

Interpreting federal policy at the local level: the wildland–urban interface concept in wildfire protection planning in the eastern United States

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Abstract. In 2003, the Healthy Forests Restoration Act (HFRA) called for USA communities at risk of wildfire to develop Community Wildfire Protection Plans (CWPPs) requiring local, state and federal actors to work together to address hazardous fuels reduction and mitigation efforts. CWPPs can provide the opportunity for local government to influence actions on adjacent public land, by establishing local boundaries of the wildland–urban interface (WUI), the area where urban lands meet or intermix with wildlands. The present paper explores local response to the HFRA and CWPPs in the eastern USA, specifically if and how communities are using the policy incentive to identify the WUI. We conducted document reviews of eastern CWPPs, as well as qualitative analysis of in-depth interviews with participants in four case studies. We found tremendous variation in local response to HFRA, with plans completed at multiple scales and using different planning templates. The WUI policy incentive was not used in all CWPPs, suggesting that the incentive is not as useful in the eastern USA, where public land is less dominant and the perceived fire risk is lower than in the West. Even so, many communities in the East completed CWPPs to improve their wildfire preparedness.

Introduction

In recent years, USA government response to natural disasters has reoriented emergency management systems away from only post-event response, and placed greater emphasis on loss reduction through mitigation, preparedness, and recovery programs (Cutter *et al.* 2000). In the case of wildfire management, there has been a noticeable policy change from primarily fire suppression to a more complex agendum of suppression, preparedness, mitigation, and community assistance (Jakes and Nelson 2007). Passed in 2003, the Healthy Forests Restoration Act (HFRA) continues this policy agendum by promoting collaboration around wildfire management and encouraging preparedness in at-risk communities. Title I of the HFRA outlines expedited procedures¹ for hazardous fuel reduction projects and calls for communities to complete Community Wildfire Protection Plans (CWPPs). CWPPs, as described in the HFRA, require collaboration between the local fire department, the state agency responsible for forest management and relevant local government, in consultation with adjacent federal land management agencies. In addition to being developed collaboratively by

multiple partners, the plans must identify and prioritize areas for fuels reduction, and provide recommendations to reduce structural ignitability throughout the community (HFRA 2003). Communities that complete CWPPs have the opportunity to identify their own wildland–urban interface (WUI), ‘where houses meet or intermingle with wildland vegetation’ (USDA and USDI 2001*a*). The present article explores the local interpretation of the HFRA and CWPPs in the eastern United States, in particular the use of the WUI concept as a policy incentive to both influence action on public land and address local needs and concerns.

Background and literature review

What brought about a change in wildfire policy to encourage greater collaboration and community involvement? The emphasis on increased collaboration and community involvement in wildfire management follows a rising trend in collaborative planning around many natural resource and environmental policy issues (Koontz and Johnson 2004). Collaboration is identified as a process by which diverse stakeholders work together to resolve a conflict or develop and advance a shared vision (Gray 1989).

¹The expedited procedures include shortened environmental analysis and predecisional administrative review for hazardous fuels projects, as well as encouragement of expedited judicial review.

Collaboration has been promoted in wildland fire management as an important tool for increasing and improving community wildland fire preparedness (Jakes *et al.* 2003; Sturtevant *et al.* 2005; Jakes and Nelson 2007), because fire management crosses ownership boundaries and involves multiple government partners.

The dominant policy for federal and state land management agencies for most of the 20th century in terms of wildland fire management was for fire suppression (Busenberg 2004). Decades of suppression and the exclusion of fire from many forest ecosystems resulted in a buildup of hazardous fuels (Dombeck *et al.* 2004; Stephens and Ruth 2005). At the same time, more people began moving out to fire-prone areas, either for permanent or seasonal living (Duryea and Vince 2005; Radeloff *et al.* 2005; Stewart *et al.* 2006; McKinley and Johnson 2007). This migration of people into the WUI and fire-prone areas in particular has placed more lives and property at risk. The combination of an increasing population in the WUI, the buildup of hazardous fuels from years of fire suppression, escalating suppression costs, and increasing severity of wildfire seasons prompted a series of policy changes. These include the formation of the National Wildland–Urban Interface Fire Program – now known as Firewise Communities (FIREWISE 2007), the Federal Wildland Fire Management Policy and Program Review of 1995 (USDA and USDI 2001*b*), the National Fire Plan (USDA and USDI 2000), and most recently, the Healthy Forest Restoration Act (HFRA 2003).

As wildfire policy shifts from suppression to a more complex agenda of suppression, preparedness, mitigation, and community assistance, there has been an increasing research focus on preparedness and community involvement in wildfire. Several studies detail homeowner perspectives about prescribed burning (Loomis *et al.* 2001), fuels reduction (Vogt 2002; Winter *et al.* 2002; Daniel *et al.* 2005), and defensible space (Nelson *et al.* 2004, 2005). In a study of several at-risk communities across the country, a research team of government and university scientists stressed the importance of leadership and the formation of networks around community wildfire preparedness (Jakes *et al.* 2003; Kruger *et al.* 2003; Lang *et al.* 2006). When community-level response to wildfire threats in New Mexico was examined, researchers found social responses were as important as structural responses in effectively addressing wildfire threats (Steelman and Kunkel 2004). Other research has explored the federal and state influence on community response in three south-western states, revealing that although the federal government provides direction and funding, state governments exercise influence over community responses through organizational arrangements, programmatic decisions, and access to funding (Steelman *et al.* 2004).

