Collaborative Planning in the Wildland Urban Interface

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Abstract: Issues and impacts previously viewed as either urban or rural have merged as a result of increased urbanization. Increased expectations, conflicting values and lack of understanding have added to the complexity of land use and community sustainability. There is a growing need for coordinated planning and understanding of impacts, mitigation and resource management for affected communities. Collaboration also implies the ability to readily share information and decisions both for those with responsibility to act and their stakeholders. This presentation focuses on incorporating current understanding of fire ecology and emergency preparedness into community planning. This paper attempts to illustrate the magnitude of the issues and offers insights into several examples in the use of geospatial technology to address the issue.

Introduction: As a society we continue to experience an acceleration of change and impacts bringing challenges globally in cultural values, politics and the economic sector. We have seen changes in populations emigrate from some regions to others. We have witnessed impacts from the continued shift away from a production based economy to increases in the service sectors and an explosion in information technology. Our society and its mobility are core to the vitality and rhythms of the country. Many urban areas continue to grow and populations are drawn for a variety of reasons, most being drawn for improved employment or life styles and many other reasons that define upward mobility.

The continuing urbanization of the population can best be seen in population shifts and is manifested by some of the "fastest growing counties in the country". Expanding subdivisions, increased property values, increase tax revenues are some of the indicators of that growth. The shift is also reflected in how we view and understand the environment. Much of that movement occurs in areas where many now have the economic freedom to live in places of natural attraction and a life style that includes the outdoors. These are the very same areas that have evolved and continue to be impacted

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by fire. What was once distinctly urban and rural have blended to suburban and exurban lifestyles. We continue to see a continuing trend of communities grow in areas sometimes described as “nestled in the pines”. There is not only a clash of values but an increasing need of understanding for the environment in which many choose to live. Ironically, many who desire to live in these expanded urban areas and preserve the values which drew them, often espouse the values of ecology.

Those of us in the natural resource professions have witnessed these changes first hand and continue to be challenged by a shift from resource outputs to long term outcomes, if you will from sustained yield to sustainability. While those terms clearly share the root word, the expected results represent a wide spectrum of public perception and social values. As an ultimate irony, we see significant lack of canopy cover in most urban areas and severe overstocking in adjoining wildlands. In the midst of these changing conditions and expectations there underlies a key element of ecological principles - the dynamic nature of change.

Fire Elements: Fire continues to be an ecological agent of change and many of us have seen increasing fire severity, intensity and its impact on social values. However, fire remains a natural phenomenon and needs to be defined in the context of natural disturbance. Fires are sustained by heat, oxygen and fuel. Fire spread is further influenced as a result of topography, weather and fuel condition. Fire behavior is defined by two key variables, rate of spread and resistance to control. These same measures of fire variables are synthesized and expressed as fire danger to the general public.

From an ecological context, the country is divided into fire regimes. In short, it is a classification of how often fire occurs in the natural state. Defined as fire return intervals, there are classifications from areas that see fire every few years to those that are hardily ever affected by fire. Further study looks at the last time the area was affected by fire. Defined as condition classes they categorize whether the area is within the normal regime, if it’s missed some “intervals” or if there are outside the normal ecological cycle of fire. Together these classifications provide a sense of what to expect in the face of fire.

Fuel conditions are another key element to the equation. The term fuel loading refers to the amount of fuel for a given area. Fuel arrangement refers to whether fuels are compacted or spread widely over the area. The issue of fuel continuity is also an important consideration. Crown bulk density is an element of how fire behaves and spread. Specifically it is a measure of whether the crown will carry fire and when conditions are favorable these are the most intense and severe of fires. The last element of consideration is fuel moisture, a function of precipitation and a product of the ecotype. It influences both species composition, flammability and often expressed as a percentage of fuel weight and fuel size.

Given ignition, and the existing fuel conditions the weather is the next variable that drives fire behavior. The most important are wind direction, wind speed and relative humidity. Changes in these key variables either sustain burning condition are can drastically change fire dynamics. Weather driven implies the fire dynamics are a function of all the prevailing meteorological conditions. Plume dominated implies that the fire is being sustained by its own energy and the prevalent fuel conditions. In short, the combined variables define conditions that sustain the life of fire.

Setting: This discussion started with forests in an urban setting and more and more the issues of the wildland urban interface becoming of increasing concern. A review of some of the recent events serves to illustrate the scope and scale of the issues and the increasing impact from fire.

