlife as well as motivations for adopting risk-reducing behavior. Clearly, wildfire has disrupted human use of the land, threatened lives, and damaged homes and natural environments people value (Daniel et al., 2007).

Although the literature focuses mainly on natural hazards including Western wildfires, it provides insights into risk perceptions, coping stages, approaches to communicating fire hazards to communities, and public participation in fire mitigation and management. Risk, for purposes of this project, was defined as how serious the threat is considered coupled with the probability of experiencing a damaging environmental event (McCaffrey and Kumagai, 2007). McCaffrey and
Kumagai (2007) further refining Burton et al. (1993, 1978) and Palm (1990) identified two categories of risk that influence individual responses to natural hazards:

…factors that affected an individual’s awareness and perception of the hazard, such as how long they had lived in the area and past personal experience with the hazard; and factors that influenced how that knowledge translated into action, such as availability of adequate resources to act, sense of control, and the salience of the hazard in comparison with other daily concerns (p 14).

Individuals also considered environmental conditions, ignition source, and potential damage to humans and natural resources when assessing risk (McCaffrey, 2008).

Natural hazard theory suggests society addresses risk through four sequential stages associated with coping with hazards: loss absorption, acceptance, reduction, and change. Each stage has a threshold and progress between stages occurs when these thresholds are crossed.

McCaffrey and Kumagai (2007) used cost to define transition between stages. Cost encompasses social and cultural adaptations as well as incidental and significant financial expenditures. The loss absorption stage has few associated costs to society and these costs are unconsciously absorbed. When the associated costs exceed society’s capacity to absorb additional costs, an acceptance threshold is reached. The public recognizes a natural event as a hazard and makes conscious adjustments to spread costs, often across a group broader than those directly affected. Action is relatively passive during this stage. When hazards costs exceed the public’s ability to spread associated expenses, a reduction threshold is crossed and mitigation activities are taken to minimize the natural hazard and change behavior. The final coping stage of change occurs in extreme situations when mitigation efforts are insufficient and require a change in land use or living standards. Because of society’s resistance to large scale change, the final stage rarely occurs (Burton, 1993; McCaffrey and Kumagai, 2007).

Risk perception plays a key role in how communities interpret and frame risk, thus researchers use community, risk, disaster, and natural resource management theories to inform an understanding of community action to mitigate risk (Flint and Luloff, 2007). Several studies
based on risk theory indicated risk perception is complex and varies based on individual interpretation and response to external factors such as environmental conditions as well as personal perceptions of benefits and risk tolerance (Daniel, 2007; McCaffrey, 2008; McGee et al., 2009). Flint and Luloff (2007) and Gordon (2007) examined community action based on community and risk theories. Both studies suggested community action is influenced by local interactional capacity to collaborate on issues and problems, shared community perception of risk, as well as socioeconomic and biophysical risk factors (Flint and Luloff, 2007; Gordon, 2007). Biophysical risk factors include topography, fuel loads, vegetation cover, and geographic distribution of communities. Flint and Luloff’s (2007) results indicated communities mitigated threats when residents care about the place they lived and each other. Similarly, Flint and Haynes (2006) building on Heimer (1988) suggested risk-decision behavior has a situational context and uniformity across communities should not be expected. Likewise, Gordon (2007) studied community action and interactional capacity in wildfire prone communities in Pennsylvania, Minnesota, Wisconsin, and West Virginia. He found that overall risk perception was community specific and social groups within communities perceived risk differently. Within Pennsylvania, communities had no awareness of wildfire, rather more pressing daily concerns including suburban sprawl, pollution, commuting, and family problems overshadowed fire risk (Gordon, 2007).

Studies designed to assess homeowner risk perceptions of wildfire indicated hazard events either reduced or had no effect on (McGee et al., 2009; McCaffrey 2008) post-hazard risk impression. McGee et al. (2009) examined homeowner risk perceptions in Alberta and British Columbia communities affected by 2003 high-intensity crown wildfires. Homeowners, who expressed low risk perceptions pre-fire and post-fire, accepted the risk as a normal part of living in fire prone areas. Likewise, a study of Alaskan residents in the Kenai Peninsula found residents were less likely to take action when they weren’t concerned about potential for further problems.
(Flint and Luloff, 2007). Similarly, some residents believed another wildfire was unlikely to occur or had a fatalistic attitude – nothing could be done to reduce personal property damage or loss (Monroe et al., 2006; McGee et al., 2009). For this reason, it was not surprising that while people were aware of wildfires, a “it won't happen to me” attitude prevailed, even in areas that had recently experienced wildfires (Ryan et al., 2006; McCaffrey and Kumagai, 2007; Shindler, 2008). Furthermore, studies indicated wildland-urban interface residents were willing to trade fire risk for amenities they gained from the place where they live (McCaffrey, 2005; Shindler, 2007). Amenities included proximity to forests and wildlife as well as natural landscapes views (McCaffrey, 2005; Shindler, 2007).

Further adding to low wildfire hazard perception was the limited impact they have on people and property and the relatively few associated fatalities despite the hundreds of thousands of acres burned annually when compared to other natural disasters. Firefighters, not the general public, are injured or killed in wildfires, which contributes further to the public’s perception of low fire risk (Daniel et al., 2007).

To address attenuated risk perception, studies recommended better knowledge of individual and community responses to natural resource issues was needed (c.f., Elmendorf and Luloff, 2001; Brennan et al., 2005; Flint and Luloff, 2007; Gordon; 2007). Similarly, studies suggested it is essential to improve the knowledge of and capacity to measure those forces that are the foundation of individual judgments, perceptions, and evaluations as well as the larger context in which they were formed (Flint, 2006; Gordon, 2007; Gruver and Luloff, 2008). A mixed methods approach integrating key informant interviews, focus groups and surveys was effective in identifying and measuring individual and community natural resource attitudes, perceptions, and decisions (Flint, 2006; Gordon, 2007; Gruver and Luloff, 2008).

Once perceptions, attitudes and decisions are identified, studies evaluated the basis of individual and community responses to natural resource issues including fire. In particular studies
examined approaches for communicating fire risk information noted that sources must be credible and trustworthy to encourage adoption of information and mitigation measures (Lindell and Perry, 2000; Lindell and Whitney, 2000; Monroe et al., 2006; Daniel et al., 2007). Furthermore, effective communication strategies needed to do more than inform. Through community discussion and involvement, education programs need to motivate behavior change and inspire action (Monroe et al., 2006). For instance, brochures and pamphlets worked best with citizens who had low initial knowledge, but to be effective this information should be followed by interactive activities such as workshops or guided visits (Toman and Shindler, 2006). Monroe et al. (2006) suggested effective communication had verbal and visual components such as wildfire images to illustrate the message. They also recommended against using overly dramatic visuals that could distract individuals from the intended message and action. Several studies recommended multiple communication strategies including community advisory committees, demonstration sites, newspaper, radio, and television as the best approach (Ryan et al., 2006; Toman and Shindler, 2006; McCaffrey and Kumagai, 2007). In particular, these studies recommended the use of communication approaches tailored to the audience such as press releases, human-interest stories, community radio stations, and local newsletters (Monroe et al., 2006). How television coverage and reports portrayed fire was central to public perception. Some television reports added to public misconceptions by focusing on wildlife and habitat loss. On the other hand, media stories highlighting fire suppression’s role in increased fire risk as well as successful wildfire management responses improved public knowledge (Toman and Shindler, 2006).

One of the messages natural resource and fire fighting professionals are communicating to the public is the need for fuel mitigation to attenuate fire risk. Studies recommended increased public participation in fuel mitigation and fire management (Ryan et al., 2006; Toman and Shindler, 2006; McCaffrey and Kumagai, 2007). Federal, state, and local agencies need to work
with communities to remove vegetation and trees using controlled burns or mechanical treatments to reduce the risk of wildfires spreading to homes in the WUI. Several studies suggested identifying key community leaders who can disseminate information, build trust, and gain acceptance of specific fuel treatments including controlled burns, thinning forests, and removing shrubs (Toman and Shindler, 2006; McCaffrey and Kumagai, 2007). Public discussions must focus on risks and benefits, especially ways mitigation efforts can add to the benefits derived from living in wildland areas such as improved wildlife habitat and forest health (Daniels, 2007; McCaffrey, 2007). Furthermore, it was necessary to customize public participation efforts for communities as they differ in their perception of and response to fire risk as well as rates of participation in risk-management programs (Ryan et al., 2006; Toman and Shindler, 2006; Paveglio et al., 2009). For example, rural communities with a history of forest management might accept thinning and controlled burns more readily than would suburban communities where opposition to thinning might exist (Ryan et al., 2006). In the latter case, suburban residents purchased properties for their amenity values and residents perceived thinning or controlled burns as degrading naturalness or leading to loss of wildlife habitat (Ryan et al., 2006; Daniel et al., 2007). Ideally, outreach efforts need to occur immediately after a wildfire during the “window of opportunity” that motivates individuals to adopt wildfire reduction measures (McGee et al., 2009). The ultimate adoption and retention of programs depended on economic feasibility, convenience of implementing new management techniques (e.g., thinning, controlled burns), and public understanding of fire and fuel management.

**Sense of Place**

A landscape framework provided insights into why individuals and communities disagree over risk perceptions, changes in the natural environment, and consequences of change. Meinig
(1979) noted the central problem was “…any landscape is composed not only of what lies before our eyes but what lies within our heads” (p 34). Just as there are many ways of perceiving the landscape, there are numerous theoretical approaches to defining sense of place. Tuan (1977), a sense of place pioneer, defined it as people giving meaning to places through experience, thoughts, and feelings. Sense of place encompasses an individual’s experience of living in the place, attributing symbolic meanings, and interpreting the space (Tuan, 1977; Greider and Garkovich, 1994; Stedman, 2003). Gordon (2007) citing Relph (1997) noted place underpins the way humans understand the world and interact with society and nature.

Several studies suggested landscape preferences and meaning are based on cultural values and beliefs (Greider and Garkovich, 1994; Brandenberg and Carroll, 1995). Our relationship with nature is a cultural expression of who we were, who we are, and who we hope to be in a given place. Some suggested place is more about understanding ourselves than the natural environment (Tuan, 1977; Brandenberg and Carroll, 1995). Place attachment developed through repeated experience with the landscape. Through this, individuals develop deeply personal feelings, memories, and emotional bonds with places. Similar to the bonds we form with community, place attachment promotes development of individual and shared meanings of place. A group’s shared meaning of place defines appropriate and inappropriate behavior relationships with the natural environment (Brandenberg and Carroll, 1995) including, in the case of fire, the acceptance of fuel management programs (i.e., thinning and controlled burns). As societal understanding of the relationship between fire and natural landscapes changes and accepts fire as part of the natural landscape, shared definition of appropriate relationships with fire, fire management, and fuel reduction methods shift.
Place-Based Education

Place-based education proposes that as individuals understand and study their local environment it has a bearing on the social and ecological well-being of places they inhabit (Gruenewald, 2003). This was not a novel concept. Orr (1992) noted John Dewey introduced the concept of place as part of education in 1897. Building on Dewey’s work, Mumford, an urban planner and sociologist, in the 1940s recommended adding “regional survey” to student curriculum (Orr, 1992). “Regional survey” is the intensive study of the local environment to create thinking across disciplines, promote cooperation, and dissolve distinctions between nature and human society as well as facts and values (Orr, 1992). However, the “regional survey” interdisciplinary approach was not adopted. Instead conventional education became a celebration of all that is human to the exclusion of our dependence on nature (Orr, 1992). Furthermore, education has evolved into a passive process, indoor activities are designed for students to master basic functions that can be measured and tested (Orr, 1992). For example, the No Child Left Behind Act of 2001 emphasizes standards and “teaching to the test” without teaching critical thinking (Gruenewald, 2003). Standards emphasize cleverness based on short-term, reductionist thinking. The result is an education system that creates more problems by producing individuals alienated from life, focused on success and careers, and who make decisions void of social, ethical, and environmental considerations (Orr, 1994). To address current issues, education systems need a paradigm shift to intelligence based on a long-term, interdisciplinary perspective and where decisions balance social, economic and ecological needs (Orr, 1994).

Further elaborating on the current lack of place-based education, Orr (1992) suggested place had been overlooked for several reasons. First, things that are closest, such as environmental hazards or social injustice, are often difficult to see or acknowledge. Second, place was a nebulous concept defined by human scale (e.g., neighborhood, community, state). Third,
studying place could lead to thinking in the abstract. For example, conventional education taught students about nature through television programs thereby encouraging thinking of nature in the abstract rather than permitting direct experiences with local forest, fields, wildlife and streams. (Orr, 1989; Gruenewald, 2003). Therefore, according to Orr (1992) it is easier to teach about distant issues such as the Brazilian rainforest than local issues or local places.

Several studies suggested place-based education is multidisciplinary, enhances critical thinking, combines intellect with experience, and uses direct observation, investigation, and experimentation skills in the application of knowledge (Orr, 1992; Williamson and Smoak, 1999; Gruenewald, 2003). While education can create specialists, place-based education promotes interrelatedness of disciplines and diversity of thought. Although place-based education began with an understanding of the local environment, it can expand to study relationships among places such as communities, ecosystems, and countries (Orr, 1992).

Some studies suggested place-based curriculum teaches children about the effect human actions have on the environment. Students need an understanding of how humans change landscapes and impact ecosystems as well as human communities (Orr, 1992). Williamson and Smoak (1999) developed a gardening program to teach nine through twelve year olds responsible stewardship and informed decision-making through interdisciplinary topics. The students created garden plots, developed and tested hypotheses about plant interactions, collected data, and summarized their findings. Through the experience, they gained an understanding of local plant communities as well as developed critical thinking skills. Their overall academic achievement improved as a result of the class.

Teachers who use place-based education should be sensitive to child development phases (Sobel, 1997). When teachers instruct children about world problems before they have a safe connection with the world around them, students could feel disempowered and become “ecophobic” or fearful of the natural world (Sobel, 1997):
Between the ages of 4 and 7, the objective of environmental education should be empathy with the natural world, or “becoming” the natural world; between 7 and 11, the key notion is engagement with, and exploration of, the natural world; and from the ages of 11 to 14, the core idea becomes social action (p 32).

Likewise, teaching children about faraway places disconnected them from their immediate environment. Figure 2.1 taken from Powers (2004) illustrates the potential of place-based education. Through an understanding of their local community and opportunities to apply stewardship, ecology and civic concepts to community projects, children develop a sense of place and self as well as real world skills. When students are allowed to develop a sense of purpose and identity, it provides a foundation for addressing complicated social and ecological issues later in life. Place-based education seeks to improve community well-being (socially, ecologically, and economically) by broadening and deepening individual connections to community.

Figure 2-1: Change Theory Model for Place-based Education. An individual becomes active in the community once they have skills to act and attachment to their place (Powers, 2004).
Children Teaching Adults

Family, friends, and community can shape an individual’s understanding of the landscape. Early research on child-parent relationships suggested a unidirectional process in which children were “blank slates” that adults molded and shaped (Dillon, 2002). Dillon (2002) suggested that Bell’s (1968) seminal work, “A Reinterpretation of the Direction of Effects in Studies of Socialization,” shifted parent-child socialization theory from unidirectional to bidirectional. Specifically, Bell (1968), as cited by Dillon (2002), proposed children had as much socialization influence on their parents as parents had on their offspring. Likewise, Ambert (2001) suggested child and parent relationships are a reciprocal exchange of knowledge, beliefs, and values. Furthermore, in a rapidly changing world, adults are learning at all times and offspring increasingly help parents adapt and learn (Bateson, 2008). Parents recognize they do not have all the answers and are open to learning from their children (Bateson, 2008).

Beyond a few studies on the influence of children on parental development (Purrington, 1980; Ambert, 2001; Dillon, 2002), there was not a great deal of research on concrete ways in which children teach parents new behavior or affected risk perceptions. For example, Bateson (2008) based on personal observation suggested children teach their parents lessons on respecting themselves and others as well as protecting the natural world.

A few studies elucidated potential ways children could teach parents. Purrington (1980) interviewed forty-three families in central Michigan and asked participants how their child influenced them as a person. Results indicated all parents experienced substantial shifts in values, which, in some cases, led them to take stands on issues, such as religion, that otherwise would have been unexamined or not acted upon. In addition, parent socialization by children occurred in a system they could not leave, which is not the case in most social interactions such as work. Similarly, Dillon (2002) examined the effect of children on adult development. Thirty-five
parents and fifteen teachers were asked to discuss when a child shifted their values or priorities or they learned something valuable from a child. Interview data indicated all adults were impacted by children. In particular, data showed:

Adults reported that children could cause them to (a) shift their values or priorities, (b) integrate memories or experiences previously disowned or repressed, (c) become more creative and cognitively flexible, or (d) look at the world with more wonder, awe, or curiosity (p 267).

Specifically, parents and teachers reported children altered their behavior and attitudes towards the environment, pollution, littering, and recycling. In one case, a daughter constantly reminded her father to recycle glass and newspapers and as a result he felt closer to the earth (Dillon, 2002).

**New Curriculum Impediments**

Studies indicated teacher lack of confidence and background knowledge as well as ease of use could be barriers to incorporating environmental or place-based curriculum in the classroom (Broussard and Jones, 2001; Gruver and Luloff, 2008; Gruver et al., 2009). In particular, Broussard and Jones (2001) developed, implemented, and evaluated a comprehensive forest education program for Philadelphia inner city schools. Their research found teachers were less likely to integrate environmental education curriculum if they lacked the necessary tools and knowledge. In addition, some youth were uncomfortable in nature. To overcome this barrier, Broussard and Jones (2001) organized teacher-training programs to equip educators with the necessary skills to deliver specific curriculum. Furthermore, they suggested outdoor experiential learning needed to be incorporated with indoor activities to reduce student fears of forests and get them acclimated with the natural environment. Broussard et al. (2001) found ease of use, including the ability to easily incorporate new curriculum into what teachers were already doing in the classroom, was an important consideration for any education material.
Similarly, Gruver and Luloff (2008) and Gruver et al., (2009) surveyed school teachers to determine what watershed curriculum they used, how they used it, and how confident they were in teaching about watersheds. Results indicated teachers interacted more with the curriculum when they perceived they were effectively communicating watershed concepts to students and students gained necessary watershed competencies. In cases where teachers lacked confidence in the curriculum or their understanding, curricula developers needed to cultivate teacher confidence in teaching about watersheds as well as self-perceived effectiveness in comprehending and conveying curriculum concepts.

Summary

This chapter presented connections between fire risk perception, the ways people understand and connect to the natural world, as well as methods to improve understanding of complex community issues, especially by children. The literature reviewed revealed gaps in understanding how and why people value their local environment. Furthermore, much of the research focused on risk and public outreach to adults. There was relatively little research on Northeastern wildfires and outreach to youth.

A need remains to better understand Northeastern wildfires and approaches to reducing fire risk through youth education. The literature suggested place, place-based education, and children teaching adults are relevant to the question I explored. Thus, I used the literature in the following way to define my research. Literature noted place contributed to wildfire hazard and community members within a place defined risk. Since Northeastern wildfires tend to occur in specific areas, this study was conducted in locations identified as wildfire prone. Discussions with community members elucidated their needs. Specifically, qualitative methods were used to explore perceptions, concerns, and education needs across study areas. Qualitative data suggested
community members perceived youth education as the best approach to reducing wildfires. Consequently, teacher focus groups were organized to develop and evaluate wildfire lesson plans targeting middle school students. Descriptions of the study areas and methodologies used in the study to develop youth education materials are explained in Chapter Three.
Chapter 3

Methodology

Introduction

Qualitative research methods were used to identify public perceptions of wildfires and controlled burns (See Figure 3-1). Specifically, Tara Claghorn, a former graduate student in the School of Forest Resources at Penn State, conducted preliminary focus groups and these provided insights on firefighting professionals’ wildfire perceptions. For the study described in this thesis, key informant interviews were conducted in three new fire prone communities. Both Claghorn’s focus groups and the key informant interviews recommended youth education. As a result, teacher focus groups were conducted to develop and evaluation wildfire lesson plans.

This chapter is divided into five sections to elucidate the methods used in this study. The first section explains the rationale for using key informant interviews and focus groups for data collection as well as the purpose for developing education materials for middle school children. The second section describes how the sample sites were selected, and provides brief descriptions of the sites and methods used to identify key informant participants. The third and fourth sections describe the protocol used to gather information during key informant interviews and teacher focus groups. The fifth section describes the methods used to analyze the qualitative data and develop lesson plans.
Figure 3-1: Research Method Flow Chart. Claghorn conducted focus groups in three fire prone communities. Key informant interviews were conducted in three new fire prone communities. Results from Claghorn’s focus groups and key informant interviews recommended youth education. Teacher focus groups were organized to develop and evaluate wildfire lesson plans.

**Qualitative Research Rationale**

Wildfire is a human-social problem. Individuals and communities define what is at risk during a wildfire including people, homes, businesses, and forests. Through social construction, community members define and interpret wildfire’s impact and meaning. Social construction of risk occurs when community members confer meaning on events based on shared experiences, perceptions, and knowledge (Greider and Garkovich, 1994; Flint and Luloff, 2005). If residents collectively recognize risk, community action occurs based on community capacity and interactions (Flint and Luloff, 2005) social construction occurs.

To understand community social construction regarding wildfires and controlled burns, qualitative research methods were used to provide in-depth narrative. Redmore and Tynon (2011) citing Driscoll and McFarland (1989) suggest qualitative methods are valuable in exploratory research; researchers use the rich narrative to examine the meaning and context of an experience.
or issue. In this study, qualitative research methods were used to identify community wildfire concerns, awareness, and risk tolerance. Specifically, the qualitative research methods of key informant interviews and focus groups were used to gather information.

Ethnography, a qualitative research method, is used to explore a social group’s behavior, language, attitudes, and interactions (Creswell, 1998). Key informant interviews, a technique employed with ethnography, provide in-depth information for describing and interpreting context such as community. In particular, key informant interviews provide rich, spontaneous responses to open-ended questions. Key informants are generally community members selected based on their reputations, positions within the community, knowledge of the research topic and their community, and representative of local interest groups (Luloff, 1999; Elmendorf and Luloff, 2001). Their insights, experiences and perspectives offer important data about the social reality of the community, its residents, and the issue under study. A modified snowball procedure becomes a mechanism for identifying additional key informants beyond those originally selected. In this process, initial informants are asked to identify other potential participants knowledgeable about the community.

Focus groups are a planned series of discussions designed to elicit ideas and perceptions from participants on a specific topic (Krueger and Casey, 2009). The discussions are facilitated to encourage rich conversation and to fully explore the study topic. Through the discussion participants have opportunities to contemplate and explore the topic in ways they might not have considered in a one-on-one interview. In addition, Krueger and Casey (2009) suggest conducting several focus groups with participants who have similar demographics and professional backgrounds to allow the researcher to identify patterns and trends.

