

Managing Wildland Fire Risks: Climate and Weather Information and Uncertainty

Co-Investigators:

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Background:

Wildfires are an ongoing source of risk for homeowners, communities and public resources, particularly in the rapidly developing urban/wildland fringe areas of the western states. Climate plays a role by affecting the probability, extent and intensity of fire events. As development increasingly pushes into vulnerable areas, wildfire is becoming a more tangible and potentially significant risk. Questions are arising as to whether development decisions adequately take fire risks into account. Much attention is now focused on identifying appropriate individual and community and county-level actions that can be taken to reduce the likelihood of damaging wildfires or to mitigate their impacts.

Activities that can be undertaken by individual homeowners include selecting building sites with lower background risk (as determined by topography, access, proximity to water and characteristics of surrounding vegetation) and undertaking specific risk mitigation investments, such as installing fire resistant roofing, tree thinning, creation of defensible space, and access improvements. At the community and county levels, land use planning, zoning and building code policies can influence the activities of developers and homeowners. In addition, communities are also in the position of making investment decisions regarding fire-fighting capacity, management of vegetation on public lands and road construction.

Project goals:

This project seeks to develop methods to: (a) identify the significance of uncertainty about wildfire risks, including climate-related variability in such risks, and (b) document what people understand about wildfire likelihood and behavior and about the role of climate variability and (c) assess the value of various types of information for decisions regarding land development and wildfire risk mitigation at the urban/wildland fringe. Addressing these issues requires adequate characterization of the decision context – i.e., the many other factors driving people’s decisions to locate in fire-prone areas, including demand for access to recreational and aesthetic amenities.

Approach:

We take the perspective of looking at the relevant decisions as both investment and consumption decisions made under uncertainty. A home building decision, for example, is a long-term investment that is expected to yield a multi-faceted stream of consumption benefits over the life of the structure. An interesting aspect of this decision problem is the fact that valued attributes of a site may be coupled with undesirable exposure to fire risk. At the broad scale, the forested setting that attracts people to an area is itself the source of the risk. At the site level, hilltops that are valued for views and canyon bottoms that are aesthetically pleasing, both tend to be especially high-hazard types of sites with respect to wildfire. In addition, structures can be made more resilient to fire, but always at a cost. Tradeoffs are, therefore, inevitable.

There are well-developed models of such decision problems, which suggest that individuals will make appropriate tradeoffs, if they are both well informed about the objective probabilities of loss-producing events, and they bear all of the costs and benefits associated with development and use of the property. In reality, however, those conditions may not hold – in fact, they generally do not. People may have imperfect information about the risks that they are facing, and there may be uncertainty about how the likelihood of hazardous events will change in the future. In addition, there may be significant spillovers or neighborhood effects, such that the risk faced by an individual property owner is determined, in part, by the condition of surrounding properties.

From a policy perspective, building codes protect the unwary, and zoning ordinances and tax levies are justified by the fact home builders impose costs on communities. Development of effective policy requires understanding how individual decisions are actually being made.

This project examines the extent to which decisions to build or to engage in risk mitigation investments are sensitive to differences in perceived probabilities of potentially damaging fire events. As part of this work, we will use a decision tree tool to identify the probability thresholds at which we might expect decisions to change. Those results will be used as a benchmark against which to evaluate individuals' preferences and beliefs as revealed by their actions. The primary focus of the project will be on the development of methods to elicit information about how people form their perceptions of wildfire risks—and in particular how scientific information does, or could, play a role in promoting realistic understandings of these risks.

Research Activities:

This has been a small exploratory research activity. We began with a review of the literature and creation of a directory of web-based resources pertaining to the policy environment for wildfire risk management. Work then progressed to preliminary model development, data acquisition, and definition of a potential research program.

Ongoing work involves three activities: 1) explore the sensitivity of decision outcomes to uncertainty – using the decision tree model to back out the threshold probabilities that would cause decisions to change; 2) elicit information from experts and from published literature on wildland fire frequency and behavior, together with sensitivity to climate variations; 3) conduct a survey of property owners regarding their interactions with climate and wildfire risk information: ◦ where do individuals get their information about the risks they are facing?; ◦ how strongly they believe it?; and ◦ what actions do they take relative to the set of available responses?

Future Work and Link to NCAR Wildfire Initiative:

This project will survey homeowners about their wildfire mitigation investment decisions. Using a web-based scenario driven program respondents will answer questions about what they believe about the likelihood of fires of various magnitudes in the area near their homes, the potential effectiveness of a set of possible mitigation actions, and how they make decisions about risk and mitigation. Specifically the survey will address how information about climate influences economic decisions about household mitigation actions. Initially, the tool will be used to provide information to the project about the role of scientific information in mitigation investment decisions. Ultimately, it will be redesigned so that it can be used by homeowners to inform their mitigation decisions and to provide input to community planning efforts.

Procedure

Brian Muller and a team of programmers in the College of Architecture and Planning at the University of Colorado are currently developing the scenario program as part of NCAR's Wildfire Collaboratory. Stacey Schulte will work with Brian to create an element of the tool that will address the questions summarized above.

The survey will be conducted in two ways. The first will be through homeowners associations in several Colorado counties. Selected counties will vary based on fire risk and amount of information that has been disseminated to residents. The program will be taken to homeowners association meetings where members will respond and comment on the instrument. In addition, a letter will be sent to residents of several fire districts in the state asking recipients to go to the web site and respond to the survey.