Firewise Communities, the National Fire Plan, and the HFRA all emphasize working with local communities to reduce their risk of wildfire. In order for land managers and agencies to conduct wildfire mitigation measures across ownership boundaries, it is important to further understand the dynamic and diverse natures of these communities (Jakes *et al.* 2003; Cheng and Becker 2005), but this is no simple task. Not only is it difficult to stimulate local responses to natural hazards, but incentive and collaborative policies – such as CWPPs – can meet with considerable variation in local responses (Berke 1998). Field and

Jensen (2005) suggest exploring community experiences implementing land use and hazard mitigation measures as a way to formulate an evaluation framework for policy that could assist both communities and land managers with ways to improve their wildfire preparedness. In addition, there has been a call to evaluate the effectiveness of collaborative processes as a means to understand what can and cannot be expected of them (Conley and Moote 2003). The relatively recent passage of the HFRA, with its call for collaborative CWPPs, creates an opportunity to explore how diverse local authorities are responding to and implementing a federal hazard mitigation policy. In particular, we evaluated the identification of the WUI.

CWPPs and the wildland–urban interface

In general terms, the WUI is considered ‘where structures meet or intermix with wildlands’. There have been efforts to set a specific definition of the WUI, as the Federal government did in 2001 by identifying the WUI as an area with a density of at least one house per 40 acres (or 16.1 ha) (USDA and USDI 2001*a*). However, the WUI itself is not a physical place, but rather a set of conditions that are constantly changing as human development continues to expand into previously uninhabited areas. According to the HFRA, the WUI is ‘an area within or adjacent to an at-risk community that is identified in recommendations to the Secretary [of Agriculture] in a community wildfire protection plan’ (HFRA 2003). This vague statement essentially gives communities that engage in CWPPs the chance to identify and define the WUI as they see fit. Policy summaries and documents related to the HFRA and CWPPs, such as the Society of American Foresters’ handbook ‘Preparing a Community Wildfire Protection Plan’, and the National Association of State Foresters’ ‘Community Wildfire Protection Plans: a Briefing Paper’ emphasize this opportunity for communities to establish a locally appropriate definition and boundary for the WUI (SAF 2004; NASF 2005). The process of defining the WUI in a CWPP may create common ground among diverse participants in fire management, something previous research (Jakes *et al.* 2003) has identified as important for wildfire preparedness. In addition, with the passage of the HFRA, the WUI has become a policy incentive and planning tool to possibly influence action on public land, and set local priorities for action. In order to address the larger question of how communities in the East are responding to the HFRA and identifying the WUI, we explored several questions:

1. How is the concept of the WUI used in CWPPs?
2. What factors influence the WUI definition and designation?
3. Do communities redefine the terms and boundaries of the WUI to meet local needs?
4. What role does the WUI play in prioritizing fuels reduction activities?

An assessment of CWPPs in the eastern USA offers specific insights for HFRA analysis, as well as general insights into *how* communities respond to policy. Such information will be useful not only to the communities and agency staff that have yet to engage in community wildfire protection plans, but also for land managers and policy makers who operate under natural resource planning and policy guidelines.

Methods

The present research was part of a broader project supported by Joint Fire Science (JFS) investigating the development and implementation of CWPPs across the USA. The goals of the larger project are to improve the ability of stakeholders to work together collaboratively to reduce the risks of wildland fire and to enhance the long-term social capacity of communities to address wildfire risk (JFSP 2007). The findings presented here are the first in a series of papers on CWPPs looking at the development of intermediary roles, government involvement, social learning and the creation of communities of understanding, and networks as mechanisms for community wildfire preparedness, among others. Whereas the larger project includes 13 case studies of CWPP development across eight states, the present paper focusses on CWPPs in the eastern USA and includes four of the case studies.

We define the eastern USA as the 33 states in Regions 8 and 9 of the USA Forest Service (see Fig. 1). The East was chosen for analysis based on several factors. Using the Federal Register definition of the WUI, a spatial analysis of land cover and census block data performed by Radeloff *et al.* (2005) found that although the greatest number of houses in the WUI is in California, the eastern USA actually contains the greatest extent of WUI in the 48 contiguous states. Wildfire is often seen as a 'western problem' but large fires are still a part of the many forest ecosystems and threaten communities in the eastern USA, as evidenced by fires in Minnesota, Florida, and Georgia in 2007 (Associated Press 2007) that collectively burned over 300 000 acres (121 000 ha). The majority of social science research related to wildfire in the East has focussed on homeowner perceptions and preparedness (Winter *et al.* 2002; Jakes *et al.* 2003; Monroe *et al.* 2003; Monroe and Nelson 2004; Nelson *et al.* 2004, 2005). Examining how eastern communities have responded to the HFRA and the call for CWPPs will broaden the understanding of wildfire planning and policy as a whole and its implementation in states east of the Rocky Mountains. To address the research questions, we used two methods of data collection and analyses: (1) review of available CWPP documents in the East, and (2) qualitative analysis of four case studies. This mixed-methods approach allowed for a broad look at how the concept of the WUI is used in eastern CWPPs, which was then complemented with the in-depth insights from the case studies.

CWPP document review

In order to qualify for document review, plans had to come from one of the 33 states in Forest Service Region 8 or 9, be completed or updated after the HFRA guidelines were announced in January of 2004, and show evidence of collaboration between the three entities the HFRA requires: local government officials, local fire departments, and the state forestry agency.

An initial internet search conducted in February 2007 using Google and the search terms 'state name community wildfire protection plan/CWPP' turned up very limited results. To facilitate the gathering of plans, a list of CWPPs in Region 9 was

obtained from the Forest Service, and we contacted states that had plans via email and phone. For Region 8, all states were contacted to determine the presence or absence of CWPPs. Statewide coordinators of WUI programs and wildfire planning were asked to provide completed CWPPs from their state. We coded available plans that met the requirements noted above for study variables including: (1) scale of the plan, (2) participants in the plan, (3) use of the WUI concept, and (4) identification of WUI or interface areas.

Of the 33 states in the study area, 15 responded to our inquiry for CWPPs. Twelve states in the eastern USA were found to have no completed CWPPs as of 30 April 2007, although some plans were in progress. The six remaining states did not respond to email or phone-call inquiries. CWPPs may exist in these states, but time constraints prevented further attempts to contact state WUI coordinators. The 15 responding states sent a total of 44 wildfire plans. Of the plans sent, some did not meet the CWPP requirements established for review.² As a result, 29 of the 44 collected CWPPs, representing 10 states, were used for document review, including the four plans from the case study sites (see Fig. 1). Some CWPPs found for the document review served as dual plans for other efforts, including Firewise Communities/USA Action Plan or Natural Hazard Mitigation Plans required by the Federal Emergency Management Agency (FEMA).