Key informant interviews and focus groups are carefully planned discussions that allow participants to contemplate and express their viewpoints on complex issues. Self-disclosure and diverse perspectives are encouraged which allows for the emergence of a broad range of
viewpoints. Both approaches provide insights into social relations and social construction of events and risk perception. Key informant interviews and focus groups also illuminate the social construction process and can be used to identify approaches for helping communities address issues such as fire risk and adopt wildfire prevention methods.

Gordon (2007) citing Luloff (1999) acknowledged others believe key informant interviews incorporated bias and lack generalizability; however, he argued that this perspective ignores the point that key informants as individuals influence and are influenced by public opinion. In his work, municipal officials and firefighting professionals tried to influence resident opinions and actions to address wildfire issues and in this process effective communication and outreach were essential. Effective communication and outreach are characterized by inclusive, two-way communication that empowers individuals (Elmendorf and Luloff, 2001). Accordingly, community members need to be engaged in conversations to gather information about their beliefs, attitudes and needs. Lack of two-way communication can lead to apathy, mistrust, or violation of policies. Key informant interviews and focus groups serve to gather information about community members’ opinions, attitudes, and needs. That the responses garnered in these sessions can lead to clear, realistic outreach strategies is a benefit of communicating with and including a broad set of individuals in information gathering and education program development process. In addition, the information can be used to develop better education programs (Monroe et al., 2006). By including residents in education program planning, it could lead to a sense of ownership through identification with the project. Furthermore, focus groups could be used to validate and reinforce information and perspectives gathered in key informant interviews.
Preliminary Work

Prior to this study, Claghorn conducted three focus groups in October – November 2007: Mehoopany, Johnstown, and Meyersdale, Pennsylvania. Each community had recently experienced a wildfire and focus groups were used to identify perceptions, issues, and concerns regarding wildfires and the Pennsylvania Firewise program. These focus groups were advertised in local newspapers as well as through the district office of the Bureau of Forestry associated with each community. Table 3-1 provides a participant break down by community and affiliation. Seventy percent of the participants were firefighting or forestry professionals familiar with wildfires.

Findings from these sessions suggested that those directly affected by wildfire were fearful of loss or harm, but the concerns were short-lived. While participants acknowledged the need for fire education programs, few exist and as a result wildfire awareness, from the perspective of the professionals who participated in the focus groups, amongst adults was almost non-existent and ineffective. As a result, participants recommended education programs target fire prone communities as well as children because they were more receptive than adults. Furthermore, there was agreement among participant landowners that fire companies were viewed as a trusted source for fire prevention information; however, participants who were firefighters acknowledged they were overwhelmed with their current responsibilities and have experienced a dramatic decline in volunteer commitment leaving little time or resources to conduct community outreach and education. The preliminary focus group results and questions are available in Appendix A.

Table 3-1: Caghorn’s Preliminary Focus Group Participants by Community and Affiliation - 2007

<table>
<thead>
<tr>
<th>Location</th>
<th>Landowners</th>
<th>Bureau of Forestry</th>
<th>Firefighters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mehoopany</td>
<td>6</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Meyersdale</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Johnstown</td>
<td>0</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>
While the intent of Claghorn’s study was to obtain perceptions from the general populace, most of focus group participants were forestry and firefighting professional knowledgeable about wildfires. This issue was addressed through an iterative research design. First, three fire prone research sites were selected based on discussions with Pennsylvania Bureau of Forestry personnel. Next, key informant interviews were conducted in each site and key informant participants with wildfire knowledge were limited to one forestry professional and firefighter per community. Claghorn’s focus groups and the subsequent key informant interviews recommended youth education as the best wildfire prevention approach. Thus, a set of teacher focus groups were organized to develop and evaluate wildfire curriculum.

**Site Selection**

For the purpose of this thesis, a purposive sample of research sites was used where key informant interviews and focus groups were conducted. Research sites were selected in collaboration with Pennsylvania Bureau of Forestry Fire Prevention personnel. The Bureau of Forestry maintains data on wildfire locations, event dates, acres burned, cause, and suppression costs. Bureau of Forestry analyzed these data and using selected criteria, including wildfire frequency, topography, and real estate values, to identify fire prone communities and townships and to calculate fire risk scores. Fire risk scores ranging from slight risk to severe risk were created using the following criteria.

The selection model included topography since fires move faster as terrain slope increases. Consequently, municipalities containing steep slopes have increased risk of loss due to wildfire. Home values correlate to community willingness to invest in fire mitigation, which is relatively expensive. Therefore, communities with moderate to high real estate values might have
the tax base needed to institute such programs. Fire risk scores were added to a GIS layer of Pennsylvania townships (see Figure 3-2).

![Figure 3-2: Pennsylvania wildfire risk by township. Fire risk scores calculated based on wildfire frequency, topography, and real estate values. Red was high fire risk and green was low fire risk.](image)

Using these fire risk scores, site selections were finalized based on informal discussions with Bureau of Forestry (BoF) fire personnel familiar with the townships and individuals in specific high-risk communities (See Figure 3-3). Forestry personnel identified communities that had either frequent or recent wildfires and they considered “open” to discussing wildfire prevention. Sites were selected in northeastern, central, and eastern Pennsylvania to achieve geographic diversity (See Table 3-2). After key informant interviews were completed, teacher focus groups were organized in school districts that either served or were in close proximity to the selected municipality. In particular, West Branch Area School district is in Morris Township, which is next to Rush Township.
Laurel Run, PA

The town of Laurel Run is one mile southeast of Wilkes-Barre, Pennsylvania (See Figure 3-4). Wilkes-Barre in northeastern Pennsylvania is an urban center with a population of 40,964 and Laurel Run has a population of 500. Students in the area attend Wilkes-Barre schools or Bear...
Creek Community Charter School (See Table 3-2 and Figure 3-4). Laurel Run covers 5.13 square miles (Laurel Run Profile, 2008). Iroquois and Delaware Indian initially inhabited the area. Early American British and Germans first settled the area and were followed by Polish and Italian immigrants. The area’s economy was historically agriculture and coal mining (History of Luzerne County, 2008), both of which have declined in importance. The town’s demography is 99 percent Caucasian, 0.5 percent African American, and 0.5 percent Native American. Most of the adult population has a high school diploma or higher. Residents tend to work in manufacturing, health care, or retail trade (Laurel Run Profile, 2008).

Figure 3-4: Pennsylvania Public School Intermediate Unit 18 included Wilkes-Barre Area School District, Bear Creek Community Charter School and Laurel Run.
Laurel Run is a fire prone WUI community, where homes have been built adjacent to flammable vegetation (Daniel et al., 2007). The regional topography consists of steep ridges and valleys and Laurel Run is located on a northwestern slope of Penobscot Mountain. Eastern hardwood forests including highly flammable scrub oak and table mountain pine cover the ridge. Forests including a large tract of Pennsylvania Game Commission land surround the community. As noted by the Pennsylvania Bureau of Forestry wildfire specialist, housing subdivisions in some cases were built in forests with streets not wide enough to handle emergency vehicles (Deppen, telephone conversation 2009).

The steep terrain, highly flammable vegetation, and close proximity of homes to forests lead to a high wildfire risk. Laurel Run has a history of wildfires. There are, on average twelve wildfires reported annually. Furthermore, a 1,500-acre wildfire in April, 2009 surrounded the community and required a partial evacuation of residents.

**Rush Township, Centre County, PA**

Rush Township is located in western Centre County in central Pennsylvania (See Figure 3-5). The area was initially settled in 1797 with farming, sawmills, and iron production the major industries until the 1850s. Coal and clay extraction replaced iron production as the primary industry through the early 20th century. From 1850 to 1900 the population increased from 371 to 6,200. As clay and coal production diminished, the population dropped to its current level of 3,499 (Rush Township website, 2011) with 23.3 people per square mile. The population is 97 percent Caucasian; the residual are predominantly African American and Asian.

Rush Township, the largest in Pennsylvania, covers 149 square miles. It is located on Sandy Ridge high plateau and is covered by oak-hickory forests. More than 50 percent of the township is in public ownership including Black Moshannon State Park, Moshannon State Forest,
and Pennsylvania Game Lands. Hunting cabins on some in-holdings are dispersed throughout Black Moshannon State Forest. Several developments with moderate to high-value homes are nestled in Moshannon State Forest. Thus, the cabins and housing developments are located in fire prone areas and at risk. Students attend Bald Eagle and Philipsburg-Osceola Mills School Districts. West Branch School district is north of Rush Township in neighboring Morris Township (See Table 3-2 and Figure 3-5).

Forty-two wildfires occur on average each year in this high fire risk township. In some instances, sparks from off-road vehicles or campfires that were not properly controlled or extinguished start wildfires; however, more often residents burning trash instead of using municipal waste and recycling services start wildfires. In addition, the township does not have a burn ordinance. Further adding to fire risk are recent multiple gypsy moth infestations which have killed oak trees resulting in high volumes of standing and down dead timber.

Figure 3-5: Pennsylvania Public School Intermediate Unit 10 includes West Branch Area School District and Rush Township (shaded).
Middle Paxton Township, Dauphin County, PA

Middle Paxton Township is in Dauphin County in south-central Pennsylvania. It is due north of Harrisburg, the state capitol. John Harris, who established a fur trade business with Native Americans as well as a ferry service across the Susquehanna River, was the first to settle the area in 1729 (Dauphin County History, 2002). Scottish and German immigrants settled there.

The current population is 4,823 consisting of 98 percent Caucasian with the remaining 2 percent comprised of Hispanic/Latino and Asian. Middle Paxton Township has remained largely rural and is generally seen as a bedroom community for nearby urban centers. The 54.6 square mile township contains two state game lands and the Susquehanna River forms its western boundary (Middle Paxton city-data.com, 2011). Students in the area attend Central Dauphin, Halifax, or Middle Paxton schools.

Transportation is the major source of ignition for wildland fires in the township. The township’s proximity to Harrisburg, an urban center, means it contains an active rail line and high traffic roads. Sparks from trains as well as cigarettes from motorists cause approximately eleven wildfires annually. Furthermore, homes are intermixed with mesophytic forests. The township’s burn ordinance promotes safe debris burning; but, does not ban the practice. Consequently, there is the potential for fire from debris burning to escape and affect properties and forests.

Key Informant Interviews

Community Leaders

Key informants interviews were conducted in Laurel Run, Rush and Middle Paxton Townships. To develop a well-rounded, nonbiased understanding of wildfire risk and community actions to mitigate the risk, key informants were selected from six different groups, perceived
knowledgeable about local actions (Krannich and Humphrey, 1986). In particular, key informants had a capacity to make decisions to reduce wildfire risk or inform community members about approaches for reducing wildfire risk. Key informants from the following six groups were selected:

1. county planner or emergency management coordinator
2. elected official (mayor or township supervisor)
3. newspaper reporter
4. fire warden
5. firefighter
6. middle school teacher

In addition, local water supply companies were contacted. Local water reservoirs are traditionally located in forested areas where wildfire could negatively impact community water supplies. In this process Rush Township was the only community identified as depending on a reservoir-based water supply. Laurel Run and Middle Paxton homeowners depend on well water sources. These key informant categories were considered sufficient to collect information about wildfire perceptions and mitigation activities from several different institutional or decision-making sectors (Krannich and Humphrey, 1986). Although not all were directly involved in wildfire prevention, informants in these groups were expected to be knowledgeable about such activities in their community.

Using a modified snowball sampling technique, forestry personnel familiar with sample sites were contacted in March, 2009 and asked to recommend one or two key informants in the municipality. Key informants were called and read a telephone script (Appendix B) inviting them to participate in telephone interviews for this project. At the end of the interviews, key informants were asked to identify additional individuals to interview. Through this process key informants in the remaining key informant categories were identified and interviewed in each community.
Teachers

As stated earlier, Claghorn determined through her focus groups that youth education was a practical way to disseminate wildfire educational materials. As well, the community key informants interviewed for this thesis suggested the same approach. Based on these findings, key informant interviews were also conducted with teachers in the target communities. Therefore, principals in the three districts were called and invited to have their school participate in the research project. If the principals expressed interest in the project, they were asked to recommend teacher(s) to interview. If principals declined to participate, adjoining school districts were contacted. Principals at Wilkes-Barre Area School District and Bear Creek Community Charter School near Laure Run expressed interest in participating. Likewise, the West Branch Area School District principal agreed to participate in the study. Principals at Central Dauphin, Halifax, and Middle Paxton School Districts all declined participation citing full academic school year schedules and lack of teacher interest.

One or two teachers in the three participating school districts were selected for key informant interviews. Table 3-3 indicates the number of key informants, including teachers, by municipality. The same interview protocol and questions used for the initial set of key informants were used for the teachers. In particular, one question explored the best approach to reducing wildfire risk. Knowing the research objective was to create education materials, potential bias was prevented by asking a general question and not leading key informant responses toward the need to have education programs designed.

Table 3-3: Key Informants and Focus Group Participants by Community/Township

<table>
<thead>
<tr>
<th>Location</th>
<th>Key Informants</th>
<th>Teacher Focus Group 1</th>
<th>Teacher Focus Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laurel Run</td>
<td>6</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Rush Township</td>
<td>9</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Middle Paxton Township</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Interview Procedure

To identify community leader key informants, Pennsylvania Bureau of Forestry wildfire personnel in each county were contacted to discuss the research project. These personnel work with local communities to reduce wildfire risk, are well respected, and know the decision makers. They were asked to recommend one or two key decision makers to contact.

Based on their recommendations, individuals were contacted using the Office of Research Protection approved telephone script (see Appendix B). The script provided a basic introduction to the research project and asked if the individual was willing to participate in the interview. If the individual was interested in participating, a follow-up thirty-minute telephone interview was scheduled. On that call, the verbal informed consent was read (Appendix C), which included information on the research project, confidentiality, the right to end the interview, voluntary nature of the interview, and permission to digitally record the session. All interviews were digitally recorded, which provided backup information to check notes and to help with interpreting responses. If the interviewee had no questions before starting the interview, the digital recorder was turned on and interviewees were asked to verbally affirm their permission to be recorded. Their response was noted on the informed consent and the interview was conducted.

The interview consisted of nine questions in three sections (see Appendix D). The first section focused on the individual’s general understanding of wildfire frequency and its causes in their community or township. The second section introduced the Firewise Program, specifically its purpose, objectives, content, and participation requirements. Key informants were asked, knowing what they now know about Firewise whether their community would be interested in Firewise. Interviewees were asked about their community’s level of interest in the Firewise
Program, current approaches for delivering wildfire reduction information to community members, and messages community members need to hear to reduce wildfires in their municipality. The third section addressed the merits of controlled burns. Individuals provided input on their community’s openness to controlled burns as well as concerns about using them as a management tool.

When the interview questions were completed, interviewees were offered an opportunity to ask further questions or to provide additional comments. The interviewees were thanked for their time and the digital recorder was turned off. Key informants were also asked to identify additional community members to interview. These individuals were then contacted and interviewed. Similarly, principals were asked to identify teachers to interview. The teachers were contacted and interviewed using the same protocol and questions. This modified snowball process continued until key informants in all categories were contacted for interviews. A few potential key informants in Laurel Run and Middle Paxton Township declined to participate.

**Focus Groups**

Preliminary and follow-up teacher focus groups were conducted in Laurel Run and Rush Township where teacher key informant interviews had occurred. Specifically, focus groups were held with teachers in the Wilkes-Barre Area School District and Bear Creek Community Charter School, which serves Laurel Run and West Branch Area School District teachers who borders Rush Township. All teachers who participated as key informants were invited to participate in focus groups in November 2010 and May 2011.
Focus Group Procedures

After the key informant interviews with individual teachers were completed, these teachers were invited to participate in a focus group to develop wildfire prevention curriculum. As well, these teachers were asked to recruit colleagues and were provided with recruitment materials including a recruiting letter (Appendix E) and the focus group informed consent form (Appendix F).

The preliminary focus groups (Table 3-3) occurred at the respective schools in November, 2010 after students were dismissed from classes at the end of the school day. Participating teachers signed the informed consent form and gave their permission to digitally record the discussion. Questions (Appendix G) garnered information on existing fire prevention curriculum, concepts and content to include in new curriculum, impediments to teaching the subject matter, and approaches to overcome the impediments. Focus group results were used to develop three wildfire related lesson plans: From the Woods: Wildfire (Schoonhoven et al., 2011), Safe Debris Burning, and Habitat Restoration Using Controlled Burns.

Follow-up focus groups were designed to evaluate the newly created lesson plans and to develop an implementation strategy. These focus groups occurred from late April to early May 2011. Although five teachers from Wilkes-Barre Area School District and Bear Creek Community Charter School planned to attend the follow up focus group, three cancelled the day of the session and the focus group discussion was continued with two teachers. The three teachers who cancelled were invited to provide feedback via email; but, none offered input. Participating teachers were asked to review the aforementioned lesson plans. They were asked to indicate what they would change if they had to teach the lesson plans next week, and what additional resources would they need to feel comfortable teaching the materials. As well, they were asked how the
lesson plans should be packaged for use and implementation in schools. Focus group results were used to further refine the three lesson plans, lesson plan packaging and implementation strategy.

Management and Analysis of Data

Interview and focus group data were transcribed and analyzed for common themes. The digital recordings were downloaded to a password-protected computer and deleted from the digital recorders. The interviews were coded to protect the names of the participants. Interview notes were transcribed and the recorded interviews were reviewed to ensure key concepts were captured. The interview responses were compared for common themes and to identify message content, information dissemination approaches, and the target audience(s).

Chapter Summary

This chapter described the qualitative research methods used to collect data on public perception of wildfires in fire prone communities in Pennsylvania. Initially three focus groups were held in Mehoopany, Johnstown, and Meyersdale. Eighteen key informant interviews were conducted in three communities: Laurel Run, Rush Township, and Middle Paxton Township. Claghorn’s focus groups and key informant interview results indicated youth education was the best wildfire prevention approach. Thus, teacher focus groups were conducted in Laurel Run and Morris Township to develop and evaluate wildfire curriculum. The chapter described data analysis and how individual information was protected. This approach permitted an iterative process to explore people’s perceptions of wildfire risk and awareness of controlled burns and develop outreach mechanisms.
Chapter 4

Results and Discussion

Introduction

The chapter presents the findings from key informant interviews in three fire prone municipalities and teacher focus groups in two of the three fire prone municipalities. Findings are from eighteen key informants and seven teachers who participated in preliminary and follow-up focus groups. The key informant and focus group data was analyzed for emerging themes as well as difference between municipalities. Themes were further organized into broader, common themes. Diverse viewpoints from key informants both within and among municipalities are discussed and based on common themes the results are presented by three topics: wildfire perceptions, controlled burn perceptions, and approaches to increasing public awareness. Similarly, teacher focus groups findings were divided into lesson plan development and lesson plan evaluation. Individual responses that contributed to understanding the research topic are included in the results to capture the depth of nuances and perspectives.

Key Informant Interviews

Wildfire Perceptions

The key informants were asked about wildfire frequency, concerns, and causes in their community. One or two informants in each community were either unaware of wildfires or believed they occurred infrequently in their community. Those who were unaware of wildfire
occurrence later in the interview acknowledged wildfire events did happen in their municipality.

For instance, a teacher and resident noted the following:

The more I learn about the culture of this particular area, the more I think there were more fires than I realized. This year from talking to people who fight fires through the Department of Conservation of Natural Resources, I realized there were more fires than I thought. Kids come in after the weekend and talk about fires near the school or their homes.

Some informants suggested two to four wildfires occurred each year and some informants suggested two or three wildfires occurred each month. All the informants who suggested two or three wildfires each month had a connection to wildfire events; most were firefighters. In one case, a respondent’s home and community had been threatened by wildfire. Local volunteer firefighters had a better sense of wildfire frequency, since they generally were the first to respond to grass and debris fires. Key informants from the Bureau of Forestry indicated they have strong connections with local fire companies; however, local fire companies do not always inform Bureau of Forestry personnel of small wildfires. Bureau of Forestry personnel often become involved in wildfire suppression efforts when fires get too large for the local fire company to contain.

Most informants, with the exception of those from Laurel Run, were unaware of the size of local wildfires. One individual defined fire size by how long the fire burned. For example, a small wildfire was “…contained quickly and did not spread” and a large wildfire was “one that burns for a couple days.” Some informants suggested there were numerous small wildfires and a few significant wildfires each year or several years. For instance, an elected official and resident noted the following:

Major fires occur every decade. Last one was a decade before the one this spring and fifteen years before that. A large fire involves one hundred acres. Have a dozen small brush fires a season between March and October. The magnitude of the spring fire was fifteen years. Small fires are the size of a playground to several hundred feet.
Across the three study municipalities, most of the small wildfires were half to one acre. A Laurel Run firefighter suggested significant fires in his borough were 50 acres and a Rush Township firefighter noted significant fires were 500 acres and larger in his township. Rush Township had a 1,200-acre fire in 1990. Some informants suggested large fires and high fire frequency occur during dry or drought conditions. Most of the informants who were not firefighters or foresters could not identify the time of year when wildfires occurred. Responses to the question varied with a few suggesting late summer and fall and others suggested spring and fall.

Loss of life, property, and habitat damage were identified as key wildfire concerns. Rush Township and Middle Paxton Township were largely forested and contain state game lands, state parks, and/or state forests. Forests, including a large state game land tract, surround Laurel Run.

Some informants expressed concern about the close proximity of houses to forests and the associated potential wildfire risk. This intermingling of forests and residential development defines the WUI where there was increased risk of fire to individuals, families, and personal property. A reporter expressed concern about his area’s rapid conversion from rural to “semi-rural development housing tracts:”

Trees surround the houses and there is usually one way in and one way out and it is the same way. If all those people start to leave at the same time, they are not going to make it. And at the same time if they try to leave, the fire units can’t get in. So generally speaking most of the fires…we have a ton of people who literally live in the woods. There is no practical way to get them out and we have more and more development.

At least some informants in each township or community expressed concerns about public safety. A Bureau of Forestry fire forester familiar with wildfire issues raised concerns about smoke and wildfire fatalities. Fire foresters are responsible for protecting the state’s 17 million acres of wildland from potential wildfire damage. It is accomplished through public outreach as well as wildfire prevention and suppression (DCNR, 2011). For instance, he expressed concern that wildfire or prescribed fire smoke was a potential hazard to motorists. Smoke could also
negatively affect individuals with asthma or breathing disorders. Furthermore, the fire forester expressed concern that elderly people died as a result of debris burning; one died in 2008 and three in 2009. They were burning debris, which got out of control. Three of the four individuals fell into the fire and the fourth had a heart attack as he tried to extinguish the blaze.

In Pennsylvania, local municipalities have the authority to establish zoning and land use regulations. Each township or borough involved in this study had a unique approach for dealing with zoning and wildfire risk. Laurel Run has a burning ordinance and the local fire company implements burn bans during high fire risk conditions. A Laurel Run informant noted the community’s sole source of revenue was property tax. Housing subdivisions in some cases were built in forests with streets not wide enough to handle emergency vehicles noted a firefighting professional and a reporter. The firefighter suggested this created potential evacuation risks for residents as well as fire containment challenges. The reporter suggested Laurel Run and neighboring communities “…take the money over the fire risk because they need the revenue from property tax.” Middle Paxton has a burning ordinance and most informants were unaware of structures or lives having been threatened by wildfire. Rush Township does not have a burn ban but the county planner worked with elected officials to ensure adequate access by public safety vehicles as well as a public water supply or dry hydrants.

