



International
Association of
Wildland Fire

Extended Abstracts from the Human Dimensions of Wildland Fire Conference October 23-25, 2007 Fort Collins, Colorado

Sponsored by:

The International Association of Wildland Fire

In Conjunction with:

Interior West Fire Council

Additional Sponsors:

Canadian Forest Service

Colorado State Forest Service

Sustainable Forest Management Network

Fire and Aviation Management

Joint Fire Sciences Program

Pacific Northwest Region

University of Alberta

USDA, US Forest Service

Wildland Fire Lessons Learned Center

Thank you for joining us along the Front Range in Colorado for a conference aimed at advancing the knowledge and practice related to the human side of managing fire prone landscapes. Specifically, this conference was intended for researchers and professionals involved in the science or practice of the human dimensions of wildland fire including suppression, fuels management, and community preparedness

Many within the wildland fire management community and the human dimension field of study will recall the report to the National Wildfire Coordinating Group titled: "Burning Questions". This conference "Human Dimensions in Wildland Fire" was in response to that report.



The objectives of the conference included:

- To serve as a venue for communication between wildland fire managers (policy makers, community planners) and social scientists - managers communicating their management problems and research needs to the science community and scientists communicating their research findings to the management community.
- To expand and build the network of individuals involved in human dimensions of wildland fire management:
 - *Researchers in various disciplines related to human dimensions of wildfire*
 - *Wildland fire and land managers, and community representatives, facing the challenges of fire management.*

- To foster the development of new research collaborations between managers and researchers and between groups in different regions and countries.
 - To raise awareness of the diversity of approaches, issues and ideas in wildland fire management - with the objective of developing innovative ideas for management and research.
-

Special thanks are owed to the conference steering committee, who formulated the structure, planned and implemented details of the conference. The conference was a success due to the contributions of dedicated individuals.

CONFERENCE STEERING COMMITTEE:

- ♦ ***Dr. Vic Adamowicz***, Co-Chair, Professor, University of Alberta, Edmonton, Canada
- ♦ ***Dr. Daniel Williams***, Co-Chair, Research Scientist, Rocky Mountain Research Station, USFS, Fort Collins, CO
- ♦ ***Dr. Paul Woodard***, Operations Coordinator, Professor, University of Alberta, Edmonton, Canada
- ♦ ***Mr. Bill Gabbert***, Finance, Executive Director, International Association of Wildland Fire, Hot Springs, SD
- ♦ ***Mr. Chuck Bushey***, President, International Association of Wildland Fire, Billings, MT
- ♦ ***Mr. Rich Homann***, Representative for International West Fire Council, Fire Division Supervisor, Colorado State Forest Service, Fort Collins, CO
- ♦ ***Dr. David Martell***, Professor, University of Toronto, Canada
- ♦ ***Dr. Bonnie McFarlane***, Senior Human Dimension Specialist, Canadian Forestry Service, Edmonton, Canada
- ♦ ***Dr. Sarah McCaffrey***, Research Scientist, USFS - North Central Research Station, Evanston, IL
- ♦ ***Dr. Alan Rhodes***, CFA/RMIT, Victoria, Australia
- ♦ ***Ms. Mikel Robinson***, Special Events Manager, University of Montana, Missoula, MT
- ♦ ***Dr. Todd Steelman***, Professor, North Carolina State, Raleigh, NC
- ♦ ***Dr. Jennifer (Thackaberry) Ziegler***, Professor, University Valparaiso, IN
- ♦ ***Mr. Dave Thomas***, Renoveler, USFS Retired, Ogden, UT

INVITED SPEAKERS

- ♦ ***David A. Cleaves***, Director, Rocky Mountain Research Station (RMRS), USDA Forest Service, Research and Development
- ♦ ***Rick Gale***, Chief of Fire, Aviation and Emergency Response (retired) , United States National Park Service
- ♦ ***Marc G. Rounsaville***, Deputy Director, Emergency Operations, U.S. Forest Service
- ♦ ***Kathleen Tierney***, Professor, Department of Sociology and Institute of Behavioral Sciences and Director of the Natural Hazards Center, University of Colorado-Boulder
- ♦ ***Jim Saveland, Ph.D.***, Program Manager for Social, Economic, & Decision Sciences, RMRS

You may order additional copies of this CD by sending \$25 and your mailing information in label form through one of the following media to:

TELEPHONE: (888) 440-IAWF (4293)

INTERNATIONAL: (605) 890-2348

FAX: (206) 600-5113

E-MAIL: iawf@iawfonline.org

MAILING ADDRESS: International Association of Wildland Fire
P.O. Box 261
Hot Springs, SD 57747-0261

Citation Example:

Author. Title. IN Extended Abstracts from the Human Dimensions of Wildland Fire Conference, 10/23-25, 2007, Fort Collins, Colorado, S. McCaffrey, P. Woodward, M. Robinson, compilers. International Association of Wildland Fire, 135 pp

THIS PAGE WAS INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Tools- Planning

- [Integrating Ecological and Housing Development Simulations to Forecast Fire Disturbances](#) 1
Susan I. Stewart, Northern Research Station, USDA Forest Service, Evanston, IL
- [Lessons from the Australian Interface – reconciling wildfire risk with biodiversity conservation objectives](#) 3
Owen Gooding, Land Use Planning Coordinator, Country Fire Authority Victoria, Australia
- [The Perils and Promise of Using NEPA to Develop Fire Management Plans on the National Forests](#) 5
Timothy Ingalsbee, Ph.D., Firefighters United for Safety, Ethics, and Ecology, Eugene, OR
- [The impact of human activity on forest fire occurrence in the province of Ontario](#) 7
David L. Martell, Faculty of Forestry, University of Toronto

Sensemaking and Decisions

- [Organizational Culture, Risky Behaviors, and Decisions Affecting Wildland Firefighters' Safety: A Review and Synthesis of Recent Literature](#) 9
Chuck Harris, University of Idaho
- [The clock time as the Procust's bed in the Cramer Investigation Report](#) 11
Elena Gabor, Purdue University, West Lafayette, IN
- [Sensemaking, Decision Gates, and Linear Thinking in an Exponential Environment - Lessons from the Cramer Fire](#) 13
Kelly R. Close, Poudre Fire Authority
- [Levinas on the Fireline: Recovering an "Ethic of the Other" in Stakeholder Reactions to Fatal Accidents and Close Calls in Wildland Firefighting](#) 15
Christopher S. Roberts, Purdue University, West Lafayette, IN

Tools for Organizational Effectiveness

- [The Emergent Culture of Safety Tools: Applying Signal Detection Theory to Assess the Culture of Fire Shelter Use in Wildland Firefighting](#) 17
Jennifer A. Ziegler, Valparaiso University, Valparaiso, IN
- [Wildland Fire Decision Support Systems and the Rapid Assessment of Values at Risk Model](#) 19
Krista Gebert, USDA FS, Rocky Mountain Research Station, Missoula, MT
- [A 5th Slice of Swiss Cheese: The Command Concept in Wildland Firefighting](#) 21
Kent Maxwell, Colorado Firecamp / Chaffee County Fire Protection District, Salida, CO
- [Questioning the Normative Approach to Wildfire Management Decisions: The Malleability of Acceptability Standards](#) 23
Robert Jakubowski, Colorado State University, Fort Collins, CO

Using Science to Improve Fire & Fuels Management

[Personal and organizational influences to the use of fire and fuels research by federal agency managers](#) 25

Vita Wright, Aldo Leopold Wilderness Research Institute, Missoula, MT

[Human Factors & Risk Management RD&A](#) 27

James M. Saveland, U.S. Forest Service - RMRS, Fort Collins, CO

[Public preferences and expectations of fire management during a wildfire](#) 28

Sarah McCaffrey, Northern Research Station, USDA Forest Service, Evanston, IL

Organizational Learning & Change

[Beyond Active Failures and Latent Conditions: Using Organizational Communication to Repair a Popular Accident Causation Model for Wildland Firefighting and other High Risk Industries](#) 30

Rebekah L. Fox, Purdue University, Lafayette, IN

[The U.S. Fire Learning Network](#) 32

Bruce Goldstein, Virginia Tech, Blacksburg, CA

[The Structuration of Dysfunction: Opportunities to Change Enduring Organizational Problems](#) 34

Elizabeth Williams, Purdue University, West Lafayette, IN

Org & Crew Leadership

[Understanding and Developing Tomorrow's Fire Managers: From 'Keeper of the Flame' to 'Fire-fighter' to 'Fire-warrior'](#) 36

Anne Black, Social Scientist/Ecologist, Aldo Leopold Wilderness Research Institute

[Making Sense of the Fire Environment\(s\): Applying Mode Confusion to Understand Failed Organizational Change in Transition Fires](#) 38

Kristine Clancy, Purdue University, West Lafayette, IN

[But Are We Making a Difference? Evaluating the L-380 Leadership Training](#) 40

Michael T. DeGrosky, Guidance Group, Inc., Wisdom, MT

[What Does it Mean to Communicate Intent? Examining Auftragstaktik and its impact on leadership and doctrine in wildland firefighting](#) 42

Jennifer A. Ziegler, Valparaiso University, Valparaiso, IN and Michael T. DeGrosky, The Guidance Group, Wisdom, MT

Special Session - FireSmart-ForestWise: Engaging Citizens In Risk Mitigation In Canada

[Getting the Public On Board in the Wildland/Urban Interface: Effective Tools for Fire Protection Officers](#) 44

Alan Westhaver, Vegetation/Fire Specialist - Parks Canada, Jasper National Park

[Non-traditional approaches for involving audiences in understanding and supporting a fuel modification project in a national park](#) 46

Kim Weir, Fire Communication Specialist, Jasper National Park

<u>Factors that Influence Citizen Engagement in the FireSmart-ForestWise Community Protection and Forest Restoration Project: Citizen, Community and Program Characteristics</u>	48
<i>Bonnie McFarlane, Canadian Forest Service, Edmonton, Alberta, Canada</i>	
<u>Community Impacts</u>	
<u>Resilience to, and recovery from, wildland fires in New Zealand: a research beginning</u>	50
<i>E.R. (Lisa) Langer, Ensis, Christchurch, New Zealand</i>	
<u>Utilizing Ecosystem Service Values to Assess the Benefits of the CA Bureau of Land Management Community Assistance and Hazardous Fuels Programs</u>	52
<i>David J. Ganz, Ph.D., TSS Consultants, Oakland, CA</i>	
<u>After the Fire: Local Residents' Perceptions of Post-Fire Forest Restoration</u>	54
<i>Robert L. Ryan and Elisabeth Hamin, Department of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst</i>	
<u>Special Session - CWPP: Collaborative Capacity Planning: Comparative Case Studies</u>	
<u>Community Wildfire Protection Plans: Enhancing Collaboration and Building Social Capacity—Project Overview</u>	56
<i>Pamela Jakes, USDA Forest Service, Northern Research Station, St. Paul, MN</i>	
<u>Defining the wildland-urban interface: how local government becomes a partner at the table in community wildfire planning</u>	58
<i>Stephanie Grayzeck, Natural Resources Science and Management Program, University of Minnesota, Saint Paul, MN</i>	
<u>Social Learning, science and the creation of communities of understanding in Community Wildfire Protection Planning</u>	60
<i>Rachel F. Brummel, Conservation Biology Program, University of Minnesota, St. Paul, MN</i>	
<u>Bridging the Federal Local Divide: Governmental Collaboration in the Development of Community Wildfire Protection Plans</u>	62
<i>William E. Fleeger, Department of Natural Resources, University of New Hampshire, Durham, NH</i>	
<u>Communication</u>	
<u>What's Happening? - An Australian perspective on keeping the community informed during major wildfires</u>	64
<i>Alan Rhodes, CFA/RMIT, Victoria, Australia</i>	
<u>Understanding Obstacles to Firewise Implementation</u>	66
<i>James Absher, Ph.D, Research Social Scientist, USDA Forest Service, Riverside, CA</i>	
<u>Special Session - Community Response During Wildfire: The Australian "Stay Or Go" Approach</u>	
<u>Stay or Go - The Evidence base for the approach</u>	68
<i>John Handmer, RMIT, University/Bushfire CRC, Melbourne, Victoria Australia</i>	
<u>Factors Influencing the Decision to 'Stay or Go'</u>	70
<i>Alan Rhodes, CFA/RMIT, Victoria, Australia</i>	

Applying Australia's Stay or Go Approach in the U.S. Would it work?	72
<i>Sarah McCaffrey, Northern Research Station, US Forest Service, Evanston, IL</i>	
Perspectives of a Firefighter and Community Member	74
<i>Tony Jarrett, Hazelbrook Rural Fire Brigade, New South Wales Rural Fire Service, Australia</i>	
<u>Outreach/Education Programs</u>	
Landscape Aesthetics and Environmental Education: Wildfire Management in the Wildland Urban Fringe of the Northeastern U.S.	76
<i>Robert L. Ryan, Department of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst, MA</i>	
Community education and preparedness for wildfire	78
<i>Lisa Sturzenegger, CFA, Victoria, Australia</i>	
<u>Special Session - Wildfire Risk: Human Perceptions And Management Implications</u>	
Wildland-Urban Interface Residents' Views on Risk and Attribution	80
<i>Dan Williams, USDA Forest Service, Rocky Mountain Research Station, Ft. Collins, CO</i>	
Diversity in Southwesterners' Views of Forest Service Fire Management	82
<i>Pat Winter, USDA Forest Service, Pacific Southwest Research Station, Riverside, CA</i>	
<u>Risk Reduction Programs</u>	
An Analysis of WUI Residents' Defensible Space Attitudes and Behaviors	84
<i>James Absher, Ph.D, Research Social Scientist, USDA Forest Service, Riverside, CA</i>	
Homeowner response to wildfire hazard mitigation programs and incentives	86
<i>Christine Vogt, MSU, E. Lansing, MI</i>	
State and Local Wildfire Risk Reduction Programs: Strategies to Protect Wildland-Urban Interface Communities	88
<i>Terry K. Haines, US Forest Service, Covington, LA</i>	
<u>Risk Perception & Mitigation: It's not just about fire</u>	
Situation Risk Perceptions of Forest Fire within a Broader Context of Forest Health Disturbance in Colorado	90
<i>Courtney Flint, University of Illinois at Urbana-Champaign, Urbana, IL</i>	
One Year after the Cottonville Fire: Wisconsin Defensible Space Survey	92
<i>Jolene Ackerman, Wisconsin DNR, Madison, WI and Sarah McCaffrey, USDA Forest Service, Evanston, IL</i>	
Is Fire on the Radar Screen? A Comparative Analysis of Wildfire Perception in the USFS's Northeast Region	94
<i>Jason S. Gordon, Penn State University, University Park, PA</i>	
<u>Economics Effects Of Wildfire Events And Policy</u>	
Factors affecting Fire Suppression Costs as identified by the Incident Management Team	96
<i>Krista Gebert, USDA FS, Rocky Mountain Research Station, Missoula, MT</i>	

<u>Investigating National Fire Plan Implementation in Northern New Mexico</u>	98
<i>Curt Shepherd, Department of Economics, University of New Mexico, Albuquerque, NM</i>	
<u>Health and Economic Impact of Wildfires: Literature Review</u>	99
<i>Ikuho Kochi, Colorado State University, Fort Collins, CO</i>	
<u>Special Session: Economics Of Mitigating Wildfire Risk</u>	
<u>Economics of fuel treatment and cost sharing for private timberland owners</u>	101
<i>Robert Haight, USDA Forest Service Northern Research Station, St. Paul, MN</i>	
<u>Willingness to Pay Function For Two Fuel Treatments To Reduce Wildfire Acreage Burned: A Scope Test and Comparison of White and Hispanic Households</u>	103
<i>John Loomis, Colorado State University, Fort Collins, CO</i>	
<u>Special Session: Nonmarket Valuation And Wildfire</u>	
<u>Do Repeated Wildfires Change Homebuyers' Demand for Homes in High-Risk Areas? A Hedonic Analysis of the Short and Long-Term Effects of Repeated Wildfires on House Prices in Southern California</u>	105
<i>John Loomis, Colorado State University, Fort Collins, CO</i>	
<u>Social Value of Environmental Amenities at Risk from Wildfire and Fuel Treatments in the WUI in Northwest Montana</u>	107
<i>Kyle Stetler, Graduate Research Assistant, Department of Forest Management, College of Forestry and Conservation, The University of Montana, Missoula, MT</i>	
<u>The Link between Perceived and Actual Wildfire Danger: An Economic and Spatial Analysis Study in Colorado (USA)</u>	109
<i>Pamela Kaval, University of Waikato, Hamilton, New Zealand</i>	
<u>Special Session - Managing The Impacts Of Smoke From Wildland Fires: Identifying Our Gaps In Understanding Between The Physical And Social Sciences</u>	
<u>Investigation of the Properties of Smoke from Wildland Fires: The Relationship to Visual Impacts of Smoke</u>	111
<i>Christian M. Carrico, Colorado State University, Fort Collins, CO</i>	
<u>The Potential Health Effects of Smoke from Wildland Fires: Acute and Long-term Impacts on Wildland Fire Fighters and the General Public</u>	113
<i>Jennifer Peel, Colorado State University, Fort Collins, CO</i>	
<u>Keynote Presentations</u>	
<u>World Leaders in Risk Management: Developing an Action-Research Agenda</u>	114
<i>Jim Saveland, Program Manager for Social, Economic, & Decision Sciences, Rocky Mountain Research Station</i>	
<u>Poster Presentations</u>	
<u>Public Viewpoints on Fire Management in New Jersey and New South Wales</u>	116
<i>Stentor Danielson, Clark University, Worcester, Massachusetts</i>	

<u>Effect of protective Filters on Fire Fighter Respiratory Health during Simulated Bushfire Smoke Exposure in Western Australia</u>	118
<i>Annemarie De Vos, School of Population Health, The University of Western Australia, Crawley, Western Australia</i>	
<u>Behavior Trends and Mechanisms to Evaluate the Efficacy of BLM’s Community Assistance and Hazardous Fuel Programs in California</u>	120
<i>David J. Ganz, Ph.D., TSS Consultants, Oakland, CA</i>	
<u>The National Database of Wildfire Hazard Mitigation Programs</u>	122
<i>Terry K. Haines, US Forest Service, Covington, LA</i>	
<u>Wildfire management by municipal governments in Alberta</u>	124
<i>Lauren Harris, University of Alberta, Edmonton, Alberta, Canada</i>	
<u>Success in Collaboration – Community Wildfire Protection Plans (CWPP)</u>	126
<i>Cheryl Renner, Louisiana State University, Baton Rouge, LA</i>	
<u>Wildland Firefighting and its Impacts upon the Personal Relationships of Firefighters</u>	128
<i>Charles G. Palmer, The University of Montana, Missoula, MT</i>	
<u>Measuring Community Capacity for Wildfire Planning</u>	130
<i>Ryan Ojerio, Resource Innovations - Institute for a Sustainable Environment at the University of Oregon, Eugene, OR</i>	
<u>Community Preparedness for Wildfire: A Pilot Study of Underlying Factors and Influences</u>	132
<i>Menka Bihari, Department of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst, MA</i>	
<u>The role of trust relationships in fire management strategies in south-eastern Australia</u>	134
<i>Emily Sharp, Charles Sturt University/Albury, New South Wales, Australia</i>	

Community Planning and Fire: Understanding Long-Range Implications

Susan I. Stewart, Northern Research Station, USDA Forest Service, Evanston, IL
sistewart@fs.fed.us

Shaun A. Golding, Department of Rural Sociology, University of Wisconsin- Madison, Madison, WI

Roger B. Hammer, Department of Sociology, Oregon State University, Corvallis, OR

Brian R. Sturtevant, Northern Research Station, USDA Forest Service, Rhinelander, WI

Key Words: LANDIS; “planning support software”; “community fire protection planning”;

Introduction

The wildland-urban interface (WUI) communities in northern Wisconsin’s pine barrens exist in a unique social and biophysical setting, characterized by a fine-scale mix of ownerships and land uses, and by fire-prone forests embedded in large areas of fire-resistant forests. While short-range plans for mitigating fire danger can be developed based on existing data and the collective expertise of community leaders and land managers, long-range planning requires information about future forest conditions, housing patterns, and the effects of people on wildfire ignition and spread. Adding difficulty to long-range planning, the spatial variability of fire risk in this landscape is compounded by the temporal mismatch created by mixed ownership patterns. Private lands subject to rapid changes in ownership, use and cover are intermixed with public lands that are relatively stable over long time periods. Oconto County spans an area from the fringe of Green Bay, Wisconsin, north and east through agricultural areas and into pine barrens in the northern 1/3 of the county. In this setting we applied GIS-based planning tools and will use its outputs to map human-modified fire regimes, now and for decades in the future, generated with the LANDIS landscape-level succession and disturbance model (Gustafson et al. 2004).

Methods

We generated housing development projections with a GIS-based planning support system (PSS) (Klosterman, 1997) to demonstrate two potential future social settings, one reflecting permissive zoning that also encourages large-lot development (Hobby Farm Sprawl or HFS), the other based on zoning that encourages suburban rather than exurban and rural growth (Constrained Suburban Growth or CSG).

The What if? planning support software uses population forecasts or projections of past trends to determine the basic demand for land at given points in the future. From there, allocation depends on user specification, such as the extent to which current land uses may be converted to different uses in the future, and the percentage of new growth which will occur as infill in existing development. The user also specifies the proportion of future growth that will be comprised of each land use type, the density of structures for each future land use type, and the anticipated average household size and number of employees per acre in commercial space. While these inputs are not literally nor operationally the same thing as zoning codes, the intent of the exercise is to mimic the outcome generated by applying a restrictive or permissive zoning code over time.

The Hobby Farm Sprawl scenario places few restrictions on where growth can occur, allowing low density development across the agricultural countryside and higher density development in the private in-holdings of Oconto County’s national forest. The suitability rankings do not strictly govern future development on each parcel, which means that the software may allocate land as needed, even if the most suitable parcel is not available. Under this thirty year projection, a sizeable portion of agricultural land is lost and much of the

ecologically fragile land adjacent to conservation areas (and near lakes where second homes are common) converts to high density residential development.

The Constrained Suburban Growth scenario assumes that because Oconto County is immediately adjacent to the Green Bay metro area, the parcels closest to Green Bay will see the most residential development. Growth in the county, as in the past, is predicted to be almost entirely residential. Although the low densities typical of rural sprawl seem likely, they do not accommodate the population growth estimated for Oconto County, and thus, we specify that future growth must include a higher proportion of high and medium density residential land uses, which we assign to likely areas such as those adjacent to existing cities and villages.

Results

The outcome of the simulations are time series of land use projections indicating where the county's projected population growth will result in housing development. In the HFS scenario, low-density residential growth occurs throughout the county, impacting farms and forests. The increase in low density residential extent and decrease in agricultural and forest land mimic the patterns seen over the past 40 years in many rural counties in the Midwest. Using the CSG scenario, where growth follows infrastructure and is not permitted adjacent to sensitive lands, the outcome is quite different, with growth in the extent of medium density residential land. Simply by encouraging higher density growth, the impacts on agricultural and forested land is significantly less. Low density residential areas do not expand, and growth is focused closer to Green Bay in that part of the county where wildland fire hazard is negligible.

These landscape-specific projections will be integrated with forest succession and related landscape ecological changes to identify future interactions between human and natural systems, characterized as human-modified fire regimes (Gustafson et al. 2004). The human-modified regimes not only characterize vegetation relevant to fire behavior, but also delineate areas where housing density and road networks will result in more ignitions. Because planning can determine how widespread development is, and in which areas it occurs, this direct impact on future fire likelihood must be recognized by planners. Integrating the PSS and LANDIS software holds promise for doing just this.

Conclusions

Scenarios such as these can provide better insights regarding cumulative impacts of land use policies in relation to fire and many other resource management issues. But these high-tech tools are also data-hungry, requiring extensive spatially explicit data, something smaller, less prosperous communities may not have. A further difficulty is that the PSS software is designed to the logic of urban and suburban growth, where development radiates outward from a central place along roads and rail lines. Rural growth has a different logic, one where amenities count more than access or infrastructure. In Wisconsin and across the Midwest, growth faces few barriers, since building septic systems, roads, and wells is cost effective on a single-lot basis. More extensive data and rules are thus required to use the PSS software in settings such as these.

Literature Cited

Klosterman, R.R. 1997. Planning Support Systems: A New Perspective of Computer-Aided Planning. *J. Plann. Ed. Res.* 17: 45-54.

Gustafson, E.J., P.A. Zollner, B.R. Sturtevant, H.S. He, & D.J. Mladenoff. 2004. Influence of forest management alternatives and land type on susceptibility to fire in northern Wisconsin, USA. *J. Lands. Ecol.*19(3):327-341.

Lessons learned from the Australian interface – reconciling wildfire risk with biodiversity conservation objectives

Owen Gooding

Community Safety Directorate, Country Fire Authority, 8 Lakeside Drive, East Burwood, Victoria, Australia 3127. Telephone +61 03 9262 8540; fax +61 03 9262 8399; email: o.gooding@cfa.vic.gov.au

Keywords: *vegetation management, regulatory instrument, community engagement*

Introduction

In Victoria, Australia vegetation management is a permit requirement for new developments in high wildfire risk areas. This is implemented by a statutory planning instrument known as the Wildfire Management Overlay (WMO).

The aim of implementing WMO permit conditions is to make it possible for a resident to defend their home and protect themselves from the impacts of wildfire.

In the Victorian statutory planning system, the WMO is one of number or overlay controls which apply permit requirements to discrete areas of risk or value that are subject to a set of policy objectives. Several of these overlays relate to biodiversity conservation. The areas mapped for high wildfire risk correspond to with areas of high conservation value, and historically there has been a conflict between the objectives for wildfire risk and biodiversity conservation.

The wildfire and native vegetation controls have equal weight in the planning system. Inputs into the planning system for both sets of objectives are provided to local government by two separate state government agencies - the Country Fire Authority (CFA) and the Department of Sustainability and Environment (DSE).

This situation may result in a planning decision that will cause unacceptable wildfire risk or unnecessary losses of biodiversity value, or both. Importantly an opportunity to influence land use patterns or to create a more sustainable outcome for an individual development is missed.

Reconciling the competing land management issues is a challenge that requires a partnership approach between planning authorities, land managers, fire services, and the community. The joint CFA and DSE project *Property Bushfire Preparedness and Native Vegetation Management* aims to provide agencies with the capacity to address these issues.

Method

The *Property Bushfire Preparedness and Native Vegetation Management* project

Program Pilot

The purpose of the program pilot was to test and refine the project solutions prior to state wide implementation. The pilot consisted of a six-month trial of a draft tool kit with supporting training. The tool kit provides a set of decision making tools and technical or process information for use by local government. The training covered the process requirements for WMO permit applications, and the principles of integrated decision making where WMO and native vegetation considerations apply.

Program Pilot Evaluation

In the program planning phase there was an emphasis on the tangible actions (for example published decision making tools and training provided). Whilst these elements played a role, the evaluation of the program pilot shows that the main process contributing to successful outcomes appears to be the close working relationship between the agencies.

The evaluation strongly reaffirms that the extent to which the community understands and accepts the risks associated with wildfire and loss of native vegetation is a significant factor in the adoption of behaviours that mitigate the risks.

All participants in the evaluation of the pilot program reported an improvement to the decision making process as a result of participating in the project. However this does not tell us to what extent the planning permit decisions meet planning policy for wildfire safety and native vegetation conservation. Nor does it tell us if the owner or occupier has implemented the requirements of the planning decision. The mechanisms that underpin both these outcomes need to be researched in order to inform programs that aim to implement a higher order outcome which may be expressed as ‘a community has the capacity to protect itself from the impact of wildfire’.

Results

The evaluation of the project *Property Bushfire Preparedness and Native Vegetation Management* indicates that the implementation of a planning control needs to be supported by timely and relevant community education and engagement. Further, the community must also be able to receive consistent advice from multiple agencies.

In order to achieve a sustainable and more comprehensive change to a community’s capacity to address wildfire risk, stakeholder agencies must have:

- a sound working knowledge of the policy objectives, tools and drivers for their partner organisations,
- a shared understanding of the methods of effective community engagement,
- acceptance of the need for achieving multiple land management objectives, and
- combined advocacy for solutions put forward.

As wildfire risk managers considering or implementing a regulatory instrument, our program design must integrate that instrument with community education programs, and include coordinated delivery through multiple agencies.

This approach represents a fundamental shift in philosophy where we move from merely seeking to ensure *compliance* by the resident, to one where we gain their *commitment*.

The Perils and Promise of Using NEPA to Develop Fire Management Plans on the National Forests

Timothy Ingalsbee, Ph.D.

Firefighters United for Safety, Ethics, and Ecology, 2852 Willamette #125, Eugene, Oregon
fire@efn.org

keywords: Fire Management Plan, National Environmental Policy Act

Introduction

The Federal Wildland Fire Management Policy (1995 and 2001) mandates Fire Management Plans (FMPs) for every acre of federal land containing burnable vegetation. As a “major federal action” that involves an “irreversible commitment of resources” and “affects the human environment,” wildland fire management planning requires environmental analyses and public involvement in compliance with the National Environmental Policy Act (NEPA). Department of Interior agencies such as the National Park Service use NEPA processes to develop FMPs for National Parks, but the U.S. Forest Service is opposed to using NEPA procedures to develop FMPs for National Forests. Forest Service officials allegedly fear that the same kind of lengthy, costly, and contentious “process predicament” that afflicts its timber sale planning may also affect fire management planning if they were to directly use NEPA to develop FMPs.

In response to a lawsuit filed by the California Attorney General and nonprofit conservation groups, a federal district court ruled in July 2006 that the Sequoia National Forest (SNF) violated NEPA in its FMP, and ordered a NEPA-compliant FMP to be developed. Instead, the SNF was granted a special exemption by the Chief of the Forest Service to operate without a FMP, and the court’s decision was mooted. Currently, the SNF is managing its wildland fire and fuels management programs without a FMP, using direction from its 1988 Forest Plan. Forest Service officials continue to refuse public demands for NEPA processes to develop FMPs, and have threatened to withdraw other FMPs if additional lawsuits are filed elsewhere, putting at risk fire management planning and full implementation of the Federal Fire Policy on the National Forests.

Methods

A comparative qualitative analysis of the FMPs and underlying NEPA documents for the SNF and the Sequoia/Kings Canyon National Park (SNP) was conducted in the fall of 2006 along with follow-up telephone interviews of SNF and SNP fire management staff. Documents analyzed included the SNF’s FMP (2004-2005) and the NEPA documents it tiered to, including its Forest Plan (1988) and the Sierra Nevada Amendments (2001 and 2004), the SNP’s FMP (2005) and its NEPA documents (2004). Documents were qualitatively analyzed to see if and how key topics for FMPs and fire management program elements were discussed. Topics included: compliance with environmental statutes and the Federal Fire Policy; conformity to the interagency FMP template; general fire management goals and objectives; methods for assessing fire/fuel hazards and identifying fire management units; fuels management including wildland fire use, prescribed fire, mechanical fuels treatments; ecosystem fire restoration; fire research and monitoring; and economics.

Results

Both quantitatively and qualitatively, the SNF's 39-page FMP has considerably less data, less environmental analysis, and less scientific substantiation than the SNP's 370-page FMP. This assessment also holds true when adding in the information presented in the SNF's Forest Plan documents and the SNP's EA/FONSI. To cite one example from the topical areas used to perform this analysis—description of Fire Management Units (FMUs), a foundational component for determining the Appropriate Management Response (AMR) and participating in the Fire Program Analysis System--none of the Forest Service's Forest Plan NEPA documents even mentions the concept of FMUs. The SNF defined FMUs according to its Management Area boundaries rather than ecological criteria, and made decisions to allow WFU in one FMU but commit to total suppression in another FMU without any environmental analysis or public input. Since the SNF withdrew its FMP, it has been managing its entire landbase as a single FMU. In contrast, the Park Service provided detailed analysis of its rationale for FMU boundaries and their management goals in its NEPA document. The SNP's 12 FMUs are based on subwatershed boundaries that contain unique social values, fuel hazards, or fire risks.

The SNP's direct use of a NEPA process to develop its FMP did require a considerable investment of staff resources, but it resulted in a mere nine public comment letters, and had no appeals or litigation. By conducting a programmatic NEPA process for its FMP, the SNP can implement fire/fuels management projects without any additional cumulative effects analysis, giving fire staff considerable flexibility. The SNF's attempt to avoid directly using NEPA, however, forced managers to make several programmatic decisions in its FMP in order to "fill in the gaps" of missing data from the Forest Plan documents it had tiered to--a process that was rejected by the Court. The SNF must also do a NEPA process for each fire/fuels management project. Directly using NEPA processes to develop FMPs offers a useful means for incorporating the best available science and informed public input, complying with federal environmental laws, and implementing the Federal Fire Policy. Despite the up-front costs and challenges, using NEPA to develop FMPs promises net assets for agency fire staff, including better guidance for managing fire and fuels, and cultivating citizen stakeholders willing to support taxpayer funding streams and community collaborations needed for long-term fuels management, forest monitoring, and fire restoration projects.