Several states did not send all of their completed CWPPs, but rather a smaller subset. Therefore, the population for this document review does not represent a complete sample of CWPPs in Regions 8 and 9, but rather an initial assessment of how communities are responding to the HFRA in their CWPPs.

Case study methodology

Case study data were collected through in-depth, semi-structured interviews with key informants in four eastern communities: Lake County, Minnesota; Barnes and Drummond, Wisconsin; High Knob, Virginia; and Taylor, Florida (see Fig. 1). We identified potential case study sites using established contacts with the Forest Service, internet research, and contact with state officials. Site selection followed guidelines established for the broader JFS project. These criteria included: a completed CWPP, multiple participants, geographic distribution across the study area, presence of federal land, varied planning levels, and varied levels of community capacity. We visited each of the sites for 4 to 5 days, conducting interviews with key informants and touring the communities and adjacent forests.

Sampling strategy for selecting interviewees consisted of contacting the coordinator or facilitator of each plan to identify individuals who were involved in the CWPP process. When the documents were available, interview lists were supplemented by reviewing meeting minutes for participant names, and individuals who attended two or more meetings were contacted. The interviews reinforced our key informant selection, as no names were mentioned during interviews that were not part of our sampling list. We were careful to interview a diversity of stakeholders in each case study, including forestry, fire, and

²Several of the plans not used for the document review were wildfire hazard assessments done for communities by state forestry professionals; others were completed pre-HFRA.

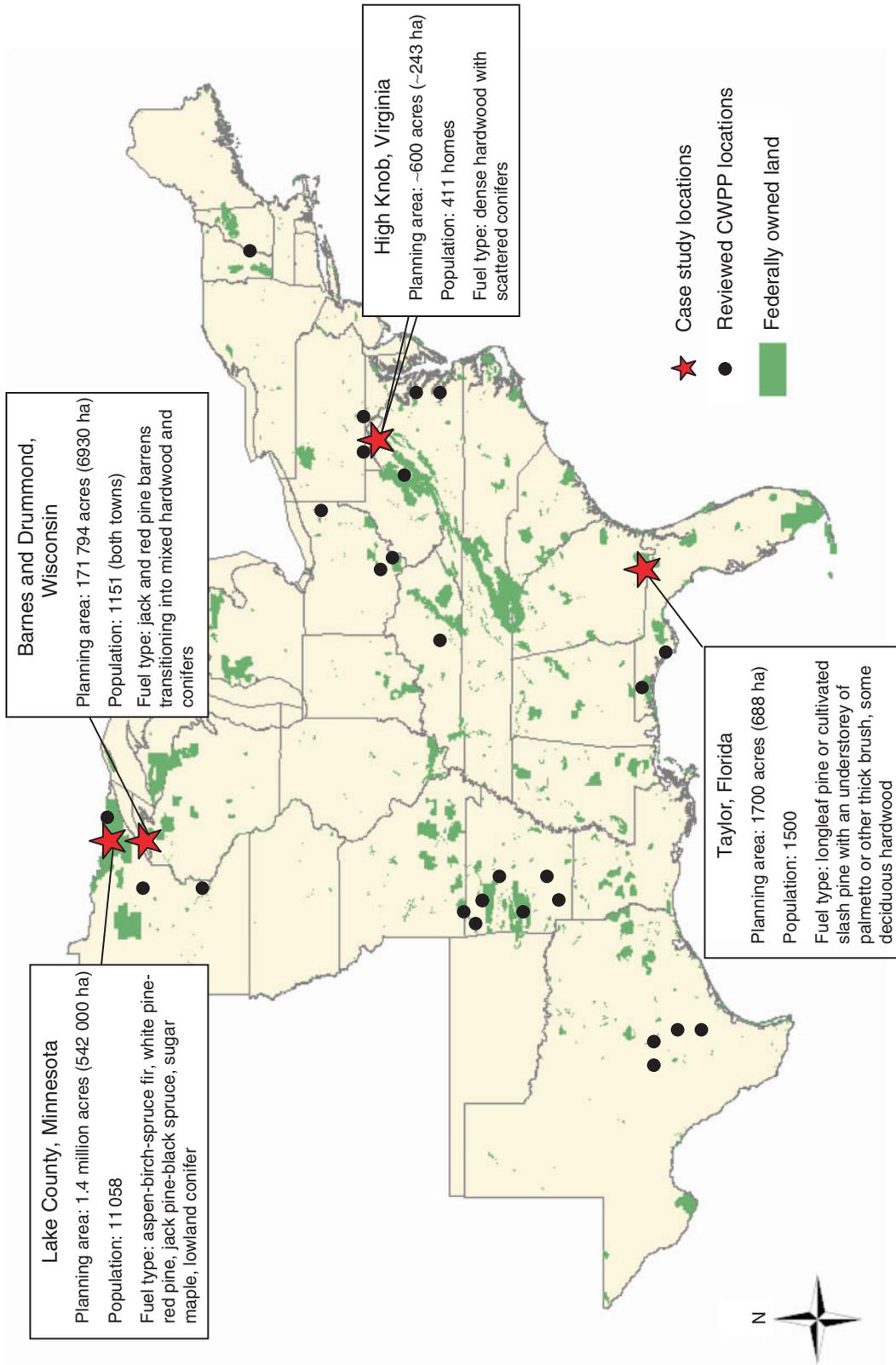


Fig. 1. Thirty-three states considered for document review, locations of case studies and reviewed Community Wildfire Protection Plans (CWPPs).

emergency management professionals at the federal, state, and county level, local elected officials, volunteer fire department members, non-government organization representatives, homeowners' association members and staff, and local homeowners. The full JFS research team developed a 21-question interview guide of closed and open-ended questions that covered three main topics: the context of the community, the CWPP process itself, and perceived outcomes of the plan. We conducted interviews with the majority of CWPP participants across all four cases, but were unable to contact ~15% of the target population. A total of 58 interviews were completed in the four case study sites. The number of interviews per case study varied depending on how many people were involved in the CWPP, as well as how many people we were able to interview. Sixteen interviews were conducted for Lake County, Minnesota; 13 interviews in Barnes and Drummond, Wisconsin; 18 interviews in High Knob, Virginia; and nine interviews in Taylor, Florida. Interviews ranged from 25 min to 2 h in length, depending on how involved the interviewee was and the extensiveness of their responses. All interviews were recorded and transcribed verbatim. Questions pertaining to the WUI were read and hand-coded by two researchers for themes.