In addition to concerns for human lives as well as personal property, some informants were concerned about damage to forests. Individually they acknowledged forests provided recreation opportunities to residents and visitors, a verdant landscape and aesthetic appeal. A teacher observed small fires had “no long lasting impact on plants and animals” and “large fire takes a few years for that to come back.” Another teacher noted, besides recreation, forest provided shade, clean air and water, and crucial wildlife habitat. The local water supply manager made a connection between forests and fires and the resulting impact on streams. She noted wildfires could destroy habitat and trees. This, in turn, could have a negative impact on streams,
community water supplies, and aquatic life such as native brook trout. Severe wildfires could cause erosion with sediment runoff damaging streams and aquatic life. In addition, people dump trash in forests and a wildfire might release toxic waste into the water. These results indicate non-fire professionals made connections to the impact of wildfire on ecosystems, wildlife, and water.

Most informants were aware of the causes of wildfires in their community. They suggested four possible causes: human carelessness, arson, lightning, and mechanical. Carelessness was the primary wildfire cause. One informant, who was a teacher, noted that when “careful precautions were not taken, that was when there could be some problems.” Individually, informants acknowledged problems arise during dry conditions when recreational campfires, debris burning, and pit fires were left unattended or not properly extinguished. Sparks from the fire easily ignite nearby dry grass, leaves, twigs, and branches. This suggests some individuals understood the link between fuels and ignition as well as the potential risk it presents to their communities.

Debris burning is a common practice in rural Pennsylvania. Homeowners clean up their yards and burn the leaves, branches, and dead plants. Some individuals burn their trash either out of necessity or to save money instead of using municipal trash services. Debris is burnt in open pits or steel barrels. For example, a teacher described the following situation:

We are considered a rural area. There are enough properties with open space that people can burn. Like my neighbor does burn. Actually, I have two neighbors that burn. We have a can in our backyard that we use now and then. There were farmers who will pile up brush and burn. I don’t see people burning regularly every week. But since we were allowed to do it, it does happen. From my neighbors it was probably every two to three months you see them out there burning something.

To reduce wildfire risk from debris burning, Laurel Run and Middle Paxton Township enacted burning ordinances. An informant, who was the fire chief, noted:

Our residents are allowed to burn in a container or a contained area with a water source. The person has to be present. It has to be so many feet from a road and a
house. It is from sunrise to sunset. In times when the fire incidence was high I do put a burning ban on the town.

Arson was the second leading cause of wildfires. Resident assertions were based on rumors they heard in the community. Firefighting professionals acknowledged this was the case based on Bureau of Forestry wildfire statistics as well as their own methodical investigation of fire ignition sources. Fire inspectors investigated the site and interviewed responders and community members. A fire inspector noted, “If you can find absolutely nothing at the origin, a Bic lighter does not leave anything there.” This suggested the individual who started the fire left no evidence of an ignition source, which might mean it was arson. He also made the following comment:

The difference is debris burning we get a lot of starts and they are usually small fires because the fire company gets the call. The landowner who was burning actually calls the fire company and they get there in short order. Your arson fires, the arsonists pick the area and sometimes they pick areas that are hard to get to or there is a delay of fire crews so the fires can get a little bit bigger.

Some informants suggested lightning started wildfires. A few informants suggested mechanical causes such as railroads, all-terrain vehicles, and motorcycles. Railroad tracks run through all three municipalities. Informants in each municipality suggested sparks from trains ignite nearby dry grass. Likewise, sparks from recreation vehicles such as all-terrain vehicles and motorcycles could cause wildfires.

Overall, most people were aware of wildfires and their causes. Informants were concerned about lives, property and habitat. To reduce wildfire risk, one township and one borough involved in the study had burning ordinances to manage where, when, what and how residents burned trash. Since few homes or structures were lost and fewer lives were lost in wildfires, risk perception was low. Similarly, Gordon (2007) interviewed residents in fire prone communities in Pike and Monroe counties in northeastern Pennsylvania. Residents were unaware of wildfire risk in their municipalities and more
concerned with daily issues including commuting, pollution, and family problems (Gordon, 2007). Furthermore, studies indicated residents were less like to take action to mitigate risk when they were not concerned about risk (Flint and Luloff, 2007; McCaffrey, 2008; McGee et al., 2009).

**Controlled burn perceptions**

In 2009, the Pennsylvania legislature passed the Pennsylvania Prescribed Burning Practices Act (The General Assembly of Pennsylvania, 2009) allowing state agencies to conduct controlled burns for ecological management and limited liability in cases where the controlled burn moves outside the designated area. As a result, Pennsylvania’s natural resource professionals could increasingly use controlled burns to manage forest ecosystems. Because of this change in legislation and the likelihood that the use of controlled fire will increase in Pennsylvania, informants were asked two questions about controlled burning: (1) if we were to develop an education program on the proper role of fire, what concerns would they have about using fire in their community; and (2) did they see any issues with introducing or using fire as a management tool in their community.

Most informants were not concerned with controlled burns as long as they were properly done. Some participants suggested a safe controlled burn involved trained professionals who had taken necessary precautions such as having adequate staffing, water, and other resources to manage and extinguish the fire. One informant, who was a township supervisor, recommended precautions should include firebreaks to protect homes and the environment. Firefighting professionals recommended trained professionals with in-depth fire knowledge conduct controlled burns. Fire knowledge includes understanding fire behavior and safe burn parameters. A fire inspector who managed control burns noted, “…look at the objectives and why you are
doing it... If you have a plan, you need to follow it. If the conditions are not there or it is not working out, you shut her down.”

Part of the planning process includes natural resource professionals working with elected officials and the public to educate them about controlled burns and to dispel misconceptions. One such misconception is the difference between controlled burns and wildfires. Several informants, both fire and non-fire professionals, recommended clearly differentiating between controlled burns and wildfires because the average person might think they could do a “controlled burn” on their property. A few fire professionals were concerned the average person would do a “controlled burn,” which would turn into a wildfire. Trained professionals conduct controlled burns based on a fire management plan that includes sufficient staff and resources to control the fire. The average person lacked the knowledge and resources to conduct a controlled burn.

The second controlled burn misconception dealt with Smokey Bear’s fire prevention message. A fire inspector noted, “People might see a conflict between Smokey Bear program to prevent fires and…here we are igniting forest fuels.” Some fire professionals suggested public education about the differences between controlled burns and wildfires were needed to address this issue. In particular, they suggested the need to emphasize that a controlled burn was controlled and stopped when it reached the planned boundaries. Furthermore, one fire professional noted:

…when I am out with Smokey Bear especially in the center region over there - you know a lot of people come up and say Smokey was kind of old school and they start the discussion on using fire. There are a lot of legitimate reasons to use fire. But, we also need to understand Smokey never said all fire was bad either, just the ones that get a little too hot or do the damage.

In addition to addressing misconceptions, twelve of the eighteen informants recommended conducting public education prior to a controlled burn to highlight the rationale and benefits associated with this management action. Similarly, some studies recommended introducing communities to the benefits of controlled burns to garner public support and trust.
(McCaffrey, 2005; Ryan et al., 2006; Blanchard and Ryan, 2007). McCaffrey (2005), in particular, noted a direct link between community approval of controlled burns and residents understanding its purpose and benefits. Specifically, some informants proposed public forums and meetings with elected officials to discuss the controlled burn objectives and projected outcomes. Along with public meetings, some informants recommended public service announcements, announcements in community newsletters, radio spots, and inviting a newspaper reporter to do a story on the controlled burn. Likewise, Ryan et al. (2006) recommended a multiple strategies approach to introducing residents to controlled burns that included newspapers and radio as well as small-scale demonstration sites to increase public awareness of controlled burn benefits. Informants further suggested meetings with public officials should address approaches to accommodate threatened and endangered plants and animals as well as options to limit erosion on steep slopes that could result in sedimentation of high quality streams.

While controlled burns have potential negative environmental impacts, some informants proposed controlled burns also benefited forests. When used as a forest management tool, controlled burns could maintain or restore healthy forests. Likewise, a reporter suggested controlled burns could eliminate forest pests and promote healthy forests:

There were insects in the area destroying the trees. They did the burn off to get rid of bugs. It was done properly and it will grow back greener and better than it was in the past. It was interesting to watch. It was done by forestry in Moshannon State Forest. They did it on their own property. I was covering for the newspaper. I did a story on it. No feedback from the public.

Outreach is needed to emphasize controlled burns are done for habitat restoration and to improve forests. As a result, non-fire professionals could come to understand controlled burns are not a risk to their homes or communities.

When asked about introducing controlled burning into their community, most participants thought some community members would be open to it and others would resist. A fire chief best
reflected the viewpoint expressed by other informants, “People have seen and read articles or television on what happened…they were concerned for their safety.” For instance, one participant who was a reporter suggested controlled burns conducted in areas not burned for twenty years could be dangerous. “It makes it worse now that we have the growth in property in the woods at the same time that they cut back on controlled burns.” However, a forestry professional noted, “We don’t have the fuel build up and so on like we hear about out West…fire is not a natural part of the eastern area.” Similar to wildfires, some informants also expressed concern about smoke affecting neighborhoods. To calm fears, across the board, trained and non-fire professional informants recommended public education prior to controlled burns. In particular, education needed to emphasize controlled burns were low intensity ground fires, not catastrophic wildfires.

**Approaches to Increasing Public Awareness**

Informants were asked a series of questions about reducing wildfire risk in their community. In particular, they were asked whether their community would be interested in learning about Firewise (www.firewise.org), a program that collaborates with communities to reduce wildfire risk before fires start. They were also asked what could be done about forest fires, the best approaches to reach people, and what people needed to hear about the Firewise program. Informant responses varied regarding community members’ interest in learning about Firewise. Some informants in communities with heightened wildfire awareness suggested community members would be interested in Firewise. Specifically, Laurel Run experienced possibly the largest wildfire in the state in 2009 and the fire chief noted it “really made people aware of how serious they could be.” Another informant from Laurel Run who was an elected official remarked, “… before the fire there was negligible interest in the Firewise program.” The same
informant suggested now “25 percent of the people are interested, which by today’s world is enormous.”

Similarly, Rush Township has the potential for increased wildfire risk. A resident who managed local water resources commented:

Public would be extremely interested especially with a garbage dump coming into the area…new rails opening up and the increased risk of wildfires. Static electricity from rails caused fires in the forests. What will happen if they open the rails and the trains increase the risk of fires? People were very concerned about having something in place in their home and around their home. A forest fire could wipe out an entire village. I would think they were very much interested.

A few informants suggested negligible public interest in Firewise, since community members might perceive the program as government interference. Middle Paxton Township is a rural township with a population of old and new residents. The township manager noted new residents were in favor of a burn ordinance while “old school” residents were against it. The ordinance did not prohibit burning; rather, it provided guidelines to make burning safer. An informant residing in a rural community expressed similar sentiments:

I think people who have gotten away with burning wherever they want whenever they want, they are not going to be as likely to see the sense, perhaps immediately, in following some guidelines. Not everyone will be like that. There will be a number of people who will be interested in some guidelines. They have a lot of freedom to do what they want. A lot of those people if they have never had a problem don’t see the need to have any guidance.

Informants unsure about community member interest in Firewise cited lack of interest as the major reason for their response. In particular, Rush Township and Middle Paxton had not recently experienced a wildfire, potentially attenuating risk perception and interest in Firewise. Similarly, a study of Pike and Monroe county residents indicated lack of wildfire concern led to low public interest in fire prevention programs (Gordon, 2007). A teacher who lived in a small community noted “Wildfires don’t affect most people” in small towns. People who live in or near wooded areas might be more interested in Firewise. Some informants, who were forestry
professionals, suggested lack of interest was their biggest challenge. They noted most wildfires are an acre or less and are quickly extinguished by local fire companies. Homes are rarely threatened or damaged by wildfires. A fire professional acknowledged few sheds had been lost in the last few years but the media seldom reported this information. Likewise, few human fatalities resulted from wildfires. McCaffrey and Kumagai (2007) citing Burton et al. (1993, 1978) and Palm (1990) suggested people act on perceived risk based on “adequate resources to act, sense of control, and salience of hazard in comparison with daily concerns.(p14)” Wildfires have limited impact on people and property. As well, Pike and Monroe county residents were more concerned with pollution, commuting and crime than fire (Gordon, 2007). Some informants acknowledge wildfire risk was low relative to fire prone regions of the country. In particular, a fire professional noted the following.

Realistically, in Pennsylvania we are intermittent. We are not like westerns states and their issues where they can have them on a regular basis. We can have problems if we look at worst-case scenario. If we have a severe drought and you have high winds, you are going to have a problem and you are going to lose structures. It just does not happen often. It is hard for people to realize there is a problem. It is too late to do anything when the problem occurs. Your mitigation is before the fact situation.

While lack of interest impacts led some communities to not mitigate risk, it was not the case with all communities. Sense of place or the value people assign to a location is developed through recurring interactions (Brandenberg and Carroll, 1995) and might determine whether homeowners are interested in protecting their homes. Flint and Luloff (2005) indicated when residents cared about their community and each other they were more likely to mitigate risks. Similarly, permanent residents might have a strong connection to their home and their community and therefore might be more interested in protecting property. Gordon (2007) suggested new residents evaluate a place’s ability to fulfill meaning based on existing and past meaningful places. In addition, new residents had singular interests with the new location (Gordon, 2007). Consequently, absentee owners might have less connection to their second home, especially if it
was used for a single purpose such as hunting. A fire professional who conducted outreach efforts to absentee owners made the following remark:

> Obviously there are people who live in town or in a village they are not going to have the same concerns as someone who lives out in an interface area. But even in the interface area we run into problems. They may be a second home and absentee owner, somebody who lives somewhere else. It is really hard to make connections or identify a concern. A lot probably think, “Oh we are insured.” When they come up, their time is spent on other things, more on recreational activity… It is hard for them to understand the importance of it. The only way they see it is if some experience happens close to them or in the area. They might look at it differently. Possibly if something were lost they would look at it differently. It is a very difficult situation to try and push it.

Two reporters from different communities suggested insufficient time diminished the willingness of communities to investigate the Firewise program. In particular, one reported noted the following:

> Public won’t be interested in Firewise. They have full time jobs and no time to participate in such an activity. The community is working class families and children too busy to do anything.

Furthermore, interest in fire prevention programs was either short lived or community members did not follow through. For instance, one fire professional proposed “once the smoke goes away so does the interest.” Another fire professional who had conducted outreach in several communities one year and did follow up visits the next year noted that while “initially they might have an interest in the long haul whether they take corrective action that might be a different story.” Similarly, Monroe et al. (2006) suggested prevention information did not always translate to behavior change or action.

Both non-fire professionals and firefighting informants recommended public education was the best approach for dealing with forest fires. Several studies (Monroe et al., 2006; Ryan et al., 2006; McCaffrey, 2008) suggested public education rather than policy and regulations was effective in reducing wildfire risk. A reporter noted nothing could be done about forest fires since forest agencies lacked the financial resources to remove undergrowth. He went on to say people
who lived in the “semi-country…need to live with the risk of forest fires.” However, others suggested lack of knowledge caused carelessness. In particular, a teacher noted, “People are not as knowledgeable and aware as they used to be of things they need to do to be safe.” Consequently, education and prevention programs need to increase awareness and encourage community members to get involved, making their home and community safe. Non-fire professionals understood the role of educations was to inform as well as motivate community members to action as mentioned in the prescribed and wildfire perspectives literature (McCaffrey, 2006; Monroe et al., 2006). A fire professional suggested the following:

   People can do a lot to reduce that risk. Not rely entirely on the fire departments to provide protection. Take it into their own hands to reduce their risk.

Homeowners need to know what they can do to protect their homes such as moving leaves and combustible items away from their home. Concomitantly, township and municipal officials need to ensure roads are wide enough for emergency vehicle access and neighborhoods have water supplies for firefighters to extinguish wildfires.

   When asked the best way to reach people in their community, most informants recommended community-based education programs as the best approach for reaching residents. A diverse suite of approaches were suggested including school programs, community meetings or events, public service announcements, television, radio, local volunteer fire company, social media (e.g., text messaging, Facebook, Twitter), local newspaper or community newsletter, presentations, posters, billboards, and electronic road signs. Several informants suggested bringing back Smokey Bear and his fire prevention message. A county official noted “I know growing up we used to see Smokey Bear all the time on television – have not seen Smokey in a while.” One participant, a forestry professional, currently uses Smokey Bear to teach wildfire prevention to fourth and fifth grade students.
In some cases, informants recommended the same approach and in other cases recommended very different approaches. For instance, Laurel Run participants recommended their borough newsletter while participants in rural townships suggested community events. This suggests non-fire professionals recommended outreach measures they perceived as effective for their community, which were similar to the wildfire and prescribed fire literature. In particular, Monroe et al. (2006) encouraged natural resource managers to develop outreach programs adapted to local needs and to use diverse approaches to reach all groups within a community. Some informants recommended using one or two approaches; while, others proposed using multiple approaches to reach community members. Ryan et al. (2006), Toman and Shindler (2006), and McCaffrey and Kumagia (2007) suggested multiple strategies and interactive activities were the best approaches to communicating wildfire risk and prevention.

Informants recommended school programs needed to be age appropriate and target elementary, middle, and high school students. One informant noted “television ads, coloring books and things like this…are not going to reach certain demographics.” A teacher suggested the younger generation was more aware of environmental problems, but wildfire awareness programs need to reach students multiple times for them to remember.

One informant, who was a teacher, recommended starting early with Smokey Bear and other simple things to get children engaged. Then teach middle school children about fire safety, prevention, and how it was wrong to set forest fires because they destroy wildlife habitat and trees. Middle school students were ready to watch videos showing wildfire damage. Sobel (1996) noted eleven to fourteen year olds have a safe connection to the world around them and were ready to take social action. Monroe et al. (2006) also recommended showing visuals to illustrate the message. In addition, Orr (1992) suggested lesson plans need to engage students by integrating a hands-on approach. Similarly, teacher informants suggested hand-on activities such as trying on fire equipment.
There were mixed opinions on working with teenagers and young adults. A few informants recommended working with teenagers. A teacher suggested engaging seventh and eighth grade students because they were “watchdogs.” Another teacher recommended targeting “…15-30 year olds. People who were more likely to be outdoors doing those sorts of activities that led to some of the problems whether it was camping or hanging out with friends in the woods.” This population was technically savvy and a text message reminder might appeal to them. Yet another teacher suggested working with sixth graders and younger while they were open to adult opinions. She went on to note the following:

Teaching the children a lot of the time they do go home and share with their parents what they are learning in school. At least the younger kids, sixth grader and under are pretty open. I realize that with the recycling I teach. The parents stop by and say thanks for teaching my child about recycling. I did not realize how important it was. I think the same thing can be done with forest fires. The parents of teenagers, you definitely will have to hit the parents for the most part. There is a lock down stage that usually starts at the end of 6th grade and entering 7th grade. They don’t really share anything with their parents. They want to be more autonomous and independent so they don’t really share what goes on good, bad or indifferent at school. For the most part, but not everyone.

Besides youth education, many informants suggested on the ground efforts like community events or public meetings to target community members. Similarly, Monroe et al. (2006) recommended education programs focused on community discussion and involvement that inspires action and behavior modification. Some informants, especially elected officials, recommended giving presentations as well as handing out pamphlets at community days or public meetings. A teacher in a rural community noted, “Those community events are great times to get the word out to community members by setting up a booth.”

Other ways to get the word out include posters, local media, and social media. Posters could be hung in places where community members frequent such as the township building, post office, hardware store, and supermarket. Local newspapers or municipal newsletters could advertise public awareness events. Most of the Laurel Run participants recommended their
quarterly town bulletin, which has broad distribution and solid readership. The mayor noted they get a good response from it and word-of-mouth advertising increases awareness of events. In addition, schools send information home with students for parents to read. Again, information would spread through word-of-mouth.

Local media such as newspapers, television, and radio might have limited appeal and other outreach mechanisms need to be considered. An elected official suggested the following:

Hitting the latest media outlets is probably the way to go whether it is blogs, Facebook. It seems like anybody is doing that anymore…The non-traditional ways of getting the news out. I think when you do your PSAs you hit your traditional markets. Then again for the more modern folks you have to go to these non-traditional ways. Use Facebook, Twitter and blogs.

Social media appeals to individuals who are more technically savvy. In addition, a newspaper reporter acknowledged, “media is not interested in forest fires” and community events are more effective. He went on to note the following:

Big media campaigns don’t work. Television message is too fast. Billboards work. Public glosses over the newspaper. Health fairs are a good event, people attend them. Government exhibits at the Bloomsburg fair are well attended. Pamphlets are quickly picked up. Go to events where people are more likely to be.

Finally, some informants suggested their local volunteer fire company as a resource for reaching out to the community. The volunteer fire companies host fundraising events which are often well supported by the community. They are also a trusted and credible source which is needed to encourage adoption of information and mitigation measures (Lindell and Perry, 2000; Lindell and Whitney, 2000; Daniel et al., 2007):

My perception is that the fire companies in the area are very active with community. Almost every fire company in the area has a carnival. They frequently have bingo. They hold ham and oyster dinners. There is a lot of community involvement with the fire company. So that would be a natural outlet for getting the word out.
A fire chief recommended state agencies work jointly with fire companies on reducing wildfire risk. He made the following remark:

We are a small community and have contact with the community from time to time… generally the same people do burn in the town and in the same spots. It is a point of education, if we go to a burn or check a burn we give the person a little education on a better place to put their burning barrel. Things they should be looking out for, do and not do. I think it that one-on-one that is our advantage as a small community, that we can address it like that. We do have a good connection in the community. It is key and it does work well.

Forestry professionals also recommended working with local advocates and fire companies. The Pennsylvania Bureau of Forestry hires local firefighters as forest fire wardens. In that capacity, they could disseminate information about safe debris burning and talk with community members about potential fines for unsafe practices resulting in escaped fires. Furthermore, firefighters have strong relationships with the local community. An informant who was a fire forester noted the following:

You just need that local voice in the community. You go riding in there and the people don’t know you and it is just another government program, they either want or don’t. But you get somebody local like the fire company just somebody in the community I think is the best way to reach the rest of the community is just one of their own.

Absentee owners are a challenge to local communities, fire companies and forestry professionals, especially in Rush Township. Urban and out-of-state owners sporadically use their homes for hunting, recreation, or vacations. Uncertainty regarding homeowner’s availability makes it difficult for firefighters and forestry personnel to schedule outreach programs targeting this population. In some cases, absentee owners were unfamiliar with safe burning procedures as well as how volunteer fire companies operate in rural communities. In particular, a fire forester noted the following:

But statewide we have a lot of people coming in from, you know, the bigger cities – Baltimore, Washington, DC, New York. Who just really for a lack of a better word, lack common sense when it comes to fire. They were used to paid fire departments that is paid to look out for them. They move into the area and
don’t realize what a volunteer fire company is and how strapped they are just for manpower anymore. I think really it is a whole retraining on just about any age group anymore.