- Oakland Hills Fire, California: Oct 20, 1991. A human caused fire, thought to have been extinguished, comes to life in an off shore wind event that exploded in the East Bay hills. As fires go, it was not significant having burned only 1600 acres. However the impacts included 25 fatalities, 150 injuries, almost 3000 homes lost and $1.5 billion in damages. Contributing factors included steep slopes, high temperatures, strong winds and low relative humidity. Combustible building materials (shingles and decks), dense vegetation and "closely spaced eucalyptus" were significant added factors.
- Buffalo Creek Fire, Colorado: May 18, 1996. The human caused fire occurred in the South Platte drainage and threatened several communities. The drainage also served as part of the water supply for the City of Denver. The fire was contained without any serious injuries but the subsequent flash flood resulted in two deaths. The cost of the suppression was approximately $4.2 million. Denver Water Board expended in excess of $20 million to clear sediment and debris from Strontia Reservoir.
- Florida Wildfires: Florida, June-July 1998. Over a six week period, more than 2,500 fires burned over 500,000 acres with over 300 homes destroyed with sustained threats to public safety. The state was faced with county wide evacuation orders (most notably Brevard, Volusia and Flagler) and challenged with an unprecedented need for interagency coordination and unified command. Cost for suppression exceeded $135 million as a result of a national mobilization effort. Contributing factors were the impacts of prolonged drought, accumulation fuels and fuel type. Some managers believe that "without the nation's largest prescribed fire program, the efforts would have been even more difficult to contain and control".
- Cerro Grande Fire, New Mexico: May 4, 2000. With all the best of intentions personnel from the Bandelier National Monument ignited a prescribed fire with an approved plan. An escape and a subsequent wind event pushed the fire to Los Alamos resulting in an 18,000 acre fire that destroyed 235 homes, damaging many other structures and posed a significant threat to the Los Alamos National Laboratory.
- Southern California Wildfires: California Oct-Nov 2003. Multiple fires, involving multiple counties make the Siege of 2003 the worst fire impact in California history. Statistics included: 24 fatalities, 273 serious injuries, over 750,000 acres consumed, approximately 5200 home building and businesses destroyed. Suppression costs exceeded $123 million. Subsequent flooding and mudslides claimed 12 lives. Ironically this significant impact occurred in a year of below average wildfires across the nation

Should you believe these are just incidental statistics a short review of recent experiences impacts would include the following:

- Spokane Fire Storm, Washington, 1991
- Kenai Peninsula, Alaska, 1991, 1996

- Sydney, Australia: 1993, 1994, 2002
- Sunrise Fire, Long Island New York, 1995
- South Africa 1998
- Jasper Fire, South Dakota 2000
- Hayman, Missionary Ridge, Mt Zirkle Fires, Colorado, 2002,
  (Burning simultaneously with 23 other major fires, each of these interface fires qualified as "largest in state recorded history")
- Canberra, Australia 2003
- Firestorm, British Columbia, Canada, 2003
- Portugal and Spain 2005
- Texas and the Northwest 2006
- Day and Esperanza Fires, California 2006,
  (Significant toll in costs and more importantly, in the loss of life)
- Victoria, Australia, 2007

Policy evolution: The case of evolution in fire policy might best be described by the phases that reflect the needs of the time, prevailing social values and political expectations. The phases of fire policy evolution could be characterized by the following:

- Fire protection - "the moral equivalent of war"
- Fire Control – 10 am policy
- Fire Prevention – only you can prevent forest fires
- Fire Management – appropriate management response
- Fuels Management – application and use of prescribed fire
- Fire Ecology – fire restoration and land stewardship

The dichotomy of providing community protection and a recognition of the need to restore fire in the ecosystem continue to influence the evolution of fire policy and land management. Local governments are looking to land planning, codification and some measure of home owner responsibility for mitigation. The growing situation and impacts continue to challenge fire managers, local governments and influence changes in national policy

The interface places critical challenges to suppression tactics. The traditional line of structural fire protection and wildland fire fighting techniques and tactics have blended. Challenges exist in communication, mixed command and coordinated tactics. The issues and solutions vary by locations, statutory authorities, frequency of events and technical expertise.

Planning: Fire planning involves accounting for local fire history, determining "values at risk" and determining the appropriate level of fire protection needed. Current expectations are to seek an interagency approach that aligns common approaches and solutions for all elements of fire programs. Efforts need to synthesize current conditions, key objectives and common outcomes. It implies that stakeholders understand decision processes and the need for those with decision responsibility to work across jurisdictional boundaries toward a common good.

The capability to respond and need for command oversight is linked critically to spatial perspectives and temporal influences. Simply put, it defines the event, its location, and the expected extent of the impact. Beyond the characteristics of the event, emergency managers look to identify vulnerabilities and to understand what values are at risk. Behind those questions is the need for blending data, sharing information across jurisdictions, providing analysis and synthesis to meet critical timelines.

There is increasing sense of understanding and utility of risk assessments. Conventional protocols includes an assessment of risk (probability of the event), hazards (the characteristic of the event) and values (effects of the event, both positive and negative). The ability to integrate and to share information is becoming increasingly important to affected communities. The ability to blend these elements of strategic planning provides a foundation for decisions and activities. The ability to infuse real time information brings the element of tactical applications that improves decisions and gives affected publics an edge with preplanned responses.