Case study site descriptions

Lake County, Minnesota

Lake County is located in the Arrowhead region of north-eastern Minnesota, bordered on the north by Canada and the south by Lake Superior. The county is fairly rural, with most of its 11 058 residents living in the southern end of the county near Lake Superior. Of the 1.34 million acres (542 000 ha) in the county, ~78% is publicly owned. As much as 89% of the county is forested, which includes large tracts of the Superior National Forest and the Boundary Waters Canoe Area Wilderness, as well as county- and state-owned forestland. In Lake County, increases in fire frequency generally correspond with severe droughts that occur in 20- to 30-year intervals. Fire concern heightened in the northern section of the county after a major 1999 blowdown event, which increased the fuel load considerably. For the southern portion of the county, the largest concern is railroad fires along the lines that carry iron ore to Lake Superior ports. The CWPP process for Lake County was initiated by the Superior National Forest, in part as a way to address the thousands of acres of blowdown in the county. After preliminary discussions with the Lake County Board of Commissioners and county lands department, the Minnesota Department of Natural Resources, Sheriff's office, and local volunteer fire departments were brought into the process as well.

Barnes and Drummond, Wisconsin

Barnes and Drummond are two small towns located in north-western Wisconsin, each with a population of ~600 people. Approximately 70% of the 172 056-acre (6960-ha) CWPP planning area is under public ownership and management. The western half of the planning area around Barnes includes large tracts of Bayfield County forest, whereas the eastern half around Drummond is almost completely surrounded by the Chequamegon–Nicolet National Forest. The planning area has experienced more than 80 wildfires in the past 20 years, although

most have been relatively small. In addition to the fire-prone sandy jack pine barrens around the town of Barnes, several wind-storm events have moved through the Drummond area causing blowdown areas, providing a large amount of wildland fuels. The combination of these factors has resulted in an increased awareness about wildland fire events and the development of the Barnes–Drummond CWPP. Federal and state land managers in the Barnes–Drummond area initiated discussion around CWPPs and approached the two communities about their interest. At the same time, the central Wisconsin Department of Natural Resources office was looking for a pilot project on CWPPs. As a result, the communities of Barnes and Drummond were the first completed CWPP in Wisconsin. Participants in the CWPP included elected board members from both towns, the Wisconsin Department of Natural Resources, US Forest Service representatives from the Chequamegon–Nicolet National Forest, Bayfield County forestry and emergency management, and the local fire chiefs for each town. The CWPP was developed with the help of the North-west Regional Planning Commission, a Wisconsin quasi-governmental planning agency, which was responsible for writing the plan, facilitating meetings, and compiling meeting minutes.

High Knob Owners' Association in Front Royal, Virginia

High Knob Owners' Association is a gated community of ~400 homes, outside Front Royal, Virginia. High Knob is located in Warren County, which contains portions of nearby Shenandoah National Park and George Washington National Forest. However, the planning area for this CWPP was focussed specifically on private land within the subdivision. The subdivision is located on a mountainside, with a steep gradient to the top of the mountain and is characterized by dense hardwoods with scattered conifers. The fire risk is considered low, but the facilities manager as well as some residents had major concerns about the buildup of fuels on private property, as well as issues with access, egress and emergency response capability. After an initial assessment by the Virginia Department of Forestry (DOF), the High Knob Board of Directors and staff were contacted about completing a CWPP and obtaining Firewise Communities/USA status. The nearby Linden volunteer fire department became involved in the plan, as well as several homeowners and the Warren County Administrator, who also happens to be a resident. High Knob obtained Firewise Communities/USA status as a result of the plan and the subsequent implementation.

Taylor, Florida

Taylor is a small, relatively isolated community in north-eastern Florida, located ~45 miles (~72.4 km) from Jacksonville. The county estimates that there are ~425 structures and 1500 residents in the Taylor area. The community of Taylor is bordered on the south-west side by Osceola National Forest, John Bethea State Forest to the north and east, and private industrial timberland to the south-east. In recent years, private industrial forests have been sold to real-estate developers and public land management agencies. Wildfires are common in and around the community, and several major fires have threatened Taylor in the past 10 years. This includes the recent Bugaboo Fire in May

2007, which burned over 120 000 acres and caused the evacuation of Taylor residents for several days. The CWPP was initiated by the Florida Department of Forestry, with participation from the Osceola National Forest, Baker County Fire Department and Taylor volunteer fire station. Taylor is an unincorporated community, so the local pastors were brought into the process because of their community leadership status.

Results

Results from the case study analysis and CWPP document review are presented here in a combined format. Whereas the document review revealed trends about the WUI and CWPPs in general, particularly related to scale and the use of templates, the case studies provided more detailed analysis of how participants identified the WUI, and also how the WUI ultimately impacted fuels reduction activities. The flexible nature of the HFRA led to a wide range of reviewed CWPPs. Just over half of the reviewed plans used the WUI, with tremendous variation regarding the method used and how areas were identified. We found the assessed plans developed at four planning scales, using several templates. Both the planning scale and template appear to influence if and how the WUI concept was used in CWPPs. In addition, participants in the CWPP process influenced how the community and planning team addressed the WUI. Local influence, agency participation, and the presence of an experienced planning organization were all found to contribute to the formation of a WUI boundary. Finally, we offer examples from our case studies on how identification of the WUI related to prioritizing fuels reduction projects and moving forward with implementation.