Adding to the challenge, fire companies and the Bureau of Forestry are facing reduced budgets and personnel. Volunteer fire companies are experiencing reduced participation. One informant, who worked for the Bureau of Forestry, noted they had gone from two fire inspectors, eight patrolmen, and four tower positions to one fire inspector and four patrolmen. As a result, fire companies and Bureau of Forestry have limited resources and personnel to conduct wildfire prevention outreach.

As noted in the literature, sense of place and the importance residents assign to events or groups determines which events have the greatest outreach potential (Tuan, 1977; Heimer, 1988; Brandenberg and Carroll, 1995; Monroe et al., 2006). This notion also explains the diverse responses within and among community informants. In addition to community of place, participant occupations appeared to influence their responses and perspectives. For example, among firefighters the primary wildfire concern was to quickly extinguish it before lives and properties were threatened. A mayor in one community and a county planner in another both discussed community infrastructure. One suggested emergency vehicles could cause collateral damage to town roads, while the other acknowledged working with local communities to ensure emergency vehicles had access and a water supply.

Informants were asked the best time to implement their ideas in addition to being queried about the best way to reach community members and where to target efforts. Most informants recommended conducting programs prior to fire season in the winter before snow melts and before recreationists begin outdoor activities. Some individuals also suggested having an educational event soon after a wildfire while it was on people’s minds. “As time goes on, people have the tendency to forget.” A few informants noted you need smoke to get people interested in wildfire prevention.
Furthermore, when asked about messages the public needed to hear, informants reiterated safety and prevention as central to any education program. Specifically, people needed to understand how to protect their home, neighborhood, and community from wildfires. A reporter suggested “builders need to hear about the risk and be the first line of defense.” The public also needed to understand how to safely recreate while riding all-terrain vehicles, camping, and doing bonfires. For example, the fire chief noted carelessness with campfires was 90 percent of Laurel Run’s wildfire problem. If campers coming to the area understood how to properly control a campfire and extinguish it, the fire problem would be eliminated. Furthermore, an informant who was a teacher suggested individuals needed to be able to identify when the conditions are okay to burn and understand windy and dry days are factors contributing to wildfire risk.

A township manager suggested showing wildfire videos and images to “open eyes up about the beauty it devastates.” Others similarly suggested conveying the negative side of wildfires such as danger to firefighters and impact on the environment. In addition to the devastation, programs needed to cover potential human hazards such as smoke inhalation and injury or death from trying to put out the fire. Several informants recommended discussing homeowner’s responsibility for wildfire extinguishing costs including equipment, firefighting personnel, hefty fines, and damage to neighboring properties. Homeowners also need to consider the cost of getting their life and home back. A Bureau of Forestry fire forester familiar with wildfires expressed the following sentiment:

People need to hear what is at stake; they need to understand wildfire and what to do to make their home survivable. I like to use that term because fire resources are not going to get there in time. They have insurances, but how long does it take to get your life back. It takes one year of dealing with paperwork to get it back. Learn how to try to make a difference and make a change to protect their structure.

Furthermore, education programs need to include recommendations of alternatives to burning trash such as recycling, chipping branches to use as mulch, and using municipal trash services.
Another fire forester pointed out, “…you don’t have to burn this stuff anymore…it is just a lot easier to haul it down to the curbside anymore than it is to burn.”

Results from preliminary focus groups conducted in Johnstown, Mehoopany, and Meyersdale as well as key informant interviews in Rush Township, Laurel Run, and Middle Paxton Township indicated education programs needed to target youth. As a result, teacher focus groups were organized to develop and evaluate lesson plans designed to reduce wildfire risk and increase public awareness of the purpose and benefits of controlled burns. The next section reviews results from the teacher focus groups and the education materials they evaluated.

Teacher Focus Groups

Teacher focus groups were organized in school districts near the two fire prone municipalities identified by the Bureau of Forestry. In one case, the town fell within the school district and the other the school district neighbored the township. School districts near Middle Paxton Township including Central Dauphin and Halifax Area declined to participate in focus groups due to a full school schedule and lack of teacher interest. Students from Laurel Run attend either Bear Creek Community Charter School or Wilkes-Barre Area School District, the public school. Laurel Run lies within both school districts.

Bear Creek Community Charter School is in a semi-rural area and serves students in nearby communities. Although students do not reside in Bear Creek, the two communities are largely forested with intermixed homes and communities. In addition, some Laurel Run informants suggested most Laurel Run youth attend the charter school. The charter school is classified as being green with an environmental focus. Wilkes-Barre Area School District is a public school system that serves students in the city as well as nearby communities.
West Branch School District borders Rush Township in Centre County. Students and their families use the state park and game lands located in Rush Township. Like Rush Township, homes and communities in the West Branch School District intermingle with large forested areas.

Six middle school principals at the public and charter schools were called and invited to participate in the research project. Three principals who agreed to participate were asked to recommend middle school teachers to participate in key informant interviews. The teachers who were key informants were asked to participate in the focus groups and recruit teachers for the focus groups. Through an iterative process the focus groups were used to develop and evaluate wildfire education materials. The preliminary focus group gathered information on existing fire education curriculum, lesson plan content, and impediments to teaching the material. Appendix G provides a complete list of focus group questions. Following this preliminary session, lesson plans were developed based on teacher feedback. During the follow up focus groups, teachers were asked to evaluate the lesson plans and assist in developing a marketing strategy for the lesson plans.

**Preliminary Teacher Focus Groups: What Should a Wildfire Curriculum Include?**

All teachers who participated in these two focus groups indicated current fire education emphasized in-home fire safety and prevention. Local firefighters who taught fire prevention material were viewed as guest speakers and their presentations were not considered part of the school curriculum. Children in kindergarten through second grade were taught to stop, drop, and roll if their clothing was on fire and strategies to get out of their home safely. Programs varied between the three schools with West Branch Area School District and Bear Creek Community Charter School fire companies showing children their fire equipment and teaching them how to
create a fire evacuation plan as well as a place to meet afterwards. Wilkes-Barre fire company tested student’s ability to get out of a model smoking house in a specified amount of time. A public school teacher described how they introduced the fire triangle and suggested how situations could influence fire response:

Firefighters cover what goes into a fire like oxygen, talk about causes, what could make it spread more rapidly throughout a house, and things that can be done to put it out -- extinguishers, blankets…those sorts of things.

Students were encouraged to tell their parents about fire hazards within the home. In addition, West Branch Elementary has a one-day program for sixth graders focused on careers and fire prevention.

Beyond describing local fire prevention programs, teachers were asked specifically about state and national wildfire education programs including Smokey Bear (www.smokeybear.com) and Project Learning Tree (PLT) (www.plt.org). None of the teachers were aware of these teacher resources including lesson plans available on Smokey Bear’s website. Some teachers observed Smokey Bear taught wildfire prevention to kindergarten through second graders. They noted Smokey Bear wildfire prevention material covered not playing with matches, campfire safety, and ensuring the campfire was completely extinguished. Smokey gave students a coloring booklet and reminded them “only you can prevent forest fires.” None of the teachers recognized Smokey’s message had changed to “only you can prevent wildfires.” The United States’ Forest Service revised the message in April 2001 to address the nationwide increase in wildfires as well as differentiate between controlled burns and wildfires (Rideout et al., 2003).

Most teachers were not aware of PLT’s wildfire curriculum. A West Branch teacher noted you had to attend a PLT seminar to get that material. Due to lack of interest, time or funds teachers did not participate in PLT training. Concomitantly, a Wilkes-Barre science teacher acknowledged his school district used PLT materials in third through sixth grade:
We don’t use it for particular lessons, it is more so as a resource. But I know there is a lot of information in there that our third grade uses. It expands into middle school and even high school. You can use a lot of resources in there. There are actual, developed lesson plans in there that you can use. It is not just third grade teachers, our third through sixth grade teachers have it. It can be utilized at any time specifically for the earth and life sciences.

However, the PLT lesson plan resources were used more so than the lesson plans. He also suggested the lesson plans failed to engage students. Consequently teachers integrated the resources into other lessons. In addition, he noted the following:

…bring in materials that are going to be more interesting to the students than what is in the Project Learning Tree book quite frankly. So you are teaching the same concepts. It is up to the individual teachers when they are going to use those additional resources. Just because it is more hands on things, experiments and investigations, it is not just reading about the concepts in the book, it is actually doing something with wildlife, with trees, with resources.

Some studies (Broussard and Jones, 2001; Gruver et al., 2009; Gruver and Luloff, 2009) indicated teacher’s lacked confidence presenting environmental education materials and this prevented them from teaching it. Gruver and Luloff (2009) found that teachers who were confident about material were more willing to teach it. Most of the teachers interviewed felt confident delivering wildfire prevention material as long as they had time to look over the lesson plan and supporting background information. In particular, a science teacher suggested the following:

Helps to get a background information sheet. Needs to include statistics to get the students interested; like, there are this many forest fires in this areas, fires that happened recently, top three to five reasons why forest fires start, anatomy of a fire, and what it entails.

Most teachers suggested new lesson plan needed to meet Pennsylvania state education standards, be relevant, facilitate learning at multiple cognitive levels, and hold students’ attention. Most indicated a lesson plan’s inability to engage students was a deterrent. Related to engagement, most teachers noted students had five to ten minute attention spans. An environmental education teacher suggested, “You have to have a good dog and pony show for the
kids that nowadays are used to changing their attention span at the click of a button.” Lesson plans need to grab their attention and the content needs to be relevant. A science teacher noted, “That is the thing, if there is not a reason for them to learn it, they are not going to care.” Some teachers suggested trees and forests are not important to students, but fifth through eighth graders are interested in fires and wildlife. The environmental education teacher added, “You have to connect it to their own personal lives in some way. Proximity to the forest is a major thing. They need to realize it could directly affect them one day.” Research by Gruenwald (2003) and Orr (1992) recommended using place-based education as a tool to help students understand the affects human actions have on the local environment.

As noted in the literature, Broussard and Jones (2001) introduced urban youth to forestry to help them understand their urban forests and forest stewardship principles. Likewise, Bear Creek, Wilkes-Barre, and West Branch teachers recommended engaging students in discussions about local wildfires to help them recognize they live in a fire prone area and the value in adopting safe burning protocols. Show pictures illustrating the impact of wildfire, especially on animal habitat and populations helps. Teaching students skills they could use such as campfire safety, safe debris burning, and procedures to report a wildfire are essential. An environmental education teacher suggested we should provide information the student could in turn teach their parents. She suggested they might:

…remind their parents about burning trash. We still have people who burn trash up here. Unbelievably. Burn leaves this time of year and then of course again in the spring. Kind of like recycling, the kids are going home and teaching their parents probably the same thing with this. Usually the kids will say something, especially if it is the opposite of what they are seeing at home.

Likewise, Bateson (2008) and Dillon (2002) proposed children could teach their parents proper approaches for protecting the environment.
Lesson plans need to not only capture student’s attention, they need to be adaptable to facilitate different learning styles and cognitive abilities. In particular, a middle school science teacher noted:

I have got kids reading at a first grade level and kids reading at a seventh grade level in the same class. That is where pulling out the activities is better for them, tactile things that they can work with rather than struggling through trying to read about it.

Consequently, some teachers recommended activities and materials that keep students active and engaged. For example, several said show them a 10-minute movie followed by a game or quizzes to review what was just covered could work well. Games could include word searches, crossword puzzles, or sorting pictures into categories. One teacher recommended using a word wall to introduce students to wildfire terminology. They suggested vocabulary could be integrated into writing assignments on how wildfires could impact them, or used in a journal entry discussing wildfire impact on the community, or involve writing a summation of the lesson plan. The same middle school science teacher recommended substituting drawing a picture for writing. “This gives students an option, which is always good, and also allows them to use different modes of representation to express their ideas.” The same teacher suggested seventh and eighth grade students could create eye-catching posters that include paraphrased and cited lesson plan information. The posters could then be displayed in the classroom or school. In addition, most teachers recommended adding math, graphing, and statistics. A fifth grade teacher described a technique he used: “Do a math minute with a quick calculation like calculating percentages based on data about wildfires.” Kids like giveaways, such as pens, bracelets, bookmarks, and Frisbees; however, most fifth through eighth grade students are too old for Smokey Bear paraphernalia. Teachers suggested students could be introduced to natural resource and wildfire fighting careers through lesson plans and recommended inviting firefighters into classes to talk about their training and work, bringing in gear for students to try, and showing students their firefighting
equipment was always engaging. Research by Ryan et al. (1978) indicated students were engaged and gained an understanding of fire prevention principles when forestry professionals taught it in schools.

All teachers noted state education standards mandate topics covered in each grade and limit their ability to integrate new material. Consequently, they recommended all new lesson plans meet state education standards. Most teachers suggested the lesson plan could fit into science, especially ecology, ecosystem interactions, environmental health, and human impact education standards. A teacher from Laurel Run suggested new material might also incorporate threatened and endangered plants and animal education standards if species are lost or enhanced by wildfires or controlled burns:

Look at life sciences and biology. Human impact deals with homes, people starting fires, and impact on the community. Environmental health covers actual health of forest habitat and how it is altered after fire. Succession could be relevant to controlled burns and invasive species. Some wildlife will decline while others will be able to get away. Ecology covers how everything impacts everything else like oxygen, cycling, tree loss impacts wildlife dependent on it, and air pollution from wildfire. We touch on carbon cycle in fifth grade. Fire releases carbon and ashes return nutrients to the soil. Cycles are part of nature of science and ecosystems...Younger ones do water and the older students touch on carbon.

In addition to science, most teachers suggested adding a writing component to the lessons, which allowed them to integrate the material into humanities. One teacher suggested teachers are always trying to incorporate extra writing into fifth grade lessons to prepare them for a writing test.

All teachers noted time was the major impediment to teaching new or additional curricular materials because the school year was full. One middle school teacher noted “we are always eliminating material to fit in upgraded curriculum.” Another teacher acknowledged, “There is so much to cover that if you tried to do it in one year, it is simply impossible.” Most teachers suggested new material could be substituted for current curriculum, especially if it met state standards. In particular, a teacher who was the middle science curriculum coordinator noted:
If you keep it standards based, better for teachers. It could be worked in so that a standard that is already covered substitute for other material and still cover the standards. Getting what you need to get covered, just in a different way.

To fit wildfire material into their schedule, most teachers suggested creating lesson plans covering twenty- to forty-minute sessions in ten-minute segments. Public school teachers noted they could use ten-minute segments to fill gaps during the class period. The charter school environmental education teacher noted she approved her own curriculum and could easily integrate it into her classes. Furthermore, most teachers recommended developing four to six wildfire related lesson plans. That way, they could do two periods at the beginning of the year and two periods at the end of the year.

In summary, teachers noted current fire curriculum targeted kindergarteners through second graders and focused on home fire safety. In particular, Smokey Bear taught them not to play with matches as well as campfire safety. Sobel (1997) recommended teaching this age group empathy for the natural world. Based on teacher focus group statements it was unclear whether Smokey Bear material caused children to fear the natural world. PLT wildfire lesson plans had limited use in schools and perceived lack of interactive student activities. Teachers need lesson plans that keep students actively engaged in the material and the class.

Lesson plans also need to be interesting, easy to use, age appropriate, and meet Pennsylvania state education standards in order for teachers to use them. They recommended lesson plans have background information. They further recommended wildfire curriculum engage student, be relevant, and facilitate learning for different cognitive levels and styles. The school year is full and new curriculum needs to easily replace or build on existing curriculum. Lesson plans need to be 50-minutes or several ten minute sections, which teachers could use in between other lessons. Based on teacher input and Sobel’s (1997) work, lesson plans targeting fifth through eighth grade students were developed. As Sobel (1997) suggested, students this age are exploring the natural world and ready for social action. Furthermore, participants and Orr
(1992) recommended place-based material that teaches the effect human actions had on the environment. Finally, key informants and teachers recommended education materials address human carelessness and increase awareness of the controlled burns, especially its benefits.

**Material Development**

The lesson plans presented in this section were developed based on key informant interviews, teacher focus group recommendations, place-based and wildfire literature, and evaluation of existing curriculum. Existing curriculum either targeted younger children or was not used by teachers. Based on these results, three lesson plans were developed addressing current fire topics: wildfires, safe debris burning, and controlled burns. Most published and widely circulated wildfire material focuses on Western wildfires and Northeastern forests and wildfires are different. Students need to understand local wildfires including behavior, causes, and prevention approaches. Second, debris burning is the major cause of wildfires in Pennsylvania and the literature strongly suggested that middle school children are teaching their parents what they learned through reciprocal learning (Bateson, 2008; Ambert, 2001). Finally, controlled burning is increasingly used as a forest management tool. McCaffrey (2003) noted individuals who understand the purpose and intended benefits of controlled burns are more likely to approve its use. Consequently, the controlled burn lesson plan covers the purpose and benefits of the technique using a local Pennsylvania example. As with the safe debris burning material, students could teach their parents how trained professionals use controlled burns to improve ecosystems.

A brief description of each lesson plan follows and includes learning objectives, state educations standards, and teaching modes. Teacher recommendations were integrated into the lesson plans, especially ease of use, state education standards, and material that was relevant and practical.
Wildfires: Not in My backyard!

The wildfire lesson plan used a publication, *From the Woods: Wildfire* (Appendix H), which was developed by myself and Drs. James Finley and Sanford Smith in response to key informant and teacher input. It incorporates the Pennsylvania Bureau of Forestry Pennsylvania Wildfire PowerPoint (http://sfr.psu.edu/youth/sftrc/from-woods/wildfire). Both the publication and PowerPoint cover Pennsylvania wildfire causes, frequency, behavior, and approaches to reducing wildfires. Teachers are encouraged to talk with students about local wildfires to help them understand wildfire risk in their area. The lesson plan has the following learning objectives and meets state education standards listed below:

- Students will be able to describe a wildfire.
- Students will be able to list and explain the stages of a wildfire.
- Students will be able to identify wildfire causes and impact on the environment.
- Students will be able to recommend ways to protect homes and communities from wildfires.

State Standards Addressed (Pennsylvania Department of Education, 2002):

4.2.7.B. Examine the renewability of resources.
4.3.7.B. Describe how human actions affect the health of the environment.
4.6.7.A. Explain the flows of energy and matter from organism to organism within an ecosystem.
4.6.7.C. Explain how ecosystems change over time.
4.8.7.C. Explain how human activity may affect local, regional and national environments.

Common Core State Standards in English Language Arts (Pennsylvania Department of Education, 2002):

Reading Standards for Informational Text 5-8: key ideas and details; craft and structure; and integration of knowledge and ideas

Writing Standards 5-8: text types and purposes; research to build and present knowledge

The lesson plan has a pre- and post-test to evaluate student content knowledge. Tests could also be administered as question relays. With this technique, test questions are located on different tables and students move from table to table to answer them. The student who answers the most questions correctly in the shortest amount of time wins. Students do a think-pair-share wildfire vocabulary exercise. This promotes critical thinking, problem solving, and decision-
making skills (Rao and DiCarlo, 2000). The question relay and think-pair-share exercises increase students’ classroom participation and interactions as well as aids in student learning (Rao and DiCarlo, 2000). The teacher gives a PowerPoint presentation that is divided into three sections while students complete a fill-in-the-blank handout. This allows teachers to review content with students. Pausing for class discussion enhances student understanding and ability to synthesize and integrate material (Rao and DiCarlo, 2000). Additional material or instruction might include fire foresters making part of the presentation, showing firefighting equipment, and talking about wildfire fighting careers.

To deliver this lesson, students are asked to read *From the Woods: Wildfire* (See Appendix H) with their parents at home. The family completes the home hazard assessment on the booklet’s last page and parents sign a form acknowledging task completion. The students also write up their findings and include wildfire vocabulary in the writing assignment. Through this process students introduce their parents or family to Pennsylvania wildfires and wildfire prevention methods.

**Safe Debris Burning**

The lesson plan includes a Bureau of Forestry narrated movie on safe debris burning practices as well as alternatives to burning debris. The movie has three two and a half minute segments. Teachers are encouraged to discuss local burning practices and burning ordinances. The lesson plan has the following learning objectives and meets state education standards listed below:

- Students will be able to list and explain five steps to reduce wildfire risk.
- Students will be able to identify five things wildfires affect.
- Students will be able to recommend alternatives to debris burning.
- Students will be able to identify items illegal to burn.
State Standards Addressed (Pennsylvania Department of Education, 2002):

4.2.7 B. Examine the renewability of the resources.
4.3.7 B. Describe how human actions affect the health of the environment.
4.2.10 B. Evaluate factors affecting availability of natural resources.
4.3.10 B. Explain how multiple variables determine the effect of pollution on environmental health, natural processes and human practices.

Students do a think-pair-share vocabulary exercise. To do this they work in small groups and sort what to burn and what to consider before burning cards, or working as a class they sort the same cards using an interactive whiteboard. What to burn cards are images of objects such as leaves that could be burnt and tires that should not be burnt. Similarly, what to consider cards shows sunny, windy, and foggy pictures, which are weather conditions taken into consideration before burning debris. Teachers are increasingly incorporating interactive whiteboards into their classrooms. The technology potentially aids students in learning faster and allows teachers to use innovative education methods (Cuthell, 2005). The teacher provides students with a fill-in-the-blank handout to complete as they watch each segment of the Safe Debris Burning DVD. As noted in the wildfire lesson plan, pausing for class discussion allows students an opportunity to synthesize and integrate material. To gauge student comprehension of safe debris principles, the class sort what to burn and what not to burn cards again on the interactive whiteboard and compare it with previous card sorting. After viewing all three DVD segments, the teacher and students discuss lessons learned. Teachers in urban/suburban, location where debris burning is prohibited can replace safe debris burning with safe campfire or bonfire practices. Additional activities can include building a safe campfire and students measuring leaves, grass, twigs and branches to understand one-hour, ten-hour, and one hundred-hour fuel concept.

Students are asked to journal or draw examples of what they learned in class using vocabulary words contained in the lesson. The writing assignment could be integrated into a humanities class. Students might teach their parents safe debris burning or campfire procedures.
Habitat Restoration Using Controlled Burns

The lesson plan introduces students to controlled burns as a tool to restore and maintain habitat for the rare Regal Fritillary butterfly. The teacher uses KWL technique to guide students through the topic. Ogle (2009) developed the technique to encourage student inquiry and questioning. The “K” stands for know and teachers begin the lesson by asking students what they know about the topic being covered. As different opinions and experiences emerge, teachers guide students toward framing questions they want (“W”) to investigate. Finally, “L” stands for what the students learned and still need to learn. Thus “L” is both a self-evaluation as well as guide to generation additional questions and inquiry. The lesson plan has the following learning objectives and meets state education standards listed below.

- Students will be able to list and explain the life cycle of a regal fritillary butterfly.
- Students will be able to identify the stages of ecosystem restoration.
- Students will be able to identify the three components of the fire behavior triangle.
- Students will be able to identify the benefits of controlled burns.