Literature Cited

- National Park Service, Sequoia and Kings Canyon National Park (2005) *Fire and Fuels Management Plan*
----- (2004) *Environmental Assessment and Finding of No Significant Impact*
U.S. Forest Service, Pacific Southwest Region (2004) *Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement and Record of Decision* ----- (2001) *Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement and Record of Decision*
U.S. Forest Service, Sequoia National Forest (2004) *Fire Management Plan*
----- (1988) *Land and Resource Management Plan, Final Environmental Impact Statement, and Record of Decision*

The impact of human activity on forest fire occurrence in the province of Ontario

B. Mike Wotton^A, Ita Waghray^{B,C} and David L. Martell^C

^A Canadian Forest Service, Natural Resources Canada
Great Lakes Forestry Centre, 1219 Queen St. East, Sault Ste. Marie, Ontario, Canada, P6A 2E5
Email: mwotton@nrcan.gc.ca

^B Present address: Long Range Planning Department, Town of Oakville
1225 Trafalgar Road, Oakville, Ontario, Canada, L6J 5A6
Email: iwaghray@oakville.ca

^C Faculty of Forestry, University of Toronto
33 Willcocks St., Toronto, Ontario, Canada, M5S 3B3
Email: martell@smokey.forestry.utoronto.ca

Introduction

The Ontario Ministry of Natural Resources (OMNR) is responsible for forest fire management in the roughly 800,000 km² fire region of the one million km² province of Ontario in central Canada. An average of 1,730 fires occur in Ontario each year, roughly 60 percent of which are caused by people with the remaining 40 percent caused by lightning. The annual area burned is approximately 220,000 hectares, roughly 150,000 of which are in the extensive protection zone that stretches across the northern portion of the province - a zone where fires are not actively suppressed unless they pose a significant threat to people or property.

The OMNR maintains a large network of fire weather stations that are used to gather daily fire weather to assess fire danger using the Canadian Forest Fire Weather Index (FWI) System codes and indices (Van Wagner 1987). The province is partitioned into administrative districts and sectors and sector-specific historical fire weather and fire occurrence data is used to develop daily people and lightning-caused fire occurrence models. These models can be used to produce sector-specific daily fire occurrence predictions (see for example, Cunningham and Martell 1973, Martell et al. 1989, Wotton et al. 2003 and Wotton and Martell 2005). However, such simple empirical models do not include demographic or land use variables that describe the factors that influence fire occurrence processes. Our objective was to investigate how some demographic factors influence people-caused fire occurrence in Ontario with a view to eventually incorporating them into fire occurrence prediction models.

Methods

We used an eco-climatic zoning system to partition the province of Ontario into 36 fire management compartments each of which was reasonably homogeneous with respect to climate, topography, soil and vegetation (Ecological Stratification Working Group 1996). We then studied people-caused forest fire occurrence in the intensive fire protection zone of the province, an area of approximately 400,000 km², during the 1976-2004 period. We summarized

fire occurrence into the OMNR's eight primary human cause categories and by day of the week. We then explored how fire occurrence patterns varied by cause and the extent to which fire occurrence rates varied by day of the week and during special statutory holidays. Digital maps of roads, railways and communities were used to explore the impact of such infrastructure on people-caused fire occurrence patterns within those compartments. In addition, we developed regression models that related fire occurrence rates to the length of roads and railway lines and to the number of communities in a compartment.

Results

We found that people-caused fires occur more frequently on weekends (Saturday and Sunday) than during other days of the week. We also found there was no significant difference in the number of fires occurring on the Saturdays and Sundays of long holiday weekends compared with normal two-day weekends. Seasonal variation in fire occurrence rates appeared to vary by cause. Railway fires were, as expected, clustered near railway lines, and the number of railway fires observed in a compartment was linearly related to the length of the railway line within it. Resident-caused fires were highly correlated with the number of communities in a compartment but not with the total compartment population. Fire occurrence was significantly correlated with road system density.

Literature Cited

- Cunningham, A.A., and Martell, D.L. 1973. A stochastic model for the occurrence of man-caused forest fires. *Canadian Journal of Forest Research*, 3(2): 282-287.
- Ecological Stratification Working Group. 1996. A National Ecological Framework for Canada. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of Environment Directorate, Ottawa/Hull. pp. 125.
- Martell, D.L., Bevilacqua, E., and Stocks, B.J. 1989. Modelling seasonal variation in daily people-caused forest fire occurrence. *Canadian Journal of Forest Research*, 19(12): 1555-1563.
- Van Wagner, C.E. 1987. The development and structure of the Canadian Forest Fire Weather Index System. Canadian Forest Service, Forestry technical Report FTR-35. Petawawa National Forestry Institute. Chalk River, Ont. 36 pp.
- Wotton, B.M., Martell, D.L., and Logan, K.A. 2003. Climate change and people-caused forest fire occurrence in Ontario. *Climatic Change*, 60(3): 275-295.
- Wotton, B.M. and Martell, D.L. 2005. A lightning fire occurrence model for Ontario. *Canadian Journal of Forest Research*. 35(6): 1389-1401.

Organizational Culture, Risky Behaviors, and Decisions Affecting Wildland Firefighter Safety: A Review & Synthesis of Key Literature

Chuck Harris & Alexis Lewis¹

Dept. of Conservation Social Sciences, University of Idaho, Moscow (charris@uidaho.edu)

Keywords: Firefighter safety, fire leadership & decisionmaking, fire culture.

This review and synthesis of recent literature focuses on (1) the sociology of the organizational culture of wildland firefighter (WFF) organizations, (2) the social-psychology of risk-taking and decisionmaking behaviors, and (3) diverse socio-cultural perspectives on key factors affecting wildland firefighters' safety. The paper develops a preliminary model based on these perspectives that details relationships among key characteristics and behaviors of fireline crewmembers and the fire managers on whom they depend. In particular, it builds on increased understanding of the cognitions, feelings, experiences, and responses of wildland firefighters on the fireline, as well as those of their superiors -- with a focus on leadership, decisionmaking, and procedures at the mid-level (i.e., crew bosses, foremen, supervisors, etc.) and upper-levels (i.e., FMOs, ICs, etc.) of WFF management. The review specifically focuses on the ramifications of this understanding for increasing firefighter safety. This review not only analyzes recent cases of burn-overs, entrapments, and accidents in the context of diverse theories, but also suggests implications of this analysis for potential reductions in the dangers posed by WFF. Key findings of recent literature have focused on the inherently dangerous and risky nature of WFF activities and their complexities for effective leadership and decisionmaking. Less well understood are other significant influences on effective conduct and response, such as the personalities of WFF personnel, gender, experience and training, inter-personal relationships, and cognitive, attitudinal and interpersonal abilities – all within the context of a unique organizational culture. The conclusions of this analysis complement and are supplemented by the work of Lewis (see paper, this volume), who is providing a base-line understanding of wildland firefighters' experiences and behaviors with a phenomenological methodology: her purpose is to use qualitative approaches to assess (1) comfort levels of crewmembers on the fireline with decisions made by their supervisors and higher levels of management and (2) the extent to which firefighters voice their opinions when they feel uncomfortable or unsafe about situations perceived to be risky, as well as reasons and factors under-lying their responses. The present paper elaborates on the model presented in Figure 1. At the center of that model is the construct of *on-the-ground events* (Box 1) that occur on the frontline of a wildland fire and result from interactions of several key constructs. These constructs include the *fire* itself (Box 2), which can be *profiled* in terms of the *topography* of the landscape in which the fire is burning, the *vegetation and fuel loading* through which the fire is burning, the *weather* at any given time, and other factors affecting *fire behavior*. Another key construct is *fireline safety* (Box 3), which both drives the *organizational practices and procedures* (Box 4; i.e., organizational structures and processes, such as in-

centives/disincentives to discourage unsafe practices, etc.) implemented to carry out an agency's efforts to ensure safety on the fireline; they also are directly influenced by the priority placed on fireline safety. An important intervening variable here is the extent to which the agency is operating as a *learning organization* (Box 5), whereby principles of *high reliability organizations* (that is, organizations engaged in dangerous, risky activities like firefighting) are practiced through efforts to learn important lessons from past experiences (and mis-steps on the fire line; e.g., the Forest Service "Lessons Learned" Program). Organizational practices and procedures are related to a third key construct, *situation awareness and responses* (Box 6) to it -- which can vary based on *pre-fire* decisions and knowledge, information received *during the fire* and actions taken, and *post-fire*, whereby agency leaders and their crews are debriefed and opportunities are taken for recognizing successes and mistakes, improving decisions, and responding more effectively. These *outcomes* (Box 7) result from firecrew and management *behaviors*; the behavioral responses of individuals and groups are influenced by experiences, characteristics, interpersonal relationships, and motivations that play key roles in WFF situations and outcomes (Boxes 8-11). Elaboration of the model and the analysis it is based on will provide useful insights for future research, as well as recommendations for improved WFF operations and policy-making that can increase firefighter safety and overall WFF organizational effectiveness.

¹This research is supported with funding from the USDA Rocky Mountain Research Station; Jim Saveland & Anne Black provided valuable input, but are not responsible for preliminary statements or conclusions presented.

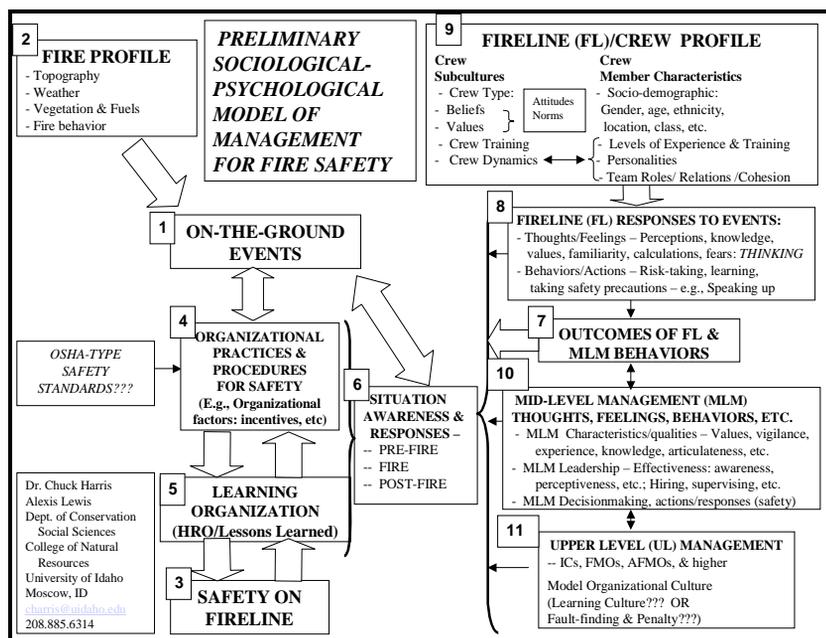


Figure 1. A preliminary sociological-psychological model of management for fireline safety.

The clock time as the Procrustean bed in the Cramer Investigation Report

Elena Gabor

Department of Communication, Purdue University, West Lafayette, IN 47906, USA

Email: egabor@purdue.edu

Key words: time, clock, firefighter, Cramer

Introduction

The time of the fire appears to be non-linear and uncontrollable. This creates psychological demands on the firefighters that lead to altered perceptions of time. This paper uses the Cramer Fire as a case study to illustrate that how firefighters make sense of time is different from how accident investigations make sense of time, and that investigations may be making incorrect assumptions about firefighters' sensemaking of time. On July 22, 2003 in the Cramer Fire, two firefighters (rappellers Jeff Allen and Shane Heath) who had been assigned to create a helispot lost their lives after being surrounded by the flames. The conventions of accident investigations and report writing in general tend to assume a linear, objective and even omniscient experience of time following the measurable clock time. But this paper shows how from their own words, it is apparent that firefighters experience time subjectively and intersubjectively, in polychronic fashion, dealing with multiple tasks, each with its own time. Thus, there is a gap in the investigation process that is worth addressing because time is also one of the instruments for assessing efficiency of work processes. The ancient Greek legend of Procrustes is used here as a metaphor for the way subjective and intersubjective experiences of time are shrunk or stretched to fit the objective time of investigation reports.

Literature review and Method

A combination of archival research and discursive analysis of the Cramer Accident Investigation Report (USDA, 2003) and three OSHA interviews with firefighters was used for this study. The literature informing this problem stems from four areas: philosophy, anthropology, psychology, and organizational communication. In philosophy, Heidegger (1924/2000) pointed out that the clock does not communicate duration, but a "now." He also found that the clock has made people view time as uniform, rhythmic and the same all over.

In anthropology, Hall's (1989) findings reveal that societies can be categorized as *monochronic* (e.g., United States), where schedules are prioritized rather than relationships, and where time is viewed as linear and tangible, and *polychronic* (e.g., Mediterranean countries), where relationships are prioritized, and where time is viewed as cyclical and intangible. Furthermore, Hernadi (1992) found that individuals exist at the intersection of three times: *subjective* (individual), *intersubjective* (dictated by the activities of the group/community), and *objective* (the clock time). The anthropological literature identifies the macro-cultural characteristics (that are often taken for granted) of the society in which firefighters live.

The psychological literature helps us understand the mind processes that can alter our perceptions of time in situations of increased stress. Specifically, according to the theory of self regulation, when people attempt to manage their emotions in a stressful situation, they tend to perceive that more time has passed than it actually has (Vohs & Schmeichel, 2003; Kathleen & Schmeichel, 2003). The norms of communication via radio that encourage firefighters to hide their emotions of panic or fear can facilitate such perceptions of time. On the other side of the

coin, when individuals are in a state of *flow* (Csikszentmihalyi, 1996), deeply absorbed by their activity, they perceive that less time has passed than it actually has.

Finally, studies of time in organizational communication show that time is socially constructed in organizations. Ballard and Seibold (2004b) proposed ten dimensions of time classified along two criteria: how people perform time (flexibility, linearity, pace, precision, scheduling, and separation) and how they interpret it (scarcity, urgency, and present and future time perspective). For firefighters, the dimensions of time are influenced by the fire and by the resources and strategies of their organization. These different theories support the idea that there is not only one kind of temporal experience (the clock time), but there are several *times* that individuals can experience in various contexts and situations.

Findings

Data from three interviews with firefighters involved in the Cramer Fire and from the radio transcripts illustrate that firefighters experienced time as being uncontrollable, non-rhythmic, and nonlinear, although it is likely they expected it to evolve linearly (Close, 2005). Individuals had *subjective* and *intersubjective* (via radio) experiences of time reflected in different levels of urgency. At the same time, the radio communication maintained linearity, as it only allowed one speaker at a time.

However, investigation reports tend to construct a sequence of events taking in consideration only the clock time, homogenous, the same all over, ignoring subjective and objective experiences of time. Thus, accident reports function like a Procrustean bed where the subjective and intersubjective time are shrunk or stretched to fit the clock time. The linear way of reporting reifies only one orientation to time, thus legitimizing the expectation that firefighters should be in control of their temporal experiences.

Given these findings, there is hope that investigators could be sensitized to how people process time in the moment and to finding ways to report incidents in alternative ways besides the chronological narrative. I also hope that this information can be of use to firefighters in learning to pay attention to time during fire, in learning how to process information, and how to understand their own experiences during fire.

Literature cited

- Ballard D, Seibold D (2004b) Organizational members' communication and temporal experience: Scale development and validation. *Communication Research*, **31**, 135-172.
- Close K R (2005) *Fire behavior vs. human behavior: Why the lessons from Cramer matter*. Paper presented at the Eighth International Wildland Firefighter Safety Summit: Human Factors 10 Years Later (April 26-28, 2005, Missoula, MT), Fairfax, VA.
- Csikszentmihalyi M (1996) *Creativity: Flow and the psychology of discovery and invention*. New York: HarperCollins.
- Hall ET (1983) *The dance of life: The other dimension of time*. New York: Doubleday.
- Hernadi P (1992) Guest editor's introduction. *Time & Society*, **1**, 147-158.
- Kathleen DV, Schmeichel BJ (2003) Self-regulation and the extended now: Controlling the self alters the subjective experience of time. *Journal of Personality and Social Psychology*, **85**, 217-230.
- United States Department of Agriculture (2003) *Accident investigation factual report: Cramer Fire fatalities North Fork Ranger District Salmon-Challis National Forest Region 4* (No. 0341-2M48-MTDC). Missoula, MT: USDA Forest Service Technology and Development Program.

Sensemaking, Decision Gates, and Linear Thinking in an Exponential Environment - Lessons from the Cramer Fire

Kelly R. Close

Poudre Fire Authority, Ft. Collins, CO, USA; email: kclose@fcgov.com

Abstract. The Cramer Fire of 2003 resulted in the tragic deaths of two firefighters, and there has been no shortage of debate and controversies since. However, the Cramer Fire also offers some powerful lessons, particularly in the breakdown of rational thinking and decisionmaking in a rapidly-changing fire environment. The final 20 minutes at H-2 can provide important insights and lessons in this realm.

Additional keywords: Cramer Fire, acceleration, decision gates, sensemaking.

Introduction

Humans tend to be linear thinkers, not readily able to think in an exponential fashion or effectively "multi-task" (Putnam, 2007). In volatile, extreme burning conditions in steep terrain, the immediate fire environment changes rapidly, and the rate of spread has actually been shown to accelerate exponentially during a fire's final run (Viegas, 2005).

In this situation, fire spread can intensify far more quickly than people's perceptions and cognitions can readily reconcile, making it difficult for someone immersed in this environment to accurately assess a rapidly-changing situation and take appropriate actions. As conditions deteriorate and fire spread accelerates, rational thinking also deteriorates. Perceptions, cognitions, emotional reactions, and judgments that would be appropriate under normal circumstances fall short. "Sensemaking," the interpretation by an individual of the surrounding environment and events, begins collapsing and complex analysis and decisionmaking are hampered. Increasing stress from the situation causes the individual to fall back on simpler, previously-learned behaviors that may not apply to the new environment (Zeigler, 2006; Weick, 1993).

Methods

An examination of the events during the final 20 minutes at H-2 on the Cramer Fire, and the communications between H-2 and the helibase, builds a compelling and powerful story. Though all the facts will never be known, interpretation of evidence, events and communications, through known human factors on past fatality fires, indicate a strong interaction of deteriorating cognitive processes and critical actions against a backdrop of a volatile, rapidly-changing environment (Close, 2006).

Once fire was established in the bottom of the canyon below where the two firefighters were working, and as it moved up the drainage, it accelerated significantly. The final estimated rate of spread was two to three times the initial rate (Donoghue et al., 2003). The firefighters were not in a position where they could monitor the fire's progress effectively, and likely did not receive any other information indicating the fire's spread rate was accelerating. Based on the consistently calm tone of voice in the radio transmissions from H-2 to the helibase in the final 20 minutes, it's likely they didn't perceive they were in

immediate danger and possibly thought they had more discretionary time than they actually did. Further, there appears to have been a growing mis-match between their "linear" perception of events and the actual fire spread and intensity in an exponentially-changing environment. Other analysis of the final timeline indicates the firefighters were experiencing "time subjectivity," essentially operating on altered perceptions of time, and on a time scale that was subjective and "polychronic" (Gabor, 2007).

Results

On the Cramer Fire, sensemaking appears to have broken down significantly in the final 20 minutes before the fatalities. Critical "decision gates" (Gleason, 2000) were passed through with an ever-narrowing window of time in which to think, decide, and act. As the minutes passed and the firefighters remained near H-2, waiting for a helicopter to pick them up, each of the two most viable options for escape on foot to a safe area disappeared. Ultimately, they were unknowingly committed to the final outcome.

The tendency toward linear thought processes can too often cause firefighters to underestimate changes in fire behavior and potential. And the dynamic process of sensemaking in a rapidly deteriorating situation, coupled with deteriorating cognitive processes, can lead to a significant gap between perceptions and reality. The resulting human behavior and actions can have a critical influence on the final outcome, and appear to have been significant factors at H-2 on the Cramer Fire. These factors have also been implicated in the outcome on other past fatality fires (Putnam, 1995). Until we can break the cycle, similar patterns and outcomes are likely to be repeated again and again.

Literature Cited

- Close, K. (2006) 20 Minutes at H-2: Linear decisionmaking in an exponential environment. In: Proceedings 9th Wildland Firefighter Safety Summit; 2006 April 25-27, IAWF.
- Donoghue et al. (2003). Accident Investigation Factual Report: Cramer Fire Fatalities. U.S. Forest Service, 0351-2M48-MTDC.
- Gabor, E. (2007). The clock time as the Procust's bed in the Cramer Investigation Report. in: Human Dimensions of Wildland Fire (oral presentation).
- Gleason, P. (2000). Kate's Basin Fatality Report. Appendix 6 – Operations and Critical Decision Gates.
- Putnam, T. (2007). Personal communication.
- Putnam, T. (1995). The collapse of decision making and organizational structure on Storm King Mountain. In Findings from the Wildland Firefighters Human Factors Workshop. (Ed. T. Putnam). (USDA Forest Service MTDC: Missoula, MT).
- U.S. Forest Service (2006). FOIA request 06-3051-R: Redacted transcripts of Forest Net radio traffic from Central Idaho Dispatch, Salmon-Challis N.F., July 22, 2003.
- Weick K.E. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly* 38, 628-652.
- Viegas, D.X., L. P. Pita, L. Ribeiro and P. Palheiro (2005). Eruptive Fire Behaviour in Past Fatal Accidents. In: Butler, B.W and Alexander, M.E. Eds. Eighth International Wildland Firefighter Safety Summit; April 26-28, 2005 Missoula, MT.
- Zeigler, J. (2006). Personal communication.

Lévinas on the fireline: Uncovering an “ethic of the other” in responses to wildland fire accidents and near misses

Christopher S. Roberts^A and Jennifer A. Ziegler^{B,C}

^APurdue University, Department of Communication, 100 N. University St. BRNG 2114, West Lafayette, IN 47907, USA.

^BValparaiso University, Department of Communication, 1809 Chapel Dr. Schnabel 6, Valparaiso, IN 46383, USA.

^CCorresponding author. Email: jennifer.ziegler@valpo.edu; Website: <http://blogs.valpo.edu/jziegler>

Keywords: Lévinas, case studies, culture, heroism, safety ethic, training, ultimatum, wildland fire

Introduction

Numerous safety initiatives have emerged since the tragic South Canyon fire claimed the lives of 14 firefighters in 1994. However, contradictory messages about “ultimate” safety responsibilities have also emerged since that time. In formal messages firefighters tend to hear that they are responsible for providing for their own and others’ safety; in informal messages firefighters tend to hear that they are “ultimately” responsible for their own safety (with a few exceptions in either case).

Because these messages express moral guidance for action, we examine this contradiction through the lens of ethical philosophy, specifically with the help of theologian Emmanuel Lévinas. Using Lévinas’s “ethic of the other,” we explore the possibility that the notion that firefighters are “ultimately” responsible for their own safety is not a viable stand-alone ethic, but rather a defensive reaction to an “ethic of the other” that was already encoded in organizational structures but failed to be realized. We search for ways that this ethic can be explicitly reclaimed in both formal and informal discourse in order to resolve the contradiction.

Methods

First, we explain Lévinas’s “ethic of the other,” which regards the existence of the other person as the “bedrock” of ethics (Jovanovic and Wood 2004). The concept of self only originates in one person’s separateness from another; nevertheless, similarity and dependence create ethical responsibilities that are realized in communication (Levinas 1999). Lévinas divides ethical communication into three components: the face, the trace and the saying (Levinas 1994). The face is the presence of the other person, who may be physically present or recalled from memory. According to Lévinas, acknowledging the face recognizes another’s “alterity”: they are completely outside your own being and can never be fully understood, yet that person also contains a trace of what you share in common. Because Lévinas is a theologian, he calls the trace the “supreme authority” (God) that compels ethical action. The saying is the act of communication that is compelled by the presence of the face and the compulsion of the trace. According to Lévinas, ethical action compelled by the face of the other is not some “extra” moral imperative but something that is innate in human nature. Thus, Lévinas would reject the claim that individuals are ultimately responsible for their own safety; instead, he would argue that individuals are ultimately responsible for each others’ safety, and in being “other” to others, one’s safety is ultimately provided for as well.

Second, we examine how formal structures like ICS and LCES may represent attempts to encode an “ethic of the other” into organizing, particularly because they specify interpersonal communication responsibilities. Specifically, we examine messages that firefighters learn in training about unity of command and span of control in ICS, and lookouts and communications

in LCES. However, recognizing that these are ideals that occasionally fail to be realized, it may be the case that the “ethic of the other” will fail to be realized as well. We thus posit that “everyone is ultimately responsible for their own safety” may be a defensive reaction to a preexisting “ethic of the other” that was encoded in ideal organizational structures but failed to be realized.

Third, we ask, how can the “ethic of the other” be upheld even if ideal organizational structures fail to be realized? Specifically, do organizational structures that attempt to embed an “ethic of the other” nevertheless require occasional acts of heroism to be fully realized? To answer this question we look to moral lessons of heroism and tragedy embedded in three cases involving burnovers and near misses: the 1994 South Canyon fire near Glenwood Springs Colorado, the 2006 Little Venus fire shelter deployment on the Shoshone National Forest in Wyoming, and the 2003 Cramer fire on the Salmon-Challis National Forest in Idaho.

Results

In our analysis of the three cases we find that communication issues that tend to disturb us most in tragic and near miss cases are not necessarily problems in the *saying* or what is said, but rather in the *face*, or the fact that firefighters were apparently not present to one another. South Canyon illustrates that attempts to summon the face of the other can be regarded as heroic even when there is a tragic outcome. Little Venus demonstrates how being entirely in control of the presence or absence of one’s own face is evaluated in retrospect as ultimately putting the other in danger. The Cramer fire illustrates that although tragedy can result from failures to realize ideal organizational structures, missed opportunities where the face of the other might have been recalled tend to be evaluated as even more disturbing.

Examining “ultimate” safety responsibilities from a Lévinasian perspective has implications for discourse and training. An embedded “ethic of the other” might be explicitly brought into training about ideal organizational structures like ICS and LCES. Directives to make sure systems are working as intended might go beyond “compliance” to pointing out that it may mean realizing an “ethic of the other.” Similarly, encouraging firefighters to speak up about safety problems might also be framed within an overall “ethic of the other”: speaking up might not only address safety problems in the moment, but might also remind others of their responsibilities to the other (in this case, to the firefighter who is speaking up). Finally, firefighters can also be reminded that ensuring that their own faces remain present to others on wildland fires may be equally as important as keeping others’ faces present to themselves.

Literature Cited

- ICS Overview (2005) In ‘ICS-100: Introduction to ICS’ (FEMA: Washington, DC)
- Jovanovic S and Wood R (2004) Speaking from the bedrock of ethics. *Philosophy and Rhetoric* 37, 317-334.
- Levinas E (1994) ‘Otherwise than being or beyond essence’ (A Lingis, Trans.) (Kluwer: Boston)
- Levinas E (1999) ‘Alterity and transcendence’ (MB Smith, Trans.) (Columbia UP: New York)
- NWCG (2003) ‘Firefighter Training (S-130), Student Workbook (NFES 2730)’ (Boise, ID)
- USDA Forest Service (2003) ‘Accident investigation factual report: Cramer Fire fatalities’ (Region 4: Salmon ID)
- USDA Forest Service (2006) ‘Peer review report: Little Venus fire shelter deployment’ (Region 2: Cody, WY)
- USDOI BLM and USDA Forest Service (1994) ‘Report of the South Canyon Fire accident investigation team’ (Glenwood Springs)

The Emergent Culture of Safety Tools: Applying Signal Detection Theory to Assess the Culture of Fire Shelter Use in Wildland Firefighting

Jennifer A. Ziegler^A

^AValparaiso University, Department of Communication, 1809 Chapel Dr. Schnabel 6, Valparaiso, IN 46383, USA.
Email: jennifer.ziegler@valpo.edu; Website: <http://blogs.valpo.edu/jziegler>

Keywords: argument, culture, fire shelter, signal detection, sensemaking, unintended consequences

Introduction

Decades of research on fire shelters has led to vast improvements in design and training since their introduction in the 1970s. However, technical and behavioral studies do little to address the culture of fire shelter use as a human factor. The culture of tool use is influenced by formal and informal messages, personal experience, stories, and even organizational attempts at deviation correction. This goes beyond human factors narrowly defined as behavior and calls for human factors understood as sensemaking. Thus, studying the culture of fire shelter use, or of any tool, requires different methods of study. This study employs sensemaking, argumentation, and signal detection theory to begin to tap into the culture of fire shelter use in wildland firefighting, including the potentially unintended consequences of investigating all deployments.

Background

Shelter deployments have been investigated as entrapments since the creation of the NWCG Safety Committee in 1987. Investigating shelter deployments as entrapments overlooks the possibility that not all deployments may have been due to entrapment and that not all entrapments may be investigated if they do not involve a shelter deployment. Thus, according to sensemaking theory (Weick 1995), the environment perceived by firefighters may be more complex than the environment officially recognized by policy. According to signal detection theory (Saveland 2005), which is a specific “friend or foe” application of a more general theory of error types (Heimann 2005), an organizational “signal” may legitimately be set at such a low threshold. However, something else must shift in the culture to accommodate. As an example, the threshold for discussion of bombs at airport security in the U.S. is extremely sensitive; thus we modify our behavior accordingly. With fire shelter deployments as signal, accommodation may take the form of intended consequence of reducing entrapments, or the form of unintended consequences of firefighters delaying, avoiding, hiding shelter deployments. Unlike “friend or foe” systems (where an actual enemy can be identified in retrospect), the reality of whether danger was *actually* approaching is subjective. As a result, there is no necessary symbol that corresponds with the signal (Feldman and March 1981). For these reasons, cultural sensemaking about the shelter deployment as signal is subject to influence through argument.

Methods

Archival data (e.g. USFS 1989) yielded arguments that have attempted to fix the meaning of shelter deployments for wildland fire culture since the introduction of fire shelters. The arguments’ basic assumptions are analyzed using argumentation and signal detection theories. The analysis does not try to determine “what happened” on historic fires, but rather how members of the wildland fire community have *used* those fires to influence meanings surrounding shelter deployments, and thus the culture of fire shelter use.

Results

Two strong arguments have emerged from the analysis thus far. Proponents of Argument 1 claim that an increase in shelter deployments signals an increase in entrapments, and thus

shelter deployments signal that firefighters are potentially increasing danger by taking more risks. With the goal of reducing entrapments, they have traditionally called for firefighters to get “back to basics” (e.g., follow the 10 Standard Fire Orders), where success would be indicated by a reduction in deployments. Proponents of Argument 2 identify a stigma regarding fire shelter use, which they attribute to Argument 1 along with other cultural reasons. A stigma, they claim, potentially discourages the use of the tool, which puts firefighters in danger because they may delay or avoid using the shelter. With the goal of removing the stigma, they have traditionally called for firefighters to practice deploying and to use shelters at their own discretion.

The basic assumptions are then analyzed using signal detection theory. Starting with a given status quo condition, factors are environmental change (yes/no) and response to perceived environmental change (yes/no), laid out in a 2x2 grid. The corresponding outcomes are *Correct Action*, Type I error (*Miss*), Type II error (*False Alarm*), and *Correct Rejection*. Argument 1 assumes entrapments are preventable and thus regards shelter deployments as a *Miss*, under the conditions where status quo is “engage” and the new action required is “disengage if danger is approaching.” Argument 2 assumes entrapments are inevitable and thus regards shelter deployments as a *Hit*, under the conditions where the status quo is “do not deploy” and the new action required is “deploy if danger is approaching.” These arguments fundamentally differ on whether entrapments are inevitable. As a result, Argument 1 focuses on engage/disengage, whereas Argument 2 focuses on do not deploy/deploy. According to argumentation theory, they are not addressing the same points of *stasis* (Aristotle) and thus will never be resolved.

If all shelter deployments are to continue to be investigated as entrapments, options should be explored to prevent unintended consequences (i.e., delaying, avoiding, or hiding deployments), and to encourage intended consequences (i.e., avoiding entrapment). These include studying all entrapments and not just deployments; studying entrapments differently so that deployments are not regarded as a *Miss*; and legitimating more arguments for firefighters to disengage from a fire in order to avoid entrapments. To some extent recent initiatives in training (e.g. the annual refresher), risk management (e.g. “how to properly refuse risk”), and investigation methods (e.g. Chamberlin 2007) have begun to address these issues. Nevertheless, as recently as 2006 firefighters deployed shelters for “environmental” or “precautionary” reasons, and investigators examined “potential” and “possible” shelter deployments. The environment perceived by firefighters remains more complex than the environment recognized by policy, and cultural accommodations may be occurring in the “unintended” direction. More broadly, future studies of human factors associated with wildland fire tools should go beyond technical and behavioral frames, and toward sensemaking to tap into the culture of tool use. This includes the influence of measures taken for deviation correction, and the strong arguments that attempt to influence cultural sensemaking about an otherwise ambiguous signal.

Literature Cited

- Aristotle (1991) ‘On rhetoric: A theory of civic discourse.’ (GA Kennedy trans.) Oxford UP.
(New York) Orig work published 4th Century B.C.
- Chamberlin P (2007) ‘Facilitated learning analysis.’ (Author: Missoula MT)
- Feldman MS, March JG (1981) Information in organizations as signal and symbol.
Administrative Science Quarterly **26**, 171-186.
- Heimann (2005) Repeated failures in the management of high risk technologies. *European Management Journal* **23**, 105–117.
- Saveland J (2005) Integral leadership and signal detection for HRO. In ‘Proceedings of the 8th wildland firefighter safety summit’ (Ed. BW Butler) (IAWF:Fairfax, VA)
- USDA Forest Service (1989) ‘Fire shelter deployment review: 1988.’ (Region 1: Missoula MT)
- Weick KE (1995) ‘Sensemaking in organizations.’ (Sage: Thousand Oaks)

Wildland Fire Decision Support System

David Calkin

USDA Forest Service; Rocky Mountain Research Station
800 East Beckwith
Missoula, MT 59801
(406) 542-4151
decalkin@fs.fed.us

Krista Gebert

USDA Forest Service; Rocky Mountain Research Station
800 East Beckwith
Missoula, MT 59801

Kevin Hyde

METI
800 East Beckwith
Missoula, MT 59801

Keywords: wildland fire, decision support systems, fire economics

Introduction

Researchers with the Forest Service Rocky Mountain Research and National Wildfire Technology Transfer Specialist with the National Interagency Fire Center have developed a new Wildland Fire Decision Support System (WFDSS). WFDSS was designed to provide improved decision support to ongoing large fire incidents with an intention of replacing the existing requirements for strategic fire assessments; the Wildland Fire Situation Assessment (WFSA) for suppression events and the Wildland Fire Implementation Plans (WFIP) for wildland fire use events.