Flexible policy leads to diverse CWPPs

Although the HFRA requires the involvement of 'local government', the law does not specify who that local partner should be. As a result of this flexible legislative guideline, we found CWPPs developed at a diversity of scales. The 'local government' entity ranged from a county commissioner to the president of a homeowner's association. The four planning scales³ identified in the 29 reviewed plans included: county ($n = 5$), multiple townships ($n = 2$), city or township ($n = 13$), and subdivision ($n = 9$). The four case study CWPPs, which were also part of the document review, represented each of these four planning levels. Typically, at the larger planning scales, there was less involvement from local homeowners. Three of the four case study sites involved mainly agency officials working in conjunction with the local fire departments and local government. A majority of the CWPPs used for document review also followed four main planning templates: a 'south-east' template used in Virginia, Kentucky, Arkansas, and Florida; a Texas template; an Ohio and Pennsylvania template; and a Minnesota County template.

Fifteen of 29 CWPPs reviewed explicitly included the WUI concept, whereas the remaining 14 plans did not (Table 1). Of those 15 communities that did identify the WUI, there was a gradient of precision in how the WUI was defined and located. It appears that planning scale, the use of a planning template, and the participants in a CWPP process all influenced if and how the

Table 1. Use of wildland–urban interface (WUI) concept in Community Wildfire Protection Plans (CWPP) across planning scales

| Planning scale | Used WUI | No WUI | Total |
|-------------------|----------|--------|-------|
| County | 5 | 0 | 5 |
| Multiple township | 2 | 0 | 2 |
| City or township | 8 | 5 | 13 |
| Subdivision | 0 | 9 | 9 |
| Total | 15 | 14 | 29 |

WUI concept was used in the CWPP. Although some plans used the WUI concept but did not identify specific areas, others singled out specific neighborhoods, road intersections, or even used Geographic Information Systems (GIS) to spatially define WUI areas. A few of the CWPPs identified the entire planning area as WUI, whereas others subdivided the planning area into different WUI sections. Finally, at least two of the reviewed CWPPs gave a more general statement identifying the WUI as areas near federally managed land, without providing much spatial detail.

Important factors for determining the WUI

Whereas the document review provided an initial overview of if and how the WUI concept was used in CWPPs, the case study analyses allowed a more extensive look at what factors CWPP participants considered for establishing the WUI boundary. Three of the four case study CWPPs identified the WUI: Lake County, Minnesota; Barnes and Drummond, Wisconsin; and Taylor, Florida.

Seven themes emerged from qualitative analysis regarding the factors participants used to define and identify the WUI: *hazards, values, infrastructure, tools, policy considerations, additional criteria, and difficulties* (Table 2). *Hazards, values, and infrastructure* were the most commonly identified themes across the three cases. As the WUI is defined in simple terms as the 'area where houses meet or intermingle with undeveloped wildland vegetation', we expected fuels and structures to play a significant role in the identification of the WUI boundary. Although these factors were identified by several participants, several additional factors that were more specific to the case study sites were also important for identifying the WUI. In Lake County, Minnesota, for example, many participants identified fuels and structures, but the infrastructure of volunteer fire department jurisdictions and fire incidence were the two most mentioned WUI factors. In Barnes and Drummond, Wisconsin, presence of fuels and structures were also mentioned by several participants, but this was in conjunction with various policy considerations pertaining to the Federal Register definition of one house per 40 acres and the HFRA's guidance for identifying a local WUI boundary. Interestingly, some Barnes and Drummond participants also noted difficulties agreeing on what exactly the WUI boundary should be:

'That was probably the biggest area of contention, was the [WUI] boundaries and how they were going to be defined.' (Wisconsin case study, July 2006)

³In the context of the present research, the term 'scale' refers to a planning level, not a mapping scale, thus 'larger-scale' indicates a greater CWPP planning area.

Table 2. Emergent themes and factors used by participants to define the wildland–urban interface (WUI) boundary

| Themes | Factors |
|-----------------------|---|
| Hazards | General ‘hazards’, fuel loads, fire occurrence or incidence, population (human-caused fires), lack of planning |
| Values | General ‘values’, population centers, structures, timber |
| Infrastructure | Fire department boundaries, public land boundaries, distance from fire station (response time), access or egress |
| Other criteria | What needed work, landscape-level planning, presence of public land blocks, local concerns |
| Policy considerations | Ability to redefine the WUI, Healthy Forests Restoration Act definition, population density (one house per 40 acres (16.1 ha)), federal definition |
| Tools | Condition classes, timber typing, local knowledge, risk assessment tool, fire incidence maps, Madison WUI data, Geographic Information Systems, census data, aerial photographs |
| Difficulties | Confusion and conflict on WUI definition and boundaries, changes to the lines, more information needed |

In Taylor, Florida, however, there was no such conflict, as all CWPP participants unanimously agreed to use public land and private timber industry ownership boundaries as the primary determinant for creating a WUI boundary that circles the entire community:

‘It’s pretty well-defined. . . you got government ownership all the way around, and then Rayonier [timber company] owns over. . . on the East side. . .’ (Florida case study, March 2007)

Overall, although participants in these three CWPPs kept in mind the HFRA definition of the WUI, communities used additional criteria for identifying the actual WUI boundaries. The additional criteria show that many communities engaged in CWPPs are modifying the WUI concept to meet their specific local needs and defining the region using other considerations.

The importance of scale

Because fire crosses multiple ownership boundaries, scale is particularly important in terms of CWPP development. The planning scale at which CWPPs were developed appears to have influenced whether communities used the WUI concept. Although large-scale plans that included substantial areas of land identified the WUI, as the planning scale moved down to the subdivision level, the WUI was used less and less (Table 1). In fact, all 14 of reviewed CWPPs that did *not* use or identify the WUI were at the subdivision or small township planning scale.