State Standards Addressed:
3.3.7A. Describe the similarities and differences that characterize diverse living things.
4.3.7.B. Explain the distribution and management of natural resources.
4.5.6.D. Identify reasons why organisms become threatened, endangered, or extinct.
4.1.7.E. Identify factors that contribute to change in natural and human-made systems.
4.4.5.C. Investigate the factors influencing plant and animal growth.

Common Core State Standards in English Language Arts:
Reading Standards for Informational Text 5-8: key ideas and details; craft and structure; and integration of knowledge and ideas
Writing Standards 5-8: text types and purposes; research to build and present knowledge
Speaking and Listening Standards 5-8: comprehension and collaboration; presentation of knowledge and ideas

Using KWL, students discuss what they know about rare and endangered species and habitat restoration. From this foundation of existing knowledge, the teacher shows the use of fire in a local site and the students could share it with their parents. Students are then asked what they want to learn and their suggestions could be incorporated into the following exercise. Students divide into groups to read, research, and deliver presentations on Regal Fritillary Butterfly topics.
including characteristics, natural history, preferred habitat, reasons for concern, and management programs. Topics range in difficulty and small groups are assigned subjects based on their cognitive and reading comprehension levels. This process empowers students and provides a collaborative learning environment (Ogle, 2009). When students present their material, fellow classmates need to note two items they learned during the presentation. This keeps students engaged.

Students are also shown a video on Fort Indiantown Gaps restoration efforts as well as a controlled burn PowerPoint, which address fire history, controlled burn stages, and wildlife habitat benefits. To conclude this lesson, the teacher and students review KWL and this provides an evaluation of student understanding of the material covered. As an alternative, teachers could invite natural resource professionals, who conduct controlled burns, to talk about their training, equipment, and career opportunities as well as other reasons for conducting controlled burns.

**Follow up Teacher Focus Groups: Lesson Plan Evaluation**

When the lesson plans were completed, Bear Creek Community Charter School teachers, Wilkes-Barre School district teachers, and West Branch School district teachers were invited to participate in follow-up focus groups to evaluate the lesson plans and develop a marketing strategy. Specifically, focus groups were organized in Wilkes-Barre and West Branch. In preparation for the second focus group, teachers were sent the lesson plans and supporting materials via email and asked to review the drafts in preparation for the second focus group. In that focus group, we discussed and evaluated each lesson plan, activities, and connections to education standards. As well, the teachers were asked how the material should be packaged and what additional resources they would need to implement the curriculum. This information then informed a discussion of the best approach for marketing the lesson plans.
All the teachers liked the lesson plans and acknowledged they would use them and share the curriculum with colleagues. Three themes emerged from teacher comments: (1) enhancing lesson plan delivery; (2) curriculum packaging; and (3) approaches to marketing. Teachers suggested integrating several teaching methods such as think-pair-share, KWL chart, and interactive whiteboards. Rao and DiCarlo (2000) suggested think-pair-share promoted critical thinking, problem solving, and decision-making skills. It also increased students’ classroom participation and interactions. A few teachers suggested using think-pair-share to introduce new vocabulary. They noted the technique involved students quickly thinking of definitions for new words, followed by pairing with another student to define the word, and working as a pair to look up the words. The pair presented their results to the class. Similarly, a teacher suggested including a vocabulary list with writing assignments to inspire students with different learning abilities.

Lesson plan worksheets were another learning aid some teachers recommended. A few teachers suggested fill in the blank for fifth and sixth grade students and writing complete sentences for seventh and eighth grade students. One teacher noted younger students need routine and repetition to do well. For example, one teacher suggested students fill in a section of the worksheet as they watched a movie and the class would then review the answers to reinforce the information. The handouts could also be turned in at the end of class to assess student learning.

Teachers recommended a KWL chart as another technique to engage students. KWL technique enhances student brainstorming and collaborative learning by encouraging them to ask questions and make connections to each other’s ideas. Similarly teachers at West Branch and Bear Creek recommended integrating interactive whiteboards into lesson plans. Cuthell (2005) suggested interactive whiteboards are increasingly used in classrooms and they have the potential to help make student learning a faster, more effective process while restoring teachers’ creative autonomy. Specifically, interactive whiteboards allow teachers to use teaching styles and learning outcomes that might not be possible with other education pedagogy (Cuthell, 2005). The
technology could be used to play instructional videos, create and tract the KWL process, and transform images into “flipcharts”, which could then be sorted. Furthermore, a science teacher noted, “kids love anything with technology.” A few teachers recommended converting what to burn and what not to burn digital images into “flipcharts.” Subsequently, students sort the “flipcharts” before and after the safe debris-burning lesson. Teachers could use the post-lesson “flipchart” sorting exercise to evaluate students’ content comprehension. Furthermore, some teachers in the first set of focus groups recommended keeping students active. The Promethean board (i.e., the whiteboard) and think-pair-share activities provide students with opportunities to interact with classmates and move around. A teacher also suggested turning quizzes into question relays. As noted earlier, test questions would be located on different tables and students would move from table to table to answer them. The student who answered the most questions correctly in the shortest amount of time would be declared the winner.

Some studies (Orr, 1992; Sobel, 1997), as well as the focus group teachers recommended that any curriculum be sensitive to the students development phase. In particular, a sixth grade teacher, recommended two criteria for integrating lesson plans into classes: (1) examine the lesson plan’s capacity to dovetail with existing grade-specific curriculum; and (2) evaluate students’ cognitive development and ability to comprehend the curriculum. Based on these criteria, and his personal teaching experience, the teacher suggested fifth graders be introduced to wildfires, sixth graders to safe debris burning, and seventh graders to the study of controlled burns. The teacher noted each year students are introduced to increasingly complex and broader material. For instance, students begin with a foundation in wildfire concepts and causes, as well as methods for making their homes safer from wildfires. The next year they learn about how their family could safely burn trash and wildfires potential impact on their community. The third year students learn how controlled burns are used as a management tool to maintain healthy ecosystems.
Focus group participants suggested lesson plan marketing began with lessons teachers found appealing. Lesson plan appeal included easy to use and modifiable materials as well as links to additional resources for teachers. For instance, the lesson plans needed to be packaged in a binder with both paper and electronic versions. One teacher preferred to copy paper documents while another teacher preferred to print the electronic version. In addition, a few teachers suggested educators could easily modify electronic versions. Several recommended providing links to additional web-based information. One teacher requested links for *From the Woods* lesson plans and lesson plans located on Penn State School of Forest Resources Teacher Resource webpage (http://www.sfr.psu.edu/youth/sftrc). Most teachers recommended offering alternative activities and options to expand the lessons such as interviewing and reporting on a forest firefighter, giving a half hour persuasive presentation on wildfire prevention, journaling, measuring wildfire fuels and classifying them by time needed to dry out, and giving a presentation on wildfire and natural resource careers.

However, before teachers could introduce the material in their classrooms, lesson plans needed to be approved by the school principal or science curriculum coordinator. Once approved, teachers recommended several approaches to marketing the lesson plans including working with Pennsylvania school intermediate units, Pennsylvania Department of Education personnel, presenting the lesson plans through teacher in-services or Pennsylvania Act 48 training. A sixth grade teacher noted Act 48 required teachers to take 180 continuing education credit hours in five years. He suggested:

> Regardless, people need hours all the time. So when you attach Act 48 hours to it, it makes it more appealing for the teachers to say, “yeah, I’ll go to that. I will get professional development for that. If it is offered right here at school, I will definitely go to that.”

Continuing education programs are conducted at school after classes end and before teachers depart. One teacher suggested contacting the Department of Education to get the wildfire material
approved for Act 48. He noted it would be an efficient approach to introduce the new curriculum and would assist teachers in understanding the subject matter. In addition, he recommended presenting the wildfire curriculum in two half-hour sessions. Once the focus groups were completed, the data was analyzed and teacher suggestions were used to further refine the three lesson plans.

**Distribution of the Lesson Plans**

The education materials developed in this project include: (1) *Wildfires: Not in my Backyard*; (2) Safe Debris Burning; and, (3) Habitat Restoration Using Controlled Burns. Paper and electronic versions of the lesson plans, handouts, teacher background information, videos, and lesson plan alternatives were organized in binders. These binders were distributed to the environmental and ecology advisor for the Pennsylvania Department of Education as well as the two principals and one science curriculum coordinator in the fire prone study municipalities. They will be asked to assess the curriculum. If the curriculum is approved, the principal and science curriculum coordinator will distribute the curriculum to teachers in their school district. If the Department of Education environmental and ecology advisor approves the curriculum, she will make the curriculum available to Pennsylvania teachers. The resources will also be available through the Bureau of Forestry fire prevention program, and US Forest Service Northeast Fire Prevention Specialist. The lesson plans and their accompanying materials will be available to download from the Penn State School of Forest Resources Teacher Resource and Youth Publication webpage at http://sfr.psu.edu/youth/sftrc.
Summary

Generally, the public, represented by the key informants and teachers had low perceptions of wildfire risk. Surprisingly, there was relatively high acceptance for controlled burns when they were properly planned and conducted by trained professionals with adequate resources; however, to ensure acceptance of the practice, participants believe it was important to provide explanations of their benefits and use. Education programs about wildfire and controlled burns needed to be on-the-ground, community-specific, and address wildfire safety and prevention as well as the benefits of controlled burns. There was strong support for developing new school curriculum materials. Teachers offered very specific ideas for how to deliver such educational materials and how to encourage student understanding and participation. The lesson plans developed through the study satisfy state education standards and integrate teaching methods and approaches recommended by participants.
Chapter 5

Conclusion

Introduction

This study addressed perceptions of wildfires and controlled burns in three Pennsylvania municipalities identified through a Pennsylvania Bureau of Forestry assessment project. The municipalities are located in Pennsylvania’s WUI where wildfires frequently occur. Concomitantly, controlled burns are increasingly used by natural resource agencies to promote forest health and reduce wildfire risk. To better plan for the implementation and use of such a tool, it is important to understand both fire as a management tool and public attitudes toward wildfire. Findings from key informant interviews indicate most municipalities do not perceive risk and take limited action. Lack of interest and low risk perceptions frustrate natural resource professionals.

Perceptions of Wildfires and Controlled Burns

The Pennsylvania Bureau of Forestry classified the borough and townships studied in this project as fire prone; each had the highest wildfire occurrence for their region. Laurel Run, in particular, was threatened by a 1,500-acre wildfire in spring 2009. However, most non-fire professional key informants were unaware of wildfire occurrence, size, or when they occurred. Those who recently experienced a wildfire event were more likely to have an understanding of these issues; however, their concerns were short lived. The apparent disinterest in wildfires might reflect the smallness of the events, generally an acre or less, the fact they were extinguished
quickly, rarely threatened homes, and caused few fatalities. Moreover, in contrast to the more well studied and better understood Western wildfire experiences, Eastern wildfires tend to be ground fires where limited damage enable forest vegetation to recover in several months in many cases. The media rarely covers Eastern wildfires contributing to a continued low level of public wildfire awareness. All these factors contribute to low wildfire risk perception, especially when compared with other daily concerns.

Loss of life, property and habitat were the major wildfire concerns identified by participants. Most non-fire professionals understood wildfire causes and made linkages between weather conditions, fuels, ignitions sources, and wildfire risk. They identified carelessness, arson, and mechanical means as the primary wildfire causes. Most informants suggested a lack of common sense on the part of community members led them to not take the necessary precautions before, during, and after a campfire or debris burn. Participants recommended education programs focus on safety and prevention. In particular, they recommended community events and youth education in schools.

Pennsylvania passed legislation in 2009 that promoted controlled burns as a natural resource management tool and limited liability for state agencies and others trained and certified in the use of prescribed fire. Consequently, state agencies and some land managers or larger owners have increasingly turned to the use of controlled burns to improve forest health and mitigate wildfire risk. All communities involved in this study were open to the use of controlled burns conducted by trained professionals with sufficient resources, staffing, and water to manage and extinguish the fire. Participants understood controlled burns reduced fuel loads and minimized potential ignition sources which resulted in safeguarded communities.

Participants suggested some community members would be open to agencies implementing controlled burns in their jurisdiction, while other community members would resist. Informants recommended public education as a means for addressing misconceptions and
fears, and to highlight the benefits of controlled burns. Misconceptions included differences between controlled burns and wildfires, Smokey Bear’s fire prevention message and state agencies igniting forest fuels, as well as some individuals conducting their own “controlled burns.” Another social dynamic was public concern for their safety during a controlled burn.

**Approaches to increasing public awareness**

Informants recommended community-based education programs focused on wildfire prevention and the benefits of controlled burns delivered through school programs. Some informants recommended social media (i.e., Twitter, Facebook, text messages) and traditional media (radio, newspaper), and several reporters suggested traditional media is not effective for reaching individuals. Ideally, prevention programs need to reach youth who would educate their parents and post-event programs need to occur immediately following a wildfire to ensure community participation. As with wildfires, controlled burn public education should be introduced to communities so they could better understand controlled burn practices and benefits. The public does not know that controlled burns have the capacity for reducing wildfire risk and improving forest health.

Some informants recommended collaborating with local fire companies to deliver presentations on wildfire prevention. Local volunteer fire companies were viewed as a trusted source and in many cases had strong community ties. As well, Bureau of Forestry fire personnel had good relationships with local fire companies. However, fire professionals indicated a lack of staffing and limited financial resources reduced their capacity to conduct community outreach programs. In addition to working with local fire companies, some fire professionals recommended engaging advocates within the community to garner support to adopt the Firewise program or reduce wildfire risk in the municipality.
Since adults have numerous time commitments and fire professionals have limited resources for outreach efforts, some informants recommended teaching middle school children about wildfire prevention and controlled burning. Furthermore, some teachers suggested children share what they learn with their parents. Current curriculum focuses on in-home fire safety as well as safe campfires. It targets kindergarten through second grade students. Teachers were either unaware of PLT wildfire lesson plans, could not afford to purchase the materials, or used the materials on a limited basis.

Teachers recommended science-based lesson plans that were relevant, easy to use, and met state education standards. Since the school year was full, teachers could only adopt new curriculum if it met state education standards, covered existing topics, and was approved by the principal. To enhance lesson plan adoption, it needed to contain background information and resources for teachers as well as activities that engage students and facilitate learning for students with different cognitive abilities and learning styles.

Based on teacher feedback three lesson plans were developed on wildfires, controlled burns, and safe debris burning. The lesson plans met state education standards, are modifiable to facilitate student learning, and help students understand they live in fire prone areas. Lesson plans will be distributed to DCNR Bureau of Forestry, Department of Education, teachers in fire prone areas, and the US Forest Service. Lesson plans will also be available in electronic format on the web.

**Future Research**

This study used key informant interviews and focus groups to sample a small portion of the population. To further validate the findings, future research needs to use this study data to develop and distribute a survey to a large sample of Pennsylvania residents. The results could be
used to inform outreach efforts and policy. As well, this study used an iterative process that began
with key informant interviews and concluded with teachers developing wildfire prevention
curriculum. Low school interest limited focus group participation and teacher input with lesson
plan development and evaluation. Future research needs to begin with school and teacher
recruitment followed by key informant interviews with individuals in municipalities within those
school districts.

Three lesson plans were produced through this study that will be available to
Pennsylvania teachers and environmental educators. Future research needs to evaluate lesson plan
implementation in Pennsylvania. Specifically, are the lesson plans being used? If so, where and
how are the lessons used (i.e., entire lesson, part of lesson, or resources)? What affect do the
education materials have on individuals and families? Do they adopt fire prevention behavior
discussed in the lesson plans?

Implications for Land Managers

Findings suggest variable risk perception and wildfire awareness within and across
communities. In addition, participants recommended outreach approaches specifically tailored to
their community. This concurred with a recommendation against a one size fits all approach to
education (Monroe et al., 2006). Natural resource professionals should identify key
communication strategies for each community as well as develop collaborations within
communities to disseminate information. Collaborators are trusted voices within the community
who understand social constructs, community subgroups, and best communication methods. Once
collaborators are identified, natural resource professionals could work with them to foster
community discussion on wildfire risk, approaches for reducing risk, and the value and utility of
controlled burns.
The lesson plans were designed to be additional resource for teachers and natural resource professionals. Teachers could be a gateway into communities. In addition, student presentations on lesson plan topics at community events may lead to adult interest and behavior change. However, education alone will not change behavior (Monroe et al., 2006). Outreach needs to empower and inspire community members to take action. Combining education with community activities could motivate residents to act.

**Conclusion**

Previous research indicated wildfire awareness programs needed to use multiple approaches to educating and enabling communities to address wildfire risk and controlled burn perceptions. Most activities focused on adults as agents of behavior modification. Participants suggested adults lack time to attend public events and youth education was the best approach. Students and parents have reciprocal learning relationships where youth frequently teach their parents and other adults the latest concepts such as recycling. Consequently, this study developed three lesson plans to address wildfire prevention, safe debris burning, and controlled burns. The wildfire prevention lesson, in particular, requires students to work with parents on a home wildfire risk assessment. Integration of the lesson plans into schools coupled with targeted community outreach is essential for creating community dialogue on risk management.
References


Cohen, J.D. 2000. *What is the wildland fire threat to homes?* Thompson Memorial Lecture. School of Forestry, Northern Arizona University, Flagstaff.


Appendix A

Compilation of 2007 FireWise Meeting Notes and Comments
Interim Report

By Tara Claghorn, Graduate Assistant, Penn State University
Jim Finley, Professor, Perm State University

On October 15, 17, and November 7, 2007, facilitated discussions were held in Meyersdale, Johnstown, and Mehoopany, Pennsylvania to learn of stakeholder interest in the use of FireWise in communities identified as “fire prone” by the PA Bureau of Forestry. There were 27 non-agency participants (19 firefighters and 8 landowners - a breakdown of attendance is found in Appendix 1). These FireWise facilitated discussions were extremely informative.

Prior to the first meeting, a set of standard questions was developed (Appendix 2). The original set of questions was designed to involve landowners and citizens. Because the first meeting was dominated by firefighters, alternative questions were drafted (Appendix 3). This alternative set was used in the second session. In the third session, where there was a mix of firefighters and landowners, questions were drawn from both the first and second set of questions. Following is a summary of recurring themes, information learned, and needs for future development of FireWise in Pennsylvania.

Facilitated Discussion Questions and Answers

Have you experienced wildfire recently?
Each of the communities had recently experienced wildfire. In each community, absentee landowners were dominant. In two locations, wildfires had threatened structures and scorched buildings, and when they did, only those directly affected conveyed real fear of loss or harm. In one community, several fires had burned underground and ignited multiple times, raising more fear among those exposed directly to the fires. All meeting participants noted that people are investing more in their homes and their communities were changing with a rapid growth. They expressed that people are building out into the woods - people who do not understand the dynamics of living in the woods - and it is only a matter of time before a house is lost to wildfire. Then the question will be, "Why weren't we educated about fire danger?" Although meeting participants acknowledged wildfire awareness was low, they also noted it was very possible a major wildfire could happen in their communities.

How do you think the public feels about wildfire? How does the public respond after the fire? Was there discussion in the community post-fire? Did people pay attention?
Concerns about wildfire were short-lived and felt mainly by those directly affected by wildfire and/or smoke. Media recognition of fire weather danger and burn ban implementations seems to assist with wildfire awareness. Many WUI residents do not make the connection between dry weather and fire danger or understand the relationship between fuels and structures. Lack of signage, access, and water in an area are not usually acknowledged until needed. On the whole, unless it has been directly experienced, people are not concerned or aware of wildfire risk.
Do you talk about wildfire risk in the community?

There are existing fire education programs in Pennsylvania. Many of the fire personnel who participate in wildfire education are volunteer, which means most are already overextending their schedules. The PA volunteer fire fighting force has dramatically declined over the last 20 years (1978=300,000 volunteers, 2007=72,000). This has increased the importance of solid relationships between the Bureau of Forestry fire personnel and PA fire fighters. Participants working with volunteer fire companies fulfill their wildfire awareness education almost always in elementary education classes. Wildfire awareness education amongst adults is almost non-existent and not considered effective. In each community, fire fighters could identify high risk areas for wildfire ("we wouldn't put a crew in there"), but all acknowledged that people generally do not discuss wildfire. FireWise needs a leader.

How do you suggest landowners could become more aware of wildfire risk? How can we educate the public about wildfire? How can the community get involved with FireWise? How could we structure education programs? How do we engage people?

In all cases, the landowners were willing to take actions that would assist their local fire companies. "Educate, educate, educate" resounded throughout the meetings. There is a need to empower individual homeowners with activities they can undertake to protect their homes and communities. Suggestions to raise wildfire awareness in communities included:

- Collaboration among homeowners
- Articles in publications like Forest Leaves, etc.
- Block parties
- National Fire Prevention Week
- Add to Smokey programs
- **4H groups: write a 4H project about FireWise**
- Insurance associations
- Developers
- **Cooperative extension agencies**
- Family living newsletters
- **County vo-tech schools/high school projects**
- **Boy scout badges**
- Announce fire weather with regular weather forecast
- BOF can distribute FireWise pamphlets, etc.
- Shade Tree Associations, etc. (include FireWise in their program/newsletters; recruit community)
- Include FireWise in the wildfire prevention programs (pre-school, etc)
- Local school districts
- NFPA & FireWise
- Pamphlets about FireWise landscaping at Best Buy and Home Depot
- Zoning/Planning boards
- Include in annual volunteer firefighter fundraising activities
- Insurance agent associations
- Realtors
- Builders (get FireWise landscaping, roof materials, etc. into the rules and regulations when building)
- Media
- Radio
- Use a permitting system to burn
- Announce burn bans through papers, news, neighbors, etc.
- Teach people how to have safe campfires
- County commissioners
- Display boards, videos
- Put FireWise pamphlets in with peoples taxed, utility bills, etc—build a relationship with these people
- Fundraisers
- A commercial on TV may reach adults...the way they put smoke detector commercials
- Make a video of wildfire burning (like a leaf pile/debris pile/campfire burning above and underground to a house and burning it down); play the video clip during fire season
- PA Outdoor Channels
- Teen community service time
- Hold children's birthday parties at fire halls and distribute the message
- Homeowners Association newsletters

**Final thoughts:**

- Homeowners who attended the meetings were very interested in FireWise and genuinely believed their homes were potentially at risk to wildfire.
- Fire companies recognized many local communities at risk to wildfire and in need of fire prevention education, but were overwhelmed with their current duties.
- The Bureau of Forestry has positive working relationships with homeowners and fire companies, and is willing to work with both on improving communications in targeted areas at risk.

**Recurring Ideas in All Three Meetings:**

- Fire occurrence = Awareness
- There is a multi-level interest in FireWise
- Children are more receptive than adults
- Being FireWise validates concerns and the reality of a threat—this could create action
- Does not appear to be an overall need for FireWise education, just targeted efforts in communities at risk
- Landowners were unsure of WHO they were supposed to hear the message from, but all agreed that fire companies should be involved

**Points to explain/advertise more clearly:**

*How big is a community? How lame does a community need to be to qualify for FireWise?*

It became apparent there are many targeted communities appropriate for the FireWise program. However, the definition of "community" is very broad. Pennsylvania should look more thoroughly at this definition and make it more palatable to those in need.