Methods

The WFDSS addresses weakness identified within the WFSA process: primarily the quality of long term fire behavior projections and the economic impact assessments. WFDSS has two foundational models: the Fire Spread Probability (FSPro) model and the Rapid Assessment of Values At Risk (RAVAR) model. FSPro simulates fire behavior in the absence of control for a number of potential future weather patterns and allows for the analysis of likely fire behavior over longer periods than typically modeled in existing tools such as FARSITE. The model simulates the 2-D growth of the fire across the landscape (fuels & topography) using a computationally efficient form of the *FARSITE* calculations. FSPro differs from *FARSITE* in that it simulates fire growth for thousands possible weather scenarios using the latest recorded perimeter (or point). Different weather possibilities are developed statistically using the data from local weather stations (fuel moisture, wind speed and direction). The probability for each cell is a calculation of counting how many times a cell burns divided by the total number of simulations.

RAVAR identifies resource values at risk from wildfire and integrates spatial resource value data sets with areas threatened identified by FSPro. A primary layer to the RAVAR model is the structure layer. The structure layer is generated by reaching out to local county offices including assessors, planners, natural resources, and GIS staffs, to acquire the county's spatial (GIS) parcel records. A building clusters map is developed representing the general location of structures identified within the parcel records. In counties where spatial data is limited, an arrangement has been made with the USGS Rocky Mountain Geographic Science Center to conduct aerial photo interpretation to rapidly identify structure location. However, RAVAR is not limited to the assessment of threatened structures. Any resource value that has been spatially mapped may be included within a RAVAR assessment. National and Regional data layers have been incorporated into the model including but not limited to critical infrastructure (e.g. power lines, road networks, and gas pipelines), municipal water intakes, developed public recreation facilities, sensitive wildlife habitat, and ecological data from the LANDFIRE project.

WFDSS allows field personnel to develop a stratified cost index (SCI) to identify historic cost averages for fires with similar characteristics. The WFDSS system was identified as a component of the Forest Service management efficiencies designed to improve large fire oversight for the 2007 fire season. The WFDSS system is being built in a Web based environment with a fully operational system planned for the 2009 fire season.

Results

WFDSS was tested on over 70 large fires during the 2006 fire seasons with substantially increased use during the 2007 fire season through an expanded web based prototype system. Through these trials, WFDSS has been demonstrated to improve strategic fire suppression planning, support appropriate management response (AMR) decision making, inform fire prioritization for scarce suppression resources in area command settings, and address agency concerns regarding suppression cost containment.

A 5th Slice of Swiss Cheese: The Command Concept in Wildland Firefighting

Kent B. Maxwell

Colorado Firecamp / Chaffee County Fire Protection District, Salida, Colorado
e-mail: kmaxwell@coloradofirecamp.com

Introduction

The Swiss Cheese Model fails to account for one of the most important human factors - incident command - that can either defend against or cause and contribute to entrapment fatalities at wildland fires. As studied using the Human Factors Analysis and Classification System (HFACS,) the Swiss Cheese Model provides a useful metaphor which can accommodate all human causal factors for military, commercial and general aviation accidents. While intuitively applicable to all organizational accidents, the utility of the model diminishes when studying entrapment fatality incidents, due to differences between the cockpit and fireline.

Methods

Shappell and Weigmann (2001) adapted their “Taxonomy of Unsafe Operations” (1997) to create HFACS by defining the “holes” in the four slices of Reason’s Swiss Cheese Model. Ryerson and Whitlock (2005) proposed a “de-aviationized” system for use by wildland agencies (Human Factors Accident and Incident Analysis) which eliminates both the slices and taxonomy, as demonstrated by the 11-page checklist of the Esperanza Fire Accident Investigation Factual Report (2006).

A review of a couple dozen entrapment fatality reports finds human causal and contributing factors that do not fit neatly within the HFACS taxonomy. Those factors relate to command.

Results

The Command Concepts Theory (1999) can serve as a 5th slice of the Swiss Cheese Model, with three categories of active failures closely related to 9 of the 10 Standard Firefighting Orders and their implementation as a 3-part system concerned with fire behavior, fireline safety and organizational control. The Command Concepts further relate to the 3 principal efforts of the last 15 years to improve firefighter safety: the Campbell Prediction System, LCES (Lookouts-Communications-Escape Routes-Safety Zones,) and the fireline leadership initiative.

The command slice occupies a middle position among the defenses between firefighters and the fire. Unsafe acts (many) and preconditions for unsafe acts (few) sit on the end closer to the firefighters, with unsafe supervision (few) and organizational influences (many) on the other. Because the command slice often contains only a single individual – the incident commander – the resulting shape of the slices tapers in the center like an hourglass. For the purposes of accident investigation or criminal prosecution, this makes for an easy task of plotting the “trajectory to tragedy” through the command slice.

The question remains whether the Command Concepts or the Fire Orders can be implemented and evaluated in real-time, or used only in hindsight judgments of error and blame.

Literature Cited

- Builder, C.H., Bankes, S.C., Nordin, R. (1999). *Command Concepts: A Theory Derived from the Practice of Command and Control*. RAND National Defense Research Institute.
- Church, A. (2007). *Appearances, Reality, and the Rhetoric of Fighting Wildfires*. Fire Management Today, vol. 67, no. 1, U.S. Department of Agriculture, Washington, DC
- Moore, R. and Harris, B. (2006). *Esperanza Fire Accident Investigation Factual Report*. USDA Forest Service/California Department of Forestry and Fire Protection, Riverside County, CA.
- Reason, J. (1997). *Managing the Risks of Organizational Accidents*. Ashgate Publishing Company, Burlington, VT.
- Ryerson, M. and Whitlock, C. (2005). *Use of Human Factors Analysis for Wildland Fire Accident Investigations*, Eighth International Wildland Fire Safety Summit, Missoula, MT.
- Shappell, S.A., and Wiegmann, D.A. (2000). *The Human Factors Analysis and Classification System—HFACS*. U.S. Department of Transportation Report, DOT/FAA/AM00/7. Office of Aviation Medicine, Washington, DC.
- Shappell, S.A., and Wiegmann, D.A. (2001). *Applying the Human Factors Analysis and Classification System (HFACS) to the Analysis of Commercial Aviation Accident Data*, 11th International Symposium on Aviation Psychology, Columbus, OH.

Questioning the Normative Approach to Wildfire Management Decisions: The Malleability of Acceptability Standards

Robert D. Jakubowski^{A,E}, Paul A. Bell^A, Tom C. Brown^C, and Terry C. Daniel^D

^ADepartment of Psychology-1876, Colorado State University, Fort Collins, CO, 80523
^BUSDA Rocky Mountain Research Station, Natural resources Research Center, 2150-A Centre Ave., Fort Collins, CO 80526

^CDepartment of Psychology, University of Arizona, 1503 E University Blvd. Building 68, Tucson, AZ 85721

^ECorresponding Author: Department of Psychology-1876, Colorado State University, Fort Collins, CO, 80523, email: jakurd36@lamar.colostate.edu

Additional Keywords: norms, context effects, policy making

Introduction

Recent research has suggested that the application of norm theory to wildfire management decisions is an effective way to discern what management actions are acceptable (1). Other research has begun to look at individual standard deviations across wildfire scenarios to establish how much consensus or “crystallization” is occurring in the sample (2). It has been suggested that this “crystallization” may be a valuable aspect of wildfire management (2). Although the utility of normative approaches has been thoroughly investigated, other research has questioned the existence of norms in resource management decisions (3). Often, the debate about whether the normative approach to resource management is useful has revolved around methodological issues (4).

Research conducted beyond the recreation norm literature has shed some light on methodological differences that can alter normative results. The role of context and methodological manipulations on attitudes, behavior, and judgments in environmental research has been extensively researched (5, 6, 7, 8). Brown and Daniel demonstrated the role of context on environmental judgments quite clearly. In a three-study investigation, the authors reported that simply manipulating the scenic beauty of initial slides participants saw prior to rating subsequent common slides led to differences in ratings. Brown and Daniel concluded that alterations of prior environmental context can shift the criteria that individuals use in rating subsequent environments. Other context effects have been demonstrated in judgments of environmental loss (8), reported levels of environmental concern (5), and overall reported knowledge regarding certain environmental situations (6).

Using acceptability norms to guide management policy is a sound practice only if these norms are not sensitive to methodological and context effects. The current project attempted to test the robustness of normative acceptability standards for wildfire management decisions. Using a published survey on wildfire management practices (2), the current project tested the malleability of acceptability norms. In line with the work on contrast effects previously discussed, it was expected that severe context scenarios would lead to an increase in acceptability for more active and extreme management policies such as putting a fire out, whereas doing nothing would become less acceptable

Method

The original 8 scenarios used by Absher et al. were assembled in the same original order and were designated as “Set A” of the stimulus materials. An additional 24 scenarios were also created, designated as “Set B.” Of these, 8 simply employed different combinations of the same

causes and outcomes as used in Absher et al., and were designated as “original range.” The other 16 scenarios in Set B were designated as “more severe and unfavorable” because they employed a more extreme cause and/or outcome than those in the original range. Thus, for these 16 scenarios an additional cause could be “arson” and additional outcomes could include “very poor and unhealthy” air quality, “extreme” burn danger, forest “will not recover to pre-fire ecological state,” and outdoor recreation “closed for 5+ years.” Two conditions were created. For condition 1, the neutral condition, participants received the Set A items only. For condition 2, the severe context condition, participants received the Set B items first followed by the Set A items.

For all items, the source of the fire was presented, followed by the four outcomes if the fire was allowed to burn. Fire sources could be variations of lightning, human accident, or arson. Outcomes included the fire’s impact on air quality in nearby communities, risk to private property, forest recovery time, and impact on outdoor recreation. Three management actions based on how the U.S. Forest Service could handle the fire were presented for each scenario. The actions included immediately put out the fire out, let the fire burn but contain it so it does not get out of control, and let the fire burn out on its own without trying to contain it. For each management action, acceptability of the management action was assessed using a Likert scale, ranging from 1 (highly unacceptable) through 7 (highly acceptable). The design of the study allowed testing for the effect of context between groups, with the dependent measure being the acceptability ratings of the target scenarios.

Results

Preliminary analysis suggests that altering the range of possible fire outcomes affects the mean ratings of the acceptability of the originally offered management alternatives. A three-way interaction was found for context x scenario x policy, $F(14, 132) = 1.83, p = .03, \eta^2 = .01$. Comparisons between neutral (i.e., pre-context) Set A policy ratings and severe (i.e., post context) Set A ratings revealed that out of 24 possible comparisons (8 scenarios with 3 policies each), context effects were present for 3 (12.5% of total) of them. Overall, multiple comparisons suggest that immediate context has the largest impact on the moderate policy ratings (i.e., let the fire burn but contain it so it does not get out of control). Ratings for this management policy were rated less acceptable after exposure to the severe context. The results presented herein suggest that management related norms can be a moving target and that caution should be exercised when making policies using the normative approach. These findings are also currently being investigated by the author in wildlife management settings as well.

Literature Cited

1. K Kneeshaw, J.J. Vaske, A.D. Bright, J. Absher, *Soc. Natur. Resour.* **17**, 477 (2004).
2. J.D. Absher, J.J. Vaske, A.D. Bright, M.P. Donnelly, *Soc. Natur. Resour.* **19**, 381 (2006).
3. J.W. Roggenbuck, D.R. Williams, S.P. Bange, D.J. Dean, *J. Leisure. Res.* **23**, 133 (1991).
4. T.E. Hall, J.W. Roggenbuck, *Leisure Sci.* **24**, 325 (2002).
5. D.E. Blake, *Environ. Behav.* **33**, 708 (2001).
6. A.M. Brandenburg, M.S. Carroll, *Soc. Natur. Resour.* **8**, 381 (1995).
7. T.C. Brown, T.C. Daniel, *J. Environ. Psychol.* **7**, 233 (1987).
8. T.C. Brown, G.L. Peterson, R.M. Broderson, V. Ford, P.A. Bell, *J. Environ. Psychol.* **25**, 13 (2005).

Individual and Organizational Influences to the Use of Fire and Fuels Research by Federal Agency Managers

Vita Wright

USDA Forest Service, Rocky Mountain Research Station, Aldo Leopold Wilderness Research Institute, 790 E. Beckwith Avenue, Missoula, MT 59801, United States
E-mail: vwright@fs.fed.us

Additional keywords: technology transfer, science delivery, science application

Introduction

The Joint Fire Science Program (JFSP) and the National Fire Plan (NFP) spend considerable amounts of money on fire and fuels research. From Fiscal Year 1998-2006, the JFSP spent approximately \$145 million, and from Fiscal Year 2001-2005, the NFP spent approximately \$104 million on research. For the costs of research to be fully realized, it is critical that science communicators effectively deliver relevant research results and that potential users apply them.

Fire and fuels research scientists most commonly deliver results by publishing scientific articles, hosting information on web sites, and presenting their results at conferences, workshops, and trainings. Federal agencies also provide access to scientific information and tools by offering free publication distribution (e.g., <http://www.treearch.fs.fed.us>), library and document delivery services (e.g., <http://www.nal.usda.gov/digitop>; <http://library.doi.gov/ill.html>), and searchable web syntheses (e.g., <http://www.fs.fed.us/database/feis>). However, the use of research by fire and fuels managers is dependent on more than awareness and information accessibility.

There is a wealth of research on interpersonal and organizational communication, organizational learning, social psychology, and public administration that can provide insight into how and when federal agency managers adopt scientific information and tools. This literature is dispersed throughout a variety of social science disciplines and has not yet been synthesized and integrated to inform fire and fuels science delivery efforts.

For example, the *Diffusion of Innovations Theory* explains that adoption of new ideas and approaches is a multi-stage process with the potential for active or passive rejection at several points during the innovation-decision process. This theory recognizes that diffusion takes time. The time it takes for diffusion to occur is influenced by a variety of factors, including potential users' characteristics at both the individual and community levels (Rogers 1995; Wright 2004).

Additionally, communication research reveals that the potential for misunderstanding during communication is high. Scientists and managers can be misunderstood as a result of language ambiguity, inference and guesswork, inadvertent secondary messages, selective attention, and preconceived notions (Sillars 2006; Wright 2007). By better understanding and predicting potential users' beliefs and reactions to the introduction of innovations, science communicators may be able to reduce the potential for misunderstanding, thereby shortening the time for diffusion to occur (Berger 1997; Wright 2007). More effective science delivery should lead to better use of relevant science, better accountability, and ultimately, better stewardship.

The study presented here aims to understand perceptions of potential users about influences to the use of fire and fuels research, to evaluate the relative strengths of these influences for different user groups, and to develop recommendations for prioritizing limited fire/fuels science delivery resources. Studied user groups include decision makers and assistant decision makers,

fire management officers, fuels specialists, and fire ecologists at regional/state and field offices in the United States Forest Service (USFS), National Park Service (NPS), and Bureau of Land Management (BLM).

Methods

This study employs a multi-method approach. First a literature review and agency meetings were held to identify the range of perceived influences to science application. Next, regional case studies with in-depth interviews are being used to gain a deeper understanding of identified influences by targeted user groups in each agency. Finally, a survey will be used to evaluate the strength and prevalence of influences among the studied potential users groups.

Four agency meetings were held in the western United States during Spring 2005. The results were used to develop an interview guide. During Spring 2007, 34 interviews were conducted at 5 USFS study sites and 3 NPS study sites. An additional 20 interviews are planned at 5 BLM study sites during Fall 2007, and the survey will be administered during Winter 2007/2008.

Interview topics include the role and relevance of research for fire and fuel management goals; organizational culture regarding science and innovation; individual comfort with trying new approaches; history with, and perceptions of, science and scientists; balancing time spent to apply research with other priorities; weighing research results against experiential knowledge; the uncertainty of science; professional communication networks; the limitations of science; and public influences to the use of research.

Drawing from the interviews as well as relevant literature, the survey will measure potential users' perspectives on their past experiences with scientists, beliefs and attitudes about research and scientists; cultural and process attributes of innovative/learning organizations; organizational culture regarding science; leadership; and external influences to the use of science.

Results

Data collection and analysis are ongoing.

Acknowledgements

Research represented in this paper is supported by the Joint Fire Science Program; the USDA Forest Service: Rocky Mountain Research Station, Pacific Northwest Research Station, National Fire Plan, and Washington Office – Fire and Aviation Management; the BLM National Science and Technology Center; and the National Center for Landscape Fire Analysis.

Literature Cited

- Berger, C (1997) Message production under uncertainty. Pages 29-55 *In* G. Phillipson & T.L. Albrecht, eds. Developing communication theories. (State University of New York Press. Albany, NY)
- Rogers, EM (1995) Diffusion of innovations, fourth edition. (The Free Press: New York, NY) 519 p.
- Sillars, AL (2002) For better or worse: re-thinking the role of “misperception” and communication in close relationships and families. 17th annual B. Aubrey Fisher Memorial Lecture, University of Utah.
- Wright, V (2004) How do land managers adopt scientific knowledge and technology? Contributions of the Diffusion of Innovations theory. In: ‘Making Ecosystem-based management work’ Proceedings of the Fifth International Conference on Science and Management of Protected Areas. (Eds Munro Neil, Dearden, Phil, Herman, Tom B., Beazley, Karen, Sorun Bondrup-Nielson) [CD-ROM]. Chapter 8(3). (SAMPAA: Wolfville, Nova Scotia, Canada) Available: <http://www.sampaa.org>.
- Wright, V (2007) Communication barriers to applying federal research in support of land management in the United States. In: ‘Proceedings: international conference on transfer of forest science knowledge and technology’. (Eds Miner, Cynthia; Jacobs, Ruth; Dykstra, Dennis; Bittner, Becky) pp. 55-62. General Technical Report PNW-GTR-726. (US Department of Agriculture, Forest Service, Pacific Northwest Research Station: Portland, OR)

Human Factors & Risk Management RD&A

Jim Saveland

USDA Forest Service, Rocky Mountain Research Station, 240 West Prospect Road, Fort Collins, CO 80526
Email: jsaveland@fs.fed.us

The complex world of fire management is fraught with great challenges: dramatically improve firefighter and public safety, reduce the costs of large wildfires, restore fire-adapted ecosystems across large landscapes while minimizing the nuisance of smoke and the chance of escaped fires. And do this in a polarized political environment, while the wildland-urban interface grows rapidly, and the climate changes. All of these challenges require expertise in risk management. The Rocky Mountain Research Station has recently created a Research, Development and Application unit (Human Factors & Risk Management) as an experiment in trying to focus attention and attract resources for the application of social science to the evolution of risk management in wildland fire organizations.

The work of the unit will be integrally informed, i.e. embracing all four quadrants and all levels of Ken Wilber's integral model. The scale of work will span the entire spectrum; from individual behavior & psychology, to small group dynamics, to organizational systems and culture. The RD&A seeks to develop new social networks between social scientists in academia (a variety of colleges and departments), social scientists in government agencies, and land management practitioners, especially fire managers. The focus of the RD&A is action research – the simultaneous development of robust theory and actionable practices in the field. As John Dewey put it many years ago, “there is no question of theory versus practice but rather of intelligent practice versus uninformed, stupid practice.” The advancement of knowledge and practice will be grounded in injunction, experience, and communal confirmation/rejection. The RD&A will work with all eight major methodologies (autopoiesis, empiricism, phenomenology, structuralism, hermeneutics, ethnomethodology, social autopoiesis, and systems theory) that our outlined in Ken Wilber's four quadrants of integral theory.

This presentation reviewed current activities of the unit including: fire doctrine dialogues, leadership development, high reliability organizing, seeing and transforming safety culture, evaluating incident management operations, reviewing various accident investigation reform efforts, and investigating upward voice on the fireline.

This presentation then reviewed the American Association for the Advancement of Science (AAAS) data on 25 years of federal spending on R&D in the United States. In recent years, funding for weapons development and health care R&D has skyrocketed, while energy and environment R&D has remained low and flat for decades. Earmarks have risen dramatically in federal R&D in recent years. After the National Academy of Science published *Rising Above the Gathering Storm*, the Office of Science and Technology Policy developed and published the *American Competitiveness Initiative: Leading the World in Innovation*. The President's proposed budget for R&D in fiscal year 2008 reflects the administration's priorities for weapons development, spacecraft, and continued support for the American Competitiveness Initiative. Congress supports the American Competitiveness Initiative, spacecraft, and their priorities for biomedical, energy, and environmental (climate change) research and development. Funding for social science to address the major social adaptive challenges facing the country and the world is negligible.

Public preferences and expectations of fire management during a wildfire

Sarah McCaffrey

USDA Forest Service Northern Research Station

1033 University Place, Ste 360

Evanston, IL 60201

smccaffrey@fs.fed.us

Introduction

Fire management decisions need to take into account public preferences and expectations. However, most studies on public acceptance have focused on pre-fire fuels management strategies such as prescribed fire, thinning, and community preparedness (McCaffrey 2006). Less attention has been paid to understanding public expectations for general fire management, and more specifically of management actions during a fire. Partly to illuminate this issue, a series of focus groups were held in five locations in the western United States to explore public opinions of fire management in general and in terms of specific aspects including thinning, defensible space, prescribed fire, and management actions taken during a fire. This paper will discuss results of these focus groups specific to understanding participant opinions on general fire management strategies with particular attention paid to views and expectations related to actions taken during a fire, including how much emphasis should be placed on protecting structures and the option of letting some naturally occurring fires burn.

Methods

Fifteen focus groups were conducted from May to July 2004 in five fire-prone areas of the western United States: Boulder, Colorado; Flagstaff, Arizona; Hamilton, Montana; Reno, Nevada; and San Bernardino, California. Participants were recruited via phone calls using a geographically targeted sample list. As the purpose was to obtain perceptions from the general populace rather than those with a particular interest in wildfire issues, individuals employed by a government agency with jurisdiction over forestry or air quality, those with any affiliation with the logging or timber products industry, or those who worked with any firefighting organization were excluded from the sample. Quotas were established to ensure an appropriate cross section of the population. Three focus groups were conducted in each location. Focus group size ranged from 8 to 15 participants, with an average size of 11. All groups were recorded and transcribed. Transcripts were then systematically coded for analysis using N6 software. Initial discussion focused on forest health, general wildfire risk, and use of defensible space. Discussion then moved to questions designed to understand participant reaction to fire management in general and to specific practices that might be used during a fire such as letting some natural fires burn (wildland fire use) and use of backburns.

Results

When asked how society was doing overall on fire management, the response was almost uniformly negative (not good, terrible). Interestingly, both in terms of how people judged how

well we are doing and in discussions of what needs to be done differently the emphasis was clearly on actions that are not occurring *before* a fire starts. These actions focused on active forest management, particularly use of prescribed burning and thinning, to decrease the fire risk, as well as the need to control building in high fire risk areas. The only action commonly cited in judging overall effectiveness that involved actions taken during a fire were related to initial response, specifically speed of response and use of aerial resources. In general, respondents had a rather high faith in the effectiveness of aerial resources in the fire fighting process.

A series of questions were asked to understand perceptions of who is responsible for protecting homes. The answer was complex, reflecting the nuanced reaction of participants. Overall, the dominant view was that local fire departments are responsible for protecting homes, followed by the homeowner. State and Federal agencies come into the home protection equation when fires get big. Most participants recognized that those who built in fire risk areas needed to take responsibility for their decisions and shouldn't expect federal fire protection. But many also recognized that when it was their own house that was threatened, their views might change.

When asked if more naturally occurring fires should be allowed to burn, there tended to be a negative reaction. However, once the moderator provided a detailed explanation of the amount of planning that was required before this could occur, the vast majority of participants thought it was a good idea, particularly if this meant it would free resources – either financial or firefighting – that could be used to limit harm from more damaging fires.

Another question explored the trade-offs participants were willing to make in the firefighting process. Specifically, participants were asked whether a backburn that might help control a fire but put two houses at risk should be lit. As with the wildland fire use question, a great deal of clarification was required before people felt comfortable providing an opinion. Overall, responses were more mixed than for the wildland fire use, but still showed a majority of respondents who supported lighting such a fire, provided the likely benefits outweighed the likely negatives.

Ultimately, the discussion indicated that efforts to communicate the need to mitigate fire hazard, both on public and private lands, have been reasonably effective. While there remains much confusion around issues of actually fighting fires, results indicate that with explanation (such as has already been provided for pre-fire mitigation efforts) of the reasons behind the firefighting decisions, support for actions often considered controversial can increase.

Literature Cited

McCaffrey, S.M. (tech ed)., *The Public and Wildland Fire Management: Social Science Findings for Managers*. Gen. Tech. Rep. NRS-1. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 202 p. (2006)

Beyond active failures and latent conditions: Applying organizational communication metatheory to rework the “Swiss Cheese Model” of accident causation

Rebekah L. Fox^A, and Jennifer A. Ziegler^{B,C}

^A Purdue University, Department of Communication, 100 North University Drive, West Lafayette, IN 47907 USA

^BValparaiso University, Department of Communication, 1809 Chapel Dr. Schnabel 6, Valparaiso, IN 46383 USA

^CCorresponding author. Email: Jennifer.ziegler@valpo.edu

Introduction

In recent years, organizations in high risk industries have begun to embrace models of organizational accidents that downplay individual error in favor of examining systemic factors that may have contributed to the tragedy, of which the individual played *a* part but not the only one (Perin, 2005). A stated role of accident investigations seek to identify systemic failures that can be corrected by adjusting work procedures (Thackaberry, 2005).

James Reason’s (1997) model of organizational accidents, often referred to as the “Swiss Cheese Model of Accident Causation” has been influential in creating this change. Reason developed the model in order to help high risk organizations to better “manage the risks of organizational accidents.” The Swiss Cheese model was translated to the Human Factors Analysis and Classification System for aviation by Shapel and Wiegmann (2000), and was recently embraced by the wildland fire community (Ryerson and Whitlock 2005; USDA 2003).

Our paper is concerned with the fact that in modeling organizational accidents, Reason’s model is implicitly modeling *the organization* and the role of individuals in it, which implicates communication (Taylor, 1999). Therefore, in addition to transforming accident investigations in high risk industries, Reason’s model also has the potential to transform popular and theoretical conceptions of organizing per se.

Given Reason’s critical impulses to transform investigation, but also given the tendency of popular management discourses to overly reinforce the organization as a “container” within which communication flows like a conduit, in this paper we examine the model’s implicit assumptions about the nature of organization and organizing, including the role of individuals in contributing to organizational accidents.

Methods

We rhetorically analyze the model’s two key terms, “latent organizational conditions” and “active failures,” as well as the implications of the two terms being set in opposition to one another. By juxtaposing “latent conditions” and “individual actions,” Reason’s model relegates *being* only to the organization and *action* only to the individual, and thus fails to capture organizational becoming, plus how individual action may be shaped by context. These limitations, we argue, potentially short-circuit the model’s explanatory power and emancipatory potential. We are not critiquing the utility of having such a model but rather how meanings associated with its key terms may train practitioners’ thinking in limited ways (Deetz 1996).

After explaining the model and identifying these limitations, we apply the organizational communication equivalency theory developed by J. R. Taylor and associates, particularly his ontological conception of organization as both “text and conversation” (Taylor *et al.* 1996) to challenge the model’s rather static conception of organizational ontology.

Finally, we reanalyze data from the fatal 2003 Cramer fire using the reworked model. Organizational problems in conveying weather related information to the firefighters illustrate how the emergence of organizational defects can be a quite “active” process; and, how 30

individual action may be influenced by sensemaking about emerging organizational defects. We also note how the model itself can be used as a conversational tool to overcome both problems.

Results

The model divides up action and being and parcels them out separately to the individual and the organization, respectively. In the realm of being, only the organization exists; moreover, it exists as a static entity. The model provides no way to understand how organizations “become” through ongoing activities including communication. Conversely, in the realm of action, it is only individuals who act. There is no acknowledgement of the role of context and how it can shape individual sensemaking and action (Weick 2005). Perhaps constrained by an underlying machine metaphor for organization, there is thus no acknowledgement of the role of *interaction* in the process of organizing (Taylor *et al.* 1996).

Three implications stem from these limitations. Juxtaposing active and latent conveys meanings of passivity for the emergence of organizational defects, when the breaking down of organizational defenses can be a quite active normalizing process (Vaughn 1996). Second, juxtaposing latent with active represents individuals as if they behave consistently without regard for sensemaking in a changing context that includes the emergence of organizational defects. Third, juxtaposing latent with active suggests that organizational defects are only knowable in retrospect, that is, after a tragedy has occurred, whereas the model may actually be used as a discursive tool to talk about defects as they are emerging (exteriorization) (Taylor 1999). We explore how these before and after scenarios apply to understanding the Cramer fire.

We recommend a reworking of the model by expanding its key terms to capture organizational being and becoming, how individual action is shaped by sensemaking in a changing context, and ways to use the model itself in everyday conversation to point out organizational defects as they are emerging.

Literature Cited

- Deetz SA (1996) Describing differences in approaches to organization science: Rethinking Burrell and Morgan and their legacy. *Organization Science*, 7, 191–207.
- Perin C (2005) ‘Shouldering risks: The culture of control in the nuclear power industry.’ (Princeton University Press)
- Reason J (1997) ‘Managing the risks of organizational accidents.’ (Ashgate: Burlington, VT)
- Ryerson M and Whitlock C (2005) *Use of human factors analysis for wildland fire accident investigations*. In B Butler (Ed.) ‘Proceedings of the Wildland Firefighter Safety Summit’ (April 26-28, 2005, Missoula, MT). (IAWF: Fairfax VA)
- Shapel SA and Wiegmann DA (2000) ‘The Human Factors Analysis and Classification System–HFACS.’ (FAA: Washington DC)
- Taylor JR (1999) What is “organizational communication”? Communication as a dialogic of text and conversation. *The Communication Review*, 3, 21-63.
- Taylor JR, Cooren F, Giroux N, and Robichaud D (1996) The communicational basis of organization: Between the conversation and the text. *Communication Theory*, 6, 1-39.
- Thackaberry JA (2005) ‘Stakeholder participation in the myth of managerial rationality: Consequences of a “successful” managerial rhetoric of control in wildland firefighting.’ Paper presented at the annual meeting of the National Communication Association (Boston, MA).
- USDA Forest Service (2003) ‘Accident investigation guide.’ (Missoula MT: MTDC)
- Vaughan D (1996) ‘The *Challenger* launch decision: Risk technology, culture, and deviance at NASA.’ (University of Chicago Press)
- Weick KE (1995) ‘Sensemaking in organizations.’ (Sage: Thousand Oaks)

The U.S. Fire Learning Network

Bruce E. Goldstein,^{A, C} William H. Butler^A

^A Urban Affairs and Planning Program, School of Public and International Affairs, Virginia Tech, Blacksburg, VA 24060

^C Corresponding Author. Email: brugo@vt.edu

Keywords: Learning network, organizational learning, ecological fire restoration, landscapes

Introduction

Wildland fire management in the United States is in a state of frustrated transition. The single-minded commitment to suppression that dominated a century of U.S. fire management ended three decades ago (1). Wildland fire policy now embraces multiple goals including ecosystem restoration, fuels reduction and community protection as a deeper understanding of the dynamics of disturbance-adapted ecosystems informs new policy directions. However, the suppression legacy persists, continuing to reproduce itself through incentive structures, professional practice and other aspects of institutional culture (2).

In order to foster the transition to ecologically-based fire management, the nation's primary land management agencies, the US Forest Service (USFS) and various agencies of the Department of Interior (DOI), have joined with The Nature Conservancy (TNC) to create the U.S. Fire Learning Network (FLN). The first iteration of the FLN connected 25 project teams from across the nation in a carefully structured planning effort that spanned two years. Fire management professionals from selected regions worked together to prepare an account of the past, present, and desired future conditions of fire in their region's ecosystems, and then create operational plans to restore fire-adapted landscapes. Four structured workshops offered opportunities for peer review of plans and sharing of fire management strategies and science on the national stage. Following this first phase, projects were grouped together into geographic regions. By 2007, the network had included 87 project level landscapes in 10 regional networks engaging more than 500 partners in collaborative fire planning for over 90 million acres.

The FLN represents an innovative approach to engaging fire management practitioners in a structured network designed to enhance capacities to restore fire adapted ecosystems at ecologically meaningful scales and utilizing the best available science and practice to inform management decisions and actions. Through their participation in the network, fire management agencies and organizations develop new opportunities for collaborative action that cuts across disciplinary, operational, and jurisdictional boundaries, creating the potential for changing the very nature of how fire is managed on US wildlands to be more ecologically informed and at a scale that is ecologically meaningful.

Methods

In order to articulate the characteristics of the network that catalyze learning and change, the researchers have engaged in a qualitative case study of the FLN. We have observed 3 national FLN meetings, 8 regional meetings and numerous project level interactions. We have conducted dozens of interviews with and have reviewed hundreds of documents including summaries of regional and national meetings, semi-annual progress reports, fire management plans developed by network participants, evaluations, presentations, and documents created for internal and external communication purposes. We analyzed text files of all pertinent documents

and interview transcripts using NVIVO™ qualitative analysis software and a grounded theory methodology to develop initial theoretical constructs which are continuously modified and reinterpreted as new data is fed into the analysis process (Strauss and Corbin 1990).

Results

The FLN catalyzes change by creating structured opportunities for collaborative learning. The national network guided fire management professionals through a four step planning process. This process, modeled after TNC's Conservation by Design framework while integrating agency planning procedures, provided management professionals with high quality planning documents that could be integrated into existing organizational planning efforts. Professionals worked collaboratively with stakeholders in their region to jointly collect data and develop strategies for restoration work. Peer review processes and scientific and technical presentations at national workshops enhanced the quality of the plans.