Large-scale plans at the county and multiple-township level tended to use the WUI concept. Compared with subdivision- or township-level plans that might cover a few hundred acres, the planning area for the Lake County CWPP covered over 1 million acres of private, federal, state and county lands. Given this planning scale, a Lake County CWPP participant said:

‘We wanted to cover most of the county with some sort of WUI. . . wherever we thought that there might be an area that some work needed to be done, we wanted that to be included within a WUI area. So that’s more of the bigger picture, on more of a landscape level.’ (Minnesota case study, June 2006)

In this county-level plan, the CWPP group expanded the WUI concept to fit a landscape level management vision, and therefore separated the county into various ‘WUI areas’. The

CWPP ultimately included the entire county in some sort of WUI.

There was greater variation within the city and township CWPPs: seven of the thirteen plans at this level identified the WUI. Larger cities with more than 10 000 people, covering more land area, were more likely to use the WUI concept in the plans. Some of these city-level plans identified specific areas; examples include Stillwater, Minnesota, and Fayetteville, Arkansas. However, at least one larger city CWPP in Hot Springs, Arkansas, simply noted that the WUI was considered to be ‘generally near National Park lands’. This idea of identifying WUI in less specific terms was reflected in at least one other plan in the smaller town of Knifley, Kentucky.

A majority of the smaller township- and subdivision-level plans did not identify the WUI. For example, four plans in Arkansas following the south-east template had the opportunity to identify WUI but left the space for identifying ‘interface areas’ blank. These communities were all very small, with between 200 and 600 structures.

In addition, none of the nine subdivision CWPPs used the WUI concept in their plans. These subdivision-level plans ranged from just 63 homes in a Maryland community to more than 400 homes in some of the Virginia and Texas subdivisions. Our Virginia case study of the High Knob Owners’ Association was a community-driven CWPP, where many of the interviewees were homeowners or association staff who did not have knowledge of the WUI or fire suppression. When asked about using the WUI concept in CWPPs, the Virginia mitigation specialist who worked with High Knob said:

‘I probably didn’t use it. . . Like I say, I go in and I sit down and talk with these communities as if we’re sitting around your table and talking.’ (Virginia case study, October 2006)

This individual felt that the term itself was not accessible to homeowners. At such a small scale, identifying specific WUI areas was not as useful, because the entire subdivision was considered WUI. The focus of this plan was really on access and egress issues, and fuels reduction on homeowners’ land.

The role of CWPP templates

A majority of the CWPPs used for document review followed planning templates. In conjunction with scale, these planning

tools influenced not only how a community addressed the WUI concept in planning, but if they did at all. One planning template was used by the four south-eastern states of Arkansas, Virginia, Kentucky and Florida, with the same formatting and section headings. Interestingly enough, the only place this template differed was in the 'community background and existing situation' section, where three states included space or lines for identifying WUI, and one did not. For Arkansas and Kentucky CWPPs, this meant identifying 'interface areas', whereas Florida CWPPs identified the 'area of wildland/urban interface' using acreage. In Virginia, however, there was no space within the plan to identify an interface area. This omission was likely a result of the fact that Virginia has chosen to work on a subdivision level for CWPPs, where identifying the WUI appears to take on less significance in the East. Similar to the Virginia version, all the Texas CWPPs reviewed, which follow a separate Texas template, did not include a space for identifying the WUI. Again, these plans were all at the subdivision level. Communities working with either of these templates would not be prompted to identify the WUI, as the planning document does not require it.

The three Ohio CWPPs, following another template, pre-define the WUI as 'any area where potentially combustible wildland fuels are found adjacent to combustible homes and other structures; a zone where man-made improvements intermix with the wildland fuels'. The plans go on to say that '[the community or county] has recognized that conditions in many parts of the property encompassed in their respective fire districts qualify under this definition'. Although the WUI is defined and recognized within the planning area, the concept itself was not defined by CWPP participants.

The fourth template was used in three Minnesota counties, including our case study site of Lake County, Minnesota. These counties divided the entire planning area into 'WUI areas' along fire department jurisdictions, and then modified these areas based on the presence of structures and fuel types. All three of these county CWPPs also used the same risk-assessment tool to prioritize the WUI areas. Landscape-level management played a role in the development of these CWPPs, as our case study revealed, and as a result the WUI was broadly defined.

Participant influence

Participants in the planning process also play an important role in how a community shapes its CWPP and subsequently the WUI. Consulting federal agencies, although not official 'signatories' of a CWPP, influenced whether the concept was used at all, and in some cases what the WUI looked like in the plan. Local government and fire department members also influenced the WUI boundaries for political reasons or based on their knowledge of the landscape. We also found that experienced planners influenced the technical aspects of how a WUI boundary was formed in CWPPs.

The federal consultation role in CWPPs may influence the use of the WUI concept in planning. In the document review, we found 11 of the 29 reviewed plans had federal representative involvement, including agencies such as the US Forest Service, the Army Corps of Engineers, and the National Park Service. It is interesting to note, however, that these CWPPs addressed the

WUI concept, albeit with varying degrees of precision. Alternatively, none of the subdivision-level plans had any federal involvement, even when there may have been federal land nearby. All of the Minnesota counties that used a broad definition for the WUI had large tracts of National Forest land and extensive federal involvement. Similarly, the large tracts of public land and strong federal presence in the Barnes and Drummond CWPP may have influenced how those communities identified the WUI. Most of the Wisconsin respondents referred to the Federal Register definition as a major factor for determining the WUI:

'In comes [the US Forest Service individual], and [he] starts talking about redefining the wildland-urban interface, and that the communities within this process have the ability to redefine the wildland-urban interface, and kept focussing on the idea that okay, one home per 40 acres. [He] brought another perspective in talking about eligibility of funds.' (Wisconsin case study participant, July 2006)

Participants in this plan discussed using the WUI policy incentive to plan mitigation on public land that would be eligible for funding, and also qualify for expedited review under the HFRA. Taylor, Florida, which is a small unincorporated township that may have been less likely to identify WUI, still did so, likely owing to the fact that it too is surrounded by large public land holdings. These results indicate that whereas there is less federal land and subsequently less federal involvement in eastern CWPPs, where federal agencies do become involved in a CWPP, the community is more likely to use the WUI policy incentive to influence activities on public lands. For those communities that are not near federal or other public land, and for those at smaller scales, federal involvement is much less likely and therefore communities are less likely to use the WUI concept.