*What types of things can be done with FireWise money?*

One of the main benefits of being a FireWise community is grant availability. The types of projects appropriate for FireWise funds are varied. Many of them would not require a community to raise the maximum of $40,000. Explaining this to community members makes matching fund requirements seem less daunting and allows them to set tangible goals. A better understanding of how communities can prioritize their needs and complete an Emergency Action Plan is also needed.
Action Items:

- Change PowerPoint presentation based on information discovered in these meetings
- Discuss marketing proposal with Rick Deppen
- Improve current FireWise brochures
- Develop our next set of questions by gaining BOF input and doing a literature review of similar research projects nationally
Appendix 1

Meeting #1 October 15, 2007 Meyersdale Fire Hall, Meyersdale, PA:

Rick Deppen, Pennsylvania DCNR Bureau of Forestry
Dr. Jim Finley, The Pennsylvania State University
Tara Claghorn, The Pennsylvania State University
Lee Jordan, Pennsylvania DCNR Bureau of Forestry
Brian Vinski, Pennsylvania DCNR Bureau of Forestry
Cory Wentzel, Pennsylvania DCNR Bureau of Forestry
Two landowners
Four firefighters/chiefs/wardens (Meyersdale & Berlin Fire Co.)

Meeting #2 October 17, 2007 Lower Yoder Fire Hall, Johnstown, PA:

Rick Deppen, Pennsylvania DCNR Bureau of Forestry
Dr. Jim Finley, The Pennsylvania State University
Tara Claghorn, The Pennsylvania State University
Jim Bloom, Pennsylvania DCNR Bureau of Forestry
Mark Maser, Pennsylvania DCNR Bureau of Forestry
Eight firefighters (Lower Yoder Fire Company)

Meeting #3 November 7, 2007 Mehoopany Fire Hall, Mehoopany, PA:

Dr. Jim Finley, The Pennsylvania State University
Tara Claghorn, The Pennsylvania State University
Jack Zbrovian, Pennsylvania DCNR Bureau of Forestry
Nick Lylo, Pennsylvania DCNR Bureau of Forestry
Jim Kessler, Pennsylvania DCNR Bureau of Forestry
6 landowners from Forkston Mountain Property Association
7 firefighters/chiefs/wardens (Mehoopany, Noxen, Kunkle, & Triton Fire Companies)
*Note Rick Deppen was unable to attend
Appendix 2

**Project Title: Concerns and risk perceptions of wildfire in Pennsylvania and the potential for implementing FireWise**

These questions listed below will be used in a facilitated discussion format, where the investigator will initiate the conversation by asking the lead question, and as appropriate ask follow-on questions for clarity or to solicit further information. The investigator will encourage participants to contribute to the conversation, but participation is voluntary. The discussion will follow a short presentation by a Bureau of Forestry representative who will describe the occurrence of wildfire in Pennsylvania and outline the FireWise program.

1. Have you ever experienced a wildfire event in this community? If so, can you describe what happened?
   - a. What were your thoughts when the fire occurred?
   - b. Did you feel vulnerable? If so, what were you concerns?
   - c. As a result of the wildfire, did you do anything to protect your home or community?

2. How likely do you think it is that a wildfire could happen in your community?
   - a. Do you think that these perceptions are generally held by other residents?

3. What steps do you believe your community should take to reduce the economic and social losses associated with wildfire occurrence?

4. After hearing about FireWise earlier in these meeting, do you think it is a program worth investigating?
   - a. If yes, how might you help encourage its acceptance?
   - b. If no, what do you see as issues, problems, or impediments to its use?
Appendix 3

Project Title: Concerns and risk perceptions of wildfire in Pennsylvania and the potential for implementing FireWise

(Revised 10/16/07)

These questions listed below will be used in a facilitated discussion format, where the investigator will initiate the conversation by asking the lead question, and as appropriate ask follow-on questions for clarity or to solicit further information. The investigator will encourage participants to contribute to the conversation, but participation is voluntary. The discussion will follow a short presentation by a Bureau of Forestry representative who will describe the occurrence of wildfire in Pennsylvania and outline the FireWise program.

1. Have you ever experienced a wildfire event in this community? What was threatened?
   a. What were your thoughts when the fire occurred?
   b. Did you feel vulnerable?
   c. As a result of the wildfire, did you do anything to protect your home or community?
   d. How does the community react to the wildfire? What did they talk about? Do they talk about wildfire?

2. How likely do you think it is that wildfire that threatened life and built property could happen in your community?
   a. How commonly held are these perceptions by other residents in your community?

3. What steps do you believe your community should take to reduce the economic and social losses associated with wildfire occurrence?
   a. What could community members do to help reduce wildfire risk?
   b. How could "we" (i.e., you) become more proactive to reduce wildfire risk?
   c. Do you "talk" about wildfire risk in the community?

4. After hearing about FireWise earlier in these meeting, do you think it is a program worth investigating?
   a. If yes, how might you help encourage its acceptance?
   b. If no, what do you see as issues, problems, or impediments to its use?
   c. What elements or ideas could you suggest to FireWise managers to make the program more likely to meet your community's needs?
   d. Who are the stakeholders we/you need to reach?
   e. What communities or places do you consider at risk of wildfire in your community?
Appendix B

Telephone Verbal Script for Contacting Key Informants

Hello, my name is _____ and I am research staff at Penn State University’s School of Forest Resources. I am conducting a small study for the Pennsylvania Bureau of Forestry regarding people’s concerns about forest fires. When appropriate we will add (Name) suggested that you hold a leadership role in (township name) and would be a good person to talk with about this topic.

Do you have time to discuss this now or would there be a better time to call?

If yes, continue

If yes, but not right now, “When would be a more convenient time for us to talk?” Get the following information and thank them.

If no, thank them for their time and terminate the call.

Date _______  Time _______
Phone Number ______________________

As a leader in (township), I want to schedule a 30-minute telephone interview to ask you questions about forest fires and ways of sharing information with community members about forest fires. When would be a convenient time for us to talk?

Date _______  Time _______
Phone Number ______________________

If now is a good time, continue

Read informed consent.

If you have any questions, please call me at 814-865-7932.

Thanks.
Appendix C

Key Informant Verbal Consent Form

VERBAL INFORMED CONSENT FORM FOR SOCIAL SCIENCE RESEARCH
The Pennsylvania State University

Title of Project: Building Community Support for Firewise in Pennsylvania

Principal Investigator: James Finley, Professor of Forest Resources
302 Forest Resources Building
University Park, PA 16802
800-235-9473
fj4@psu.edu

Other Investigator(s): Laurie Schoonhoven

TO BE READ ALOUD BY APPROVED RESEARCH PERSONNEL PRIOR TO CONDUCTING A TELEPHONE INTERVIEW:

1. **Purpose of the Study:** The objectives of this study are to understand public attitudes about and awareness of forest fires and the risk of forest fire in their community and developing targeted educational tools expressing the positive and negative effects of fire in the wildland urban interface/communities. We are contacting community leaders in three Pennsylvania townships identified by the Pennsylvania Bureau of Forestry as having high fire risk and interviewing individuals regarding their concerns about forest fires and its impact on their community. The discussion will be recorded so that valuable comments are not lost or misinterpreted. Your input is crucial to developing educational tools on forest fire and reducing fire risk in communities.

2. **Procedures to be followed:** You will be asked to participate in a telephone interview regarding forest fires and your community. With your permission, the session will be audio-recorded to maintain integrity of the information you provide. May I continue to tell you about participating in this telephone interview? (Circle One Response)

   No  Yes

**Benefits:** Not only will your participation aid in shaping educational materials and programs in Pennsylvania to increase public awareness of the positive and negative effects of forest fires, but participating may also help clarify your own thinking about the way in which your community can develop an emergency action plan.

3. **Duration/Time:** The interview will last approximately 30-45 minutes.
4. **Statement of Confidentiality:** The interview will be transcribed. None of your identifying information will be included in the transcripts. Therefore, your answers would not be connected directly to your name or other identifying information. If this research is published, no information to identify specific individuals will be included. Only the Co-investigators will have access to the digital recordings. Recordings will be kept in a password protected computer file in the office or lab of the co-investigator named above. Written records will be maintained on a password protected computer. All digital recordings and transcripts will be destroyed in 2012.

5. **Right to Ask Questions:** Please contact James Finley at (800) 235-9473 with questions or concerns about this study.

6. **Voluntary Section:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.

You must be 18 years of age or older to consent to take part in this research study. Are you still willing to participate? (Circle one response)

No  Yes

To document your consent to participate in the research, I would like you to say whether you agree to have the interview audio recorded. I will turn on the recording device now and then ask you the question. Do you have any questions before we begin the interview?

**May we audio-record the interview?** (MAKE SURE THE RECORDING IS RUNNING) Mark one response with an X

- [ ] Yes, I give my permission to be audio-recorded
- [ ] No. I do not wish to be audio-recorded
Appendix D

Key Informant Interview Questions

Building Community Support for Firewise in Pennsylvania

I want to ask you about forest fires in your community/township

1. How frequently do forest fires occur?

2. When you think about forest fires, what concerns and issues do you have about them?

3. What are the major causes of forest fire in the community?

Nationally as well as within Pennsylvania there is a program called Firewise. Through this program, the state and federal government collaborate with homeowners, community leaders, developers, and others in the effort to protect people, property, and natural resources from the risk of forest fire before the fire starts. The community is responsible for developing an emergency management plan and individuals are responsible for reducing the risk of fire at their home.

4. How likely are people in your community to be interested in learning about the Firewise program?

5. What can be done about forest fires?

6. What is the best way to reach people in your community to share information about forest fires?
   a. Where should it be targeted?
   b. When would be the best time to implement the ideas you’ve suggested

7. What do people need to hear about the program?

Fire is not always a negative. Increasingly, forest resource professionals are recognizing the merits of re-introducing fire as a tool to manage forest ecosystems. Properly used, fire can improve forest regeneration, create and sustain unique habitats, and reduce the risk of wild fires.

8. If we were to develop an education program on the proper role of fire, what concerns would you have for using fire in your community?

9. Do you see any issues with using introducing fire as a management tool in your community?
(DATE)

Dear ,

You are invited to participate in a Penn State research study regarding wildfire prevention. In an effort to increase public awareness of wildfires and wildfire prevention, the Pennsylvania Bureau of Forestry and the Pennsylvania State University’s School of Forest Resources is developing a wildfire lesson plan, booklet, and pre- and post evaluations for fourth through sixth grade teachers. To develop the materials, we are doing a research study and need to talk with teachers about their understanding of wildfires. The information we gain will be used to develop a lesson plan that meets Pennsylvania education standards.

The study involves two focus group discussions taking approximately 90 minutes each and held six months apart. During the first focus group, we will discuss wildfires in your community and how to develop education materials that will potentially reduce the risk such fires and personal property loss from such fires. Education materials will be developed based on information gathered in the first focus group. The second focus group will evaluate the educational materials and barriers to using it in classrooms.

The attached informed consent provides additional details regarding the research. All aspects of this process are voluntary so you may stop at any time. We will audio record the discussion so valuable comments are not lost or misinterpreted. The recording will be used to correct and clarify notes without using individual participant names. All comments will remain confidential.

We hope that you will be able to participate in this special opportunity to influence wildfire education in Pennsylvania! We simply want to use your knowledge for the greatest good.

If you have any questions about the project, please talk to Laurie Schoonhoven by calling toll-free 800 235-9473.

Thanks in advance for your help in this research project.

Sincerely,

Jim Finley
Professor of Forest Resources

Laurie Schoonhoven
Project Associate
Appendix F

Focus Group Informed Consent

Informed Consent Form for Social Science Research
The Pennsylvania State University

Title of Project: Developing Strategies for Marketing Firewise in Pennsylvania

Principal Investigator: James Finley, Professor of Forest Resources
302 Forest Resources Building
University Park, PA 16802
800-235-9473
fj4@psu.edu

Other Investigator(s): Laurie Schoonhoven

Purpose of the Study: The purpose of this research is to determine teachers’ knowledge of Pennsylvania wildfires and use of wildfire lesson plans. We are contacting teachers in high wildfire risk areas who can provide insights wildfire education. Your input is crucial to the development of a wildfire lesson plan, booklet, and pre- and post tests for use by 4th through 6th grade teachers in Pennsylvania. The study is funded by the Pennsylvania Bureau of Forestry.

1. Procedures to be followed: You will be asked a series of questions about wildfires and wildfire education. Based on input from the first focus group, a wildfire lesson plan, booklet, and pre- and post test evaluation for students will be developed that meet Pennsylvania education standards. You will be invited to participate in a second focus where you will evaluate the wildfire education materials after they are developed. The discussions will be recorded so that valuable comments are not lost or misinterpreted. Participants must be 18 years of age or older.

2. Duration/Time: You will be asked to participate in two focus groups scheduled approximately four months apart. Each discussion will take about 90 minutes.

3. Statement of Confidentiality: Your participation in this research is confidential. The data will be stored and secured at 407 Forest Resources Building, University Park in password protected files. In the event of a publication or presentation resulting from the research, no personally identifiable information will be shared. If you speak about the contents of the focus group outside the group, it is expected that you will not tell others what individual participants said.

Although we will record the discussion, we will not put your name on the digital recording or transcript. The only information that will be on the audio recording or in our
handwritten notes will be the date of the interview. Therefore, we do not believe that you can be identified. The interview material will be in password protected files and accessible only by the Principal Investigators. The files will be destroyed in 2013.

4. **Right to Ask Questions:** Please contact James Finley at (800) 235-9473 with questions or concerns about this study.

5. **Compensation for participation:** There will be no compensation for the first focus group. A meal will be offered to participants during the second focus group session. The meal is free to participants and will be paid for by the research project.

6. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.

You must be 18 years of age or older to consent to take part in this research study. If you agree to take part in this research study and the information outlined above, please sign your name and indicate the date below.

You will be given a copy of this form for your records.

____________________________________  __________  __________
Participant Signature                  Date

____________________________________  __________  __________
Person Obtaining Consent               Date
Appendix G

Focus Group Interview Questions

Developing Strategies for Marketing Firewise in Pennsylvania
10/31/2010

Earlier this year I interviewed a few of you regarding the risk of wildfire in your community. Based on feedback you and others in wildfire prone communities, I am trying to develop wildfire education for youth. I would like your input in creating the curriculum.

1. At what age/grade do students learn about fire prevention in your district?
2. What do students currently learn about fire prevention?
3. If we were to develop a lesson plan on wildfire prevention and the proper role of fire.
   a. What concepts does the lesson plan need to contain?
   b. What educational standards would it need to meet? Other requirements?
   c. What subject(s) can it be taught under?
4. What would the lesson plan need to contain for you to use it?
5. What impediments are there to teaching the subject matter?
6. What can I do to overcome those impediments?
Appendix H

Wildfire: Not in my backyard! Lesson Plan

Keywords: Wildfire, forests, weather, environment, watershed

Lesson Plan Grade Level: 5th-8th grade

Author: Laurie Schoonhoven, Penn State Extension

Total Time Required for Lesson: two 30-minute sessions

Setting: Classroom

Subject Covered: Social Science, Environmental Science, Weather, Geography, Writing, Reading

Topics: wildfires, ecosystems, communities

Goals for the Lesson:
Students will be able to describe a wildfire.
Students will be able to list and explain wildfire stages.
Students will be able to identify wildfire causes.
Students will be able to recommend ways to protect homes and communities from wildfires.

Materials Needed:
PA Wildfire PowerPoint® including movie clips
From the Woods: Wildfire publication
Wildfire Vocabulary Activity Sheet (one per student)
Wildfire Student Handouts (one per student)
Fire Pre-test (one per student)
Fire Post-test (one per student)
Pencils (one per student)

State Standards Addressed: (Pennsylvania Department of Education, 2002)
4.2.7.B. Examine the renewability of resources.
4.3.7.B. Describe how human actions affect the health of the environment.
4.6.7.A. Explain the flows of energy and matter from organism to organism within an ecosystem.
4.6.7.C. Explain how ecosystems change over time.
4.8.7.C. Explain how human activity may affect local, regional and national environments.

Common Core State Standards in English Language Arts:
Reading Standards for Informational Text 5-8: key ideas and details; craft and structure; and integration of knowledge and ideas
Writing Standards 5-8: text types and purposes; research to build and present knowledge
Read through the entire lesson including teacher background information, vocabulary list, From the Woods: Wildfire, and Wildfire PowerPoint presentation to ensure you understand the materials. Be sure to have all the materials assembled before beginning the class.

Methods: Question relay, think-pair-share

Doing the Activity:
Introduction to the lesson plan:
“Today we will be learning about wildfires. Our ultimate goal is to understand what they are and how to prevent them.”

Steps:
1. Use the pre-test as a question relay. Divide students into pairs. Each table has a different pre-test question. Student pairs move from table to table; they have about one minute to read and answer the question at each table. Their answers are written on one piece of paper with the pair’s names at the top. Student pairs are graded based on speed and accuracy. Modification for 7th and 8th grade students, remove multiple-choice options and ask them to write one or two sentence responses. Note: Pretest answers are 1D, 2B, 3 B and C, and 4C.
2. Review some of the questions and answers with the students. “The first question asked what time of year wildfires occur. What was your answer? Why do you think it happens then? When we watch the television news, we often see stories about summer wildfires in California and other western states. We might think all wildfires are the same, but they are not. Pennsylvania wildfires occur in the spring and fall.”
3. Think-pair-share: “Let’s start with a vocabulary activity to familiarize you with wildfire terms you will hear during the lesson.” Pass out the vocabulary activity sheet. (This activity takes 10 minutes.) Students spend a few minutes quickly writing a definition for each word. Students divide into pairs and to agree on a definition for each word. They write their answer in the middle column. Each pair is assigned a word to look up in the dictionary or on-line source. The class reviews each word and each pair provides their definition.
4. Distribute the Wildfire Student Handout to students. “Now that you know some words associated with wildfire, I have a Pennsylvania Department of Conservation and Natural Resources wildfire presentation. As I go over the first set of slides, you need to fill in the blanks in the ‘introduction’ section of the handout.” Review slides 1-11. Stop at slide 11.
5. Quickly review the ways wildfires impact people and the environment. Possible ways fires can impact their community include burning structures (houses and cabins), fields, and forests. Wildfires kill plants and trees and destroy wildlife habitat including food sources. Severe fires can destroy plants and their root systems, organic matter and seeds in the soil. Loss of plant roots to stabilize the soil can increase the potential for soil erosion. This could cause sedimentation in streams, which could affect aquatic life.
6. “There are simple things we can do to reduce the risk of wildfires in our community. It helps to know the three components of wildfire behavior. You need to fill in the blanks in the ‘fire behavior and the environment’ section. Show slide 12-23. Review the handout. “Which of those three (topography, weather, or fuels) can we control?” Answer: fuels.
7. “In the final section we will learn about wildfire causes and ways we can reduce wildfire risk including wildfire fuels.” Have students fill in the blank in the final section of the student handout as you cover slides 24-32. Go over the handout.
8. “We have talked about wildfire dangers. For homework, I want you to read From the Woods: Wildfire with your parents and go over the ‘You can Prepare’ diagram on the back page. Please look at your home and see what you can do to reduce the risk of wildfire spreading to
your home. Have your parents sign the back of the booklet. I also want you to write one-page on what you and your family can do to reduce the risk of wildfire. We will discuss these reports briefly tomorrow.”

Assessment:

Give students post-test which could be set up as another question relay. Allow them five to ten minutes.

Conclusion to the Lesson (next day):

“What did you learn from the brochure? What did you and your parents learn when you reviewed the “You can prepare” diagram? What do you need to change around your home? What else do you need to consider to reduce wildfire risk? (e.g., campfire safety, raking and removing leaves from under the deck/porch…) Your family and our community can do simple things to prevent wildfires from happening.”

Alternative Activities:

Experiment: Collect and bring in leaves, grass, and branches of various diameters. Have students measure the diameter of each fuel. Have students categorize fuels based on the rate they dry out as noted in the wildfire vocabulary list. Have students look up precipitation per day for the past year. Use this information to discuss which fuels are most likely to dry out based local weather, especially number of days without rain.

Experiment 2: Divide students into five groups. Each group is given the same number of matches but different types of materials to burn. Each group’s task is to burn as much of the material they can with the matches they have. Some groups have only large fuels to burn while others have damp or wet materials. Only one group has materials that burn easily. At the end of the activity, discuss how oxygen, heat, and/or fuels affected whether or not the materials they were given burned.

Experiment 3: Build three match forests using three pie pans filled with clay. Insert and evenly space matches in the clay of each pie pan. One pie pan is flat. Elevate the second pie one to two inches to create a moderate slope. Elevate the third pie pan three or more inches to create a steep slope. Ignite matches in the first row of the flat pan. Students record how long it took the match forest to burn and percent of matches burnt before the fire went out. Repeat with the second pie pan followed by the third pie pan. Students use results determine the affect of slope by comparing the burn times and percentage of trees burned in each forest.

Additional resources:
Firewise: http://www.firewise.org/Information/Who-is-this-for/Homeowners.aspx
 http://www.firewise.org/Information/Who-is-this-for/Educators.aspx

State Standards: The lesson plan also addresses these 2009 Environment and Ecology Standards
4.1.7.E. Identify factors that contribute to change in natural and human-made systems.
4.2.6.C. Identify natural and human factors that affect water quality.
4.2.8.A. Describe factors that affect the quality of ground and surface water.
4.5.7.A. Describe how the development of civilization affects the use of natural resources.
4.5.7.C. Explain how human actions affect the health of the environment.
4.5.8.C. Describe how humans can reduce pollution.

Background information & key concepts

**Organic matter:** From US Natural Resource Conservation Service. Healthy, fertile soil is a mixture of water, air, minerals, and organic matter. In soil, organic matter consists of plant and animal material that is in the process of decomposing. When it has fully decomposed (to break down physically into simpler chemical compounds) it is called humus. This humus is important for soil structure because it holds individual mineral particles together in clusters. Ideal soil has a granular, crumbly structure that allows water to drain through it, and allows oxygen and carbon dioxide to move freely between spaces within the soil and the air above.

One of the best ways to improve soil fertility is to add organic matter. It helps soil hold important plant nutrients. Application of organic matter (compost, dead plants, and/or animal manure) to the soil adds carbon, which promotes the growth of beneficial bacteria (microbes), which increases the likelihood of hearty plants.

**Dew point** is a measure of how much water vapor is actually in the air.

**Relative humidity** is a measure of the amount of water in the air compared with the amount of water the air can hold at the temperature it happens to be when you measure it. In the image below, water vapor is constant at 7.76 grams per cubic meter. As the air temperature increases from ten degrees celsius to 30 degrees Celsius, the relative humidity decreases because warmer air can hold more water.