Following the national experience, two distinct approaches emerged in the regional networks. The first approach follows the methods and structures created at the national level. Project teams collaboratively work through fire management planning exercises. At workshops, project leaders present their plans, attend field trips, hear scientific presentations, and engage in a peer review process of each team's work. The end result is generally increased collaborative capacity and greater attendance to ecological scale and ecological targets in fire planning. Many of the project teams have begun implementation, effecting change directly on the ground. This approach facilitates longer term change as fire managers collaboratively refine a professional practice that forwards the ecological restoration agenda of the broader network.

The second approach is a more comprehensive and scientifically driven planning effort that focuses on developing tools and models to inform ecological fire restoration work at landscape scales. Rather than directly engaging in the development of planning documents, these networks involve technical modelers in collaboratively creating more complete and informative modeling systems to guide fire management action. The extent to which these systems are integrated into broader planning efforts will determine the level of change that emerges from these networks. The potential change in fire management prioritization and practice is significant. However, the technical complexity of developing these models translates into a longer timeline for completion and integration into broader fire planning efforts.

These approaches to network design and implementation suggest that various aspects of wildland fire management can be transformed through innovative network governance. Sharing knowledge and information, developing tools and technologies, and jointly creating plans that cut across jurisdictional and disciplinary boundaries in a collaborative context has the potential to shape both individual professional practice as well as catalyze shifts in fire management on the ground.

Literature Cited

1. S. J. Pyne, *Tending Fire: Coping with America's Wildland Fires* (Island Press, Washington, DC, 2004), pp.
2. D. Carle, *Burning Questions: America's Fight with Nature's Fire* (Praeger, Westport, CT, 2002), pp.

The structuration of dysfunction: opportunities to change enduring organizational problems

Elizabeth A. Williams

Purdue University, Department of Communication, West Lafayette, IN 47906, USA
Email: elizwill@purdue.edu

Introduction

Investigations of wildland fires have tended to focus on the individual model of accidents. But the wildland fire community is increasingly starting to embrace the “organizational” model of accidents (see Reason 1997). This paper introduces “structuration” as a tool for understanding the relationship between the individual and the organization in wildland firefighting. Specifically it looks at how the experience of individuals may offer the opportunity for change. The Cramer Fire is used as an illustration of this relationship.

Structuration theory focuses on systems of human practices, or patterns of activity (Giddens 1979). In the performance of these activities, humans rely on a structure comprised of rules and resources. The rules and resources which individuals perceive to be available to them come from discourse and the formal and informal communication structures in the organization. By using the organizational rules and resources, individuals become active agents in the creation of these structures and every time they act they continue to reproduce them (Poole and McPhee 2005). Organizations can provide a climate (Bastien *et al.* 1995) in which self-reflexivity is encouraged and therefore individuals come to an awareness of their part in the creation of the organizational structure (Banks and Riley 1993; Barge 2004; Cunliffe 2001; Jacob and Heracleous 2005). This awareness can be used to continue the current structure or to introduce change.

Methods

This paper relies on analysis of archival data. Particularly the paper offers a discursive analysis of the Cramer Fire Accident Investigation Report, Management Evaluation Report, and interviews from the Cramer Fire investigation. In utilizing structuration theory this paper focuses on the actions and discourses which produce the structures, rather than looking at the structures themselves. Specifically it looks at the experience of the individual at moments when he/she experiences discomfort as an indication that there may be dysfunction in the organization. These moments are treated as an opportunity to take action and change structures which may be dysfunctional.

Results

An analysis of the Cramer Fire investigation report reveals a focus on issues involving management of the fire but only hints at elements of the organizational structure which may have created a set of constraints that led to mismanagement. First, stakeholders relied on structures which had become second nature through continual use despite opposing written rules, thus creating dysfunction. Next, evidence exists within the report that there were moments in which individuals recognized dysfunction. Finally, this paper suggests that this recognition of

dysfunction may have provided an opportunity for change. This opportunity for change however, depends on the organizational reflexivity and self-reflexivity which can create a climate of responsiveness.

The paper concludes that individuals often feel helpless when they recognize dysfunction. By understanding these moments of helplessness, we may begin to understand how to identify and act on them in the future so they become potential moments for change. By creating organizations which welcome open discourse and offer a supportive climate for speaking out, we can encourage the questioning of structures which may not be functional and therefore increase firefighter safety.

Literature Cited

- Banks, SP, Riley, P (1993) Structuration theory as an ontology for communication research. In 'Communication Yearbook'. (Ed. S. A. Deetz) pp. 167-196. (Sage Publications: Newbury Park, CA)
- Barge, JK (2004) Reflexivity and managerial practice. *Communication Monographs*, **71**, 70-96.
- Bastien, DT, McPhee, RD, Bolton, KA (1995) A study and extended theory of the structuration of climate. *Communication Monographs*, **62**, 89-109.
- Cunliffe, AL (2001) Managers as practical authors: Reconstructing our understanding of management practice. *Journal of Management Studies*, **38**, 351-371.
- Giddens, A (1979) 'Central problems in social theory' (University of California Press: Berkeley, CA)
- Jacobs, CD, Heracleous, LT (2005) Answers for questions to come: Reflective dialogue as an enabler of strategic innovation. *Journal of Organizational Change Management*, **18**, 338-352.
- Poole, MS, McPhee, RD (2005) Structuration Theory. In 'Engaging organizational communication theory and research: Multiple perspectives' (Eds DK Mumby, S. May), pp. 171-196. (Sage Publications: Thousand Oaks, CA)
- Reason, J (1997). 'Managing the risks of organizational accidents' (Ashgate Publishing: Burlington, VT)

Keywords: structuration theory, climate, organizational reflexivity, self-reflexivity

Understanding and developing tomorrow's fire managers: From 'Keeper of the Flame' to 'Fire-fighter' to 'Fire-warrior'

Anne Black, U.S. Forest Service, Rocky Mountain Research Station 790 E. Beckwith Ave, Missoula, MT 59801 aeblack@fs.fed.us

Jim Saveland, U.S. Forest Service, Rocky Mountain Research Station, 240 W Prospect Rd., Fort Collins, CO 80526-2098.

Introduction

Managing fire safely, cost-efficiently, and for a variety of ecological and social purposes during times of global climate change requires the development of a new paradigm for fire management. We quickly review the human relationship to fire over time and culture as a beginning point from which to re-think our relationship to fire and what skills we need to manage it. We invite you into an on-going and developing conversation.

Methods

We use the dialectic of thesis-antithesis-synthesis as an organizing framework for surveying a variety of disciplines - ancient stories (e.g., the Hindu parable of the poison tree), anthropology (e.g., ubiquitous myths of theft of fire from the mountain gods), the martial arts and modern theories (e.g., human development, philosophy, and leadership) - to explore past, present, and future relationships between fire and society. We then discuss the implications and suggestions this journey has for our next-generation fire managers, in particular the skills and leadership qualities being called for.

Results

The Hindi story of the 'Poisoned Tree' tells a parable of maturation and development – individual and communal. On first discovering a poisoned tree, people see only its danger. Their immediate reaction is one of protection: 'Let's cut this down before we are hurt...before anyone else eats of the poisoned fruit.' After journeying further in life, when people come across this poisoned tree, they meet it with respect. Knowing the poisoned tree is somehow connected to them, they say: 'let us build a fence around it so that others may not be poisoned and the tree may also have its life'. Still further along life's journey, when people come across this poisoned tree, they embrace it: "Oh, a poisoned tree. Perfect! Just what I was looking for.' This individual – or culture - picks the poisoned fruit, investigates its properties, mixes it with other ingredients, and uses the poison as a great medicine to heal the sick and transform the ills of the world.

This dialect, of fear – protect me/us, respect – protect me/us and it, love - integration is mirrored in many disciplines and cultures. In martial arts traditions these phases are known as the killing sword, the life-giving sword, and no sword (Trungpa 2007). In the hero's journey (Campbell 1949), these are known as separation, initiation, return. In psychology, these are joined by an initial undifferentiated stage before the infant recognizes ego boundaries between self and other/mother. The core dynamic in the dialectic is that each successive stage transcends, includes, and integrates the previous; each stage includes, but is more than the sum of what precedes it.

There is an intuitive crosswalk from these traditions to fire management. In the undifferentiated beginning, fire was sacred and watched over by fire-keepers, in the differentiation/ protection phase the result is fire-suppression – everywhere, all the time as fast as

possible. As we have learned the value of fire we have become fire use managers, with fire safely contained in some places and safely prohibited in others. In the past several years, the US has begun to talk of something else... of 'Appropriate Management Response' (AMR) the blending of these two – use and protection. As we struggle to understand AMR it might be useful to reflect upon the basic lesson from the dialectic - each phase implies and requires a fundamental shift in the way we, as individuals, society and organizations, think about ourselves and our place/role within the greater system. It implies that AMR is more than simply the combination of suppression and fire use. What might that be and what sorts of skills does that require? Can we again dive into the dialectic and survey other disciplines to gain ideas?

We can look to modern management research, for this field, too, has been begun to show evidence of a dialectic when looking at leadership styles (Parks 2005). Initial studies of leaders focused on those who could achieve great things through personal dominance. Subsequent studies, in the latter part of the 20th Century, began to notice that great companies seemed to be led by those who wielded not raw personal power (fear), but those who had an ability to build and use interpersonal influence (respect). More recently, leadership scholars have begun to define an 'integral' leader, one who combines and transcends these abilities (Parks 2005). Such standouts in today's complex and highly dynamic business environment do so by giving the problems back to their group, recognizing that unilateral solutions won't suffice, but a collective one is necessary. This "requires acts that assist people in moving beyond the edge of familiar patterns into the unknown terrain of greater complexity, new learning, and new behaviors...that requires transformation of long-standing habits and deeply held assumptions" (Parks 2005:11).

The characteristics of these leaders follow closely those of the classic 'warrior' (as opposed to 'soldier') definitions from across time and disciplines – ancient eastern philosophy, cutting-edge military thinking, and Jungian psychology. Warriors are people charged with maintaining boundaries – internal and external. This requires that they know where and what those boundaries are. They need to be self-aware, humble, skilled in communication, challenge, and intervention so that they can say what needs to be said, or gather and hold diverse views without escalating those to disintegration and violence, but towards deeper understanding.

When we stand back and consider all that we and the environment ask from our fire personnel - what it takes to lead or participate on the line safely and with high reliability - are these not the skills we need?

Literature Cited

- Campbell, J. 1949. *The hero with a thousand faces*. Princeton University Press
- Parks, S. D. 2005. *Leadership can be taught*. Harvard Business School Publishing.
- Sherman, N. 2005. *The ancient philosophy behind the military mind*. Oxford University Press.
- Strozzi-Heckler, R.S. 1992. *In search of the warrior spirit*. North Atlantic Books.
- Trungpa, Chogyam. 2007. *Shambhala: the sacred path of the warrior*. Shambhala

Making Sense of the Fire Environment(s): Applying Mode Confusion to Understand Failed Organizational Change in Transition Fires

Kristine Clancy

Pepperdine University, Seaver College, Communication Division, 24255 Pacific Coast Highway, Malibu, CA 90263, USA. Correspondence email: Kristine.Clancy@pepperdine.edu

Introduction

In the aftermath of the South Canyon tragedy several studies were done to in an attempt to better understand what went wrong, and how firefighters could learn from the accident and help to avoid similar situations in the future. Despite these and other warnings transition fires continue to pose significant risks to personnel safety. The wildland fire community has begun to take these warnings seriously and address the concerns raised in the aftermath of deadly transition fires. However, National Wildfire Coordinating Group (NWCG), which includes the Forest Service, has constructed the problem of transition fires as failures of leadership within the Incident Command System. In fact, they no longer use the term “transition fire” and instead refer to these problem incidents in terms of “transfer of command.” While changing the name from “transition fire” to “transfer of command” may direct our attention toward problems with leadership and management in these fires, it simultaneously draws our attention away from focusing on why it made sense to label the fires as “transition fires” in the first place. This paper explores the possibility that the problem with these fatal fires may be rooted in a more basic sensemaking problem shared by all in the transition. The purpose of this paper is to explore how managerial directives about how to identify size and severity of wildland fires may be contributing to problems in sensemaking on both the physical and organizational levels. Details from the fatal Cramer fire that killed two helitack firefighters in Idaho in 2003 are then used to show how the type rating system, and its application, may be interfering with firefighters’ ability to properly enact the fire environment(s) during transition fires. The paper applies aviation risk management researcher James Reason’s (1997) concept of “mode” confusion as a metaphor for understanding this potentially dual sensemaking problem.

Methods

Discursive analysis of the Cramer Fire Accident Investigation Report and related materials including media coverage of the event were examined using a sensemaking perspective. Building on the work before him, Weick (1979) developed a view of organizing as adaptation to the environment. Specifically, he argued there are four elements of organizing; ecological change, enactment, selection, and retention. Ecological changes provide the impetus for an enactable environment, or as the author explains they are “the raw materials for sense-making” (p. 132). Enactment is meant to capture the active role that members play in creating their environments. Selection is the process by which organization members select an interpretation, while retention refers to the means by which the organization stores successful acts of sensemaking for recall in the future. Additionally, Reason’s (1997) examination of mode difficulties in the aviation industry can help shed light on organizational failures during transition fires. According to Reason, an aircraft has at least five ways for changing altitude. Some of these modes are determined by the pilots while others are automatically triggered by the automated

Flight Management System (FMS). The aviation industry has recognized that mode confusion can have detrimental consequences. A similar confusion over fire type (V through I) is examined during the Cramer Fire, and specifically whether the Cramer Fire was still on “initial attack” or had moved to “extended attack.”

Results

This study explored how problems in transition fires can be caused by a phenomenon that is similar to mode confusion in aviation accidents. However, rather than regarding mode confusion in transition fires to be the result of automation, this analysis traces the problem to the way that two components of the fire environment are enacted in the moment: the physical fire itself and the organizational structure that is placed on the fire. Part of this confusion is caused by the managerial rhetoric of the Type rating system itself. Although it is clear what sense needs to be made of the physical environment to enact a Type V or IV fire, and although it is clear what sense needs to be made of the organizational structure to enact a Type II or I fires, a Type III fire is by definition defined as a fire that is transitioning from initial to extended attack. The Cramer fire in particular demonstrates that in practice, it may not be entirely clear whether a Type III fire is enacted from the dictates of the physical environment or the changes realized in organizational structure. If the decision to move to extended attack is prolonged, it means putting a limited number of personnel in dangerous situations longer than they need to be with resources stretched too thin. This is the most life-threatening time in wildland firefighting. Additionally, when the firefighters on the frontline have no reasonable means for assessing the fire type (i.e., mode), then they are never in a position to participate in the planning or execution of the fire suppression strategy. This confusion can also limit the type and amount of resources a fire will be given. These problems are compounded when some members of the fire team enact the fire environment in ways different from others, such as when an Incident Commander requests Type III resources but is denied them, thus freezing the fire organization in initial attack mode even though the physical environment has exceeded their capabilities. During the Cramer Fire unfortunately IC Hackett, the District Ranger, and other administrators continued initial attack longer than was sustainable with local resources. The Forest Service has taken steps to address concerns about transition fires by enacting the problem as one of leadership and by shifting the label for these fires to “transfer of command.” The Cramer Fire demonstrates that tragedy was not simply a result of failed leadership, but instead resulted when there was confusion between the physical environment and the managerial structure in place to deal with it. Thus, to label the problem as one of leadership, localized in the transfer of incident command from one person to another, completely ignores the physical environment. In the original label “transition” fire, the word transition was used to describe both a change in the fire itself as well as the organizational structure.

Literature Cited

- Reason J (1997) *Managing the risks of organizational accidents*. (Ashgate: Burlington, VT)
- Weick KE (1979) *The social psychology of organizing*. (McGraw-Hill: New York)
- Weick KE (1993) The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly*, 38, 628-652.
- Weick, K. E. (1995). *Sensemaking in organizations*. (Sage: Thousand Oaks, CA)

But Are We Making a Difference? Evaluating the L-380 Leadership Training

Michael T. DeGrosky

CEO, Guidance Group, Inc, P.O. Box 146, Wisdom, MT 59761 USA

Adjunct Instructor, Fort Hays State University, Dept. of Leadership Studies, 600 Park St. Hays, KS 67601

Doctoral Learner, Northcentral University, 10000 University Drive, Prescott Valley, AZ 86314

Email: mtd@smtel.com

Additional keywords: Leadership; training; evaluation

Introduction

Since 2000, approximately 7,000 people have completed the Fireline Leadership (L-380) training program, and the course provides a foundational element of the overall National Wildfire Coordinating Group (NWCG) leadership training curriculum. Consequently, L-380 represents training of strategic importance to the NWCG and its member agencies. Given the importance of this training, the scope of participation, and the relative costs to the participating agencies, the sponsor organizations recognize their strong incentive to evaluate the L-380 program to maximize the return on their substantial investment in this training. In fact, when chartering its Leadership Committee and leadership training curriculum, the NWCG charged the Committee with establishing a mechanism for evaluating the effectiveness of leadership training, with the objective being able to accurately assess how the leadership training impacted job performance.

In 2005, the author developed a quantifiable and statistically supportable method for collecting and analyzing training-related data to support the NWCG leadership initiative; with the intent of validating whether the L-380 training was on track. The resulting methodology can provide a model or template for ongoing evaluation of, not only the L-380 training, but also the broader NWCG leadership curriculum.

The method provides a systematic, quantitative approach to evaluation. Such an approach allows the Leadership Committee to determine whether the NWCG leadership training is effective, uses the L-380 course as a pilot for determining whether the NWCG leadership curriculum is bringing about change in participant performance on key leadership competencies forming the core of the programs, and assesses whether the NWCG leadership training curriculum is effectively promoting cultural change in the workforce by evaluating whether behaviors are extending into the organization beyond the training environment.

Methods

The evaluation strategy employed uses self-report data as a source of feedback on the L-380 training, and evaluates the L-380 training at Kirkpatrick Level 3 (Behavior) via retrospective pretests and posttests administered to both trainees and supervisors. The evaluation surveys measured the effectiveness of the L-380 training against 36 elements reflecting the learning targets addressed by the L-380 training (DeGrosky, 2005a). At its core, this evaluation measures the extent to which people observed behavior or performance (associated with the learning targets of the training) in the workplace beyond the training environment, both before and after the training. The method also gauges how far the desired performance has diffused or penetrated

into the workforce – in other words, the percentage of participants demonstrably engaging in the desired performance. The methodology employed is described in detail in the author's master's thesis, available in the library of the Guidance Group's website at <http://www.guidancegroup.org>. The author has twice implemented key elements of the method.

Results

In late 2004 and early 2005, a small-scale test was conducted using a sample of 55 L-380 training participants and 22 supervisors of those participants. The purpose of this test was to evaluate the utility and the validity of the instruments, but it naturally provided insights into the efficacy of the training as well. Despite the small sample size utilized for this test use, results indicated high reliability of the instruments. With the exception of the Ethics group, variations were not statistically significant. Since this test involved a small sample, the author reported, at the time, that means and standard deviations could change with a larger sample, but that the results should have been encouraging to those interested in this training.

In late 2006 and early 2007, the author made the methodology operational on contract to the Bureau of Land Management, using online survey technology. The 2006/2007 evaluation effort solicited information from 800 people (400 training participants and 400 supervisors of training participants), in an attempt to obtain information from 200 training participants and 200 supervisors using a web-based application of the method developed by the author (DeGrosky, 2005a; DeGrosky, 2005b.) Ultimately, the author obtained 351 useable surveys (210 supervisors and 141 participants), providing the database from which the evaluation was made.

The results of the 2006/2007 evaluation indicate that the L-380 training is producing significant improvement between the pre-training period and the post-training period on every element measured, indicating that both participants and their supervisors have witnessed improvement in the behaviors and performance of the course participants six months to one-year beyond the training. They also demonstrate that both the rate of improvement and the degree of diffusion into the workplace culture varies by learning target. The complete evaluation report for the 2007 evaluation of the L-380 training is available at the Wildland Fire Leadership Development Program (WFLDP) website at <http://www.fireleadership.gov>

Literature Cited

DeGrosky, M. (2005a). A Method for Evaluating The Fireline Leadership Training. Unpublished master's thesis. Fort Hays State University, Hays, KS USA.

DeGrosky, M. (2005b). User's Manual: Evaluation Method L-380 Training. NWCG Training Working Team: Leadership Committee.

What does it mean to communicate intent? Examining *Auftragstaktik* and its impact on leadership and doctrine in wildland firefighting

Jennifer A. Ziegler^{A,C}, and Michael T. DeGrosky^B

^AValparaiso University, Department of Communication, 1809 Chapel Dr. Schnabel 6, Valparaiso, IN 46383, USA

^BThe Guidance Group, Post Office Box 146, Wisdom, Montana 59761, USA

^CCorresponding author. Email: jennifer.ziegler@valpo.edu; website: <http://blogs.valpo.edu/jziegler>

Introduction

Communicating leader's intent, promoted by the wildland fire leadership development program, is gaining traction in wildland fire discourse as a way to think about effective leadership. For example, giving effective briefings was the national annual refresher topic this year, and trainees were introduced to the concept of briefing for intent, offered a rationale for communicating intent, and offered specific communication advice for doing so. Whether "intent was communicated" is also emerging as a criterion for evaluating leadership in retrospect, such as can be found in the investigation reports for the Nuttall and Esperanza fires.

In this paper, we consider leader's intent as a practical metadiscourse (Craig 1999a, 1999b). Metadiscourse literally means talk about talk. According to Craig, talking about how communication works in everyday conversation and in abstract theorizing is only a difference in levels of abstraction. Everyday talk about how communication works contains an implicit theory. Theorizing refines and abstracts particulars, and finds its way again into everyday conversation, and so on. We literally talk ourselves into believing certain things about how communication works. This is a never-ending process that takes place along the entire spectrum.

When organizations promote specific models for communication, leadership, or other practical disciplines, they are shaping the way employees think and talk about how those processes work. The fact that organizations have the power to shape perception, thought, and possibly theorizing itself shape raises ethical responsibilities to reflect upon whether promulgated practical metadiscourses are the correct, best, and most coherent theory for their purposes, and furthermore that communicators are actually doing in practice what it is that they think and say they are up to. Furthermore, according to Craig's model, not only does this influence metadiscourse in everyday talk but it also has the potential to influence theorizing about those constructs as well. Thus, one goal of our paper is to recover communication and leadership theories contained in the practical metadiscourse of leader's intent, and set them back into dialogue with existing theoretical metadiscourses in leadership and communication in order to refine the concept and improve practice.

Methods

Our paper consists of series of literature reviews and an analysis of the practical metadiscourse of leader's intent. First, we review the history of the German military concept of *Auftragstaktik* loosely translated as communicating what to do and why but not how to do it (Keithly and Ferris 1999). The review includes the key elements of leadership as communicating intent and imparting presence, along with the rationale for adoption. Second, we review the U.S. military's importation of the concept as commander's intent, which shifted the focus to the person of the commander and intent as a particular kind of message, to the exclusion of cultural notions of shared mind (Shattuck 2000). Third, we chronicle the wildland fire community's importation of the military version of commander's intent as leader's intent (NWCG 2007), and describe the implicit communication and leadership perspectives it expresses. Each translation

not only interprets the concept in a particular way but is also incorporated into existing practical metadiscourses within each context. Fourth, we review what formal communication theory has had to say about the possibility and nature of communicating intent in conversation. We organize the communication theory literature review around three different approaches to communication that address intention: communication as a conduit for information, communicating as acting with speech, and communicating as relating (Taylor 2006).

Results

The wildland fire community's practical metadiscourse of leader's intent reflects an understanding of leadership as a process of interpersonal influence. Thus, it focuses on the character, actions, and skills of the leader. Intent is discussed as a particular kind of message devised by skilled communicators and conveyed to subordinates in a one-way process of information transfer. That message is included alongside other messages in a tactical briefing, rather than, say, transforming the communication situation altogether or contextualizing those other messages. Imparting presence, translated to command presence in the military, is described as a process of interpersonal impression management, and incorporates a systems feedback model only to check fidelity of the message.

Communication theory suggests expanded ways of thinking about intent that may inform this practical metadiscourse: Subordinates may have a highly active role in shaping emerging meanings for intent. Communicating intent successfully may depend heavily upon shared background and existing relationships. Intention may represent a shared cognition that exists not in the heads of but "between" the parties. People may actually co-construct intent together, making intention an outcome of conversation, not a mental precursor to it; furthermore, it may be impossible to separate out "individual skill." Finally, meaning may be already heavily influenced by the larger systems of intentionality in which both conversationalists are embedded.

The upshot is that in trying to "communicate" intent, firefighters may have less control over the conversation and the meanings that emerge out of it than they believe they do when going in. They may be engaging in a new set of communicative practices that they identify as communicating leader's intent, but that practical metadiscourse may be neither faithful to the original concept of *Auftragstaktik* nor accurately reflect what is actually happening in interaction. We offer specific suggestions for how the wildland fire community might dialogue with theoretical metadiscourses of communication and leadership to expand the notion of leader's intent for the better, and thus positively affect actual practice.

Literature Cited

- Craig RT (1999a). Metadiscourse, theory, and practice. *Research on Language and Social Interaction* **32**, 21-29.
- Craig RT (1999c). Practical-theoretical argumentation. *Argumentation* **10**, 461-474.
- Keithly DM. and Ferris SP (1999). *Auftragstaktik*, or directive control in joint and command operations. *Parameters*, **Autumn**, pp. 118-133.
- NWCG Training Working Team Leadership Committee (2007). 'Leading in the wildland fire service' (*NFES 2889*). Retrieved September 1, 2007 from <http://www.nwcg.gov>.
- Shattuck LG (2000). Communicating intent and imparting presence. *Military Review*, **March-April**, pp. 66-72.
- Taylor JR (2006). *Communication as complex organizing*. In GJ Shepherd, J St. John, and T Striphas (Eds.) 'Communication As...: Perspectives on Theory' (pp. 132-142). Sage: Thousand Oaks.

Getting the public on board: tools of engagement for fire protection officers in the wildland/urban interface

Alan L. Westhaver

Vegetation/Fire Specialist, Jasper National Park,
Box 2194, Jasper, Alberta, T0E 1E0, Canada.

alan.westhaver@pc.gc.ca

Keywords: wildland/urban interface, fuel management, community protection, outreach

Introduction

Gathering public support for extensive fuel management activities surrounding residential/recreational developments - and motivating residents to take responsibility for wildfire prevention in their own backyards, presents a daunting challenge for fire protection officers. Dense coniferous fuels, mountain topography, and converging winds conspire to make wildfire a significant threat to the Town of Jasper, Alberta (population 5,000) its 500 businesses, and millions of tourists. Its location in a national park complicates community wildfire protection given agency mandates for restoration of ecological conditions (i.e. fire). Although stakeholders acknowledge wildfire risk, concern for ecological and aesthetic values also influences fuel management decisions.

From the start, fire managers recognized that neither ecological nor wildfire prevention goals would be achieved unless the public was fully “on board”. Therefore, finding successful methods of engaging people (i.e. truly involving them as active participants) was an early and ongoing focus of the *FireSmart – ForestWise* Communities Project¹, and the small team of personnel behind it. The projects purpose is to develop, implement and assess innovative methods for managing forest fuels in ways that reduce wildfire risks but also restore or optimize ecological conditions, wildlife habitat and aesthetic qualities, and are supported by the public.

Methods

The six “tools of engagement” presented here are based on knowledge and experience gained during the *FireSmart–ForestWise* project between 2001 and 2007. The author makes an important distinction between informing/educating the public – and engaging them.

1. Utilize innovative fuel management solutions that accommodate values of interface residents (e.g. wildlife, habitat diversity, aesthetics), without compromise to risk reduction standards. Appreciate that vegetation is more than fuel. Our program incorporated measures specific to local wildlife species and interface priority zones, and environmental best practices for interface fuel management (Westhaver 2006).
2. Organize and facilitate a local “interface steering team” and/or neighborhood fire protection committees by encouraging or inviting community leaders and decision-makers to come together and investigate solutions to all aspects of the interface issue. Help build a lasting coalition of problem solvers to share responsibility for informing, involving and motivating your community. The Jasper Interface Steering Team (Jasper Interface Steering Team) has representative from 20 elected bodies, agencies, business organizations, interest groups,

¹ Co-sponsored by the Foothills Model Forest

industry and citizens at large. It operates under agreed terms of reference, and a number of working committees have been established to co-ordinate various activities or investigate solutions (e.g. communications, equipment co-ordination, insurance incentives).

3. Conduct one-on-one wildfire hazard assessments with receptive homeowners and businesspersons. Use these opportunities to build relationships and trust; offer insights into fire ecology; explain how fire spreads and homes ignite; quantify overall risk and discuss contributing factors; and to offer practical solutions that reduce the risk of wildfire losses. Help residents prioritize actions, and offer follow-up assistance. Above all, listen to resident concerns regarding competing values, and be prepared to make fuel management recommendations that accommodate these.
4. Instigate neighborhood “work bees” that bring residents together to conduct fuel management activities on small patches of adjacent forest. Use crews to fall and buck trees first, then invite the public to roll up their sleeves to gather, pile, burn, and chip slash while stocking up on firewood. Ensure that knowledgeable staff is on-hand to inform and educate family members about wildfire risks and solutions. Make it a social event by providing meals, refreshments and, perhaps, a celebrity chef.
5. Utilize mandatory environmental assessments as an opportunity for involving citizens in the task of compiling information about natural/cultural features, and wildlife use. Rather than awaiting feedback by interest groups on a final document, we solicited concerns as a first step. We also engaged a 3rd party of their choosing in the process.
6. Conduct high visibility “live-fire” interface training exercises utilizing joint resources of wildland and structural fire departments. Create mock emergencies, use lots of water, make noise. Invite local media and set up a safe perimeter for public viewing.

Results

1. Residents more readily adopted fuel management treatments when aware that these were either accommodating or enhancing wildlife habitat needs and contributing to ecological restoration. Aside from the benefits of risk reduction, citizens felt rewarded as good environmental stewards. Skeptics became vocal advocates.
2. We found that citizen groups quickly took on responsibility for finding and implementing solutions. JIST members frequently appear in the media as spokespersons, and play advocacy roles within the community and to government.
3. Hazard assessments are judged to be the most successful way of engaging and motivating individuals. They also pique the interest of neighbors, and seed knowledgeable proponents for risk reduction within the community.
4. Work bees became a popular social event, resulted in tangible demonstration sites to showcase ecologically based fuel treatments, and offered many teachable moments.
5. Early public involvement in the EIA process built good faith and credibility.
6. Besides engaging municipal firefighters, these events set off good public interactions.

Literature Cited

Westhaver, A. L. 2006. FireSmart – ForestWise: Managing wildlife and wildfire risk in the wildland/urban interface. M.Sc. thesis. Faculty of Graduate Studies, Resources and Environment Program. University of Calgary, Alberta. 224p.

Non-traditional approaches for involving audiences in understanding and supporting a fuel modification project in a national park.

Kim Weir, Fire Communication Officer, Jasper National Park

How do you get public support and participation for a very visible program that involves cutting down trees in a national park community and a world heritage site? The success of Jasper's FireSmart-ForestWise program depended on managing issues and creating awareness for the project, its goals and activities. Educational opportunities offered to residents and visitors helped them to understand and support the project and get them involved.

The project's communication strategy focused on creating awareness and building support for the project as well as fostering community stewardship. Communication approaches not only depended on the standard information sheets, displays and media coverage, but included innovative ways of reaching people and involving them first hand in the project planning and implementation.

The unique name of the project, FireSmart-ForestWise, was thought to be easier for people to understand and accept than the more commonly used 'fuel load management'. Instead of just being seen as a facility protection project, the term Forest-Wise incorporated the forest protection aspect of the project and reminded people of the fact that aesthetics and ecological integrity were top priorities.

The early stages of communications coincided with the 2003 wildfire season – we were able to use examples of fire events in nearby communities to give context to the project and its goals.

The Jasper Interface Steering Team (JIST), made up of key community members, businesses, other government agencies and utilities, was formed to provide advice and perspective, help identify issues and provide recommendations for action. Upon JIST's recommendation of taking project information out to the community and to where they are, rather than waiting and expecting them to come to our functions and locations, communications efforts took a new path. As a result, project representatives joined in popular community events and functions in an effort to raise awareness as well as to become more approachable, bring the project to a personal level and gain trust for them and the project. On many occasions, this method was less onerous than having to both organise and facilitate similar events for just our agency and these functions normally had higher levels of attendance.

Some examples of these unique efforts are:

- **Moonlight Madness.** We organised an outdoor warming station with fire, marshmallow roast, fire engine tours and information during this events that brings residents downtown to shop and dine.
- **Chili Cook-off.** We joined this very popular Jasper in January function and were able to reach people in a casual manner though chatting about our chilli, names of our products and through visuals components at our booth. The event was fun and relaxed which made us more approachable. While the educational component was low, the event was

successful in increasing awareness to a broad audience.