Local participants in CWPPs brought local needs to the table with regards to the WUI, and also provided invaluable local knowledge for the WUI boundary. In Lake County, Minnesota, the County Commissioner, who was identified by several participants as a 'key player' in the CWPP process, brought both political influence and political will to the WUI boundary decisions. Other participants noted his desire to keep the focus on landscape-level management with regards to the WUI:

'[The county commissioner] also wanted [the WUI] big because...he's thinking problem assessments, problems and solutions, and...for fire that's a lot of talk, fire starts burning and it's burning fast and it's going over a lot of area quite quickly.' (Minnesota case study, June 2006)

In addition to local government, local fire department members and local field-staff played a key role in WUI boundary decisions, particularly in Minnesota, by providing local and on-the-ground knowledge of the planning area:

'[The WUI lines] vary quite a bit. . .we went back and forth, basically drawing lines on the map and that's where the chiefs came in very important, drawing those lines, because they know what's out there exactly, and they know what are the values at risk.' (Minnesota case study, June 2006)

In both Minnesota and Wisconsin, which were fairly agency-driven plans, local fire department members not only brought

this local knowledge with regards to fire suppression and the presence of structures, but they also acted as community representatives.

Finally, we found that the presence of a third-party planning commission or council influenced how the WUI was used within a CWPP. Two of the 29 reviewed plans involved quasi-governmental planning commissions who facilitated the CWPP process and wrote the plans: Berlin, New Hampshire, and our case study site of Barnes and Drummond, Wisconsin. These two plans contained a level of GIS expertise, not seen in the other 27 plans, that was used to create detailed WUI boundaries and maps using spatial data layers. In fact, many Barnes and Drummond participants noted the importance of GIS for determining the WUI boundary. The inclusion of a facilitator and planner with GIS expertise who could manipulate landcover, census, and tax parcel data layers allowed the Barnes and Drummond participants to employ a more technical one house per 40 acres WUI definition. In addition, this technical expertise was used to employ a GIS risk assessment model to determine the highest risk areas for Barnes and Drummond, influencing the WUI.

Linking the WUI to fuels reduction

With the WUI boundary established, the next step for communities is to identify and prioritize areas for fuels reduction. Although a document review cannot provide detail regarding this step, our case study communities provided insight into how the WUI definition related to fuels reduction activities, and also how it linked these to overarching federal fire management goals. The factors that emerged for prioritizing fuels reduction activities were similar to those used to identify WUI boundaries. In all three cases, the most common overarching themes used to identify the WUI were also the most commonly used for prioritizing fuels activities: *hazards*, *values*, and *infrastructure*. However, within these themes, some participants shifted focus to additional factors.

In Barnes and Drummond for example, while participants noted fuels and structures as important for prioritizing fuels reduction activities, emphasis also included access, and what fuels reduction projects agencies wanted to do on an individual basis:

‘Basically the way we handled that was, for the fuel and hazard fuel reduction, the Forest Service came back with what they felt they wanted to do, Bayfield County came back with what they felt they wanted to do, and we came back with what we felt we wanted to do, and so did the towns.’ (Wisconsin case study, August 2006)

Each agency took on implementation separately. For Taylor, Florida, the WUI boundary established at public land boundaries around the community remained their focus and number one priority for fuels reduction. CWPP participants used the actual established boundary as a baseline for creating a community-wide fuel break that would cut across federal, state, and private lands. Even though the WUI line and fuels reduction cut across different land boundaries, it was still implemented on an agency-by-agency basis, similarly to Barnes and Drummond. In general, fuels reduction activities were motivated by the same criteria the CWPP groups used to establish the WUI but specific individual

preferences influenced the prioritization of which projects would be completed first.

Discussion

Incentive and collaborative policies intended to reduce natural hazard risks at the local level are often met with considerable variation in local response (Berke 1998). This observation is supported by our assessment of CWPPs and the response to the HFRA in the East. We found plans completed at different scales, ranging from small subdivisions to counties with over a million acres. Although several communities were taking advantage of the policy incentive to identify the WUI in CWPPs, particularly those near federal land, many other communities were not using the WUI concept at all for CWPP planning. Because much of the eastern USA is already considered WUI (Radeloff *et al.* 2005), drawing distinct WUI boundaries is a more difficult task. Even among those plans that did identify the WUI, there was tremendous variation regarding how they did so.

As previous scholars have noted, even though community-level approaches to wildfire can be more effective (Burby and May 1998), state and federal levels of government are often more concerned about wildfire management as they bear the majority of costs associated with suppression (Steelman and Kunkel 2004). Not surprisingly, state and federal government were actively participating in the creation and implementation of CWPPs in the East. State governments in particular are playing a lead role developing CWPPs across the East, which is encouraged by the law, given their inclusion as a ‘signer’ of the plans. Past studies revealed that while federal government influences and encourages community responses through funding, state government exercises control over community response based on organizational arrangements, programmatic decisions, and access to funding (Steelman *et al.* 2004). We found that programmatic decisions made at the state level, such as what scale to work at and what template to use, can influence not only the size of the planning area, but also if and how the WUI concept is addressed within the plans. In Virginia, for example, all of the CWPPs are done at the subdivision level and follow a template that does not include a place to identify WUI. Virginia, as well as Arkansas and Kentucky, have also chosen to integrate CWPPs with the Firewise Communities/USA program. Along with state direction and guidance, federal involvement in eastern CWPPs also appeared to influence how the WUI concept was used in CWPPs. Although overall federal involvement in CWPPs in the East is predictably less than what we would expect to see in the western USA, those plans that did include consulting federal agencies were more likely to identify a WUI, where they might influence action on public land. It is important for policymakers to recognize not only that a vague policy such as CWPPs has resulted in broad interpretation and therefore a range of plans, but it has also allowed state and federal agencies to complete and implement CWPPs at different spatial scales, and with different objectives in mind.