Fire has been a part of the natural landscape since time began. It is viewed as both good and bad. Fire benefits nature by recycling plant nutrients into the soil. Some forest ecosystems need fire to sustain plant and animal communities. Extremely intense fires can damage ecosystems, and even small fires can destroy homes. To protect people, communities, and natural resources, we often try to prevent and stop forest fires. An out-of-control fire in a forest or natural area is a wildfire.

**EASTERN FOREST FIRES**

Wildfire frequency and intensity vary based on location, climate, and types of trees. The northeastern United States has a temperate climate with year-round precipitation. As a result, eastern wildfires are generally low in intensity and burn fuels on the forest floor. Fire risk is greater in the Northeast during the spring and fall months when leaves are off the trees. In the spring, after the snow melts and before the new foliage emerges, the sun warms and dries last year's fallen leaves. Similarly, in the fall the air is drier and the leaves fall and dry on the forest floor. These two times, fall and spring, are when most northeastern fires occur.

![Image of a wildfire]

**WILDFIRE SUPPRESSION**

A history of wildfire suppression efforts, such as fighting every fire possible, has contributed to an accumulation of forest fuels and, thus, a higher risk of wildfires in some areas of the United States. In western forests where fuels have accumulated over time and do not rot because of dry conditions, fire is increasingly common. Tree species such as Douglas-fir and ponderosa pine common to western forests contain highly flammable resins that make fuels more volatile. The combination of accumulated flammable fuels, steep mountains, and hot, dry summers makes western forests prone to large, severe wildfires.

Most eastern wildfires tend to be small, burning an average of one acre per fire. However, areas of the Northeast and Midwest can still experience large wildland fires, which burn hundreds to several thousand acres when conditions are right. Because of population increases and development expansion, eastern wildfires have become more complicated to manage and suppress over the last one hundred years. The loss of houses and other structures and the need to evacuate residents during wildfire events have become more of a concern in some areas. According to wildfire statistics, lightning strikes account for 1 percent of wildfires and human actions cause the majority of eastern wildfires. People burning debris and arsonists cause the greatest number of wildfires.

![Image of a wildfire]

**Ninety-eight percent of wildfires are caused by human activity such as this unsafe barrel burn.**
THE FIRE TRIANGLE
All fires need three components: fuel, heat, and oxygen. These three compose what is called the fire triangle. In forests, live and dead vegetation, including dry leaves, twigs, logs, and grasses, are fuel. Heat sources such as sparks, campfires, trash burn barrels, or lightning strikes start fires. Oxygen is readily available in the air. Wind, the horizontal movement of air, increases the flow of oxygen, dries fuels, and helps increase fire spread and intensity. Remove one of the three sides of the triangle and fire cannot occur.

FIRE STAGES
Fire goes through several stages as it spreads. First, heat from the fire dries nearby fuels. Next, the nearby fuels release volatile gases. These volatile gases and nearby fuels ignite. Finally, as the fire intensifies, it rapidly preheats and dries surrounding materials, allowing them to ignite and carry the fire through the forest. This process of heat transfer only happens when there is fuel continuity (unburned material close to burning material). The fire continues the cycle with nearby fuels. Under certain conditions—for example, dry fuels and high winds—these steps are almost instantaneous. Importantly, as fuel moisture levels increase, more heat is required to evaporate moisture and ignite fuel. This is why it is easier to use dry wood in a campfire.

NOT ALL FIRES ARE HARMFUL
Not all fires in a forest are harmful. Controlled fire—fire set by people for the purpose of vegetation management—is a tool used to achieve several different objectives. Some plants and trees need fires to grow. Jack pine cones and pitch pine cones need fire and heat to release seeds. Frequent low-intensity fires kill trees and plants, allowing fire-tolerant seedlings and species, such as oak, to capture full sunlight. In these fire-dependent ecosystems, controlled burns reduce fuels and prepare sites for tree regeneration and regrowth. Controlled fires are done by trained professionals knowledgeable about fire behavior. Before conducting a controlled burn, these professionals gather vegetation and terrain data in the burn area. Computer models assist in developing a fire plan based on vegetation, expected weather conditions, and desired outcomes. Firefighters with water and firefighting tools ignite, control, and extinguish the fire. Their goal is to make sure the fire only burns the designated area.

As you can see, fire is both beneficial and destructive to the environment. It is important to understand wildfire and do our part to prevent the unwanted, human-caused fires.
Wildfires: Not in my backyard! Pretest

Name: ________________________________  Period: _________________

1. When do most wildfires occur in Pennsylvania?
   a. Summer
   b. Year round
   c. Winter
   d. Spring and fall

2. What is a wildfire?
   a. Fire that starts on the first floor of a house and goes to the second floor
   b. Any unwanted fire that burns fields, brush or forests
   c. A bonfire with six foot flames
   d. A fire ignited, controlled, and extinguished by trained professionals to manage plants

3. What are two major causes of wildfires in Pennsylvania and northeastern US? (circle only two)
   a. Cigarettes
   b. Burning trash
   c. Arson
   d. Railroads
   e. Campfires

4. What is a temperate climate?
   a. Tropical or semi-tropical with year-round rain.
   b. Year round snow and temperatures below freezing.
   c. Moderate temperatures with snow in winter and rain in spring, summer and fall.
   d. Cool, wet winters and dry, hot summers.
Wildfire: Not in my backyard! Post-test

Name: ___________________________________   Period: ________________

1. When do wildfires occur in Pennsylvania?
   a. summer
   b. year round
   c. winter
   d. spring and fall

2. What is a wildfire?
   a. fire that starts on the first floor of a house and goes to the second floor
   b. any unwanted fire that burns grass, leaves, brush or forests
   c. a bonfire with six foot flames
   d. a fire ignited, controlled, and extinguished by trained professionals to manage plants

3. What are the three components of the fire behavior triangle?
   a. topography/terrain
   b. soil
   c. weather
   d. fuel

4. Which is not a fuel?
   a. branches and logs
   b. grass
   c. stone
   d. leaves

5. Which of the following are ways you can protect your home from wildfires?
   a. stack firewood 25 feet from the house
   b. clear leaves from gutters
   c. install a spark arresting screen on the chimney
   d. keep the roof and deck clear of leaves, pine needles, and debris

6. What are two major causes of wildfires? (circle two)
   a. cigarettes
   b. burning trash
   c. arson
   d. campfires

7. What is a temperate climate?
   a. Tropical or semi-tropical with year round rain.
   b. Year round snow and temperatures below freezing.
   c. Moderate temperatures with snow in winter and regular rain in spring, summer and fall.
   d. Cool, wet winters and dry, hot summers.
Thank you for coming to our presentation on Pennsylvania wildfires. When is Pennsylvania’s wildfire season? Most people would suggest summer. This program will help you make the connection between the conditions that make our woods vulnerable to wildfire and times of the year they are likely to occur. Hopefully, you can then be more aware of the risk and do your part to prevent wildfires from starting. After all, people start most wildfires in Pennsylvania.

Wildfire is defined as an unwanted fire that burns fields, grass, brush or forests.

Wildfires can negatively impact wildlife and their habitat.
Wildfires can destroy ground cover. This leads to soil erosion and causes sedimentation (soil to build up) in streams, rivers, and water supplies. This can harm or kill aquatic plants and animals.

Wildfires damage forests and plants, which can take months or years to recover to their natural state.

Wildfires can damage or destroy personal property including homes, vehicles, garages, barns, sheds, and other valuable items.
Typically wildfire risk is greater in the spring and fall when leaves are off deciduous trees. Deciduous trees (i.e., oak, maple) lose their leaves annually while conifers or evergreens (i.e., pine, fir) keep their pine needles year round. In the spring, after the snow melts and before the new leaves come out, the sun warms and dries the fallen leaves, twigs, and branches. Similarly, in the fall the air is drier and the leaves fall and dry on the forest floor.

Over the ten year period from 2000-2009 there was an average of 4300 acres burned annually in Pennsylvania. Media attention from western fires leads people to believe all wildfires occur during the summer. Western states have hot, dry summers with frequent dry lightning storms. Lightning is a major cause of western fires. Less than 2% of Pennsylvania wildfires are caused by lightning.
Western wildfire season is different from Pennsylvania’s. The western wildfire season is continuous with most fires occurring from May to October. Pennsylvania’s wildfire season is not continuous. Most fires occur primarily from March to May and then can resume from October to November.

Deciduous trees without leaves in the spring and fall allow sunlight and wind to reach the forest floor; warming the ground and drying leaves, brush and logs.

Wildfire behavior and intensity are controlled by fuels, topography (terrain) and weather.
Slide 13
Fuels consist of plant and tree materials. Grass, leaves, and pine needles can dry within an hour and easily ignite. Small twigs and branches dry in several hours.

Slide 14
Low relative humidity, warmer temperatures, and wind rapidly dry grass, leaves, twigs, and branches. A lack of rain or snow allows vegetation to dry further and increases wildfire risk.

Slide 15
Peak burning activity takes place between 10 AM and 6 PM. The driest time of the day begins after the morning dew has evaporated. The sun is high in the sky and beats directly on the ground rapidly drying light fuels. As the sun sets, temperatures drop and relative humidity increases thus reducing fire intensity.
Topography includes slope and aspect. Each plays a role in wildfire behavior. Fire moves faster up steep terrain and slower on flat terrain. Heat and air moves quickly up steep terrain accelerating fuel drying and fire spread. Aspect is the direction (north, south, east or west) the terrain faces. North facing slopes dry slower in the morning sunlight. South and west facing slopes receive dry faster in the warm afternoon and evening sunlight when the ambient air temperature is higher later in the day. This results in drier conditions.

The fire season moves from south to north because of Pennsylvania’s size. This South to North transition, as the vegetation becomes green in the spring, is fairly obvious. The process reverses itself as fall colors come upon us and deciduous trees lose their leaves prior to winter. This effects where wildfire activity occurs during these times.

The next couple slides show a progression of vegetation green up from south to north. Leaves on deciduous trees begin to come out early to mid-May in the south.
Deciduous trees leaf out in mid to late May in the central portion of Pennsylvania.

Deciduous trees leaf out in early June in the north.

Progression of fall foliage and leaf drop from north to south. In general deciduous tree leaves turn colors and drop by the third week in October in the north.
Deciduous trees in the central Pennsylvania lose their leaves in late October.

Southern deciduous trees lose their leaves in early November.

Human activity causes 98% of all wildfires in Pennsylvania. Debris burning and arson are the leading causes.
The individual responsible for starting a wildfire in Pennsylvania can be held accountable for suppression costs including manpower and equipment.

…helicopters

… and aircraft. They are also liable to a civil suit for loss of personal property, injuries, and even death. To reduce your risk of causing a wildfire, there are simple steps you can take.
Practice careful burning. When you burn debris, five simple steps will reduce the risk.

- Clear an area 10 feet around the barrel to prevent sparks from igniting material outside the barrel.
- Have a hose and rake available to quickly put out sparks.
- Use a metal container with ½ inch ventilation holes at base to allow for quick and clean burning of debris.
- Put a ¼ inch steel screen on top of barrel as a spark arrester.
- Always make sure the fire is completely out before you walk away from the burn barrel or burning debris.

Instead of burning debris, alternatives include recycling, mulching or chipping lawn debris, or creating brush piles in wooded areas. Composting debris creates rich organic matter, which can be added to gardens and flower beds.
Check forest fire danger with your local Bureau of Forestry office. When local or county-wide burn bans are in effect, campfires should not be used. When camping, use a stove to cook to reduce the risk of wildfire. A self-contained metal or ceramic fire pit can be used in place of an open campfire. And as always, be sure campfires are put out cold.

You will have a 3-5 second delay before Smokey Bear wildfire prevention video.

For more information, Contact your local Bureau of Forestry office, Forest Fire Warden, or fire company.
Wildfire: Not in my backyard! Student Handout

Name: ________________________________  Period: ______________

Fill in the blank on the follow statements as you watch the PowerPoint.

Introduction:

1. Wildfire is an __________ fire that burns fields, grass, brush, or forests.

2. Wildfires effect:
   a. _______________
   b. _______________
   c. _______________ and plants
   d. Personal _______________

3. Pennsylvania’s wildfire season is in the ______ and ______ when leaves are off the deciduous trees.

4. On average _______ acres burn each year due to wildfires.

5. Lightning is a major cause of western wildfires, but cause less than_____% of Pennsylvania wildfires.

6. Most Western wildfires occur between _______________ to October when it is hot and dry. Most Pennsylvania wildfires occur from March to May and from October to November.

Fire behavior and the environment

7. Wildfire behavior and intensity is controlled by
   a. _______________
   b. Topography
   c. Weather

8. Grass, leaves and pine needs can dry in an ___________. Small twigs and branches take several hours to dry.

9. Low relative ___________, warmer temperatures, and wind rapidly dry grass, leaves, twigs, and branches.

10. Peak burning activity/wildfire risk is between 10 AM and _____ PM.
11. Topography includes slope and _______. Each plays a role in wildfire behavior. Fire moves_______ up steep slopes and slower on flat terrain.

12. Aspect is the _______ (north, south, east or west) the terrain is facing. North facing slopes receive less direct early morning sunlight. South and west facing slopes receive direct afternoon and evening sunlight resulting in drier conditions.

13. Because of Pennsylvania’s size, there is a South to North transition as the vegetation becomes green in the spring. The process ________ itself as fall colors come upon us and trees lose their leaves prior to winter. This effects ______ wildfire activity occurs during these times.

Wildfire causes and way to reduce wildfire risk

14. Human activity causes _____% of all wildfires in Pennsylvania with ________ burning and arson as the leading causes.

15. Individual responsible for starting a wildfire in Pennsylvania can be held accountable for the cost of putting out the fire including
   a. manpower and __________
   b. ______________
   c. ______________

16. Practice safe debris burning.
   a. Clear an area _____feet around the barrel to prevent sparks from igniting material outside the barrel.
   b. Have ___________ and rake available to quickly put out sparks.
   c. Use a metal container with ½ inch ventilation holes at base to allow for quick and clean burning of debris.
   d. Put a ¼ inch expanded steel __________ on top of the barrel as a spark arrester. Always make sure the fire is completely out before you walk away from the burn barrel or burning debris.
17. Alternatives to burning debris

a. _______________

b. Mulching

c. Wildlife habitat

d. _______________

18. Check with your local Bureau of Forestry office about fire ________. When local or county-wide burn bans are in effect, campfires should not be used. When camping, use a stove to cook to reduce the risk of wildfire. A self-contained metal or ceramic fire pit can be used in place of an open campfire. And as always, be sure camp fires are put out cold.

19. Smokey’s message: Only you can ___________ wildfires.
Wildfire Vocabulary Activity

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<th>Word</th>
<th>Best Guess</th>
<th>Partner Talk</th>
<th>Glossary Definition</th>
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<td>Fuels</td>
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<td>Nutrients</td>
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### Wildfire Vocabulary List

<table>
<thead>
<tr>
<th>Word</th>
<th>Glossary Definition</th>
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</table>
| Fuels           | Plant or tree matter such as grass, leaves, pine needles, twigs, branches, and fallen trees that can burn when dry. Fuels are broken into categories based on diameter. Size affects the rate fuels dry out in the spring, summer or fall.  
   a. less than ¼ inch: Grass, leaves, and pine needles dry in one hour  
   b. ¼ - 1 inch: twigs and branches dry in ten hours  
   c. 1-3 inches: branches dry in 100 hours  
   d. Greater than 3 inches: branches and logs dry in 1000 hours |
| Nutrients       | Nutrients are the minerals and substances plants need for healthy growth. When fire burns organic matter or fuels, it releases carbon dioxide and nitrogen gas into the air and deposits ash on the soil. Ash is more soluble than the organic matter from which it originated. Thus fire increases available minerals, phosphorous, exchangeable bases, and total soluble salts as well as increases soil pH. |
| Volatile        | Readily vaporizable at a relatively low temperature. Some trees contain resins, which in their vapor or gas form are highly flammable (burn easily). |
| Relative humidity | A measure of the amount of water in the air compared with the amount of water the air can hold at the temperature it happens to be when you measure it. |
| Temperate climate | Having a climate intermediate between tropical and polar; moderate or mild in temperature. |
| Precipitation   | Rain, snow, sleet, dew, etc., formed by condensation of water vapor in the atmosphere. The deposition of these on the earth's surface. |
Appendix I

Safe Debris Burning Lesson Plan

Keywords: debris burning, recycling, flammable, public safety, wildfire

Lesson Plan Grade Level: 5th-8th grade

Created by: Laurie Schoonhoven, project associate Penn State Extension

Total Time Required for Lesson: 2-30 minute or 3-20 minute sessions

Setting: Classroom

Subject Covered: science, social science

Topics: wildfire, weather, topography, public safety

Goals for the Lesson:
Students will be able to list and explain five steps to reduce wildfire risk.
Students will be able to identify five things wildfires effect.
Students will be able to recommend alternatives to debris burning.
Students will be able to identify items illegal to burn.

Materials Needed:
Safe debris burning PowerPoint slide
Safe debris burning DVD with three 2.5 minute movies
Safe debris burning DVD worksheet
Debris burning vocabulary activity
Debris burning vocabulary list (for teacher)
What to burn cards
What to consider cards
Safe debris burning homework (journal/writing exercise)
Pencils (1 per student)

State Standards Addressed:
4.2.7 B. Examine the renewability of the resources.
4.3.7 B. Describe how human actions affect the health of the environment.
4.2.10 B. Evaluate factor affecting availability of natural resources.
4.3.10 B. Explain how multiple variables determine the effect of pollution on environmental health, natural processes and human practices.

Preparation:
Read through the entire lesson to ensure you understand the materials. Be sure to have all the materials before beginning the class. Print enough “What to burn” cards and “What to consider” cards for student small groups (5-6 students per group). Cut the handout into cards.
If you have a Smartboard, convert “What to burn” and “What to consider” images into flipcharts to be sorted during the lesson.

Doing the Activity:
Introduction to the lesson plan:
“How many of your families/parents burn trash and debris? Have bonfires or campfires? Debris burning is a common practice in Pennsylvania especially during spring and fall yard clean up. In addition, many people have outdoor fire pits or fireplaces for recreation.”

Steps:
1. Think-pair-share: Let’s start with a vocabulary activity to familiarize you with words you will hear during this lesson. This activity takes 10 minutes. Hand out the vocabulary activity sheet. Students spend a few minutes quickly writing definitions for each word. Students pair up come up with a definition for the word and write it in the second column of the vocabulary list. Each pair is assigned a word to find in the dictionary and write it in the third column of the vocabulary list. The class reviews each word and each pair provides a dictionary definition.

2. Now we are going to play a game. Break students into groups. Half the groups get the “What to Burn Cards” and the other groups get the “What to Consider Cards.” Imagine we are going to burn debris. The groups with “What to Burn Cards” sort the cards into what we can and can’t burn. The groups with “What to Consider Cards” sort the cards into what kind of weather and time of day we will burn the debris. You have ten minutes. On the blackboard write “What to Burn/Not burn” and “Good burn condition/bad burn condition”. When the groups are finished, ask the groups to report out how they sorted the cards and write the items under the appropriate heading on the blackboard. If you have a Smartboard, have the groups sort the cards on the Smartboard. Save the master flipchart and the blackboard lists.

3. Today we are going to watch a movie on safe debris burning. The movie has three sections. (Distribute safe debris burning DVD worksheet). To help understand information in the movie, I want you to fill in the blanks on this worksheet as you watch the movie. We will review the worksheet after each section of the movie.

4. Play “Introduction” of the DVD. Students complete the “Introduction” section of the worksheet. When the Introduction video is finished, have the students work in pairs or groups to review their answers.

5. Bring the class together and have each group/pair share their answers for one or more of the fill in the blanks. Why can’t you burn tires, toxic chemicals, and other materials? For example, chemicals can leak into the soil and groundwater, contaminating them. How do you dispose of them? Take them to the landfill on days when they accept toxic chemicals. They know how to safely dispose of such materials.

6. Play “What Went Wrong.” Follow the same format as before. Students complete the designated worksheet section and meet in pairs/groups to review their answers.

7. Bring the class together and have each group/pair give their answers for one or more of the fill in the blanks. Show the students the PowerPoint slide with the picture of safe and unsafe debris barrels. Review the differences. Unsafe – close to tree, leaves and a piece of wood near it, no screen, no ventilation holes at barrel base, broken at bottom allowing burning material to fall out, and no water hose or rake to extinguish embers that escape. In addition, no one is watching over the burn barrel.

8. Play “Wildfire Impact.” Students complete the designated worksheet section and work in groups to review their answers. Have each pair/group answer one or more of the fill in the blanks.
9. Divide the students into the same groups as in Step 2. Have them sort the cards again. Using the blackboard, write new lists or use the Smartboard to sort the images on a new flipchart. Review the blackboard or Smartboard – “This is what you thought at the beginning and this is what you think now. What changed and why?

Assessment:

Ask students to journal about what they learned in class. Their journal exercise needs to include the following words: debris, compost, dew, and flammable (5th and 6th grade students) or debris, vegetation, evaporation, ventilation, ordinance, and flammable (7th and 8th grade students). Have them look at their home. Does their family burn? If so, what do they burn? What do they need to change to safely burn debris? Grade students journal exercise.

Conclusion to the Lesson:

“When we burn debris or have recreational fires it is important to remember safe burning steps. Check with the local fire company or Bureau of Forestry about burn bans. Check the weather, clear an area around the barrel, watch over the burning debris, and have a water hose ready.”

Alternative: Use the “What to burn” and “What to consider” cards as a memory game. Give individual students or student groups two sets of the same cards to pair and sort into categories.
Safe Debris Burning Student Worksheet
Name: ___________________________ Period: ______

Fill in the blank on the following questions as you watch the movie.

Introduction

1. _____% of wildfires are caused by debris burning each year.
2. _____% of wildfires occur between March and May.
3. Debris burning wildfires most often occur during _________ and ___________ cleanup.
4. Types of debris include:
   a. Construction piles
   b. ________________ trash
   c. Leaf and _________ piles
5. It is illegal to burn:
   a. ______________________
   b. ______________________
   c. Toxic chemicals and materials

What went wrong?

6. What factors caused the wildfire?
   a. Windy day. It _________ out grass, leaves and fallen tree limbs. It also increased fire spread and intensity.
   b. The warm ___________ and lack of rain dried out the vegetation and allowed the vegetation to stay dry.
   c. The burn barrel was located too ________ to the house and tree on an upward slope. Fire moves faster on a slope than on level ground.
d. The person burned the trash after the morning _____ had evaporated and the plants were dry.

e. The person ______ away from the fire.

f. The area around the burn barrel had dry leaves and grass that easily ____________.

g. The homeowner did not have ____________ to extinguish the fire.

h. The burn barrel was too close to the ____________.