- Taste of the Town. Another popular Jasper in January function (more people attended than voted that year) allowed us to reach a cross-section of residents unheard of elsewhere. The Jasper Interface Steering Team members represented the project which aided the message that FireSmart is a community-wide issue. We tried to increase by offering our chili recipe on our fact sheet and through visuals and names.
- Numbers of Parks Canada staff are significant in the townsite and they are important stakeholders. We offered a free lunchtime chili tasting session to inform them of all aspects of the project.
- The Jasper Tramway is the “Ultimate Firetower” for the town. We offered tours from its upper terminal to talk about forest health and show people the fuel load situation first-hand.
- Demonstration areas were completed in key locations to show people what the treatment would look like. An effort to go door-to-door in nearby locations made to let residents know about the work and invite them to join in Community Work Bees to share the workload. This informed people, got them involved and gained trust. Refreshments and barbeque lunch were offered at the work bees and people could come for as long as they wanted – we kept them casual and fun. They were well attended and brought out a good cross section of residents, ages and influential community members. One business owner has completed treatment to his expansive property, offers it as an example and has become a good multiplier for our messages.
- Signage is now in place in all of the completed demonstration areas – these included before and after photos and images of community members working.
- A popular, live theatre presentation, Faces of Fire, is offered in Banff and Jasper national parks. It helps to give a broad understanding of fire and gives FireSmart-ForestWise context.

Efforts are made to present our information at a community level which is easy to read/understand. In order to keep residents informed of on-going work, we use methods such as handbills in doors of houses where special work will take place, speaker presentations at Parks Canada Speaker Nights, displays in key locations such as the hockey arena, ads in local publications and signage on the landscape.

The remaining challenge with the program is getting resident to take responsibility at home and make the necessary changes to their houses and property.

From research reviews and steering teams, to work bees and Chili Cookoffs, examples of traditional and non-traditional methods of educating and engaging a variety of audiences are used and help demonstrate how this project is achieving community support and success.

Factors that Influenced Citizen Engagement in the FireSmart-ForestWise Community Protection and Forest Restoration Project: Citizen, Community, and Project Characteristics

Bonita L. McFarlane^{A,C} and Tara K. McGee^B

^A Natural Resources Canada, Canadian Forest Service, 5320 – 122 Street, Edmonton, AB T6H 3S5, Canada.

^B Dept. of Earth & Atmospheric Sciences, University of Alberta, 1-26 Earth Sciences Building, Edmonton, AB T6G 2G8, Canada.

^C Corresponding author. Email: bmcfarla@nrca.gc.ca

Keywords: citizen engagement, mitigation, national parks, wildland-urban interface

Introduction

Jasper National Park in Alberta, Canada initiated the FireSmart-ForestWise Community Protection and Forest Restoration Project (FSFW) to manage forest fuels at the wildland-urban interface aimed at reducing wildfire risk in ways that also accommodate or improve ecological conditions, wildlife habitat, and aesthetics. Selective thinning, pruning, and prescribed burning are taking place around the park's townsite developments with the support and help of local residents.

We used the FSFW project as a case study to examine factors that contributed to resident support for fuels management and engagement of citizens in mitigation activities. This presentation examines how characteristics of citizens, the community, and the FSFW project itself contributed to citizen engagement.

Methods

Semi-structured interviews were used to collect information from 19 park residents (10 from the town of Jasper and 9 from the Lake Edith cottage development), 5 park business owners, and 7 government (municipal and federal) officials. Interviews were tape recorded, transcribed verbatim. The interview data were coded and analyzed thematically using NVivo® 2 software.

Results

Study participants from the Lake Edith cottage development were very active in the FSFW program and viewed it as a success. Jasper town residents in our study were not involved in the program and expressed concerns regarding the effectiveness of mitigation in reducing the risk and impacts of a large wildfire, the ecological impacts of logging in the park, and opening national parks to resource extraction.

Several themes emerged from the study that may serve to motivate or constrain engagement of citizens in mitigation activities and support for fuels management in the park. Overall, participating residents perceived the wildfire risk to the park and their community as 'high' and were well informed of the factors that contribute to the risk of wildfire and of fire management in the park. Participating residents and fire managers seemed to have a shared understanding of the

risk and risk management options. However, knowledge of risk factors and fire management, experiences with wildland fire, and awareness that their homes or cottages may be at risk were motivators for some but not all participating residents. Several other factors appeared to influence citizens' acceptance of fuels management in the park, involvement in work bees, and mitigation on their own properties. These included the desire to protect heritage and environmental values, a strong sense of history in the park, the capacity of the community to respond to park management issues, and the social cohesion of the community.

For participating residents, the benefits associated with being involved in the FSFW program extended beyond the project's objectives to reduce the risk and restore ecological integrity. These included a renewed sense of community as residents worked together for a common goal, social interaction with neighbors during the community work bees, the opportunity to learn about fire management from the parks fire specialists, protection of heritage values associated with the LE cottages, improved aesthetics, improved relations with Parks Canada, and a sense of pride in their community.

Characteristics of the FSFW program itself also contributed to citizen participation. Parks Canada staff played a key role, with their commitment, knowledge, and informal approach being crucial to encouraging residents' initial involvement and building trust with the agency. Innovative approaches to communications, project updates that reported what had been accomplished and what remained to be done, and demonstration sites showing the results of fuel modifications were factors contributing to residents' involvement. Involving residents early in the planning process and the voluntary nature of participation also motivated participation. Providing food and beverages at work bees and allowing residents to take the wood from the thinning activities were also viewed by participating residents as a gesture of good will. The FSFW project is used by Parks Canada as a showcase for mitigation in Canada, and participants' knowledge of this contributed to community pride, especially among LE residents.

In summary, our results suggest that the success of the FSFW project in Jasper National Park can be attributed to the interaction of characteristics of the citizens (their perception of risk and awareness of risk factors, and wildfire experiences), characteristics of the community (capacity to respond to management issues, a desire to protect heritage values, and social cohesion), and characteristics of the program (voluntary, involved citizens early, innovative communications, building trust, and the work bees).

Wildland fires and community recovery in New Zealand: a research beginning

E.R. (Lisa) Langer^{A, E}, Laura Kelly^{B, C}, Douglas Paton^{C, D}, and Richard Vokes^B

^A Ensis – Forest Biosecurity and Protection, Scion, PO Box 29 237, Christchurch 8540, New Zealand.

^B University of Canterbury, Private Bag 4800, Christchurch 8140, New Zealand.

^C Bushfire Cooperative Research Centre, Level 5, 340 Albert Street, East Melbourne 3002, Australia.

^D University of Tasmania, Locked Bag 1342, Launceston, Tasmania 7250, Australia.

^E Corresponding author. Email: lisa.langer@ensisjv.com

Key words: community recovery; resilience; wildland fires; wildland-urban interface; New Zealand.

Introduction

Wildland fires can be devastating, and small rural communities can be particularly vulnerable to these events. In rural New Zealand, perception of fire risk is low as large damaging wildland fires impacting on rural communities occur infrequently. However, knowledge of community resilience to, and recovery from, wildland fires is essential to improve social recovery methods in New Zealand when these events do occur. Fires can cause the evacuation of an entire town, overwhelming coping mechanisms and causing immense impact, particularly as they lack the support afforded by access to larger infrastructure. While wildland fires are not generally a natural part of New Zealand's ecosystems, knowledge of past worldwide and local disasters, particularly wildland fire events, provides background to examine beneficial recovery mechanisms, and thereby reduce social impacts in New Zealand. This paper summarises key findings from documented literature on wildland fires and communities following a review of long-term community recovery knowledge world-wide, and a case study of a New Zealand community affected by rural fire.

Methods

International literature on past disasters focusing on community recovery mechanisms and resilience, in particular wildland fire events that have occurred throughout the world, was examined to provide us with background knowledge of beneficial recovery mechanisms (Bones 2005; Kelly 2005). Increased knowledge will enable recommendations to be made to fire management agencies and local Government to increase their focus on community recovery mechanisms. In turn, this will enable communities to recover more quickly from wildland fire events in the future. In addition, an initial case study has examined a community in the wildland-urban interface of West Melton on the outskirts of the city of Christchurch, following a significant fire in December 2003 (Kelly 2007). The study investigated factors influencing the capacity for individuals to adapt to and recover from this event, and gained an understanding of the social ramifications of wildland fires in a local community. Research was based on a series of qualitative interviews with members of the community who predominantly lived on smallholdings, or 'lifestyle' properties in West Melton.

Results

Literature review findings provided background knowledge to initiate research into community resilience to, and recovery from, wildland fires in New Zealand. Major community impacts from wildland fires can be far-reaching. Personal losses can range from losing possessions with sentimental value to the extreme impact of losing a loved-one. Economic losses that affect livelihoods, income and assets can be severe. Often residential dislocation or disruption of normal routine is experienced. Conflict can arise around

identifying parties responsible for the disaster or damage caused liability for compensation, insurance issues, etc. Trauma following the evacuation process can occur, and even emotional trauma, or Post-Traumatic Stress Disorder, can result. Increased needs for mental health intervention and care are evident during the immediate aftermath and for longer periods after disasters. Early intervention lessens the distress and mitigates the risk of health problems and disorders. However, some positive effects also have been noted, including an influx of aid into communities and an increased focus on the need for mitigation in the future.

A community's vulnerability, and hence ability to respond to, cope with, recover from and adapt to hazards is influenced by economic, demographic and housing characteristics. High levels of vulnerability to natural hazards are likely to be experienced by very young, very old, disabled, single parent households, migrants, people lacking communication and language skills, new comers and low income earners. Official recovery efforts typically run for relatively limited periods of about 12 months. However, the full recovery process can last considerably longer for many groups as recovery from the loss of animals, possessions and property, or missing neighbours who were forced to move, etc. can take a considerable length of time. The key factor to increasing a community's resilience, and reducing the potential impact and level of trauma, is to increase their self-involvement in preparedness and mitigation of wildland fires, thereby achieving more effective and faster recovery. Every community member must be self-responsible to protect themselves and their possessions, as fire management agencies and emergency services are unable to protect everyone. A holistic approach to wildland fire recovery is required. Solutions include transparency in agency actions, community involvement and better relations between agencies.

The study of the West Melton community in the wildland-urban interface provided an interesting insight into a community affected by a wildland fire. Conflict (and more specially apportioning blame) was apparent between older (pre Resource Management Act 1991) and newer 'lifestylers' (post 1991) with criticism of each other's preparedness and awareness related to both the 2003 fire and other fires. Similarly, conflict existed between 'lifestylers' and local Government, with 'lifestylers' critical of the Council's preparedness and its use of fire bans. This initial study highlights the fact that greater community education and community involvement, improved communication, and improved relationships between fire authorities and the community, and between support agencies/(local and central) Government agencies, are crucial to fire management in New Zealand to raise awareness and empower communities to help themselves. As the phenomenon of wildland-urban interface living grows throughout the world, knowledge of measures to increase community resilience and recovery in small rural communities will continue to be an issue in relation to fire and other significant rural hazards. Future studies of small communities are planned.

Literature cited

Bones, H. 2005, *Wildfires and Communities: International Perspectives*, Ensis Bushfire Research, Forest Biosecurity and Protection, Ensis, Christchurch.

Kelly, L. 2005. *Wildfires and Communities: Australasian Perspectives*. Ensis Bushfire Research, Forest Biosecurity and Protection, Ensis, Christchurch.

Kelly, L. 2007. *Risk, blame and belonging: An exploration of the West Melton Fire of December 2003*. A thesis submitted in partial fulfilment of the requirements for the Degree of Master of Arts in Anthropology, University of Canterbury.

Assessment of the Efficacy of the California Bureau of Land Management Community Assistance and Hazardous Fuels Programs

David J. Ganz¹, David S. Saah², Matthew A. Wilson³ and Austin Troy⁴

¹ TSS Consultants, 3922 Magee Avenue, Oakland, CA 94619 tel. (415) 602-1395 fax (510) 336-0809, Email : Dganz@tssconsultants.com

² University of San Francisco, San Francisco, CA tel (510) 427-3571, Email: dssaah@usfca.edu

³The Gund Institute for Ecological Economics and the School of Business Administration
University of Vermont, Burlington, VT 05405 tel (802)656-8336, email: atroy@uvm.edu

⁴Rubenstein School of Environment and Natural Resources
University of Vermont, Burlington, VT 05405 tel (802)656-8336, email: atroy@uvm.edu

In this study, we provide a framework for assessing the social and environmental benefits and public education outcomes associated with BLM's Community Assistance and Hazardous Fuel Programs in California. Evaluations of fire hazard mitigation programs tend to focus primarily on the number of acres treated and treatment costs associated with mitigation without adequately assessing the benefits of these treatments. While some evaluations account for the value of protected structures or the avoided costs of suppression, few account for the ecosystem service value of protected natural capital. Ecosystem services are functions performed by nature that are valuable to humans, which may be irreplaceable or may be costly to replace. Examples include the water purification and flood abatement functions of wetlands, the hydrologic regulation functions of forests, and the recreational value of various natural landscapes. The total economic value approach to environmental assessment used in this study provides a method for quantifying these assets so that they can be counted as benefits.

The assessment is novel in its consideration of *both* the market-based and non-market values that are at risk from wildfire, particularly ecosystem goods and services. Using a decision support methodology, the study presents data that allows the BLM to more effectively quantify and account for, the social and environmental benefits derived from fire mitigation treatments. While this study necessarily was limited in its scope, suggestions are provided for how this approach could effectively be scaled up and used at a national, regional or state-wide level to analyze the efficacy of all BLM programs. Although this approach is currently compatible with BLM current reporting system, the assessment provides recommendations on how to augment the evaluation system so that future program elements or "system" elements that enable (or prevent) communities to take part in raising awareness and taking action for themselves are evaluated at the broader BLM program level for the Community Assistance and Hazardous Fuel Programs in California.

The analysis focused on San Bernardino, Napa and Humboldt counties, which represents a cross section of the broad diversity of Californian landscapes and socio-economic characteristics. A baseline estimate of environmental assets was generated using a spatially explicit value transfer method. Furthermore the value of built structures was quantified using spatially referenced assessor's data. The process developed for these three counties can easily be applied to other areas with similar land cover characteristics. Because the three counties have a wide variety of land cover these results could be generalized to almost any part of California.

The baseline ecosystem service values generated for this study provide important information about the valuable resources protected by BLM fire mitigation programs. This information can be used on its own, or in the framework of traditional cost benefit or cost effectiveness analysis. As discussed in the study, national policy and regulatory trends are clearly moving in the direction that necessitates more effective accounting for the economic benefits provided by ecological goods and services.

The study shows for example that an overwhelming proportion of economic values related to the environment in Humboldt County come from its forests. Humboldt's relatively large area of forested cover accounted for nearly 80% of total ecosystem service value delivery by naturally functioning ecological systems in the study area. While on a per-unit basis, some forest types provide a lower stream of benefits than many non-forested types, the size of forested area in Humboldt County means that ESV benefits from forests dominate. In particular, riparian forests, old growth forests and forests with spotted owl habitat provide for a high proportion of ecosystem service values relative to area. In contrast, we find that in Napa County, forested systems only accounted for 30% of ecosystem service values delivered by functioning ecological systems. Napa's open freshwater, in the form of streams, lakes and rivers, provided 31% of measured economic benefits to society. Similar to Napa County, forested systems delivered approximately 31% of the total value delivered by ecological systems in San Bernardino County. From an ecosystem services perspective, freshwater wetlands accounted for the majority (55%) of ecosystem service benefits delivered to society. Clearly, the vast deserts and arid piedmont of San Bernardino County provide extensive benefits, but lacking studies of these benefits, we are unable to quantify them.

The ecosystem service baseline layer used in this study is a lower-bound estimate as it is limited primarily to scientific, peer-reviewed empirical studies that are standardized to one static point in time. Moreover, many important land cover types, such as desert and grassland, are absent from the valuation literature, yielding a zero value for these types, which is clearly unrealistic. The data can be expanded to include high-quality grey literature (e.g. doctoral theses) if funding permits. Increasing coverage would broaden the scope of the ecosystem service estimates and improve the specificity of the results by bringing California-based studies to the foreground. We further suggest that the BLM develop a long-term monitoring program to track the cost-effectiveness of their policies over time. The program could be designed to detect the effects of new policies and land use changes on the delivery of ecosystem goods and services. Future updates of this analysis would assess changes over time in response BLM's policies. Such time-sensitive research would assist BLM's efforts to demonstrate how their management has led to increase societal benefits. The frequency and scale of monitoring will depend on which of BLM's management objectives. For fire, it may be more effective to do this monitoring out of each BLM field office and at a much more frequent basis.

After the Fire: Local Residents' Perceptions of Post-Fire Forest Restoration

Robert L. Ryan and Elisabeth Hamin
Department of Landscape Architecture and Regional Planning
University of Massachusetts, Amherst
109 Hills North
Amherst, MA 01003-9328
Tel. (413) 545-6633
Fax (413) 545-1772
e-mail: rlryan@larp.umass.edu

Keywords: wildland-urban interface - Western United States; post-wildfire forest rehabilitation; collaborative planning; disaster recovery and natural resources.

Introduction

After wildfire, land managers often undertake forest restoration efforts using a scientific perspective. However, little research has been conducted on the publics' perceptions both aesthetically and ecologically to specific fire recovery treatments, such as hazard tree removal, seeding, and mulching, as well as to the process that is used to involve the community in post-fire planning efforts. Considering the controversy surrounding wildfire recovery planning, forest managers need to know more about how restoration efforts compare to natural revegetation from the public's perspective (Mendez et al., 2003). To understand these issues, this study investigates the community- Forest Service agency relations in the post-wildfire period in three western United States communities. The goal was to better understand how forest restoration and rehabilitation efforts were perceived by community members, and how these perceptions were influenced by underlying community and fire conditions.

Methods

The three communities, Los Alamos New Mexico (Cerro Grande Fire); Durango Colorado (Missionary Ridge Fire); and Arnold California (Darby Fire), varied in the impact and characteristics of the wildfire, the extent and kind of restoration efforts undertaken by the local Forest Service, and in social conditions within the community. In each community, we conducted two focus groups with community members (total n=55) and 14-15 key informant interviews with representatives from government, native American pueblos, business and natural resource industries, environmental organizations, and recreation groups (total n=45). This qualitative data was taped, transcribed, and summarized for emergent themes.

Results

Some interesting outcomes of the study were that a wide majority of stakeholders support salvage logging after wildfire, even in communities where salvage logging did not occur. While perceptions varied about the amount of dead and dying trees to remove, there was widespread support to remove hazardous trees along popular trails and recreation areas. Participants also strongly supported rehabilitation techniques to minimize flooding and soil erosion near developed areas, but saw less need to expend resources in more remote areas.

The fact that some communities were heavily involved in the forest rehabilitation efforts had a very positive effect on perceptions of the post-fire recovery, as well as helped re-build the community spirit that was devastated by this fire (Ryan and Hamin, 2006). However, there is a

need for more follow-up information so local residents can learn how effective or not volunteer efforts were in aiding in the forest's recovery. This study also looks at perceptions of longer-term forest recovery and fuels hazard reduction treatments that were the result of these fires.

Our findings suggest that four vectors interact to determine the community's experience of the post-fire period: 1) the extent and characteristics of the fire; 2) the history of agency-community relations; 3) economic implications of the fire; and 4) the level and consistency of agency communication. In burned areas, agency facilitation of community groups' volunteer restoration activities proved helpful in restoring community spirit and improving agency-community relations. The model developed in this research argues for agency responses that consider both the social and ecological communities when planning post-fire restoration projects.

Literature Cited

Mendez, S.R., Carroll, M.S., Blatner, K.A., Findley, A.J., Walker, G. B., and Daniels, S.E. 2003.

Smoke on the hill: A comparative study of wildfire and two communities, *Western Journal of Applied Forestry*, 18(1): 60-70.

Ryan, R.L. and Hamin, E. 2006. Engaging communities in post-fire restoration: Forest treatments and community-agency relations after the Cerro Grande Fire. In McCaffrey, S. (Ed.), *The Public and Wildland Fire Management: Social Science Findings for Managers*. General Technical Report, NRS-1. Newtown Square, PA: USDA Forest Service, Northern Research Station. Pp. 87-96.

Acknowledgements

The funding for this study was provided by the U.S. Forest Service, North Central Research Station under Cooperative Agreement No. 04-JV-11231300-012. Thanks go to the project's graduate research assistant: Mark Wamsley and Jarita Sadler.

Community Wildfire Protection Plans: Enhancing Collaboration and Building Social Capacity—Project Overview

Pamela Jakes , USDA Forest Service, Northern Research Station, 1992 Folwell Avenue, St. Paul, MN 55108; pjakes@fs.fed.us

Keywords: wildland-urban interface, CWPP, community capacity, collaborative capacity

In the following four papers by Graybeck, Brummel, Fleeger, and Saeli you will be hearing some of the findings of a project funded by the Joint Fire Science Program (JFSP), “Community Wildfire Protection Plans: Enhancing Collaboration and Building Community Capacity.” The Joint Fire Science Program was created in 1998 to encourage interagency research, development, and applications partnerships. The research the JFSP sponsors is aimed at meeting emerging needs of policy makers and fire managers. This project was submitted in response to a 2003 call for proposals by the JFSP to (1) characterize different collaborative planning efforts, and/or (2) determine key elements of collaborative success. The objectives of the project are to study community wildfire protection plans (CWPPs) in order to (1) improve the ability of agencies, organizations, communities, and citizens to work together collaboratively, and (2) enhance the long-term capacity of communities to address wildfire risk. We studied the context in which planning takes place, the process used to develop CWPPs, and the outcomes of the plans. One unique aspect of this project is the creation of a Research Advisory Team to help the researchers identify relevant issues, formulate important research questions, assist in building awareness of the project, and provide guidance regarding science delivery.

Community wildfire protection plans were defined in the Healthy Forest Restoration Act of 2003 (HFRA) as a means of clarifying and refining “[a community’s] priorities for protection of life, property, and critical infrastructure in the wildland-urban interface” (SAF et al. 2004, 2). These are to be grassroots plans, with federal land managers serving as partners in the preparation and implementation of CWPPs, to the extent that the community desires. HFRA specifies that CWPPs will (1) be developed collaboratively, (2) identify and prioritize areas of fuels reduction and recommend types and methods of treatment on federal and non-federal land, and (3) recommend measures to reduce structural ignitability. In their HFRA handbook, the USDA Forest Service (2004, 35) states that “In the WUI, these plans will provide a seamless guide for fuel reduction across ownerships, identifying those treatments to be completed by public agencies and those to be completed by private landowners.”

We conducted case studies in eight states—California, Colorado, Florida, Minnesota, Montana, Oregon, Virginia, and Wisconsin (Dr. Fleeger conducted case studies in Arizona, outside the official project locations). Initial analysis of the data identifies ten themes that have been important to developing CWPPs in all case studies: the scale at which the CWPP is developed, the capacity of the local community, the context in which the CWPP is developed including antecedents to the CWPP, networks that came into play in developing the CWPP, leadership and/or intermediaries that emerge, framing of the issues, the collaborative process employed, sharing information and developing learning communities, identifying and measuring outcomes, and sustaining plans. Each of the following papers will discuss in detail one of these themes.

For more information on the project visit our website at: jfsp.fortlewis.edu.

Society of American Foresters (SAF) et al. 2004. Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities. Bethesda, MD: Society of American Foresters. 11p.

USDA Forest Service. 2004. The Healthy Forests Initiative and Healthy Forests Restoration Act: Interim Field Guide. Washington, DC: USDA Forest Service and USDI Bureau of Land Management. FS-799. 58p.

Defining the wildland-urban interface: How local government becomes a partner at the table in community wildfire planning

Stephanie Grayzeck¹, Kristen C. Nelson², Rachel Brummel³, Pamela Jakes⁴, Daniel R. Williams⁵

¹ Natural Resource Sciences and Management Program, University of Minnesota St. Paul, Minnesota, United States

² Department of Forest Resources and Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St Paul, Minnesota, United States

³ Conservation Biology Program, University of Minnesota St. Paul, Minnesota, United States

⁴ USDA Forest Service, Northern Research Station, St. Paul, Minnesota, United States

⁵ USDA Forest Service, Rocky Mountain Research Station, Ft. Collins, Colorado

Corresponding author: Stephanie Grayzeck, grayz001@umn.edu

Key words: wildland-urban interface, wildfire policy, community planning

Introduction

Due to escalating fire suppression costs and acres burned in recent years, there has been a policy shift towards greater collaboration around wildfire preparedness and prevention planning. But has this policy shift affected the extent and practice of planning? In 2003, the Healthy Forests Restoration Act called for at-risk communities across the country to develop Community Wildfire Protection Plans (CWPPs), which require local, state and federal actors to work together to address hazardous fuels reduction and wildfire prevention. 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. We evaluated this policy incentive by examining whether collaboration is evident in community interpretation of the Wildland-Urban Interface for wildfire preparedness. Using CWPPs in the Eastern half of the United States, we address the following questions: 1) how are existing definitions of the Wildland-Urban Interface used in CWPPs 2) how do communities redefine the terms and boundaries of the WUI to meet local needs and 3) what factors such as scale, participants, and land ownership influence the WUI definition.

Methods

This paper is part of a broader research project supported by Joint Fire Science Program (JFSP) investigating the development and implementation of CWPPs across the U.S. To address the research questions, we used two methods of data collection and analyses: 1) document review of available CWPPs in the East and 2) qualitative analysis of 4 case studies from the larger JFS study. To obtain CWPPs, we conducted an internet search and made phone/email contact with state officials. Plans had to include the three entities required in the legislation (state agency, local government, local fire department) and be completed after 2004. We coded available CWPPs 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. Case study data were collected from 57 in-depth, semi-structured interviews with key informants in 4 Eastern CWPP communities: Lake County, Minnesota; Barnes and Drummond, Wisconsin; High Knob Owner's Association in Front Royal, Virginia; and Taylor, Florida. Interview questions that informed our

research questions about the WUI were read by two researchers for themes, which were organized and interpreted using the grounded theory approach of Strauss and Corbin (1990).

Results

The primary objective of this study was to discover how a range of communities in the Eastern U.S. interpret federal policy designed to encourage local response to reducing wildfire risk. The flexible nature of HFRA resulted in tremendous variation in local interpretation of the policy. We found many types of wildfire plans done in the East, ranging from wildfire hazard assessments completed pre-HFRA, to Firewise-linked plans, to stand alone CWPPs. The wildland-urban interface was used or addressed in just over half of the reviewed CWPPs, and identification of the WUI varied greatly for those plans that used the concept for planning. Three of the four case study communities identified the WUI, using different factors to decide on the boundaries, including presence of fuels and structures, access, volunteer fire department boundaries, and even specific policy considerations tied to HFRA and the National Fire Plan.

While HFRA requires the involvement of “local government,” this term is not specified in the law, and as a result we found CWPPs developed at a diversity of scales: county, multiple township, city/township, and subdivision level. In addition, several communities in the East employed planning templates. Both the planning scale and template appeared to influence if and how the WUI concept was used in CWPPs. Larger scale plans tended to use the concept of the wildland-urban interface, perhaps taking into account landscape level management, while subdivision level plans did not use the WUI in planning. In addition, participants in the CWPP process influenced how the community and planning team addressed the WUI. Federal agency participation usually resulted in the use of the WUI concept in CWPPs, while local government and fire department participants provided both political influence and local knowledge when it came to the WUI. Experienced planning organizations also participated in some CWPPs, providing a level of technical assistance in developing WUI boundaries not found in other plans.

Many communities in the Eastern U.S. are taking steps to reduce their wildfire risk through community wildfire protection plans. Our findings revealed that communities are interpreting HFRA with tremendous variation at the local level; working at different scales, utilizing different planning tools and templates, and involving diverse participants. While 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 U.S. the majority of land ownership is private. The use of this policy incentive in Western CWPPs should be investigated, and may provide a useful comparison to 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.

Literature Cited

Strauss A, Corbin J (1990) *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. 258 p. (London, Sage Publications)

Social learning, science and the creation of communities of understanding in Community Wildfire Protection Planning

Rachel F. Brummel^A, Kristen C. Nelson^B, Stephanie A. Grayzeck^C, Pamela J. Jakes^D, Daniel R. Williams^E

^A Conservation Biology Program, University of Minnesota St. Paul, Minnesota, United States

^B Department of Forest Resources and Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St Paul, Minnesota, United States

^C Natural Resource Sciences and Management Program, University of Minnesota St. Paul, Minnesota, United States

^D USDA Forest Service, Northern Research Station, St. Paul, Minnesota, United States

^E USDA Forest Service, Rocky Mountain Research Station, Ft. Collins, Colorado

Corresponding author: brumm043@umn.edu

Keywords: social learning, collaborative planning, science in collaborative decision-making, community wildfire protection planning, wildfire policy

Introduction

US policy has shifted in recent years to adopt a more collaborative approach to wildfire planning. This model strives to engage multiple community and agency stakeholders in decisions concerning fuels mitigation, wildfire suppression, private property fuels management, and the restoration of fire-adapted ecosystems. Despite increasing understanding of ecological systems, however, collaborative groups struggle to effectively integrate science in their decision-making. Often science is disregarded, presented in an inaccessible way, or used as an implement of argument rather than an aid for deliberation. Alternatively, science can be privileged in a way that marginalizes stakeholders who favor other forms of knowledge. So how do such groups come to shared understandings given the ecological complexity of wildfire management and the social complexity of the decision making arena? One hypothesis maintains that social learning is essential for groups to wade through the science and incorporate multiple interests into their planning. Social learning is “learning that occurs when people engage one another, sharing diverse perspectives and experiences to develop a common framework of understanding and basis for joint action” (Schusler *et al*, 2003).

We examine social learning and the role of science in the context of Community Wildfire Protection Planning (CWPP) groups mandated through the 2003 Healthy Forest Restoration Act (HFRA). HFRA requires a minimum of three partners – a local fire chief, the state forestry representative, and a relevant local official – to sign off on CWPPs. However, CWPP groups often include a diverse group of individuals and representatives. Our research addresses these questions:

- 1) Do groups come to a shared understanding of wildfire through the planning processes? If so, what kind of shared understandings do they come to?
- 2) What process elements are important in aiding the social learning process? And in particular, what type of science are CWPP groups using and what is the role of science in planning and social learning?
- 3) What are some actionable outcomes of social learning in Community Wildfire Protection Planning?

Methods

We conducted 57 in-depth, semi-structured interviews as case studies of four CWPP groups: Lake County, Minnesota; Barnes and Drummond, Wisconsin; High Knob Homeowners Association, Virginia; and Taylor, Florida. As we were interested in the process and outcomes of social learning within the planning arena, we interviewed only those participants who were directly and actively involved with planning, which we defined as attending three or more meetings. Additionally, we strived to interview representatives from each agency or organization involved in planning. We were able to interview an average of 85 percent of primary planning participants across cases. Interviews were focused around questions concerning context, process, and outcomes related to collaborative community wildfire planning. Researchers digitally recorded and then transcribed all interviews. We analyzed interviews by hand coding text for science- and social learning-related themes using both a grounded theory approach (Strauss and Corbin, 1990) as well as using existing literature and theory to structure our codes.

Results

Three of the four CWPP groups we studied demonstrated individual change towards having the same shared understanding of the wildfire issue as a result of their participation in the planning process. However in Florida, participants entered the process with pre-existing common understanding due to a history of collaboration around suppression and prescribed burning. The type of scientific knowledge and analyses the CWPP groups utilized varied according to planning group composition and membership. The three agency-driven CWPP processes (MN, WI, and FL) used ecological and spatial data such as aerial photos, fuel models, vegetative data, and infrastructural data; this information helped the group visualize the landscape, reconfirm “problem” areas, as well as prioritize projects. The community-driven Virginia CWPP relied largely on Firewise materials as a source of discovery and persuasion. However, risk assessments, mapping and visualization, and process facilitation were important in enhancing social learning in all CWPP groups we investigated. Consequently, each of these groups formed and/or enhanced the complexity of their collective understanding of social and ecological systems related to wildland fire through the planning process. Two functional types of shared understandings emerge: 1) substantive understandings of wildfire that inform on what the group will act and why, and 2) relational understandings of social and institutional systems that inform how the group will act. In particular, groups collectively identified locally specific hazards and learned more about the roles, limitations, and capabilities of the other organizations at the planning table. Furthermore, planning participants often bring this new knowledge to their home agencies and organizations, in some cases influencing how their organization conducts business and plans other environmental projects. Learning that occurred within CWPP groups also contributed to several actionable and tangible outcomes in each of the cases we examined. Through influencing understanding in the planning group and often in organizations, social learning in the CWPP process contributes to the creation of larger communities of understanding in wildfire management across scales.

References Cited

- Strauss A, Corbin J (1990) *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. 258 p. (London, Sage Publications)
- Schusler, T, Decker DJ, Pfeffer MJ (2003) Social learning for collaborative natural resource management. *Society & Natural Resources* **16**, 309-326.

Bridging the Federal Local Divide: Governmental Collaboration in the Development of Community Wildfire Protection Plans

William E. Fleeger Department of Natural Resources, University of New Hampshire; wfleeger@unh.edu
Victoria E. Sturtevant, Environmental Studies Department, Southern Oregon University; sturtevant@sou.edu

Introduction

As landscape level phenomena, successful forest restoration and mitigation of the wildfire threat must occur at larger spatial scales and across jurisdictional boundaries. Through the development of CWPPs, HFRA established a process for multi-jurisdictional cooperation and the potential for federal, state and local governments to join efforts and strategically pool and apply resources at larger spatial scales. As part of a CWPP, communities have the opportunity to delineate a WUI boundary based on local values and conditions and to propose and prioritize management actions on lands within the WUI regardless of jurisdictional boundaries. This provides the potential for all levels of government to bring to bear their respective resources and regulatory responsibilities to comprehensively address the wildfire threat within the WUI.

Methods

This presentation attempts to answer three fundamental questions. 1) To what extent are CWPPs an effective tool in facilitating multi-jurisdictional cooperation to comprehensively address the wildfire threat? 2). If CWPPs have been successful, what element have contributed to that success and if not, what have been the barriers and challenges? 3) What measures would enhance or improve the effectiveness of community-based efforts in wildfire planning and mitigation? To answer these questions this presentation draws upon a number of case studies of CWPPs in several western states. We first provide an overview of the governmental and non-governmental actors involved in the development of each CWPP and their roles and responsibilities within the planning process. This is followed by an evaluation of the key social and decision process factors present in each community that helped or hindered the planning process. We conclude with an assessment of the outcomes achieved as the result of the CWPP process and provide recommendations for improving cross-jurisdictional collaboration and the efficacy of community-based planning processes to mitigate the wildfire threat.