Even with state and federal involvement, did we see communities in the East modifying the WUI to address local needs? Yes, in the sense that these communities worked in conjunction with agency staff to identify local problems. Although our case study sites that identified the WUI were agency-driven plans,

the presence of local leaders and local representatives was still important for identifying the WUI, supporting previous studies that emphasized local leadership (Jakes *et al.* 2003; Lang *et al.* 2006) and local knowledge (Jakes *et al.* 2003; Kruger *et al.* 2003) as important factors for wildfire preparedness. The political influence provided by local government, as well as the local knowledge provided by field-staff and volunteer fire department members were important for formulating the WUI boundaries. Ultimately however, in the eastern USA, agency involvement and interest appear to be a strong catalyst for completing a CWPP, rather than a bottom-up approach where the local government or community approaches the agencies.

Another critical aspect of wildfire preparedness is finding common ground among the many participants who engage in wildfire mitigation and suppression activities (Kruger *et al.* 2003). Even with established and specific definitions like that in the Federal Register, the WUI is not a specific place, but rather a set of conditions (NASF 2002) that these CWPP groups had to agree on. When you bring diverse agencies and different levels of government together, it is possible to have disagreement over a negotiated concept such as the WUI. Some CWPP groups were able to achieve this common ground, such as the planning group in Taylor, where the team unanimously agreed on a WUI boundary that surrounded the community, based on public land boundaries. This boundary translated into prioritization of a community-wide fuel break that crossed several land ownerships. However, in the Wisconsin case, even with the technical and planning expertise of a trained facilitator, historical precedent and organizational culture (Cheng and Becker 2005), led to difficulty agreeing on how to establish a WUI boundary. Subsequently, there was conflict over how to prioritize areas for work and a tendency to define projects within public land controlled by single agencies, rather than across the landscape as a team. CWPPs are creating opportunities for the many stakeholders in wildfire management to come together, but the long history of fire suppression and the diverse agency directives and management styles still create barriers for collaboration around defining the WUI and implementing fuels reduction.

Conclusions

Even though the perceived wildfire threat in the eastern USA is less than that in the West, many eastern communities are taking steps to reduce their wildfire risk by completing CWPPs. Our findings revealed that communities are interpreting the HFRA with tremendous variation at the local level, working at different scales, using different planning tools, and involving diverse participants. All of these factors can influence if and how communities utilize the WUI policy incentive in CWPPs. Although larger-scale CWPPs and those plans with federal involvement identified WUI areas, the policy incentive of identifying the WUI may not be useful for all communities in the East. The incentive is designed to give communities the ability to influence action on public land, but in the eastern USA, the majority of land ownership is private. Even though some plans did not use this policy incentive, many CWPPs in the East are still successfully completing CWPPs and working with agencies to reduce their fire risk by planning mitigation efforts and improving suppression efforts. Many plans were done at smaller scales and focussed

their efforts on their immediate surroundings and reducing fire risk on private property.

The power of identifying the WUI to allow local influence on public land fuel treatments may be greater in the western United States, as evidenced by our eastern case studies with land ownership patterns similar to that of the West. The use of this policy incentive in western CWPPs should be investigated, and may provide a useful comparison with the eastern plans. Even though the WUI was not used in all eastern CWPPs, the concept itself continues to be valuable as a planning tool because of its ability to frame landscape-level issues for local planners. Identifying the WUI gives communities and agencies an opportunity to make management distinctions between developed space and public lands, as well as ecological differences between managed forest, open space and urbanized areas. As this distinction continues to blur and more people move out into the wildland-urban intermix, we may see an evolution of the use of the WUI concept in the context of planning. For now, the WUI remains a good tool for communities and agencies that wish to call attention to landscape-level issues.

Acknowledgements

The present research was funded through the Joint Fire Science Program, study no. FS-NC-4803, as well as the Department of Forest Resources at the University of Minnesota. The authors thank Tony Cheng and Emily Saeli, Colorado State University, Victoria Sturtevant, Southern Oregon University, Sam Burns, Fort Lewis College, and Alex Bujak, US Forest Service, for their assistance over the course of the present project. We would also like to thank Dennis Becker, University of Minnesota, for his guidance and insightful suggestions for the present paper. In addition, the authors would like to thank all of the community members and agency officials we spoke with in the four case study communities in Minnesota, Wisconsin, Florida and Virginia, as well as all state and federal agency officials who assisted with the CWPP search.

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Manuscript received 29 May 2007, accepted 24 June 2008

Appendix

Note: The interview questions used to answer the research questions of the present paper were part of a 21-question interview guide developed for a Joint Fire Science-funded research project looking more broadly at Community Wildfire Protection Planning across the United States. The interview guide covered participant background, community background, the CWPP process, and CWPP outcomes. The questions specifically analyzed for the current study are included below, and were in the CWPP process and outcomes sections.

CWPP process

11. Did the team try to define the WUI? If so how? Tell me about how the team defined the WUI. What factors went into deciding where to draw the line?
 - a. Who were the major participants in defining the WUI?
 - b. Land ownership?
 - c. Availability of information?
 - d. Housing density?
 - e. Fire ecology and history?
12. Tell me about how the team prioritized fuel reduction activities.

CWPP outcomes

19. Federal policy encourages the development of CWPPs as a way to address the following four goals:
 - Reducing fuels
 - Restoring forests
 - Private property responsibility of fuels management
 - Improving wildfire suppression efforts.
 - a. Does your plan address these four goals? How?
 - b. How does the plan address [state's] goals and concerns about wildfire?
 - c. How does the plan address [county's] goals and concerns about wildfire?