Five simple steps to reducing wildfire risk

1. Clear an area _____ feet around the barrel to prevent sparks from igniting material outside the barrel.

2. Have a rake and _______ available to quickly put out sparks.

3. Use a _______ container with 1/2 inch ventilation holes at the base to allow for quick and clean burning of debris.

4. Put a 1/4 inch expanded steel mesh _______ on top of the barrel as a spark arrester.

5. Always make sure the fire is ____________ out before you walk away from the debris burner or burning leaves.

Before you burn consider the following:

1. local _______ bans

2. Weather. _______ and dry day is the wrong day to burn.

3. Burn barrel _____________. Make sure 10 feet is cleared around the barrel and it is not located near a structure or wooded area.

4. Clear _____________ materials away from burn barrel.

Wildfires impact

1. ____________ properties

2. State and private ______________

3. _____________

4. _____________ and their habitat
5. _______________. On average three fatalities are caused by debris burning each year.

6. If you start a wildfire, you are responsible for the cost of putting out the fire. Costs can include volunteer firefighters, Bureau of Forestry personnel, and _____________ costs. Damage to other property can leave you open to criminal or civil charges.

Alternatives to debris burning

1. _____________

2. _____________ piles

3. _____________

4. _____________

5. _____________ dumps
### Debris Burning Vocabulary Activity

<table>
<thead>
<tr>
<th>Word</th>
<th>Best Guess</th>
<th>Partner Talk</th>
<th>Glossary Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debris</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compost</td>
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<td></td>
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<td>Dew</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ordinance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Evaporation</td>
<td></td>
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<td></td>
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<tr>
<td>Ventilation</td>
<td></td>
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<td></td>
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<tr>
<td>Flammable</td>
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<td></td>
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</tbody>
</table>
### Debris Burning Vocabulary List

<table>
<thead>
<tr>
<th>Word</th>
<th>Glossary Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debris</td>
<td>Litter, trash, rubble</td>
</tr>
<tr>
<td>Compost</td>
<td>A mixture of decayed or decaying organic matter used to fertilize soil. Compost is usually made by gathering</td>
</tr>
<tr>
<td></td>
<td>plant material, such as leaves, grass clippings, and vegetable peels, into a pile or bin and letting it</td>
</tr>
<tr>
<td></td>
<td>decompose as a result of the action of aerobic bacteria, fungi, and other organisms.</td>
</tr>
<tr>
<td>Dew</td>
<td>Water droplets condensed from the air, usually at night, onto cool surfaces near the ground. Dew forms when</td>
</tr>
<tr>
<td></td>
<td>the temperature of the surfaces falls below the dew point of the surrounding air.</td>
</tr>
<tr>
<td>Ordinance</td>
<td>An authoritative rule or law; a decree or command. A public regulation.</td>
</tr>
<tr>
<td>Vegetation</td>
<td>Plants of an area or a region; plant life</td>
</tr>
<tr>
<td>Evaporation</td>
<td>The change of a liquid into a vapor at a temperature below the boiling point.</td>
</tr>
<tr>
<td>Ventilation</td>
<td>The act or process of providing a fresh air supply.</td>
</tr>
<tr>
<td>Flammable</td>
<td>Burnable, ignitable</td>
</tr>
</tbody>
</table>

Definitions provided through Dictionary.com
Safe Debris Burning Journal Homework

Name: ________________________________       Period: ____________

Write about what they learned in class about safe debris burning. Look at your home. Does your family burn trash? Does your family do campfires or use a fire pit? If so, describe when you burn and what you burn. Based on what you learned in class today, what can you do differently? Include the following vocabulary words: debris, compost, dew, and flammable (5th and 6th grade students) or debris, vegetation, evaporation, ventilation, ordinance, and flammable (7th and 8th grade students).
Safe debris burning PowerPoint slide

Ask students to identify differences between two images. Left picture is safe debris burning. The burn barrel has a metal screen and the burn barrel is metal with ½ in holes at base. A 10-foot area around the barrel was cleared of leaves. The barrel is elevated off the ground. The person has a hose and rake ready if sparks escape. The person is staying with the burning debris.

The barrel on the right is unattended and there is no rake or water hose. It is not covered with a metal screen and there no ventilation holes at the barrel base. The barrel is located next to a tree. The area around the barrel is filled with dead leaves and a piece of wood (behind right of the barrel) that could easily ignite.

Safe Debris Burning
Safe Debris Burning – What to burn cards

- Plastic Water Bottle
- Aerosole Can
- Cleaning Products
- Tires
- Lumber
- Grass clippings
Poison

Chemicals – weed killer

Leaves

Tree Branches

Toy

Toy
<table>
<thead>
<tr>
<th>Sunny</th>
<th>Cloudy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windy</td>
<td>No wind</td>
</tr>
<tr>
<td>Dry/no rain</td>
<td>Fog</td>
</tr>
<tr>
<td>Noon</td>
<td>6:55 PM</td>
</tr>
</tbody>
</table>
Appendix J

Habitat Restoration Using Controlled Burns

Keywords: Controlled burn, habitat restoration, endangered species

Lesson Plan Grade Level: 5th-8th grade

Created by: Laurie Schoonhoven, project associate, Penn State extension

Total Time Required for Lesson: 50 minutes or 3 17-minute sessions

Setting: Classroom

Subject Covered: Science. Reading, Writing, and Speaking and Listening

Topics: ecosystems, invertebrates, botany, endangered species

Lesson Goals:
Students will be able to list and explain regal fritillary butterfly life cycle.
Students will be able to identify ecosystem restoration stages.
Students will be able to identify three components of the fire behavior triangle.
Students will be able to identify controlled burn benefits.

Materials Needed:
Habitat restoration PowerPoint
Habitat restoration PowerPoint - teacher guide
http://www.youtube.com/watch?v=X41C71aSZ6Q&feature=player_embedded
Regal fritillary handout (one per student)
Regal fritillary fact sheet (one per student)
Pencils (one per student)

State Standards Addressed:
3.3.7A. Describe the similarities and differences that characterize diverse living things.
4.3.7.B. Explain the distribution and management of natural resources.
4.5.6.D. Identify reasons why organisms become threatened, endangered, or extinct.
4.1.7.E. Identify factors that contribute to change in natural and human-made systems.
4.4.5.C. Investigate the factors influencing plant and animal growth.

Common Core State Standards in English Language Arts:
Reading Standards for Informational Text 5-8: key ideas and details; craft and structure; and integration of knowledge and ideas
Writing Standards 5-8: text types and purposes; research to build and present knowledge
Speaking and Listening Standards 5-8: comprehension and collaboration; presentation of knowledge and ideas

Methods: KWL
Preparation:
Obtain permission from information technology coordinator for YouTube access. Read through the entire lesson, vocabulary list, and habitat restoration PowerPoint teacher guide to ensure you understand the materials. Be sure to have all the materials before beginning the class. Create three columns on the blackboard with the headings: “What you know,” “What you want to know,” and “What you learned.”

Doing the Activity:
Introduction to the lesson plan:
“Today we will be learning how one location in Pennsylvania, Fort Indiantown Gap, is using habitat restoration to maintain habitat for endanger species including the regal fritillary butterfly. Fort Indiantown Gap is a military training site in central Pennsylvania near Harrisburg. Our ultimate goal is to understand the role of controlled burn in creating habitat.”

Steps:
1. “Let’s start by reviewing what you know.” Ask students the following questions and have them write the answers in the first column (What you know) on the blackboard. What is an endangered species (e.g., small population that could go extinct)? What is habitat (e.g., food, water, living space needed by plants, insects and animals)? What is habitat restoration ecology? Habitat restoration or ecology is the practice of renewing and restoring degraded, damaged, or destroyed ecosystems through human intervention and action. Why do people do habitat restoration? Habitat restoration is done to create or maintain habitat for endangered species like the regal fritillary.

2. Now move onto the second column, “What do you want to learn about this endangered species and what people are doing to help it?” One approach is controlled burns. How are controlled burns conducted? Ask students what they want to learn and write responses in the middle column. If not already mentioned add regal fritillary characteristics, natural history, preferred habitat, reasons for concern, and management programs.

3. Completing the third column “What you learned,” starts with a group project. Have students break into small groups (4-5 students) and give each group copies of the regal fritillary fact sheet and five regal fritillary handouts (characteristics, natural history, preferred habitat, reasons for concern, and management programs) to read and answer specific questions. Assign a topic to each small group. “I want you to read the fact sheet and answer your small group’s questions on your handout. You will report your findings to the class.” The fact sheet has all the information needed to answer questions.

4. Come back and have the groups report out in the following order: characteristics, natural history, preferred habitat, reasons for concern, and management programs. As student groups report out, other students need to write two facts for the designated topics in the box at the bottom of their handout. For example, students in the biology/natural history group need to write two facts about characteristics and two facts about reasons for concern.

5. “Now that we know a little about the regal fritillary, I am going to show a short video on Fort Indiantown Gap’s efforts to create and maintain regal fritillary habitat. Pay close attention to the butterflies’ habitat.” Show video. Briefly discuss where the violets grow (bare soil).

6. “Fort Indiantown Gap also uses controlled burning to create habitat for endanger plants and animals as well as to restore ecosystems. To learn more about how this is done, we are going to look at a PowerPoint created by Fort Indiantown Gap.” Go through the PowerPoint using the prepared talking points/notes.
7. Return to the blackboard to review what we know, what we want to learn, and what we learned. “Earlier we listed what you know about endangered species and habitat. We also listed what you wanted to learn about regal fritillary butterfly. Now let’s cover what you learned. Who conducts controlled burns and how do they prepare?” Key points for students: trained professionals ignite, control and extinguish wildfires. Before doing a burn, they collect data on the terrain, slope, plants, and trees. They use computer modeling software to develop a controlled burn plan based on site vegetation, expected weather conditions, and desired outcomes. They only do a controlled burn when it is safe. They have equipment and water ready to control and extinguish the fire. However, when trained professionals do not follow the controlled burn plan (i.e., faster wind speed, drier conditions), fires could burn outside their designated area. In some cases, homes are sometimes threatened or lost. But, this is rare.

“Can you think of any other benefits from doing controlled burns?” In addition, a control burn may not have the desired outcome such as killing unwanted plants and trees. In this situation, natural resource professional consider next steps to achieve their management goals.

8. Close out this session by discussing the benefits of controlled burns. Repeated low intensity fires kill unwanted plants and trees. It allows fire dependent species such as oak to grow. The fire returns phosphorus and minerals to the soil. Table mountain pine and pitch pine need the heat of the fire to open their cones and release their seeds.

Assessment:
Use what you know, want to know, and learned exercise to measure student understanding of the subject matter. Students turn in their handouts. Review to ensure they completed the fact section at the bottom of the box. In addition, grade student group presentations.

Lesson Conclusion:
Fire can benefit the environment when done by trained professionals. The military at Ft. Indiantown Gap is using controlled burns to create meadows for military exercises as well as habitat restoration.

Additional Resources:
Pennsylvania Department of Military and Veterans Affairs, Ft. Indiantown Gap regal fritillary project: http://www.portal.state.pa.us/portal/server.pt/community/featured_topics/13476/regal_fritillary_butterflies_at_fort_indiantown_gap/726675

Controlled Burn Vocabulary list (for teachers):

**Nutrients:**
A substance that provides nourishment for growth or metabolism. Plants absorb nutrients mainly from the soil in the form of minerals and other inorganic compounds, and animals obtain nutrients from ingested foods. When fire burns organic matter or fuels, it releases carbon dioxide and nitrogen gas into the air and deposits ash on the soil. Ash is more soluble than the organic matter
from which it originated. Thus fire increases available minerals, phosphorous, exchangeable bases, and soil pH that plants need.

**Controlled burn/prescribed fire:**
Controlled burns are fires ignited, controlled, and extinguished by trained professionals for the purpose of vegetation management including restoring habitat for native plants and animals.
Regal Fritillary Fact Sheet
at Fort Indiantown Gap National Guard Training Center

Identifying Characteristics

- The regal fritillary (*Speyeria idalia*) is a large, orange, and black butterfly
- Forewings variously spotted and marked with black, and the upper surfaces of the hind wings greatly darkened (blueblack in the larger female) and marked by two rows of large spots.
- The sexes; the outer row white in the female, orange in the male. It was once commonly found throughout the Northeast.
- It looks like a "Monarch Butterfly dipped in chocolate."

Reasons for Concern

- Grassland destruction/alteration and loss of food or places to live/grow during critical stages of its life cycle over the past 30 years has reduced its range and abundance. At one time it was found from Maine to Montana and south to Oklahoma and North Carolina. It occurs only in local colonies in Pennsylvania and Virginia as well as from southern Wisconsin west to Montana and south to northeast Oklahoma.
- This is the largest population of this species remaining east of Indiana, a second population occurs at Radford Army Ammunition Plant in Virginia. It is also the largest documented population on a single landholding in North America.
- 219 acres of Training Areas and Ranges have been set aside to conduct research on regal habitat. In addition over 75 acres of dispersal corridor (areas where butterflies can move to live) has been created. All regal-occupied habitat is on an active or inactive military range.

Habitat

- The regal fritillary requires open damp meadows, old fields or pastures with marshy or boggy patches which also support the violets, milkweeds, thistles and other nectar sources the butterfly requires.
- Habitat is created and maintained by repeated, frequent soil disturbance, patchy fires, and stewardship efforts that create diverse grassland dominated by native plants.
- Population is around 1,000 adults and has been secure since monitoring started in 1998.
- Survival and persistence in an area depends on three main habitat components
- Larval host plants - at least 5,000 violets per acre
  - Adult nectar sources - approximately 150 blooming milkweeds and thistles per acre
  - Native warm season bunch grasses - little bluestem (*Schizachyrium scoparium*) and broomsedge (*Andropogon virginicus*) in the order of 30-75% of plant cover.
- Larval host plants - field violets that thrive in dry, grassy areas
  - The main violet species utilized as food is the arrow-leaved violet (*Viola sagittata*)
  - This violet species grows best on bare, low nutrient soils that exist due to light military training activities and both wildland and prescribed fires
  - Research shows violets increase 4-fold after tracked military vehicle activity and 8-fold after a fire for about 3-5 years after the disturbance (i.e., fire, vehicle activity).
- Adult nectar plant survival and abundance is also dependent on periodic disturbances as they are wind dispersed fluffy seeds that need bare soil to grow.
  - Common milkweed (*Asclepias syriaca*) and orange/butterfly milkweed (*A. tuberosa*)
Native thistles: pasture thistle (*Cirsium pumilum*) and field thistle (*C. discolor*)
- Others include swamp milkweed, swamp thistle, wild bergamot, dogbane, Indian hemp, non-native thistles (Canada, musk/nodding, and bull), and exotic spotted knapweed

- Native Warm Season Grasses (grow best during hot, humid summer weather)
  - Little bluestem and broomsedge grasses dominate typical habitat
  - Ft. Indiantown Gap is the best example of warm season grass in Pennsylvania with respect to quality (PA-ecotype) and quantity. Regals use native bunch grasses for protection in all stages of the life cycle.

Current research and monitoring efforts

- Pollard Walk technique - survey routes walked every week during summer to assess abundance and distribution of adults for population comparison among years
- Larval, pupal, and violet plant consumption surveys - visual surveys for presence and occurrence
- Presence/Absence surveys - time-dependent searches for colonization monitoring
- Violet, nectar plant, and warm season grass abundance surveys - habitat and ecological monitoring to aid stewardship and land management activities
- Mark/Recapture (MR) surveys - researchers mark wings to perform population census
- Repatriation (“reintroduction”) project at Gettysburg National Military Park and selected Pennsylvania State Parks funded by Legacy Program (Department of Defense) and the Wild Resource Conservation Program (PA DCNR)
- In 2006, Pennsylvania Chapter of The Nature Conservancy transferred the research and monitoring efforts to The Pennsylvania State University.

Management programs

- Controlled burn is the planned ignition/burning of plants under proper weather conditions in a controlled manner by properly trained and equipped personnel
  - Controlled burn has been used to restore regal fritillary habitat since 2004.
  - Fire decreases the amount of plant leaf litter/mulch and woody vegetation and creates bare soil necessary for the germination of violet, nectar, and native grass seeds; also may reduce pests and disease. Controlled fire is more efficient in reaching these goals than unplanned training incidents and prevents wildfires during critical points in the life cycle
  - On occasion, training related fires occur within regal research areas.
  - Large burns have occurred historically about once per decade based on tree ring data, while small, patchy fire appear to reoccur every 3-5+ years
  - All of these burns, controlled or wildland, provide us with the opportunity to conduct research and monitor fires effect on habitat (landscape) and wildlife.
- Other land stewardship activities
- Mowing, selective herbicide application, and manual tree & brush removal to supplement fire in slowing native woody plant taking over (succession) and non-native plant invasion
- Supplemental plantings of nectar species and violets have been used on post.

Disturbance

- Preventing disturbance by fire or military vehicles leads to the natural conversion of
grasslands and meadows to shrubland or forest

- Plant research plot data suggest that just removing woody vegetation maintains native grass abundance but violet and nectar plant densities decline.

**Regal Fritillary Identification/Natural History:**

Clockwise from upper left: regal larva in habitat three months after a 2004 spring controlled burn; regal pupa (quite possibly the only one photographed in the wild); male regal fritillary butterfly and female regal fritillary (two rows of white spots on hind wing).

- Adults may be found from late May to mid October, but most males are active between mid June and mid July, and females between early July and mid-August.
- Flight each day is low and steady, after an early morning period of "sunbathing."
- Both sexes imbibe nectar from various milkweeds and thistles.
- Females deposit eggs primarily in late summer on various plants as they walk through vegetation close to the ground.
- Eggs hatch in the fall, and the young larvae (caterpillars) over winter. Growth is rapid during the following spring and early summer as the larvae feed at night, only on various violets. The mature larva is velvet black with yellowish or orange mottlings and six rows of barbed spines, which are silver with black tips along the back, and yellow-orange at the base along the sides.
When mature, the larva pupates and completes its development to the adult stage within a chrysalis with a brown and yellow abdomen and pink-brown wing cases, both spotted with scattered dark brown patches.
Regal Fritillary Butterfly Handout

Name: ____________________________  Period: ________________

IDENTIFYING CHARACTERISTICS:

Describe the physical characteristics (color, markings, size) of the butterfly: For example, what color are the wings?

What distinguishes (makes them different from each other) the male and female butterflies?

<table>
<thead>
<tr>
<th>Write two facts about Reasons for Concern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Write two facts about Management Programs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
</tbody>
</table>
BIOLOGY/NATURAL HISTORY:

Describe the butterfly life cycle:

1. Starting with eggs…

2.

3.

4.

What does the mature larva look like?

What is daily routine of adult butterfly?

Write two facts about Characteristics:

1.

2.

Write two facts about Reasons for Concern.

1.

2.
PREFERRED HABITAT:

Where is the regal fritillary found?

What nectar/food sources does the regal fritillary larva and adult butterfly need?

Write two facts about Biology/Natural History:
1.
2.

Write two facts about Management Programs.
1.
2.
REASONS FOR CONCERN:

Historically, where was the butterfly found?

Where is it found today?

Why has the butterfly range changed? In other words, what has happened to the butterfly’s habitat?

Write two facts about Biology/Natural History:
1.

2.

Write two facts about Preferred Habitat.
1.

2.
MANAGEMENT PROGRAMS:

What is being done to preserve (save/protect) the butterfly habitat?

What method do they use to determine the status (health and well-being) of historical and new fritillary sites?

Write two facts about Characteristics:
1. 
2. 

Write two facts about Preferred Habitat.
1. 
2.
Regal fritillary butterfly PowerPoint teacher guide

Slide 1

Material provided by Joseph Hovis and modified by Laurie Schoonhoven, The Pennsylvania State University

Slide 2

Regal fritillary butterflies can be found at Fort Indiantown Gap military proving grounds and Virginia as well as the Midwestern great plains.

Fort Indiantown has diverse plant and animal life including…

Slide 3

In addition to managing for the regal fritillary butterfly, Fort Indiantown Gap biologists also manage for rare species including (clockwise from top left): black-crowned night heron, Allegheny wood rat, hog nose snake (orange snake), brown bat, timber rattlesnake, and spotted turtle. Military training can have an impact on rare species and vice versa.
A variety of techniques are used to maintain diverse landscapes for military training and preserving habitat for rare species.

- Lime fertilizes the soil.
- Seeding is used to disperse desirable grass and plant seeds.
- Prescribed fire or controlled burns create bare soil conditions.
- Reclamation uses mechanized tree harvesters to remove trees.
- Herbicides kill unwanted native and exotic invasive plants. Exotic invasives are plants from other places (US or other countries) introduced by humans.

Fort Indiantown Gap and Pennsylvania has a history of “controlled burns.” Native Americans burned to clear land for agriculture, improving hunting as burned-over sites provide plant re-growth for wildlife. Early settlers followed Native American practices and cleared land for farming by cutting and burning trees and shrubs.

Controlled burns are planned by trained professionals. Note: bottom left photo includes water truck (back right) to extinguish flames. All controlled burn personnel wear protective clothing. This includes Nomex (yellow fireproof) pants and shirts, goggles, helmets, boots, and gloves. They are trained in fire management including building fire breaks and extinguishing fires.
Controlled burns can have both positive and negative impacts on the landscape. Biologists and natural resource managers use fire to create desired outcomes such as killing undesirable trees and shrubs. It also burns dead leaves, grass, and twigs. Negative impacts include damaging or killing desirable plants and trees as well as seed sources. Control burn managers try to minimize negative impacts. Ultimately, repeated controlled burns create open fields.

Note: the person in the lower left image is throwing a fire starter. It is a fire management technique.

Controlled burns also have positive effects. Standing dead trees provide habitat for insect as well as homes for woodpeckers and other animals. Increased oak trees lead to more acorns. Wildlife such as deer, turkeys, and squirrels eat acorns. Fires are used to create patches of forests and meadows. This diverse landscape provides habitat for a wide variety of plants and animals.

In addition, fire ashes provide important nutrients to the soil and create bare soil. Some plants (violets for regal fritillary) need bare soil, increased sunlight, and warm soil temperatures to germinate/grow.
There are several phases for a controlled burn: (note: Image appear as you advance the presentation. Pictures are sequenced top left/right and bottom left/right.)

1. First, biologists and natural resource managers inventory (identify and count) plant and tree species in the area selected to burn. They measure the slope of the land (fire moves faster on steeper slopes). They also look at the weather including expected precipitation (rain), wind direction and speed, and relative humidity. The information is used to develop a burn plan. The burn is only done when it is safe and the fire can be controlled. (Press enter or forward arrow for second image.)

2. Trained professionals start, manage, and extinguish the controlled burn. They wear protective clothing and have water and equipment ready to extinguish the fire. The fire in the slide is low intensity with short flames. Burn done in April 2005. (Press enter or forward arrow for third image.)

3. The landscape after the burn. Remember the burnt grass and plants provide nutrients to the soil. (Press enter or forward arrow for fourth image.)

4. The warm, bare soil is filled with nutrients new plants need to grow. Here is the same field two months after the controlled burn. Look at the abundant green grass. The same field in June 2005.

Regal fritillary habitat. Left side of road was burnt two years ago and right side was burned the previous year. The fire ultimately provides the regal fritillary with place to live, grow, eat, and reproduce.
Ultimately, people enjoy observing the butterfly in its natural/native habitat.