Results

Of the four CWPP planning processes examined in this presentation, only two were developed using the collaborative processes envisioned in HFRA including participation by all levels of government and broad stakeholder representation. The remaining CWPPs, lacked sufficient participation from key stakeholders, including the USFS. In each of the cases examined in this presentation, the USFS was a key stakeholder in mitigating the wildfire risk and had substantial influence in the outcomes of the CWPP. The success of one CWPP process was in large part due to USFS support and cooperation in each stage of the planning process. The USFS also bore considerable responsibility for the inability of the remaining efforts to achieve their stated goals. Although the USFS was instrumental in the early stages of

another CWPP, the lack of commitment and follow-through by the agency to implement the community's recommendations brings the entire wildfire planning effort into question. In yet another CWPP, USFS resistance to engage in a collaborative process had implications for the entire planning process.

Based on these findings, our first recommendation for improving community wildfire protection planning is to provide incentives for USFS to participate collaboratively in the CWPP process. In this regard, it is important that USFS re-examine policies relating to annual performance "targets" and allow flexibility and provide incentives for local USFS leaders to be responsive to community concerns and recommendations. Also, clarifying the legal authorities providing for federal participation and concurrence in community-based wildfire planning and targeting funding specifically for CWPP planning and implementation might similarly provide incentive for agency participation. Our second recommendation is that CWPPs move beyond their focus on fuel reduction and wildfire suppression as the primary method of community wildfire mitigation. Although this is consistent with the emphasis placed upon these mitigation strategies in HFRA, amending the requirements of CWPP to include addressing the broader goals contained in the NFP is appropriate. Third, it is important to recognize that successful mitigation of the wildfire threat will require a sustained and long term commitment to a multifaceted approach involving actions by all levels of government. Attention needs to be given to funding and providing incentives to communities in order to encourage a more collaborative and comprehensive approach to solving the wildfire problem.

What's Happening? An Australian Perspective on keeping the Community Informed during Major Wildfires

Alan Rhodes Country Fire Authority (CFA) Australia/RMIT University, Melbourne a.rhodes@cfa.vic.gov.au

Introduction

In Victoria Australia community meetings have become an important means through which the fire service CFA (Country Fire Authority) and State public land management authority, the Department of Sustainability and Environment (DSE) engage the community affected by wildfire. The meetings create a forum to provide the community with updates on the fire situation, safety advice and other relevant information. The meetings are usually joint agency with representatives of other organisations sometimes present. Community meetings have been used during several shorter duration fires in south western Victoria and during the campaign fires in 2003 and 2006 in several parts of Victoria. In the 2006/07 Great Divide Complex fires, community meetings were used extensively throughout the affected and threatened areas. Over 300 meetings were held during the fires with over 32,000 people attending. In some locations only one meeting was held, although more commonly several were conducted during and immediately after the period of threat. In a few locations where the threat continued for many weeks over 20 meetings were held in the one location.

These meetings received widespread media coverage and have been consistently well attended. Given the high profile of community meetings over recent years an evaluation was undertaken by CFA as part of its involvement in the Bushfire Cooperative Research Centre to develop a better understanding of the role of community meetings during wildfires.

Methods

The evaluation started with the basic model of how community meetings are intended to work and then collected data to refine and test this initial model in order to produce a more developed idea of how community meetings work and what outcomes are achieved. The data collection involved interviews with agency personnel and members of local communities who attended meetings, observations of a number of meetings in different locations and at different stages of the fire threat, and a survey of residents in fire affected areas, conducted post season. Data were collected to identify the outcomes of the meetings and the processes that enabled these outcomes to be achieved, as well as a range of context factors. The data collected during this qualitative phase was then used to inform the development of questions for inclusion in the post season survey conducted several months after the fire.

Initial analysis of the qualitative data was used to inform the development of a survey that was conducted by telephone with householders in localities affected by the fires (Strahan & Rhodes, 2007, *The Victorian Bushfires: Community Engagement to Enhance Preparedness and Response*. Melbourne: CFA). Stratified random sampling – stratified by locality, was used to collect responses from 639 households. This sample enables 95% confidence that the sample result is within $\pm 3.5\%$ of the population value. The response rate for the survey was 68%.

Results

The critical components of community meetings were identified as

- Content of meetings covering the fire situation, the management strategies, and safety advice

- Resources – in particular maps of fire spread and management strategies and publications providing safety advice and information about agency services;
- Questions and answer time in meeting
- Social interaction between participants both before and after meetings

Although these four component parts were present in all the observed meetings and were also typically discussed in interviews with both agency personnel and community members, there was considerable variation in the components between meetings. Similarly the delivery of key messages varied considerably, both in its coherence, consistency and comprehensiveness, identifying a major source of potential variation in outcomes of the meetings.

Analysis of the interview data identified several important processes that lead people to change their thinking and actions. The more important of these include reassurance to reduce uncertainty, reality check leading people to acknowledge the need for decisions and action, information gathering to support decisions, acceptance of personal responsibility, the perception of agencies working together, and people sensing a common cause in dealing with the threat. These context factors largely shape both the processes activated by the meeting and the outcomes achieved in particular circumstances.

Analysis of the interviews and observations identified a range of possible outcomes of community meetings. These can be considered at three 'levels' – individuals and households, neighbourhoods, and community-agency. At the individual and household level typical outcomes included changes in risk perception involving reduced uncertainty and making the 'unknown' threat 'known', increased understanding and attitude change about the threat and agency actions, and the adoption of appropriate preparation and planning about how to respond. At a neighbourhood level there were many instances of collective action and an increased sense of community connectedness, at least in the short term. In terms of community-agency interaction there was clear evidence of increased understanding of agency roles, responsibilities and services, improved understanding of agency fire management strategies, and a stronger sense of community-agency partnership.

Two significant unintended, undesirable outcomes were also identified as possibly resulting from meetings in some circumstances. These included a false sense of security that basic or relatively low level of preparation would be appropriate for the level of risk, and unrealistic expectations about the experience of defending a house during a fire.

These findings were identified from the qualitative data and used to construct a more refined model of how community meetings work. The survey of households affected by the fire strongly confirmed the revised model of how community meetings work and the outcomes achieved. However it was also evident from the survey that while the meetings reduced uncertainty and increased people understanding, people often used the meetings to confirm their existing level of preparation and planning, making incremental improvements rather than wholesale changes. The findings suggest the importance of using community meetings during wildfires in conjunction with on-going programs to increase household and community preparedness.

Understanding obstacles to FireWise implementation

James D. Absher^{A,C}

Jerry J. Vaske^B

Andrew W. Don Carlos^B

Alan D. Bright^B

^APacific Southwest Research Station, US Forest Service, Riverside, CA, USA

^BHuman Dimensions of Natural Resources, Colorado State University, Fort Collins, CO, USA

^CCorresponding author. Email: jabsher@fs.fed.us

Keywords: FireWise actions, homeowners, attitudes, communication, wildland-urban interface

Introduction

FireWise behaviors include actions that residents should do to create defensible space and improve firefighting effectiveness. Informing residents about why and how to perform these actions is central to the agency mission of successful firefighting, wildland fire prevention, and community preparedness. Previous research has sought to understand residents' attitudes toward and familiarity with these recommendations (Absher & Vaske, 2007). An evaluation of FireWise compliance is a logical next step. A state sponsored program in Colorado has focused on actions categorized into seven different FireWise topics (Don Carlos et al., 2006). This paper focuses on understanding the importance that residents place on these recommended actions, how often they currently comply, and reported obstacles for non-compliance.

Methods

Data were obtained from a survey of residents ($n = 351$) in the Colorado front range wildland-urban interface (WUI). Seven specific FireWise topics were examined: (1) access for emergency vehicles, (2) water supply for firefighters, (3) defensible space actions around the house, (4) use of fire resistant plants and landscaping changes, (5) construction and building materials, (6) interior safety improvements, and (7) escape plans and what to do when. Using an orthogonal design, each respondent received information brochures on 3 of the 7 topics. There were 3 or 4 specific FireWise actions associated with each topic, for a total of 26. Respondents rated 10–12 actions in terms of: (1) the importance of each FireWise topic, (2) whether they had done the action, and if not (3) the obstacles that prevented them from engaging in each non-completed action using an open-ended response format. These obstacles were transcribed verbatim and analyzed using qualitative analysis software. Inter-rater reliability was .91, and all differences were reconciled.

Results

Analysis. Respondents rated the seven FireWise topics according to their importance. 'What to do when' (28%) 'Defensible space' (25%) and 'Access' (22%) rated highest in importance. They then indicated if they had already done the specific actions under each topic. Compliance varied by topic and action. Between 82–88% of respondents had addressed access issues. Water supply actions had been conducted by 68–79% of the respondents. Compliance with defensible space actions ranged from 47–80%. Between 50–82% reported planting fire resistant trees & shrubs. Household construction actions ranged from 61–92%; interior safety by 2–92%; and "what to do when" by 13–55%.

For those who had not yet completed

an action, and who also said that it was applicable to their situation, results revealed a variety of personal, social and economic obstacles for not performing FireWise behaviors. The qualitative analysis revealed 20 main themes. The most common obstacles across all topics and actions were cost, lack of decision authority, aesthetic concerns, disagreement with FireWise recommendations, lack of knowledge and lack of ability to perform the action.

The primary obstacles for each FireWise topic were: (1) access – terrain constraints, (2) water supply – cost and lack of adequate supply, (3) defensible space – aesthetic impact and cost, (4) trees and shrubs – natural vegetation patterns, amount/difficulty of work and neighbor relations, (5) construction – cost, (6) interior safety – cost and disagreement with recommendation, and (7) what to do when – amount/difficulty of work, lack of space.

Conclusions. The results show that FireWise programs face a diverse set of challenges. Understanding the obstacles that prevent compliance with FireWise actions points the direction for future management actions and education efforts. The prevalence of the cost obstacle, for example, suggests the need for cost-sharing programs and an emphasis on easy to accomplish actions. The results also highlight the need for more community-based action strategies, as opposed to individual homeowner actions. For instance, the lack of decision authority as an obstacle suggests the need to more directly involve homeowner associations, landlords, or enact of community-based regulations. The prevalence of aesthetic considerations reveals the role values play in wildland fire mitigation compliance. Natural vegetation attracts many residents to the wildland urban interface. Although the removal of trees and shrubs from private property facilitates the ability to protect a home in the event of a wildfire, such actions contradict the original impetus for moving to forested areas. Finally, it is recognized that this is a qualitative analysis from one group of WUI residents. Further development of these techniques for gauging barriers to full FireWise implementation is needed, as is a better testing of the underlying theoretical models of action (e.g., the role of attitudinal variables, relative to obstacles to individual actions).

Literature Cited

Absher JD, Vaske JJ. (2007) Modeling public support for wildland fire policy. In 'Sustainable forestry: from monitoring and modeling to knowledge management and policy science'. (Eds. KM Reynolds, AJ Thomson, M Köhl, MA Shannon, D Ray, K Rennolls) pp. 159-170. (Wallingford, UK: CABI Press).

Don Carlos AW, Bright AD, Vaske JJ. (2006) Evaluation of information about firewise behavior in the wildland-urban interface of northern Colorado. (Project Rep. 73). Project report for the U.S.D.A. Forest Service, North Central and Pacific Southwest Research Stations, Colorado State Forest Service and Larimer County, Colorado. (Fort Collins: Colorado State University, Human Dimensions in Natural Resources Unit).

“Stay and defend:” evidence for the Australia approach

John Handmer
Bushfire CRC &
Centre for Risk and Community Safety
RMIT University, Melbourne, Australia
John.handmer@rmit.edu.au

Keywords: shelter in place; stay or go; Australian approach; community safety.

The policy question: what should residents do to prepare for the fire threat?

There is a widespread view in Australia and the United States that those at risk need to take some responsibility for their own risk. Ideally, the wildfire risk is shared between fire agencies and the people at risk. The people need to know what to do and how they can reduce their own risk. Typically this is done by preparing houses and yards to make them less fire prone and to create defensible space around the property. But what about when a fire is imminent?

Options when faced with wildfire – none is risk free

When wildfire threatens an area, those at risk have four general options:

- *Leave well before the fire arrives.* This may seem to be the safest and only sensible option, and it would certainly normally carry the lowest risk in terms of life. But safe escape may not be possible, or the fire might start nearby or otherwise threaten suddenly leaving no time to leave safely.
- *Flee at the last minute.* This often involves driving or walking through flames, ember storms, and intense heat and smoke with the accompanying disorientation and poor visibility – and would appear to be the most dangerous option.

The next two options depend on a belief that the house offers some protection from the radiant heat, embers and smoke of the fire.

- *Stay and shelter passively in the structure.* “*Shelter in place*” involves in effect hiding in the structure and to be safe the structure would need to survive the fire.
- *“Stay and defend” the house.* This is often confused with “shelter in place” but is quite different. It involves active preparation and defence of the house to prevent the structure catching fire from embers or flames. The logic is that embers are overwhelmingly the cause of houses catching fire, and embers can be extinguished by vigilant householders.

The Australian approach: “Stay and defend or leave early”.

In the Australian approach, “*staying*” means being prepared physically and mentally, and actively defending the property as the fire front passes and from ember attack before and after the front. It does not mean sheltering passively. “*Going*” means making a decision not to defend the property and leaving well before the fire front arrives or makes leaving dangerous. All

Australian fire agencies signed up to this approach in 2005. In part, the relevant documents states (AFAC - Australasian Fire Authorities Council, 2005):

‘communities at risk from bushfires should be allowed and encouraged to take responsibility for their safety. Where people have adequately prepared themselves, their houses and properties they should remain with their homes during a bushfire’

There are a number of pre-requisites for this approach: houses must protect the occupants and ignite in a way that would normally allow occupants to extinguish the blaze; people must believe this, have confidence in their ability to protect the structure, and be committed to not changing their minds and fleeing into the fire front. .

The evidence - results so far

We have examined and compiled the Australian evidence for this approach (Handmer and Tibbits 2005; see also Handmer and Haynes in press). Evidence has come from oral histories, documented practice by fire agencies and those at risk, post-fire public inquiries, scientific publications and a death database. Most of this material deals with extreme fires – the worst fires in the last 70 years. In summary:

- *The evidence supports current practice.* All sources of evidence listed above support the approach: the most risky thing to do – and the cause of most fatalities - is to leave at the last moment, as the fire front arrives and when roads may be blocked by smoke and burning debris;
- Building research confirms that in Australia, *embers burn houses down*, and they can be put out by vigilant householders (Justin Leonard of CSIRO has undertaken much of this research. See his chapter in Handmer and Haynes in press);
- The critical factor in *building survival is the presence of people*;
- There is *no legal impediment*, but there are some gaps;
- There are *many implementation issues* to do with information provision, expectations that fire agencies will be there, belief that houses explode in fires, confidence, commitment, and high risk decisions.

References

Handmer J and Haynes K (eds) (in press) *Community bushfire safety*. Melbourne: CSIRO Publishing.

Handmer, J. and Tibbits A. (2005) Is staying at home the safest option during bushfire? Historical evidence for an Australian approach. *Environmental Hazards*. 6: 81-91.

The Australian ‘Stay or Go’ Approach: Factors Influencing Householder Decisions

Alan Rhodes Country Fire Authority (CFA) Australia/RMIT University, Melbourne a.rhodes@cfa.vic.gov.au

Introduction

The ‘Stay and Defend or Leave Early’ (hereafter referred to as ‘stay or go’) position (AFAC, 2005) advocates that people living in wildfire prone areas should decide how they will respond to the threat of wildfire. It does not advocate that one option is better or preferred but instead encourages people to consider their situation and circumstances and make an informed choice well before the occurrence of a wildfire. The adoption of an appropriate response by people threatened by wildfire depends on recognising the risk, accepting their responsibility, understanding their options and effectively planning and implementing the recommended actions. In this sense a person’s response is considered to result from a decision making process that will be influenced by a range of individual, situational and social factors. While there is increasing evidence that the ‘stay or go’ is based on good evidence about the nature of the threat and effective response, recent research highlights that its effective implementation depends on the public’s understanding, willingness and capacity to implement it. This paper outlines some of the findings of research identifying the factors that influence how people understand the ‘stay or go’ advice and how they respond to the wildfire threat.

Methods

Several large scale surveys of householders affected by major fires were conducted in various Australian states (Sydney, New South Wales 2002, Eyre Peninsula, South Australia 2005, Victoria, 2005, 2006 and 2007). Sample sizes ranged from 350 to 800 and used both mailed and telephone administered questionnaires. In addition, several studies using semi-structured interviews have been conducted with householders affected by several of these major fires. The results presented in this paper represent some of the findings of these various studies.

Results

Recognition of the threat

If people are to implement an effective response they need to recognise that there is a threat and that some response is necessary. Several of the studies have highlighted the differences in the recognition of threat during different wildfire events. Factors which may influence the variation in the recognition of the threat include the general level of understanding of the wildfire risk, the nature of the fire event and the extent and nature of warnings issued.

Preparedness

Effective implementation of ‘stay or go’ depends on effective preparedness. Most commonly this is understood to mean preparation of the house and property in order to enable effective protection. However effective response depends on more than physical preparation and the concept of ‘preparedness’ is used to encompass four key dimensions: physical preparation, personal protection, planning and psychological preparedness. The studies have identified that there is considerable variation in the level of each of these dimensions both within and between study areas. Some of the more important findings from these studies include:

- Most householders undertake ‘easy to do’ preparation, often for reasons other than wildfire protection;
- Effective house and property preparation is a long term outcome and, if it increases over time, is done incrementally;
- Personal protection in the form of protective clothing and other resources is more likely to be taken once a fire occurs rather than in advance;

- Household planning is a complex decision making process that is often limited in scope; and
- Many people are unprepared for the experience of wildfire and the psychological impact.

Collectively these findings mean that many households have an inappropriate level of preparedness to ensure an effective response as recommended in the 'stay or go' position.

Outcome expectations

People tend to see 'staying to defend' as effective in protecting property but risky to life but perceive 'leaving early' as protecting life but ineffective in protecting property. They also see the option of 'waiting but leaving when threatened' as an 'in between' strategy that increases the chances of achieving both outcomes of property protection and life safety. They perceive 'staying' as the most costly option in terms of finances and effort, 'leaving early' as least costly and 'waiting' as less costly compared with 'staying', but more costly than 'leaving early'. These results suggest that the most dangerous option is seen by some people as the most effective choice in terms of outcomes and costs. The results highlight the need to educate people about the benefits and costs of different ways of responding to wildfire.

Intended and actual response

There is considerable variation both within and between communities in terms of how people intend to respond during a wildfire. The majority indicate they intend to stay and defend with relatively few people indicating they will leave early. A significant minority in all studies (11-23%) intended to wait until told what to do, and 17-32% intended to wait but leave if they felt threatened. One study examining what people actually did suggests that most people who intended to adopt recommended actions actually carried out this intention. However those who intended to 'wait and see' tended to either actually stay, or to leave when the fire threatened their property. These results highlight the variability in what people intend to do and also suggest that intention strength may be an important factor influencing action during a fire. These results also highlight the relationship between preparedness and response in that people who change their mind and actually stay may not be adequately prepared to deal with the fire threat.

Complexity and Uncertainty

The 'stay or go' position recommends particular responses which, based on available evidence, are more likely to achieve safety outcomes. However, case studies reveal that fire events create particular circumstances that interact with a multiplicity of factors influencing people's response. Decision-making and response reflect complex processes that involve instinctive drives, emotional/affective factors as well as more cognitive processes. This complexity means that the outcomes are only in part likely to reflect the influence of recommended actions. Much of the complexity and uncertainty inherent in fire events and human response is beyond the influence of all but the most individualised and specific interventions. Whilst the evidence continues to support the recommendations of the 'stay or go' position, the challenges in achieving effective implementation are only emerging.

References

AFAC. (2005). *Position Paper on Bushfires and Community Safety*. Retrieved 20 March, 2006, from <http://www.afac.com.au/awsv2/publications/documents/PositionPaperonBushfireandCommunitySafety.pdf>

Applying Australia’s Stay or Go Approach in the U.S. Would it work?

Sarah McCaffrey

USDA Forest Service Northern Research Station

1033 University Place, Ste 360

Evanston, IL 60201

smccaffrey@fs.fed.us

Keywords: evacuation, shelter-in-place, Australia, Stay or go

Introduction

There are a number of similarities between fire management concerns in the United States and Australia. Both countries have large areas with fire dependant ecosystems, a significant wildfire hazard, and an increasing number of houses being built in high fire risk areas. Despite these similarities, there are a number of important differences in how the two countries manage fire including the approach each uses in working with fire threatened communities. The U.S. emphasizes evacuating residents while Australia encourages those who are prepared to stay and defend their properties. (This is described as “Leave Early or Stay and Defend” but for simplicity it will be referenced here as Stay or Go). There has been a growing interest in the United States in exploring alternatives to mass evacuation such as adoption of the Australian model. A singular focus on mass evacuation can be problematic for a number of reasons. Evacuation in the face of rapid fire movement and/or limited egress routes can place lives at more risk than having individuals remain in their community. In addition, an increasing number of homeowners appear to be refusing to evacuate. In these circumstances it is worth considering how to ensure that those who don’t want to or can’t evacuate safely understand the appropriate response to be able to stay safely. This presentation will assess in what ways circumstances between the two countries are or are not similar enough for adoption of such an approach to be appropriate. It also will touch on differences between “Stay or Go” and “Shelter in Place.”

Methods

In the Spring of 2007 ten weeks were spent in Australia working with the Country Fire Authority of Victoria which has one of the oldest and most active programs in working to inform homeowners how they can safely stay and defend their properties. During this time, I met with researchers, managers, volunteer fire fighters and members of the public from the States of Victoria, New South Wales, and Western Australia. I also presented information about findings from research in the U.S. that might be of interest. This laid the base for interesting and interactive discussions. In the process, I gained a broad understanding of the underlying logic and scientific support for the Australian policy, the specific programmatic steps they have been taking to ensure its effective implementation, and some of the remaining challenges. I also gained insight into areas of similarity and difference between the two countries that might affect U.S. adoption of their approach.

Results

First, Shelter in Place (SIP), which as used in reference to wildfire does not seem to have a consistent meaning, is not necessarily the same as the Australian Stay or Go approach- although

the two are often treated as equivalents. SIP is generally described as a fairly passive process where any individuals who stay would simply passively shelter in fire resistant structures. When the passivity of the SIP approach was described to Australians, it was greeted with horror as something that would endanger lives. The Australian process is an active one – if the homeowners aren't well prepared and actively protecting their home before, *during*, and after the fire front passes through, they shouldn't stay.

An institutional difference that may play a role is the fire management agency structure. In the U.S., wildland fire management is primarily handled by five federal agencies, all of which are responsible for some aspect of land management. By default these land management agencies have often become responsible for protecting structures from wildland fires. In Australia, land management and fire management are by and large handled by separate agencies at the State level. While the land management agencies are responsible for fire management on their lands, the responsibility of protecting houses – whether from a structural fire or from a bushfire — resides in a separate agency which operates primarily from an emergency management perspective.

Other potential differences that would need to be considered in determining appropriateness of adoption can be broken into two general categories: fire behavior and human behavior. In terms of fire behavior, differences in vegetation type and housing and construction patterns that could affect house ignition and safety of staying would need to be considered. One Australian researcher who looks at these issues indicated that although vegetation differences should not be overlooked, the more important of the two variables were differences in housing and development patterns. For instance, in Australia, metal roofs have long been a standard and preferred construction practice; whereas metal roofs are not as prevalent in the U.S. where, until recently, wood shingle roofs have been popular in many fire prone areas. In terms of human behavior, having individuals stay and protect their property requires clear understanding of fire dynamics and the significant physical and psychological resources that are required of individuals who stay. Australia has developed and laid the groundwork for its approach over more than two decades. Their outreach work is quite clear about two key items – that most houses are lost through ember attack and that radiant heat is the primary cause of death from wildfire. This knowledge is integral to understanding their concept that “People protect houses and houses protect people.”

Although a number of differences, such as development patterns and housing construction styles, mean that blanket adoption would likely not be appropriate in the United States, in localized situations the Australia approach could be a viable option. However, even where appropriate in terms of fire behavior and home ignition issues, effective adoption would require that significant resources are directed toward working with the public, both before and during an event, to ensure that individuals and communities are physically and mentally prepared to make the safest decision for their situation when faced with an approaching wildfire. Without a clear understanding of fire dynamics and the physical and psychological requirements of remaining in place, the risk is that individuals may decide to leave at the last minute, the least safe option available.

Delivery and acceptance of “Stay or Go” messages in the Blue Mountains

Tony Jarrett

Captain, Hazelbrook Rural Fire Brigade, New South Wales Rural Fire Service

PO Box 50, Hazelbrook NSW 2779 Australia

tjarrett@exemail.com.au

The Rural Fire Service (RFS) is the primary bushfire combat agency in New South Wales, Australia, with 2100 brigades, 69,300 volunteers and 600 staff. The RFS provides emergency fire and other incident cover to 95% of New South Wales.

The Blue Mountains, west of Sydney, covers 1,433,000 hectares and is one of the most bushfire-prone areas of the world. 95% of residential development is along ridge-tops, within the World Heritage listed Blue Mountains National Park.

The Blue Mountains RFS district stretches 100km from Glenbrook in the east to Mt Wilson in the north. There are 20,000 ‘wildland urban interface’ properties along 800 kms of interface. Twenty six villages are located along spine ridges above steep valleys.

Major fire events occur frequently, with most large-scale fires occurring in November and December. 4 times since 1951, a single fire has destroyed more than 50 properties - mainly houses, but including churches, a school and several shops.

Damage to urban areas has occurred on 19 blow-up days within 11 major fire seasons. Most properties destroyed were in localities adjacent to northwest-oriented valleys. Fourteen deaths have occurred as a result of wildfires since 1945.

The RFS is a volunteer firefighting force. In the Blue Mountains RFS there are 26 Brigades, 65 appliances and 1200 firefighters. Volunteers manage most fires, and volunteers always are part of the Incident Management Team for major fires.

The challenge for the Community Education Team and Brigades is to reconcile the enormous scale of the ‘bushfire problem’ in the Blue Mountains. Thus, the Blue Mountains RFS has created the innovative *FireWise Blue Mountains* project has the objective to Minimal death and injury and property losses through a bushfire aware and self sufficient community.

While the *FireWise* project has used a range of community engagements, there has been a focus on street meetings. Street meetings have been popular as they are held where residents are comfortable (their street). Again, delivery has been by a volunteer community safety force.

Key messages are consistent, however content and style is adaptable to the resident participants as well as the volunteer presenters. Residents need to be convinced of things such as that they are not going to fry, and that houses do not explode. Graphic descriptions and pictures are used, and experiences of peers are drawn on – rather than war stories from firefighters.

In preparing to stay, or preparing to go, residents are provided options. There are many different strategies, and no one way suits everyone. Support is provided for making a bushfire plan. Sharing ‘decisions’ with family and neighbours is encouraged.

In addition to street meetings, the range of engagements has included community meetings before, during and after fires; participating at events and celebrations; site visits and assessments; and action programs such as Static Water Source markings.

Successful programs and ideas from other fire agencies are adapted and adopted, as are locally developed programs. This tailoring of programs is to suit local communities and situations. Examples include comprehensive property audits, formation of neighbourhood groups, conducting post-fire community debriefs, using firestations as election polling booths, creating 'resident friends' lists, holding "Open Day" away from the fire station and making it a community event, and community participation at hazard reductions.

Anecdotally, there were examples of community education 'successes' that resulted in desired changes in behaviour. However strong validation was required, not just to argue for program funds, but probably more importantly, to justify the volunteer hours spent on the *FireWise* program.

Research initiatives were driven by volunteers and individuals, and supported by RFS staff and managers. Collaborations continue with University of Western Sydney, RMIT University, and the Bushfire Co-operative Research Centre.

As an outcome of that continuing research and analysis, there have been changes to how *FireWise* messages are delivered. Engagements are interactive and inclusive, and link the desired behaviour with the audience needs and motivations. Engagements must have a purpose eg Open Days are about the community, not the RFS.

Alarming, 30% of *FireWise* participants still intend to take risky decisions, such as leaving late if the fire gets too bad. More work certainly needs to be done to ensure residents are making informed decisions, and acting appropriately as a consequence.

The nature of fire fighting in Australia is that residents will be around in wildland urban interface fire situations. Fire agencies encourage able bodied adult residents to defend a well-prepared property, and such decisions to stay are accepted by the community, as is a decision to go early.

The operational benefits for fire managers for having residents in place include residents participating in decision making and actions that affect them or their assets, and resident tend to own the problem and consequences. Residents also provide local 'intelligence' about assets and people, and can bring additional resources.

Landscape Aesthetics and Environmental Education: Wildfire Management in the Wildland Urban Fringe of the Northeastern United States

Robert L. Ryan

Department of Landscape Architecture and Regional Planning
University of Massachusetts, Amherst
109 Hills North
Amherst, MA 01003-9328
Tel. (413) 545-6633
Fax (413) 545-1772
e-mail: rlryan@larp.umass.edu

Keywords: landscape preference; wildland-urban interface; forest management- aesthetics; defensible space- residential landscaping.

Introduction

The pitch-pine barrens of eastern Long Island and southeastern Massachusetts are at the edge of rapid suburbanization in the densely populated Northeast. These coastal ecosystems are fire dependent and home to many endangered plants and animals (Irland, 1999). While the area has historically been subject to devastating wildfires, new suburban residents may be unaware of the current fire danger and potential steps they can take to reduce their wildfire risk. Local land managers are interested in restoring the ecological health of the pine barrens through the use of prescribed fire and other management techniques, and are concerned about public reactions to new management regimes.

In our initial studies in this region, we found that local residents had more previous experience with wildland fire than originally expected and were mid-range in their support for prescribed fire (Blanchard and Ryan, 2007; Ryan et al., 2006). As in previous studies in other regions (Winter and Fried, 2000), knowledge and previous experience with wildfire became important variables that impacted perceptions of wildland fire risk and attitudes toward wildland fire management. Thus, the current study strove to understand the impact of environmental education and intervention on public attitudes toward forest management and wildfire hazard reduction strategies on both public land, as well as residential landscaping.

Methods

To understand these issues, a sample of 233 local residents from the Central Pine Barrens of eastern Long Island and the Plymouth Pine Barrens of southeastern Massachusetts were surveyed with a photo-questionnaire containing scenes of different forest management strategies and residential landscaping, as well as an educational section describing the environmental benefits and impacts of forest management near their homes. Eight photographs of pitch-pine and oak forests under different management regimes were used to elicit participants' opinions about the type of forest management that they consider acceptable for public land in their area. Next, the survey showed eight scenes of residential landscapes with a range of native and ornamental plantings to ascertain local residents' perceptions of the type of defensible space landscaping that they considered appropriate for their area. The photo sections were developed using the landscape preference methodology and data analysis from Kaplan and Kaplan (1989). Based on the work of Kearney (2001), an educational intervention was developed later in the survey that described the benefits of either prescribed fire or mechanical thinning of public land and showed photographs of the forest at different stages of these treatments.

Results

The study results provide new insights for both creating defensible space around homes, as well as management of adjacent public lands. As found by Ribe (2002), it appears that the public judges ecological health according to their aesthetic response to different management regimes. The results of the public lands management section support previous research that the public prefers more open forest conditions (Kaplan and Kaplan, 1989). Fortunately, for land managers, these open forests can be the result of forest thinning efforts to reduce fire danger. At the residential scale, there was some support for landscapes that exhibited some aspects of forest thinning as well.

Land managers often rely on environmental education to raise public awareness for management efforts. However, landscape preferences are deeply ingrained. Therefore, it is important to learn if informing the public about local ecosystems and management goals will have an affect on their attitudes and visual preference. An educational intervention section in this survey looked at local residents' support and acceptance for using prescribed fire (or mechanical thinning) on public land after reading about the technique and seeing scenes of different stages of forest regeneration. The study results are promising for forest planners and managers intent on reintroducing fire into the pitch-pine forest ecosystem and illustrate the impact of environmental education on landscape preference.

Literature Cited

- Blanchard, B. and Ryan, R.L. 2007. Managing the wildland-urban interface in the Northeast: Perceptions of fire risk and hazard reduction strategies. *Northern Journal of Applied Forestry* 24 (3): 203-208.
- Irland, L. C. 1999. *The Northeast's changing forest*. Cambridge, MA: Harvard University Press.
- Kaplan, R., and Kaplan, S. 1989. *The Experience of Nature*. New York: Cambridge Press. (Republished by Ulrich's, Ann Arbor, MI).
- Kearney, A.R. 2001. Effects of an informational intervention on public reactions to clear-cutting. *Society and Natural Resources* 14 (9): 777-790.
- Ribe, R.G. 2002. Is scenic beauty a proxy for acceptable management? The influence of environmental attributes on landscape perceptions. *Environment and Behavior*. 34 (6): 757-780.
- Ryan, R.L., Wamsley, M.B. and Blanchard, B.P. 2006. Perceptions of wildfire threat and mitigation measures by residents of fire-prone-communities in the Northeast: Survey results and wildland fire management implications. In McCaffrey, S. (Ed.), *The Public and Wildland Fire Management: Social Science Findings for Managers*. General Technical Report, NRS-1. Newtown Square, PA: USDA Forest Service, Northern Research Station. Pp. 11-17.
- Winter, G., and Fried, J. 2000. Homeowner perspectives on fire hazard, responsibility, and management strategies at the wildland-urban interface. *Society Nat. Resources* 13: 33-49.