Technology & Tools: Developments in information technology provide many ways to stay informed and remain engaged. Geospatial technology allows a chance to see the bigger picture and provides the ability to assess local conditions and explore alternative outcomes initially without the rigors of jurisdiction boundaries. It can provide the platform and ability to facilitate collaborative approaches and to consider a wider range of possible solutions.

In emergency management everything that may be affected or influenced is related and connected in space. That connectivity both spatially and temporally remains key to efficiency and literally can make a difference in life or death decisions. Geographical Information Systems (GIS) provide the capacity to build and synthesize layers of spatial information and the ability to link other data to locations on a map. GIS applications are an integral part of any emergency management platform providing a visual communication of risk to decision makers and affected publics in an intuitive way. GIS, in concert with remote sensing, has vastly improved the situational awareness necessary to provide the confidence for both responders and incident managers. By its very nature incidents in the interface bring a multitude of resources. GIS serves to provide a common operating picture to responders and emergency managers. There are numerous examples of applications and extensions applied in a variety of situations that demonstrate the strength of spatial analysis.

Emergency response tends to be the most visible and politically volatile phase of emergency management. However, managers face the largest investment in time and skills in planning and mitigation. Post incident recovery, especially if drawn out over time is a significant impact of time and budget. Seasoned emergency organizations have learned to look to emergency incidents as planned events. The planning and training are focused on the widest possible outcomes. The investments provide the ability to improve response capability, anticipate changes and adjust accordingly.

Beyond the benefits to emergency management, there is a need to address fuel reduction, ecosystem health and the application of prescribed fire. Spatial analysis allows partners to identify areas of highest priority for mitigation, for action or the need to protect

sensitive resources. GIS platforms provide not only the big picture it also provides a means of scheduling so that partners can coordinate efforts for efficiency. Applications and functionality range from mobile, wireless data acquisition to information obtained from the Internet processed and shared through server capacity. GIS provides the ability to bring spatial information regardless of source or scale and merge them in support of detailed analysis or decision support. Affected communities and stakeholders have an improved means to engage in solutions.

Geographical Information Systems (GIS) provides the common planning and operational platform, especially in support of time dependant decisions. Shared data and information, shared decisions and shared response are critical elements in the wildland urban interface. Among some of the trends in technologies and applications are:

- Mobile GIS for data acquisition, with capacity for real time loading and sharing.
- Server base technologies to author, publish and share geographic information.
- Image processing that works on the fly and serves on demand.
- Interoperability and transformation features that facilitate data sharing and integration.
- Analysis and visualization which provide tools for spatial analysis, modeling and display to improve understanding of variables and affects of decisions and actions.

The focus of community based planning continues to increase and the need to engage constituents continue to both affect the public and government officials. Community based programs for urban forestry, Firewise, forest health, biomass utilization, community composting, are increasing. Volunteer fire assistance, economic action plans, public education programs are all being mobilized to address these issues on many fronts and at many levels. All appropriate efforts need to be brought to bear, not as separate programs but as a combined package aimed at common goals. Solutions in the wildland urban interface hinge on the ability to integrate, leverage and share critical information and shared solutions. Evolutions in technology offer the ability to synthesize and share information, improve understanding and build linkage. At a time of increased complexity, multiple objectives and integrated planning, utility of geospatial information provides the common platform and improves the ability to the whole picture as more than a sum of its parts.

Conclusion: In the context of the urban interface, there is a growing recognition that events from far beyond city boundaries could result in impacts to the heart of urban communities. We are continuing to understand that municipal boundaries blend seamlessly with areas that maintain a wild character. Recent discussions refer to the increase of vegetation as a result of suppression or lack of intensive management. In my view it is merely a changed condition brought about by various factors. Invasive species have added to the equation as are the impacts of drought and subsequent insect attack on various forest components. Ecologically, it is the dynamic of seeking a new equilibrium.

The urban interface is a setting of increasing volatility and exposure to personal safety and property loss. Regardless of location the interface is subject to increasing fire severity and intensity. Globally the impact of urbanization, especially those in fire prone systems pose continued challenges to responders and residents alike. For some it is the

recognition that fire is an ecological agent that can influence ecosystems and communities. For others there is a false expectation that an emergency call will provide for their protection. Others recognize that like other natural hazards there is a need for personal preparedness. Recent world events continue to illustrate the impact of natural hazards, some can be mitigated, there are others however, whose scale and scope continue to challenge our imagination. How we choose to assess risk and determine how to respond makes a significant difference. Despite our very best efforts there remains no guarantee for prevention of loss of property or exposure to personal safety.

The fire situations we face are changed conditions in fire intensity, fuel loadings and values at risk. The solutions will undoubtedly also require a sustained effort in changing human experiences and conditions. We as a community need to understand the risk of our choices, learn to recognize our vulnerability and take reasonable and prudent measures for mitigation. We as a society need to continue to address the interaction between systems - the ecological and the human.