Acknowledgements

The funding for this study was provided by the U.S. Forest Service, North Central Research Station under Cooperative Agreement No. 02-JV-11231300-025. Thanks go to the project's graduate research assistants: Brian Blanchard, Mark Wamsley, and Frank Varro.

COMMUNITY PREPAREDNESS FOR WILDFIRE

Gwynne Brennan^{AB}, Alan Rhodes^{AB}, Lisa Sturzenegger^{AB}

^A CFA (Country Fire Authority) Victoria, Australia.

^B Email addresses: g.brennan@cfa.vic.gov.au; a.rhodes@cfa.vic.gov.au, l.sturzenegger@cfa.vic.gov.au

Keywords

Community preparedness, FRV, bushfire safety, community engagement

Introduction

Fire agencies in Victoria, Australia have developed a comprehensive strategy to increase community preparedness for wildfire (commonly known as *bushfire*) events. The Fire Ready Victoria (FRV) strategy is a three year, joint agency strategy that seeks to raise awareness of the wildfire risk, promote adoption of preparation actions, encourage planning about what to do during a fire and to provide information to threatened communities during wildfires to support decision making. The FRV strategy aims to deliver the key messages to the community that underpin the ‘stay and defend or leave early’ position supported by Australian fire agencies.¹

Methods

The strategy was developed with 5 key objectives:

1. To increase awareness that fire is a natural and inevitable process and of its role in the Australian landscape;
2. To raise awareness amongst residents of high bushfire risk areas, including those living in urban fringe areas of outer metropolitan Melbourne, of the importance and benefit of taking action to mitigate the local risk of bushfire;
3. To increase understanding of how to mitigate risk and their adoption of preparedness measures amongst residents of high bushfire risk areas;
4. To increase understanding that fuel reduction burning is carried out to mitigate risk and to reduce impact of wildfire; and
5. To promote awareness amongst residents and tourists visiting high bushfire risk areas, of available sources of information immediately prior to and during the onset of bushfire.

The program was composed of a number of deliverables based on community readiness.² This ranged from an ‘uninvolved’ community, where activities were targeted mainly through media and print campaigns. To ‘interested’ communities, where more targeted media and community meetings are held. Through to the ‘concerned’ and ‘motivated’ communities where a highly interventionist approach is undertaken.

Results

A major part of the Fire Ready Victoria Strategy is the state-wide media campaign to promote bushfire safety and awareness. An evaluation of the media campaign³ was conducted during February 2007 when most of the media activity had been completed.

A telephone survey of 601 randomly selected households in Victoria was conducted by Strahan Research over a period of eight days. The survey results indicate 89% saw or heard messages, advertisements or commercial about bushfire safety before or during the summer fire season. Of these, 91% reported they saw or heard a bushfire safety message through a television advertisement.

Over half of the respondents also saw or heard the bushfire message through:

- Newspaper articles (60%)
- Radio advertisements (57%)
- Radio interviews/ talkback (51%)

The majority of respondents correctly identified relevant key messages they had seen in the various media. Nearly half (49%) the respondents indicated that the main message was to clean up around the home (including leaves in gutters and bushes around the house, have buckets and sprinklers ready) to prepare against bushfires, and 24% said it was to develop a bushfire plan in advance and practice it. A further 16% indicated the main message was that people need to make a decision whether to 'stay or go'. Similarly, the majority of respondents correctly identified various practical steps they can take to protect their property and the community from a bushfire, including preparing homes, developing a bushfire plan and observing restrictions.

These findings relating to the recall of key messages and the level of agreement strongly suggest that the public is hearing and understanding the key safety messages

An assessment of the outcomes of the FRV strategy was undertaken through a survey of 639 households in areas affected by the major fires in Victoria in 06/07⁴. The results of the survey showed a high level of adoption of recommended actions in preparing properties and in decision making about what to do when threatened by a fire. In 84% of cases of houses directly threatened by the fire, someone from the household was present during the threat to defend the property. More than half (56%) had assistance from friends and neighbours and 42% received assistance from the fire agencies.

The high level of resident involvement in property protection is reflected in the levels of preparedness. On a range of preparation measures, respondents reported high levels of implementation prior to the occurrence of the fires. These included availability of hoses (95%), reduced fuel around house (92%), cleared gutters (90%), moved combustibles (80%), covered gaps (76%), had personal protective clothing (72%), non mains water supply (69%), fire fighting pump (63%) and protection of underfloor spaces (56%). Further, of those who had not taken particular measures prior to the fires occurring, between 20-45% implemented additional measures during the time of the fires.

There was a high level of satisfaction with service delivery, including the work of fire fighters (91% satisfied or very satisfied), the information available before the bushfires (86%), information provided during the fire (86%), the amount of warning (83%), and the overall management of the fires (74%). These results are consistent with those obtained after the 2005/06 fires, but significantly higher in relation to the overall management of the fires compared with the 2003 bushfires.

The study shows a strengthening partnership between the community and agencies in dealing with long duration bushfires. It highlights that the intended outcomes of the community education and engagement activities are being achieved at significant levels. The threatened communities appear to have been highly aware of the threat, understood key messages, were reasonably well prepared before the event, and increased their preparedness during the fires. They showed high levels of self reliance in defending properties.

Fire Ready Victoria has contributed significantly to the community's capacity to deal with the threat of bushfire. Other agencies have now expressed interest in participating in the strategy and a recent review of the strategy identified the need to further develop the partnership approach bringing all the relevant agencies together in a coordinated whole of government approach.

Literature Cited

¹ Fire Ready Victoria Strategy (2004)

² Rhodes, A. (2007) Model of Community Engagement

³ Strahan Research (2007) Media Evaluation

⁴ Strahan, K. Rhodes, A. The 2007 Victorian Bushfires

Wildland-Urban Interface Residents' Views on Risk and Attribution

Patricia J. Cohn^A, Daniel R. Williams^B and Matthew S. Carroll^A

^ADepartment of Natural Resource Sciences, Washington State University, Pullman, Washington, USA. ^BU.S. Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado USA, drwilliams@fs.fed.us

Keywords: attribution theory, community impacts of wildfire

Introduction

This paper examines WUI residents' views on wildfire risk and the role of causal attribution in wildfire risk perception and response, both pre- and postfire. Social psychologists developed attribution theory in the 1970s to describe the kinds of causal explanations people give for events and the effects these explanations have on their judgments about, among other things, success and failure. Accordingly people have a psychological need to assign responsibility for important events, but their judgments about the underlying causality often minimize personal responsibility for negative outcomes (Weiner 1986). The questions addressed in this paper are: How these attribution tendencies influence residents' responses to wildfire risk, specifically, where do homeowners place responsibility for prefire mitigation—on their actions or the actions of others? Where do homeowners place responsibility for wildfire damage (to both natural resources and built property)? To what do homeowners who have experienced wildfires attribute the fundamental cause of the wildfire—the actions of self, others (management, perceived suppression policy), or natural conditions (weather, topography)? And finally, where do WUI residents place wildfire risk in the spectrum of risks in their lives, and how does this affect willingness to engage in prefire mitigation measures?

Methods

Data come from six qualitative case studies of communities or sets of communities in the western U.S.A that experience a large wildfire between 2000 and 2002. In-depth, semi-structured interviews were conducted with residents, fire team leaders, firefighters, Forest Service officials, public safety officials, and representatives of helping organizations associated case study sites (approximately 50 interviews for each case).

Results

Respondents distinguished between the ignition source of the fire (natural or human caused), yet attributed the fundamental cause of the fire, as well as its nature and the damage it caused, to existing forest conditions, such as heavy fuel loading due to past management activities, as well as natural conditions such as drought and high winds. In making attributions on the cause of wildfire damage, respondents often find ways to blame others for the damage such as the use of

ineffective tactics and strategies by firefighters. Respondents across all sites recognized a need to raise awareness of the flammability of their environment. Respondents generally recognize that both public and private landowners had the responsibility of doing and paying for firesafing and fuel reduction work on their respective lands. In contrast to other hazards, however, wildfire mitigation is not a one-time investment in improved building design and siting, but is a potentially expensive and never-ending investment in firesafe landscape maintenance.

Several factors that appear to dampen WUI residents' perceptions of and reactions to wildfire risk. First, the experience of a recent wildfire contributes to the perception that another fire is less likely to occur any time soon. Second, homeowners are reluctant to invest in mitigation to reduce fire risk for aesthetic or lifestyle reasons. Third, following attribution theory wildfire events seem particularly ripe for projecting blame elsewhere. Because wildland fire management policy is deeply entangled with contentious forest management policies and complex suppression tactics, it may be easier to blame the problem on a public failure to properly manage the forest and downplay the inherent risk of living in the wildland-urban interface.

A key lesson from the relatively long history of hazards research, however, is that any risk perception gap between citizens and experts should not be simplistically attributed to an uninformed or irrational public. Moreover, the gap is not easily closed using education and outreach efforts (Slovic 1999). From our findings residents do not appear to be uninformed or irrational; they may simply emphasize different factors in their assessment of risk. For example, when wildfire risk is placed within a larger spectrum of the everyday life of household members, other, more pressing risks may take precedence.

Scientific literacy and public education are important but not the only factors affecting residents' perceptions of wildfire risk. Risk management in wildfire needs to direct its focus less on closing the risk perception gap and more on introducing encouraging public participation into both risk assessment and risk management as a way of maintaining and restoring trust. This approach, emphasizing the social construction of risk, seems particularly appropriate given that wildfire risk is entwined with complex and contentious forest management issues and ideologies.

Literature Cited

P. Slovic, *Risk Anal.* **19**, 689-701 (1999).

B. Weiner, *An attributional theory of motivation and emotion*. (Springer-Verleg, New York, 1986).

Diversity in southwesterners' views of Forest Service fire management: Chapter 9 in *Wildfire Risk: Human Perceptions and Management Implications*. Wade Martin, Carol Raish and Brian Kent, eds. Washington, D.C.: Resources for the Future.

Patricia L. Winter^A and George T. Cvetkovich^B

^A USDA Forest Service, Pacific Southwest Research Station, Forest Fire Laboratory, Riverside, CA 92507, USA
^B Department of Psychology, Western Washington University, Bellingham, WA 98229, USA

Keywords: southwesterners, fire management, trust, knowledge, concern, ethnic/racial group, gender

Introduction

The southwestern United States has seen an increase in the incidence of and risks associated with wildland fires. Contributors to this increase have included several years of drought and insect infestation, and urban encroachment paired with concentrated populations in the wildland urban interface. These changes, along with aggressive fire suppression, and altered vegetation have increased the risk of larger and more severe fires.

The increased risks mentioned above have led to increased importance of effective fire management, including approaches to prevention and suppression that incorporated public communication, collaboration, and cooperation.

Trust has been cited as a crucial aspect of public response to fire management. However, studies of social trust as well as trust in government suggest we ought to be concerned about relationships between publics and fire management agencies. In spite of the fact that distrust is not necessarily counterproductive, especially in risk management situations, too much distrust can compound the amount of time and energy necessary to defend agency actions in public forums and during litigation.

Studies exploring trust levels have shown patterns of lower trust among marginalized or disadvantaged groups. Understanding the intersection of trust and diversity is essential, and of particular importance in the southwestern United States, an area known for its diverse population.

While some studies have pointed to patterns of distrust, others have cited important deviations. For example, there is a distinction between social trust and trust in government. Furthermore, there is a difference between general trust and situation-specific trust (trust in an agency to do 'x'). Situation specific studies of trust have shown a more reassuring pattern, that is, a tendency towards majority trust rather than distrust.

This paper examines trust held by residents of four southwestern states (AZ, CA, CO, and NM) towards the Forest Service to manage wildland and wilderness fires in their state of residence. We examined the relationships between ethnic/racial group, gender, concern and knowledge about wildland and wilderness fires, salient values similarity (perception of similar values to the agency regarding values, goals and views), and trust.

Methods

We conducted a telephone survey based on a representative sample of residents from each state. A total of 1,811 surveys were completed. Some of the ethnic/racial groups had smaller sample sizes than would be desirable for statistical tests; however, analyses were in keeping with the overall goals of our research.

Results

Respondents had a high average concern about wildland and wilderness fires in their state (mean = 6.7, SD = 1.8, $n = 1,799$, 1 = not at all concerned, 8 = very concerned). The vast majority (78.5 percent) rated their concern as 6, 7, or 8 on the scale. Ratings of concern over wildland and wilderness fires varied significantly by ethnic/racial group (based on the six ethnic/racial groups, ANOVA, $F_{5, 1,731} = 7.47$, $p < .001$), with the highest concern among Native American/First Nations and Latino/Hispanic Americans. Follow-up t-tests comparing males and females within each ethnic/racial group revealed significant differences by gender for white/Caucasians, black/African Americans, and Latino/Hispanic Americans. White and Latino/Hispanic American females were more concerned about wildland and wilderness fires in their states than their male counterparts, but black females were less concerned than black males.

Self-assessed knowledge regarding wildland and wilderness fires in the respondent's state of residence was rated above the midpoint on the scale (mean = 5.3, SD = 2.0, $n = 1,788$, 1 = not at all knowledgeable, 8 = very knowledgeable). As with concern, knowledge also varied significantly by ethnic/racial group (ANOVA, $F_{5, 1,719} = 1.85$, $p < .001$); with Native American/First Nations and white/Caucasians rating their own knowledge about fire the highest. Differences between males and females within each ethnic/racial group were significant for white/Caucasians but not for any other group. In the majority of groups, the tendency was for males to rate their knowledge higher than females.

The salient value items were highly correlated with each other (ranging from .67 to .69), and each of the salient values items was significantly correlated with trust (.55 to .61). The prediction of trust in the Forest Service was examined through simultaneous linear regression. The predictors included the average of the three similar salient values items, knowledge, ethnic/racial group, concern, gender, and education. A significant amount of the overall variance in trust was explained by these predictors ($R^2 = .429$, ANOVA, $F_{6, 1,615} = 201.99$, $p < .001$). The most influential predictor in the regression was similar salient values.

We averaged the three similar salient value items and the trust rating to create an overall trust scale ($\alpha = .874$). The trust scale was analyzed by ethnic/racial group, revealing significant variation (ANOVA, $F_{5, 1,724} = 3.97$, $p < .001$). The lowest average trust scale ratings were provided by white/Caucasian respondents and the highest by Latino/Hispanic Americans. Contrasts by gender within each ethnic/racial group revealed significant differences for white/Caucasians and Latino/Hispanic Americans, with females giving higher trust scale ratings than their male counterparts.

Findings suggest that ethnic/racial diversity and gender are of importance in Forest Service fire management. Fire managers and public information officers working in ethnically and racially diverse areas can use these findings by anticipating that the various ethnic/racial groups will respond uniquely to some proposed and actual management actions. Given the paucity of information on variations in attitudes and perceptions regarding fire and fire management among groups of color, this study makes a significant contribution toward understanding the role of diversity in fire management. These findings offer insight into the ever-increasing complexity of managing fires and fire risk, as well as forming informational and educational strategies that are sensitive to the diverse cultures of the region. Findings suggest caution in assuming that all groups of color can be considered homogeneous (here variation was by gender was reported). Recent research has revealed the importance of considering heterogeneity within ethnic groups.

An Exploration of WUI Residents' FireSafe Attitudes and Behaviors

James D. Absher^{A,C}

Gerard T. Kyle^B

^APacific Southwest Research Station, US Forest Service, Riverside, CA, USA

^BDepartment of Recreation, Park & Tourism Sciences, Texas A&M University, USA

^CCorresponding author. Email: jabsher@fs.fed.us

Keywords: FireSafe actions, attitudes, risk perception, wildland-urban interface

Introduction

FireSafe behaviors include actions that residents should do to create defensible space and improve firefighting effectiveness. Informing residents about why and how to perform these actions is central to the agency mission of successful firefighting, wildland fire prevention, and community preparedness. In recent years wildland firefighting and fire prevention activities have been increasingly focused on the Wildland Urban Interface (WUI). Effective, persuasive communications should lead to desired behaviors in the WUI population. However, continued non-compliance and property losses suggest that more can be done. Previous research has sought to understand residents' attitudes toward and familiarity with these recommendations. Programs to affect defensible space and wildland fire preparedness among WUI homeowners are being carried out by a variety of community and agency personnel, e.g. Fire Safe Councils. Their work can be improved through a better understanding of WUI homeowners' perceptions of the underlying issues, especially risk, their wildland fire experiences and actual compliance with FireSafe behaviors. This paper focuses on these aspects in the highly fire prone setting of southern California.

Methods

A mailed survey employing a new, targeted sampling technique was developed. It identified just those living within the WUI adjacent to three southern California forests that are very fire prone and which have recently experienced severe fires and large property losses (mostly within a mile of the Cleveland, Angeles and Los Padres National Forest boundary). After follow up and duplicate mailings, 1,659 usable responses were received from the original 4,130 sent, for a 40% response rate. The questionnaire contained information about their residential situation, experiences with wildland fire, compliance with FireSafe behaviors and their perception of wildland fire risk.

Results

Analysis. Residential profile data show that residents in these WUIs have been there for a long time (average 16 years), live there year-round (98%) in single family homes (88%) that are owner-occupied (93%) and are generally within one mile of the forest boundary (55%). There are some differences across the forests but this pattern is generally consistent. In addition they are very experienced with wildland fires. They have almost all seen smoke (98%), burned areas (96%), re-growth after a fire (94%), and flames from a wildland fire (93%). Many have been evacuated (52%), had their lives or jobs disrupted (30%) or had property damaged in a wildland fire (18%). Fortunately, only a few have suffered a personal injury from a fire (2%).

Next we asked about their compliance with FireSafe behaviors. These may be broken out into those affecting the house, the site and the community. House-focused behaviors are commonly done: 92% clean their roof or gutters, 67% are careful to stack firewood away from their house, and 73% say they have used non-flammable construction materials. This high level of compliance slips a bit for site-focused behaviors: 55% choose fire resistant plantings, 44% have thinned their plantings out to 100 feet, 42% say that trees and shrubs are 15 feet apart, and 55% have pruned their trees to the recommended standard (85 feet out, 15 feet up). And there are even lower levels of compliance reported for actions that are more community and education-based: 47% say they have received information on FireSafe actions, 22% have attended a meeting about FireSafe actions, 13% have ever volunteered to help clear vegetation in their community, and only 6% say they have helped with community fire education programs. Many of the house and site actions vary significantly across the forest settings, but none of the community involvement actions are statistically different.

Clearly there is room to improve these compliance rates, so next we asked about their perceptions of wildland fire risk, specifically the extent to which they felt their community or home was at risk from a wildland fire and their expectation that a wildland fire will affect their community in the near future. These three items were combined into a fire risk scale (Cronbach's $\alpha = .81$) with a mean score of 3.28 on a 1 to 5 scale (low to high), suggesting that their risk perception is only moderately high and that a substantial proportion of the population sense a low level of risk. The southernmost residents (Cleveland NF) were statistically higher in their risk perception. Further analysis shows that the risk measure is only moderately linked to the experiences or actions presented earlier, and once again this effect is somewhat stronger for the Cleveland NF sub-sample than for the Angeles or Los Padres group.

Conclusions. WUI residents have high levels of experience with wildland fire and a strong rootedness to site. And they do some FireSafe actions very well. Despite this, FireSafe behavior compliance is sometimes disappointingly low. Further improvements may require a better understanding of the barriers to actions and a more realistic sense of what is possible for residents in these areas. The data suggest that better communications and community-based actions are not only possible but quite desirable. Because the compliance rates are at times relatively low, this area may offer the possibility of substantial improvements for each unit of effort. Increased effectiveness through FireSafe Councils and other interested community groups seems a likely means to this end.

Finally, the perceptions of risk data suggest that improving residents' understanding of wildland fire risk through clearly articulated persuasion campaigns may increase salience to the target group and thereby be a key to improving target behavior compliance.

In summary, results show high levels of personal experience with wildland fire, strong concerns about wildland fire and, at times, surprisingly low levels of FireSafe activities. Further analysis of the precursors to FireSafe behaviors or community preparedness activities reveals a strong role for natural resource agency leadership in a community partnership context, especially with strategically targeted WUI Fire Safe campaigns. Residents' geographic and social differences across WUI settings suggest that defensible space decisions can be improved by a better understanding of the residents' mindset and a tailored, social marketing approach that improves compliance and support for agency programs.

Homeowner response to wildfire hazard mitigation incentives

Christine A. Vogt, Ph.D., Michigan State University, 131 Natural Resources Bldg. E. Lansing MI 48824-1222, vogtc@msu.edu

Greg Winter, Cornerstone Strategies

Sarah McCaffrey, Ph.D., USDA Forest Service, Northern Research Station

KW: Homeowners, defensible space, mandatory, voluntary, incentives, focus groups

Introduction

Many components of wildland urban interface (WUI) risk management programs require action by local communities and individual property owners. According to some observers, the focus on federal and state policies to motivate local jurisdictions to act is disproportionate to the attention that should be paid to what is actually happening in the local community (Steelman and Kunkel, 2004) by fire officials, government resource agencies, homeowners and other parties such as insurance firms. Natural hazards researchers have shown societal response at the local level, where the greatest control over mitigation can be exercised, is difficult to motivate (Burby and May, 1998). Others argue there are few local political incentives to respond to the wildland urban interface fire problem given current patterns that shift post-disaster recovery burden or pre-disaster mitigation measures to state and national taxpayers (Davis 2001; Plevel 1997). Recently enacted federal and state policies provide some strong incentives for local jurisdictions to manage the risks associated with wildland fire (USDA and USDI 2000, WGA 2001). This has led to an array of local policies, laws, and programs. Our research helps identify similarities and differences in homeowners' attitudes toward local defensible space policies in communities where voluntary defensible space initiatives or mandatory defensible space ordinances exist and various levels of incentives or costs are present.

Methods

This research is funded by the Joint Fire Science Program and uses two phases of research to study the program. This presentation and paper is focused on the qualitative phase which used focus group interviews with homeowners in three diverse communities what attributes of local-level wildland fire policies are associated with homeowner support for and compliance with defensible space guidelines or regulations. Study sites were chosen largely for their wildland fire policy diversity: Oakland, California has a long-standing mandatory defensible space ordinance recently enhanced by a voter approved tax assessment district that provides added inspection, enforcement, and homeowner services (e.g yard waste disposal). Ruidoso, New Mexico is in the process of establishing a mandatory defensible space ordinance city-wide. Grand Haven, Michigan has no mandatory regulations, but recently partnered with Michigan Cooperative Extension to develop defensible space guidelines and education materials specifically for WUI area homeowners along the fire-prone shoreline of Lake Michigan. Qualitative coding techniques suggested by Strauss and Corbin (2004) were used for axial and open coding of quotes collected during focus group sessions and later analyzed to formulate concepts, themes, and elements.

Results

From a total of six focus groups attended by 45 participants, six concepts emerged from the data.

- **Compliance related to competing objectives, yard waste disposal and cost:** Defensible space compliance – whether mandatory regulations or voluntary guidelines – is determined primarily by the degree to which homeowner land use objectives compete with firesafe landscape objectives; options for yard waste disposal; and cost.
- **“Others” elevate the risk:** Focus group participants perceived that certain population subgroups comprise a large group of “others” that heighten the risk to their neighbors by not complying with defensible space regulations or guidelines or by practicing other unsafe fire-related behavior.
- **Share the burden:** Landowners and government agencies share the responsibility to manage WUI fuels. Local government is responsible for communicating with property owners about local WUI policies, showing property owners exactly how to comply with vegetation management rules or guidelines, enforcing

compliance, and their own vegetation management. Homeowners are responsible for vegetation management, monitoring their neighbor's compliance, setting norms to encourage neighbor compliance, and paying for risk mitigation programs through taxes or fees.

- **Mandatory regulation may be justified:** Mandatory vegetation management regulations are at odds with strict conceptions of property rights and personal liberties; however, such ordinances can be justified when the underlying wildfire risk is high, there is an acknowledged public safety role for local government, and it is also acknowledged that individual noncompliance puts others (neighbors) at risk.
- **Implementing local policies:** If mandatory regulations are justified, they should be enforced fairly and uniformly. Some suggest such a policy should be determined by a public vote. Whether voluntary or mandatory (but especially if mandatory), local enforcement personnel should make themselves available for one-on-one consultations with property owners to show them specifically how to comply. Education and communication efforts should be repeated often for maximum impact and to catch newcomers and seasonal visitors.
- **Other supporting local policies are needed:** Defensible space policies alone aren't enough to comprehensively respond to the WUI problem in high risk areas. Local governments need to incorporate WUI concerns into their comprehensive planning processes and zoning regulations. Continuing to build in high risk areas and/or to allow high risk construction practices exacerbates community risk.

Three quotes illustrate homeowners' support for different types of localized programs.

"I don't have a problem with regulations as long as they're for the common good, and public safety is for the common good." (Grand Haven, MI homeowner, voluntary and no incentive program)

"[T]here is a line between personal property rights and government enforcement. And, I believe that people should be responsible for their properties and be responsible in terms of their community responsibility." (Oakland, CA homeowner, mandatory and no incentive program)

"The village came out and said, well, this is what we're going to do, we all dug our feet in saying you can't tell me to do that to my property." (Ruidoso, NM homeowner, mandatory with incentives program)

The second phase of the research will further explore the reliability and validity of initial findings, and themes and patterns across voluntary, mandatory, and incentives-based programs. For a copy of the full focus group report and other research on homeowners, wildfires, and fuels management visit www.fire-saft.net.

Literature Cited

- Burby, R.J. and P.J. May. 1998. Intergovernmental environmental planning: addressing the commitment conundrum. *Journal of Environmental Planning and Management*. 41(1):95-110.
- Davis, C. 2001. The west in flames: The intergovernmental politics of wildfire suppression and prevention. *Publius*. 31(3):97-110.
- Plevel, S.R. 1997. Fire polity at the wildland-urban interface: a local responsibility. *Journal of Forestry*. 95(10):12-17.
- Steelman, T.A. and G.F. Kunkel. 2004. Effective community responses to wildfire threats: lessons from New Mexico. *Society and Natural Resources*. 17:679-699.
- Strauss, A. and J. Corbin (2004). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd Edition). Thousand Oaks, CA: Sage.
- USDA Forest Service and Department of Interior. 2000. A Report to the President in Response to the Wildfires of 2000. In *National Fire Plan*.
- Western Governors' Association. 2001. A Collaborative Approach to Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy. In *Western Governors' Association, Key Issues in Brief*.

State and Local Wildfire Risk Reduction Programs: Strategies to Protect Wildland-Urban Interface Communities

Terry K. Haines^{A,C}, Margaret A. Reams^B, and Cheryl R. Renner^B

^A USDA Forest Service, Southern Research Station, New Orleans, LA

^B Department of Environmental Studies, Louisiana State University, Baton Rouge, LA

^C Corresponding author email: tkhforest@gmail.com

Introduction

The dramatic expansion of development in the Wildland-Urban Interface (WUI) places property, natural assets, and human life at increased risk of wildfire destruction. The National Fire Plan and the Healthy Forest Restoration Act (HFRA) encourage communities to take action to reduce wildfire risk. State and local governments are mitigating risk and empowering home owners to reduce their vulnerability to wildfire with a mix of strategies focused on hazardous fuel reduction and firesafe structural enhancements.

Methods

A questionnaire was developed to obtain information about state and local governments' efforts to reduce wildfire risk on private property. In 2005, the survey was distributed to 150 state and local wildland fire officials listed on the National Wildfire Hazard Mitigation Programs website, <http://www.wildfireprograms.usda.gov>. Completed surveys were submitted by 51 wildfire program managers.

Officials were queried about the types of risk reduction strategies employed in their communities and their experiences in implementing these efforts. Responses to questions in the first section of the survey were used to examine how well localities are meeting criteria for community wildfire protection planning as enumerated in the Healthy Forest Restoration Act (2003). These criteria are: long-range planning with collaboration of multiple stakeholders; assessments of wildfire hazard to identify and prioritize high risk areas; and identification of activities to reduce structural ignitability. Questions about structural ignitability were organized into three broad program types. These included: public outreach and education, homeowner incentives, and regulation.

The second section of the survey focused on possible indicators of program effectiveness. Managers were questioned about obstacles to program success; effective strategies for reducing wildfire risk; and the cost-effectiveness of commonly-used mitigation activities.

Results

Key findings from the survey of wildfire program managers include the following actions in keeping with the Healthy Forest Restoration Act criteria:

- Wildfire protection plans had been developed in 75 percent of the localities surveyed and an additional 19 percent were underway.
- Hazard assessments identifying high fire risk areas had been conducted in 92% of the localities.
- Managers were implementing a wide range of strategies to address structural ignitability that varied widely among localities. All managers were implementing educational and public outreach activities, 77 percent were offering some type of direct assistance to homeowners for fuels treatments, and 59 percent were implementing regulatory programs.

Insights for effective mitigation programs included the following:

- A majority of managers indicated a mix of strategies was most effective in their locality for reducing wildfire risk rather than a focus on any one type of program. Recommendations varied widely.
- The most cost-effective strategies identified by managers to reduce wildfire risk were: 1) programs offering direct assistance to property owners such as financial incentives for fuels reduction and chipping and disposal services for residents; 2) educational efforts such as defensible space demonstration projects, and neighborhood and community meetings; and 3) regulatory requirements for firesafe subdivision design and defensible space.
- The most highly rated obstacles to program success were budget constraints, public apathy, inadequate enforcement of regulatory requirements, and property owners' resistance to vegetation management.

References

The national database of state and local wildfire mitigation programs. Southern Research Station. (New Orleans, LA) Available at www.wildfireprograms.usda.gov

Situating Risk Perceptions of Forest Fire within a Broader Context of Forest Health Disturbance in Colorado

Courtney G. Flint

University of Illinois at Urbana-Champaign
cflint@uiuc.edu

Key Words: community, forest disturbance, mixed-methods, insects, risk perception

Introduction

Forest disturbance by insects can be seen as part of a larger cascade of ecosystem disturbances (Dale et al. 2001; Flint 2006). Public perception of the impacts and risks of forest insect outbreaks include an array of concerns such as forest fire, economic insecurity, and threats to community identity. This paper describes the relationship between risk perceptions of forest fire and broader threats to individual and community well being due to a mountain pine outbreak in north central Colorado. Because fire isn't the only forest management concern in the region, it is valuable to understand not only how the public is weighing and reacting to relative risks, but also how communities differ from one other in their overall approach and response to changing forest ecosystems.

The nine communities in the study area cover a gradient from high alpine amenity orientation through more diversified communities to more economically disadvantaged areas still tied to amenity and recreation pursuits. This paper provides evidence for how community context affects the filter through which community residents perceive forest resource change and threats to ecological and local well-being. Implications from this research are offered for managing the human dimensions of forest fire risks in the broader context of forest health disturbance.

Methods

The nine study communities include Vail, Breckenridge, Frisco, Dillon, Silverthorne, Kremmling, Granby, Jackson County, and Steamboat Springs. Attempts to evaluate whether or not these communities are situated along a gradient of amenity-based community conditions focuses on indicators related to educational attainment, citizenship, employment sectors, and seasonal housing. While patterns illuminate a gradient pattern, there is some mobility in community positions along the gradient.

To gather information about public response to the pine beetle situation and the accompanying risks, interviews were conducted with 165 key informants and mail surveys were administered to over 4,000 residents in the nine study communities. Interviews were conducted with individuals representing multiple dimensions of community interests as well as those identified by others as having important perspectives to include. The mail survey was a 16-page set of questions covering various dimensions of the pine beetle outbreak as well as community and individual characteristics. Accounting for undeliverable surveys, the overall survey response rate for the region as a whole was 39% (ranging from 33% to 50% for the nine study communities).

Results

Surveys and interviews yielded valuable information illuminating public attitudes and community responses to the mountain pine beetle, forest fire hazards, and forest management efforts. This paper weaves local narratives with quantitative statistical analysis of survey data. Demographic characteristics of survey respondents indicate a predominantly wealthy, educated, white population that is relatively representative of the communities under study. The percentage of respondents having occupations in agriculture or forestry varied widely by community. This is another indication of a possible community gradient.

Wide variation was found in the degree to which respondents felt the pine beetle had killed trees in and around communities. Granby was highest with 77% of respondents indicating most or all pine trees were dead and Steamboat Springs was lowest at 6%. A Granby resident said, "It's sad. It's devastating. We bought 15 acres and the next spring we had to take out 1500 dead trees. We have a view now but no forest."

Visual and aesthetic loss and fire hazard were the highest rated impacts from the pine beetle outbreak with a long list of additional impacts perceived. While most impacts were identified as negative, some were perceived as positive including increased logging and land clearing and increased ecological awareness. Based on the aggregate data, 56.6% of survey respondents indicated that concern about wildfire had strongly increased as a result of the bark beetle. Fire risk was the top concern followed closely by risks to the scenic value of the area. Significant differences on perceived fire risk and other risk perceptions were found across the study communities. Factor analysis revealed that risk perceptions fall into two distinct categories: 1) environmental risks such as fire, falling trees, watershed and habitat concerns, invasive species, and livestock risks; and 2) socio-economic risks such as scenic loss, declining property values, resource economy loss, tourism and recreation loss, and loss of community identity. These factors were consistent across all study communities.

Perception of fire risk is strong in Colorado communities experiencing the pine beetle outbreak. However, there are additional risk perceptions beyond fire and the degree of risk perception in some areas varies greatly by community. More research is needed to uncover whether there is an amenity gradient having an impact on community response to beetles and fire risk. Natural resource managers should be aware of the broader risk context in which fire is situated as strategies may benefit from integration

Literature Cited

- Dale, V.H, Joyce, L.A., McNulty, S., Neilson, R.P., Ayres, M.P., Flannigan, M.D., Hanson, P.J., Irland, L.C., Lugo, A.E., Peterson, C.J., Simberloff, D., Swanson, F.J., Stocks, B.J., & Wotton, M. (2001). Climate change and forest disturbance, *Bioscience*, 51(9), 723-734.
- Flint, C.G. (2006). Community perspectives on spruce beetle impacts on the Kenai Peninsula, Alaska. *Forest Ecology and Management* 227(3), 207-218.

One Year After the Cottonville Fire: Wisconsin Wildfire Perceptions Survey

Jolene Ackerman

Wisconsin Department of Natural Resources
Division of Forestry
101 S. Webster St.
Madison, WI 53703
Jolene.ackerman@wisconsin.gov

Sarah McCaffrey

USDA Forest Service Northern Research Station
1033 University Place, Ste 360
Evanston, IL 60201
smccaffrey@fs.fed.us

Introduction

In May 2005, the Cottonville Fire in central Wisconsin burned 3,410 acres and destroyed 100 structures, including 37 homes. A post-fire assessment of the affected area found evidence that although many of the structures within the fire zone had defensible space, many individuals were actually unaware that they lived in a fire prone area or could remember receiving information about the fire hazard. As a result, a year after the fire the Wisconsin DNR, in consultation with the USDA Forest Service's Northern Research Station, sent a mail survey to residents of the affected county to better understand what wildfire protection actions residents were implementing and why, and how they were getting their information about wildfire. This presentation will discuss results from the survey including perception of wildfire risk, reasons why actions were or were not taken, and trust in information sources.

Methods

The objectives of the survey were to determine homeowners' wildfire risk perception, which mitigation strategies they have applied, and their trust in information sources. The goal was to provide fire control staff with a new perspective on homeowner attitudes toward wildfire preparedness. The study area was Adams County, Wisconsin, an area characterized by droughty soils, pine/scrub oak vegetation, and resultant high susceptibility to wildfire. An average of 80 fires burn 160 acres each year in the county. All cities, villages, and townships are on the state's list of Communities at Risk and Communities of Concern.

In May 2006 a mail survey was sent to all non-industrial private forest (NIPF) homeowners within the Cottonville Fire perimeter (82 households) and to a random sample of 1,500 year-round and seasonal NIPF homeowners within the remainder of Adams County. The sample represents about 12% of the approximately 13,000 households in the study area. The survey contained a total of 30 wildfire management and demographic questions. A total of 106 surveys were returned as undeliverable and a 922 completed surveys were returned for a response rate of 62%.

Results

While the majority of respondents did not accurately identify the most common cause of wildfire (which was debris burning) and underestimated the frequency of wildfires in the state, most (84%) were concerned that a wildfire could change their quality of life. A high percentage (92%) felt it was somewhat or very likely that another wildfire could occur in the county in the next five years and about half felt it was at least somewhat likely that a wildfire would damage their home during the same period.

Most survey respondents had undertaken activities around their property that mitigated their wildfire risk, although in many cases, lowering wildfire risk was not the primary reason for their action. For example, a larger percentage of respondents cited wind (50%) and aesthetic (32%) reasons for removing branches overhanging the roof than cited reducing fire risk (25%). Aesthetic concerns was also cited more frequently than reducing fire risk in terms of maintaining a 30-foot green area around the home, thinning trees and shrubs 100 feet out, and clearing away dead vegetation and plant debris. This provides a likely explanation of how people can have good defensible space and not be aware of the fire risk and also suggests that sometimes defensible space may be best promoted by emphasizing benefits other than fire risk reduction. It is notable that while fire risk was the dominant reason cited (40%) for having a fire-resistant roof, a fair portion (34%) also indicated they had done it for aesthetic reasons, again highlighting the usefulness of emphasizing non fire related benefits of an action.

Cost and time were the two biggest factors preventing people from making their homes more fire-resistant. These results were expected and suggest that a clearer message needs to be presented that many mitigation strategies can be accomplished with little or no cost and are easy to achieve with a regular maintenance schedule. Not surprisingly more seasonal residents listed time as a constraint than permanent residents. However, surprisingly, 67% of seasonal property owners had pruned or removed vegetation around buildings compared to 58% of the permanent residents. This clearly shows that the seasonal population is not as inactive in vegetation management as often thought.

Nearly 95% of respondents said they trust information about reducing their risk of wildfire damage coming from their local fire department, and 86% trusted public forest agencies (Wisconsin DNR, USFS, and county parks). While heartening that both these groups have such high trust levels, the strength of trust in local fire departments could be problematic as the vast majority of fire departments in Wisconsin's wildland-urban interface are comprised entirely of volunteers, who are not required to have wildland fire training. This brings about a concern that information coming from structural fire fighters may be focused on access improvement for fire trucks rather than the creation of defensible space.

This last result highlights one of the benefits of a research project where there is close cooperation between managers and researchers in implementation of the study. A likely conclusion that could be drawn from the high trust levels placed in local fire departments is that they would make a useful primary distribution source for wildfire information. However, manager knowledge of local volunteer fire departments suggests that such a conclusion might be problematic. Conversely, knowledge of other research results that suggested fire risk was not the only reason for defensible space led to inclusion of a question on the survey that directly addressed this topic. Results provide local managers with information on which non-fire related benefits are associated with defensible space activities in their area.

Where is fire on the radar screen? A comparative analysis of community wildfire perceptions

Jason S. Gordon^{A,C}, Richard C. Stedman^B, A.E. Luloff^A

^A Graduate Student and Professor, respectively, Human Dimensions Unit, The Pennsylvania State University, 114 Armsby Building, University Park, PA 16802, USA

^B Assistant Professor, Dept of Natural Resources, 122-D Fernow Hall, Cornell University, Ithaca, NY 14853, USA

^C Corresponding author. Email: jsg246@psu.edu

Introduction

The relationship between environmental characteristics, community perception, and collective action vis-à-vis environmental risk is poorly understood. One implication of human-nature dynamics in rural areas is increased interactions between residents and natural processes, such as wildland fire. Social and landscape change, especially at the Wildland-Urban Interface (WUI), may affect wildfire-related risks in a number of ways: for example, the proliferation of housing units in rural, fire-prone locations may increase the “real” risk of catastrophic fire events; the distribution of low density housing may tax the capacity of local services to protect these communities; and conflicting ideologies between resident groups may reduce collective agency for effective action. The characteristics of the natural resource base—e.g., forest cover and species distribution, or the presence and type of public land—affect both the degree to which a landscape is fire-prone and the local perception of risk.

Methods

In this study, we look at community leaders’ perceptions towards wildfire risk at the wildland urban interface in Pennsylvania (in the Delaware Water Gap region), Wisconsin (in the lake-rich Pine Barrens Region), Minnesota (the Arrowhead region, adjacent to the Boundary Waters canoe area), West Virginia (the Tug River region), and Maine (near the U.S.-Canada border). Using data drawn from 149 key informant interviews, the study uses a model that explores how social and physical vulnerabilities, hazard experiences, local and extra local relationships with institutions, sense of place, and residents’ capacity to work together for collective well-being affect wildfire resiliency. Community theory, place theory, disaster literature, and risk research guide this examination of wildfire-prone community characteristics and actions to reduce risk.

Results

Patterns of change differed dramatically between study sites, resulting in different types of WUI zones with different implications about perception and management of fire risks. Residents generally sought to reduce risks they perceived more salient to daily life; these were often based on the threats and opportunities associated with change. The data suggested physical and social psychological factors represented barriers to communities’ ability to mitigate risk. Alternatively, opportunities emerged to mitigate risk through awareness of competing and intersecting land use values and concerns.

The study reaches several conclusions: (1) community risk was an interactional phenomenon; (2) perceptions were amplified and attenuated based on vulnerabilities, hazard experience, institutional relationships, and shared perceptions of the landscape; (3) responses to vulnerabilities and sense of place indicated collective capacities; and (4) the risk-to-resiliency model was generally supported in the communities. However, degrees of perceptions, interactions, and resiliency differed across social groups and landscapes. Implications for

residents and resource managers in wildfire-prone communities to exploit their capacities for collective action are advanced.

Keywords: community, WUI, risk perception, resiliency, collective agency

External Human Factors in Incident Management Team Decision Making

Krista Gebert

USDA Forest Service; Rocky Mountain Research Station
800 East Beckwith
Missoula, MT 59801
(406) 542-4174
kgebert@fs.fed.us

Janie Canton-Thompson

USDA Forest Service; Rocky Mountain Research Station
800 East Beckwith
Missoula, MT 59801

Brooke Thompson

METI
800 East Beckwith
Missoula, MT 59801

Greg Jones

USDA Forest Service; Rocky Mountain Research Station
800 East Beckwith
Missoula, MT 59801

David Calkin

USDA Forest Service; Rocky Mountain Research Station
800 East Beckwith
Missoula, MT 59801

Geoff Donovan

USDA Forest Service; Pacific Northwest Research Station
620 SW Main St. Suite 400
Portland, OR 97205

Keywords: wildland fire expenditures, wildfire, wildland fire cost containment, wildland fire decision making,

Introduction

Large wildland fires are complex and costly events influenced by a vast array of physical, climatic, and social factors. Changing climate, increased fuel buildup due to past suppression efforts, and increasing populations in the wildland urban interface have all been blamed for the extreme fire seasons and rising suppression expenditures of recent years. With each high-cost year come a multitude of fire cost reviews, suppression cost studies by federal oversight agencies, and new rules and regulations focused on trying to find ways for the federal agencies to contain or reduce suppression costs. However, largely ignored in many of these inquiries are the human factors and social-political pressures that contribute to the problem. This presentation describes some of the factors that affect IMT decision-making and influence suppression costs.

Methods

Data were collected through in-depth interviews with 48 Incident Management Team command and general staff members from all federal agencies and geographic areas. We used a qualitative inquiry approach to obtain first-hand knowledge about suppression costs from team members themselves (Glaser and Strauss 1967, Gold 1997, Creswell 1998, and Strauss and Corbin 1998). This is a highly inductive methodology of going to “persons-in-the-life” known as leaders in their group to obtain descriptions and understandings of the study phenomenon. To obtain a wide range of perspectives, we used a nationally stratified sociological (purposive) sampling method that approximates the maximum variation sampling method described by Patton (1980). Interviewees were asked to identify others known to be good representatives of the IMT positions and experience pertinent to this research. We verified our data through “member checks,” continually seeking interviewees’ assessments of the credibility of our emerging findings, interpretations, and reports.

Results

Some of the external factors uncovered in our analysis were limited decision space, interaction with agency administrators, policies and regulations, resource availability, social-political pressure, and socio-cultural context. Inattention to these factors can result in policies that adversely affect the Incident Management Teams charged with managing highly volatile events in a timely, cost efficient manner.

Literature Cited

- Creswell, J.W. 1998. *Qualitative inquiry and research design: choosing among five traditions*. Sage Publications, Thousand Oaks, CA. 403 p.
- Glaser, B.G., AND A. L. Strauss. 1967. *The discovery of grounded theory: strategies for qualitative research*. Aldine Publishing Company, Chicago. 271 p.
- Gold, R.L. 1997. The ethnographic method in sociology. *Qualitative Inquiry*. 3(4): 388-402.
- Patton, M.Q. 1980. *Qualitative Evaluation Methods*. Sage Publications. Beverly Hills, CA. 381 p.
- Strauss, A. AND J. Corbin. 1998. *Basics of qualitative research: techniques and procedures for developing grounded theory*. (2nd Ed.) Sage Publications. Thousand Oaks, CA. 312 p.

What Determines the Level of Funding for National Fire Plan Fuels Reduction Projects in Northern New Mexico?: A Revealed Preference Analysis.

Curt Shepherd

Department of Economics, University of New Mexico, Albuquerque, NM (USA)

Kristine Grimsrud

Department of Economics, University of New Mexico, Albuquerque, NM (USA)

Robert P. Berrens

Department of Economics, University of New Mexico, Albuquerque, NM (USA)

Acknowledgments: Funding was provided under Research Joint Venture Agreement 06-JV-199 between the Rocky Mountain Research Station (RMRS), of the U.S. Department of Agriculture's Forest Service (FS), and the University of New Mexico. We thank Carl Edminster (RMRS, Flagstaff) for his research support, and the FS personnel who spent considerable effort filling our data request; Susan Lee (Fire Coordinator, Southwestern Region), Paul Fink (Region 3, Forester), Tom Johnston (Fuels Specialist, Santa Fe National Forest), and Thomas Marks (Timber Management Officer, Cibola National Forest). All errors and opinions are solely those of the authors. Finally, we also thank Joe Little and John Talberth for help in the initial data collection that lead to this work. Address correspondence to C. Shepherd, Department of Economics, MSC05 3060, 1 University of New Mexico, Albuquerque, NM. 87131-0001, USA Email: shepherd@unm.edu

Abstract: To combat the threat of wildfire, especially in the Wildland Urban Interface (WUI), U.S. federal land management agencies have implemented a number of forest restoration and wildfire risk reduction programs. In the spirit of revealed preference analyses, the objective of this study is to investigate the pattern and determinants of National Fire Plan (NFP) expenditures for fuel reduction treatments in northern New Mexico (NM). Results from a Generalized Estimating Equations (GEE) model are mixed with respect to risk reduction hypotheses, and also raise issues on how risk reduction should be defined for a region characterized by both pockets of urban sprawl into the WUI and large areas of chronic rural poverty. Further, program preferences for project funding under the federal Collaborative Forest Restoration Program in NM are shown to be distinctly different (e.g., greater concern for social equity) than for other NFP-funded projects.

Key words: Revealed Preference; Public Expenditures; Wildfire Risk; Social Equity; Generalized Estimation Equations.

Health and Economic Impacts of Wildfires: Literature Synthesis and Recommendations

Ikuho Kochi^{A,D}, John Loomis^A, Patricia Champ^B, Geoffrey Donovan^C

^ADepartment of Agricultural and Resource Economics, Colorado State University, Fort Collins, CO 80523, USA

^BUSDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO 80526, USA

^CUSDA Forest Service, Pacific Northwest Research Station, OR 97208, USA

^DCorresponding author. E-mail: Ikuho.Kochi@colostate.edu

Key words: wildfire smoke, health impact, health valuation, epidemiology studies, particulate matters

Introduction

The potential health risk from diminished air quality during wildfire events is a serious social concern. Many studies document that wildfires produce various air pollutants and often report that the ambient concentration of particulate matters (PM) increases substantially during a wildfire period. Epidemiology studies report significant morbidity and mortality impacts of PM, suggesting a potential for considerable health risks from wildfires.

This review study synthesizes available literature in epidemiology, economics and wildfire-related studies to provide essential information for the valuation of health costs associated with wildfire events. We focus on three issues: the health outcomes to be evaluated, whether epidemiology studies of urban air pollution are applicable to evaluate wildfire smoke health damages, and recent findings from health valuation literature. We constrain our epidemiology literature review to the major pollutant of wildfires, PM.

Summary of Literature Review

Health outcomes

We identify several key health impacts that result in substantial economics costs from wildfire-smoke. They include mortality, work days lost, restricted activity days, minor restricted activity days, hospital admissions, respiratory symptoms and self-treatment. While every possible health outcome associated with a wildfire cannot be measured, at least mortality and major morbidity effects should be evaluated.

Epidemiology studies: urban air pollution vs. wildfire smoke

There are a considerable number of PM-related health studies. However, most studies evaluate the health impact of persistent low to moderate levels of PM emitted from urban air pollution sources, such as fossil fuel burning (hereafter we call these PM studies “conventional PM studies”). Wildfires often cause short, but high levels of PM due to the vegetation burning. Whether there are different health risks from PM exposure due to urban air pollution versus wildfires is an important research question. If there is no difference, we can simply use previously estimated dose-response functions from conventional PM studies to estimate the level of health damages from wildfires.

To examine this issue, we compare the study results from conventional PM studies and wildfire health studies. While conventional PM studies find a statistically significant positive

mortality and morbidity impact from a short-time exposure to PM, not all wildfire health impact studies find statistically significant health impacts. Among wildfire mortality impact studies, only two of six studies find a significant increase of the mortality level during a wildfire event. As for hospital admissions studies, while all studies that considered respiratory-related effect find a significant impact, only two out of six studies that considered asthma-related effects find a significant increase attributable to a wildfire event. One of the two studies that considered cardiovascular effects finds a significant increase of hospital admissions during wildfire events. Among emergency room (ER) visit studies, seven out of the thirteen studies that considered asthma-related effects, nine out of the thirteen studies that considered respiratory related effects and none of the three studies that considered cardiovascular effects find a significant increase in ER visits during wildfire events. Although there are several potential reasons for inconsistencies between conventional PM studies and wildfire health impact studies, further studies are required to identify more specific source of disparities.

Health valuation studies

The health damage from wildfire events incurs direct and indirect costs to society. The U.S. EPA (1999) uses the health valuation literature to list the plausible value of per unit costs of health outcomes. Our literature review of recent health valuation studies find that the per unit mortality value presented in the U.S. EPA list is likely overestimated, and per unit value of morbidity is generally underestimated. We recommend weighing recent findings for economic valuation studies of wildfire health impacts.

Reference

U.S. Environmental Protection Agency. 1999. **The benefits and costs of the Clean Air Act 1990 to 2010.** Washington D.C.: USEPA.

Economics of Fuel Treatment and Cost Sharing Programs

Robert G. Haight

USDA Forest Service Northern Research Station
1992 Folwell Ave, St. Paul, MN 55108 USA
Email: rhaight@fs.fed.us

Gregory S. Amacher

College of Natural Resources, Virginia Polytechnic Institute and State University
Blacksburg, VA 24061 USA

Arun S. Malik

Department of Economics, George Washington University
Washington, DC 20052 USA

Key words: Financial incentives, fire risk, forest management, imperfect information, non-industrial forest landowners, wildfire damage

Introduction

We evaluated two kinds of financial incentives to encourage non-industrial forest landowners to undertake fuel treatment: compensating landowners for the cost of fuel treatment and requiring landowners to share the cost of fire suppression. Why is this problem important? Forest fires damage or destroy trees and homes. Losses can be reduced if landowners treat fuels before wildfire strikes. Because fuel treatment is costly, landowners may not undertake treatments especially if they underestimate the level of fire risk or the potential benefits of fuel treatment. Furthermore, landowners may expect that government-subsidized fire suppression resources will protect their property. In this situation, financial incentives that encourage landowners to undertake fuel reduction may reduce both the damage caused by wildfires and the cost of fire suppression, thereby reducing social costs.

Methods

Following the methods of Amacher et al. (2006), we created a stand-level model of the expected net discounted value of fuel treatment and fire suppression in an even-aged forest. The model assumes that fire occurrence is a Poisson process with probability λ that a fire occurs in a given year (fire risk). If the fire occurs before the scheduled age of timber removal, a proportion of the stand is salvaged and the land is replanted. The salvage proportion depends on when the fire arrives relative to the fuel treatment, the level of fuel treatment, and the level of fire suppression. Fuel treatment and fire suppression are substitutes in the sense that less fire suppression is needed in a stand with fuel treatment to obtain a given level of salvage. Under these assumptions, we derived a formula for the expected present net value of the stand as a function of the levels of fuel treatment and fire suppression. In the base case, we used an optimization algorithm to determine levels of fuel treatment and fire suppression that maximize expected present value assuming that the landowner paid for the cost of fire suppression. For comparison, we computed the optimal level of fuel treatment assuming that the government provides fire suppression to the landowner at no charge. Compared with the base case, less fuel treatment is prescribed because the landowner depends on the government for fire suppression to

reduce damage. However, the expected present value is lower than the base case if the cost of government-subsidized fire suppression is counted. The difference in expected present value between the two cases is the social cost of providing fire suppression to landowners free of charge. Financial incentives to encourage landowners to treat fuels, such as subsidizing treatment cost or requiring owners to share the cost of fire suppression, help reduce the social cost and the amount spent on fire suppression.

Results

We developed a case study for loblolly pine plantation management in the southeastern United States. Timber value is based on yield for loblolly pine site index 80 feet in 25 years with a planting density of 200 trees per acre. Fuel treatment involves removing brush and burning surface fuels after the plantation reaches 10 years old.

In the base case, which maximizes expected value of returns to landowner net suppression costs (net rent), increasing fire risk reduces net rent substantially. This makes sense because more frequent fires increase timber losses, suppression costs, and planting costs. Furthermore, as fire risk increases, fuel treatment expenditure goes up and suppression expenditure goes down. This makes sense because unit cost of treatment is less than unit cost of suppression. As fire becomes more likely, it is better to spend on lower cost protection measure.

When we maximize expected value of revenue to landowners without including the cost of fire suppression, investment in fuel treatment is less than the base case and investment in suppression is more. This makes sense because the landowner does not pay for suppression cost in the net revenue calculation. Because landowner spends less on fuel treatment, government spends more on fire suppression. When we put these levels of fuel treatment and suppression in the base-case formula, net rent is reduced up to 22% for a fire arrival rate of 0.04 per year. When we add a 50% subsidy for fuel treatment, fuel treatment expenditure goes up because the landowner pays only half the cost. With a fire arrival rate of 0.04 per year, the levels of fuel treatment, fire suppression and net rent are almost the same as in the base case. We repeated the analysis with a requirement that the landowner pay 50% of the cost of fire suppression and found this cost-sharing program to be even more effective at reducing both social costs and total fire suppression costs than cost sharing of fuel treatment. Further, larger reductions in both social costs and fire suppression costs can be achieved by targeting landowners who underestimate the level of fire risk.

What are the implications of these results to managers? If fire suppression reduces wildfire damage and is subsidized by the government, then landowners will depend on fire suppression rather than fuel treatment to reduce wildfire damage. From a planner's perspective, this is a second-best solution because the cost of fire suppression is greater than the cost of fuel treatment. Financial incentives can make fuel treatment more attractive.

Literature Cited

Amacher, G.S., A.S. Malik, and R.G. Haight. 2006. Reducing social losses from forest fires. *Land Economics* 82(3): 367–383.

Willingness to pay function for two fuel treatments to reduce wildfire acreage burned: A Scope test and comparison of white and Hispanic households

John B. Loomis^{A,D}, Le Trong Hung^B and Armando Gonzales-Caban^C

^AProfessor, Department of Agricultural and Resources Economics, Colorado State University, Fort Collins, CO 80523- USA

^BDepartment of Economics and Business Management- Forestry University of Vietnam, XuanMai- HaTay- Vietnam.

^C. Economist, Pacific Southwest Research Station, USDA Forest Service, Riverside, CA 92507- USA

^D. Corresponding author: . E-mail: John.Loomis@colostate.edu

Key words: contingent valuation, prescribed burning, mechanical fire fuel reduction, scope test, willingness to pay.

Extended Abstract

Introduction

On public lands there are very few market signals that reveal the demand or value for fire fuel reduction programs. Providing this type of information would allow the program managers and policy makers to determine the economically efficient level of prescribed burning and mechanical fuel reduction programs. Environmental justice requirements associated with NEPA also requires that effects to minority populations be assessed to insure there are not disproportionate effects. The analyses presented in this paper quantify the economic benefits of two fuel reduction programs to whites and Hispanics in California and Florida as well as providing a willingness to pay function that quantifies the benefits of reducing acres burned by wildfire.

Methods

To estimate the economic value of reducing wildfires via fuel reduction, the contingent valuation method is to estimate willingness to pay of the respondent to proposed programs. The contingent valuation method is a direct survey method where any biases on the part of interviewers, the design and implementation of the survey or the respondent can jeopardize the validity of the willingness to pay (WTP) estimates. One way the internal validity can be assessed is from the answer to a question: Does the willingness to pay increase when more of the public program or resource protection is offered. This is usually termed a scope effect or scope sensitivity analysis.

We estimate a marginal benefit function for using prescribed burning and mechanical fuel reduction programs to reduce acres burned by wildfire in three states. We are able to conduct an external scope test because the amount of acreage reduction varies across the three states of CA, FL and MT, and we control for differences in demographics and attitudes across states. In this paper the dichotomous contingent valuation is used to test for scope of prescribed burning and mechanical fire fuel treatment programs to reduce acreage of wildfires. The logit model is used in scope tests for white and Hispanic people. The dichotomous choice WTP question format asks households if they would pay a given increase in cost each year for the program, where the amount of the cost varies across the sample. Data collection occurred using a combination of

phone interview with a survey booklet that had been previously mailed to a random sample of households in the three states.

Results

The results of the multiple regressions show: (a) the higher the costs households are asked to pay, the less likely they will pay; (b) that the acreage reduction variable is positive and statistically significant at 1% level for both fuel reduction programs in California and Florida. The positive sign of this variable means that the more acreage reduction is proposed the more likely people would pay for the fire fuel reduction programs. Thus, the scope or change in burned forest reduction is statistically significant for the willingness to pay, or willingness to pay is sensitive to amount of acreage reduction.

This WTP function can also be used to evaluate the incremental benefits of different forest fire management plans that reduce additional acres burned. These benefits would be the justification for prescribed burning and mechanical fire fuel reduction programs to protect forests from wildfires. WTP per white household as a function of reduction in acres burned is $\$174.06 + .002578$ (Reduction in Burned Acres). This means that each household would pay for a prescribed burning program about \$2.58 per thousand acres that no longer burns in a wildfire. Given there are more than 10 million households in California, this translates to about \$20,000 an acre of benefits from avoiding wildfire. This amount is far in excess of the cost of prescribed burning in California.

Do Repeated Wildfires Change Homebuyers' Demand for Homes in High-Risk Areas? A Hedonic Analysis of the Short and Long-Term Effects of Repeated Wildfires on House Prices in Southern California

Julie M. Mueller^A, John B. Loomis^{B,D}, and Armando González-Cabán^C

A. Assistant Professor, Galen University, P.O. Box 177, San Ignacio, Cayo District, Belize, Central America

B. Professor, Department of Agricultural and Resource Economics, Colorado State University, Fort Collins, CO, 80523

C. Economist, USDA Forest Service Pacific Southwest Research Station Forest Fires Laboratory, 4955 Canyon Crest Drive, Riverside, CA 92507

D. Corresponding Author: email: John.Loomis@colostate.edu

Keywords: property values, wildfires

Introduction

It is important that local, state, and federal policymakers have an accurate measure of the indirect effects of wildfires on residential properties nearby wildfires. This information is necessary so that public policies can correctly address wildfire issues such as optimum prevention and post-disaster assistance. It is important for policy makers to use more than just the short term effects of wildfires and to include the long-term effects of wildfires when making these policy decisions. In this study, we use the hedonic property method to analyze both the immediate and long-term effects of repeated wildfires on house prices in Los Angeles County to understand how homeowners' respond to wildfires. In particular, do first wildfires have a different effect than second wildfires on the demand for housing and hence house prices in high-risk areas?

Methods

The hedonic property method is commonly used to model housing markets, and is often used to measure the value of environmental amenities or dis-amenities proximate to the home. Previous research on the effect of wildfires on house prices finds a negative initial impact on house prices. A recent study by Loomis found that house prices in an unburned community 2 miles from a Colorado wildfire decreased by 15% after the fire (Loomis 2004). In addition, a study by Price Waterhouse Coopers in New Mexico found that house prices in Los Alamos decreased by 3% to 11% after the Los Alamos wildfire (Price Waterhouse Coopers 2004). Both of these wildfire studies investigate what happens to house prices immediately following a wildfire, but neither study analyzes the long-term effect of the wildfires. Performing a broad temporal analysis is one of the objectives of our study. Both past wildfire property value studies also assess only the effect of a single wildfire on house prices. Another objective of our study is to assess the effect of repeated wildfires.

The hedonic property regression involves log of house sale price as the dependent variable. The independent variables of interest are wildfire indicator variables and the rate of change of house prices after each wildfire for houses located near and selling after wildfires. Controls for housing structure and neighborhood demographics are included.

The resulting model is:

Log (Real Sale Amount) = $\beta_0 + \beta_1$ *(After One Fire) + β_2 *(After Two Fires) + β_3 * (Days Since First Fire) + β_4 *(Days Since Second Fire) + β_5 * (Square Feet) + β_6 *(% with no High School Degree) + β_7 *(Median Household Income) + β_8 *(Distance to U.S.F.S. Land) + β_9 *(Unemployment Rate) + β_{10} *(Elevation)

Data was obtained on single-family residences located within 1.75 miles of three different wildfires in southern California adjacent to the Angeles National Forest. All parcels sold at least once between 1989 and 2003.

Results

The regression coefficient on the After One Fire variable is negative and statistically significant, indicating that house prices drop approximately 9.7% after one wildfire. The coefficient on the After Two Fires variable is also negative and statistically significant, indicating that house prices drop an additional 22.7% after a second wildfire. There is a negative coefficient on the Days Since First Fire indicating house prices continue to fall beyond 9.7% as time goes on after the first fire. However, the positive sign on Days Since Second Fire indicates that after the 22.7% drop, house prices begin to slowly recover.

The mean deflated sale price over all years in our sample is \$151,907. Hence, the marginal effect of the first wildfire within 1.75 miles is an initial decrease in house price of \$14,744. A second wildfire within 1.75 miles will cause an additional decrease of \$34,453 in house prices. The cumulative effect of two wildfires on the selling price of an average house is a \$49,198 drop. Since the coefficients on the After Fire variables are both statistically different from zero, we also tested the null hypothesis that the coefficient on the After One Fire variable is equal to the After Two Fires variable. The test had a p-value of 0.0001, indicating that we reject the null hypothesis that the coefficients on the After Fire variables are equal to each other. We conclude that a second wildfire has a different initial effect than the first wildfire.

Our results indicate that demand for houses located near wildfires decreases immediately following each wildfire, and that demand decreases more after repeated wildfires. This means that many homebuyers do not want to live in areas with repeated wildfires, and that perhaps homebuyers purchase homes in high risk areas without being fully aware of actual wildfire risk. Hence, policymakers could decrease losses due to wildfires by increasing wildfire risk awareness through public information campaigns. Such a campaign was initiated in Colorado where fire risk maps, including high hazard designated “red zones” were publicized in local newspapers. Based on the research of Donovan, et al (2007) this information campaign appears to be successful in changing house buyer awareness of wildfires.

Literature Cited

Donovan, G.; P. Champ; D. Butry. 2007. **The impact of wildfire risk on housing price: a case study from Colorado springs.** Land Economics 83 (2):217-233.

Loomis, John B. **Do nearby forest fires cause a reduction in residential property values?** 2004. Journal of Forest Economics 10 (3) :149-157.

Price Waterhouse Coopers 2001. Federal Emergency Management Agency. **Post-fire residential property value in Los Alamos.**

Social Value of Environmental Amenities at Risk from Wildfire in the WUI of Northwest Montana, USA.

Kyle M. Stetler^{A,B} and Tyron J. Venn^A

^A The University of Montana, College of Forestry and Conservation, 32 Campus Drive, Missoula, MT 59812, USA.

^B Corresponding author Email: kyle.stetler@umontana.edu

Introduction

The Flathead Valley and surrounding areas of northwest Montana offer many natural amenities such as Glacier National Park, the Bob Marshall Wilderness, Flathead Lake, skiing at The Big Mountain and Blacktail Mountain, and numerous golf courses. These amenities are at least partly responsible for the 20 percent increase in population in the region during the ten years preceding 2006 (US Census Bureau, 2007). At the same time however, almost 50 percent of new housing developments in Montana, including Flathead County, are in severe fire zones (Theobald and Romme, 2007). Wildland fire plays an important ecological role in the ecosystems of northwest Montana and will continue to do so. From 1996 to 2006, 156 fires burned approximately 226,220 ha of land in the total study area, including several fires over 20,000 ha (USDA Forest Service, 2007). This relationship between amenities and wildfire is important since it can affect the preferences of people coming to the Flathead Valley.

The Forest Service is under substantial pressure to reduce wildfire suppression expenditures. Existing decision support tools to aid allocation of resources to wildfire management activities accommodate market values, such as timber and structural values, but not non-market values including environmental amenities. Efficient allocation of wildfire management resources in the WUI, demands that non-market values be accounted for. The purpose of this study is to derive shadow prices for environmental amenities and the disamenities of wildfire, as capitalized into homes values in northwest Montana which includes parts of Flathead, Sanders, Lincoln, Lake and Missoula Counties. These shadow prices can be incorporated into existing and future wildfire decision support tools to better inform managers about tradeoffs in wildfire management in the WUI.

Methodology

This study employs the HPM, a revealed preference non-market valuation technique, to estimate how environmental amenities are capitalized into private home values. A theoretical underpinning of the HPM is that the value of the good, in this case a home, is a function of its characteristics. In this way, the HPM can be used to estimate the marginal value or willingness of consumers to pay for particular types of structural, neighborhood and environmental attributes of homes. HPM studies in the United States and Europe have found that people are willing to pay more for homes near parks and water bodies over those near densely wooded areas and forests, nuclear power plants and landfills as well as being close to wildland fires (Folland and Hough, 2000; Garrod and Willis, 1992; Hite et al., 2001; Huggett, 2003; Loomis, 2004; Tyrväinen, 1997).

House sales price and attribute data for 18,785 transactions in the five counties mentioned above over the period 1996 to 2007 were acquired from the Northwest Montana Association of Realtors®. After some data refinement there were 17,699 useful observations. ArcGIS 9.2™ was used to develop some of the amenity variables. Some of these variables included distance to water bodies, distance to wilderness areas and distance to wildfire. The model that was finally used to analyze the data had a log-log functional form and standard OLS regression was used. The dependent variable was the natural log of sold price. Some of the structural variables included the type of home, the square feet of the home, and the size of the lot that the home was on. A Chow test was performed in order to test if there were structural differences between the preferences of homebuyers around Kalispell and homes elsewhere in the study area. The results reported in this paper focus only on the non-Kalispell areas.

Results

Preliminary results indicate that property value decreased by almost 21 percent for homes within five kilometers of a wildfire. Homes within ten kilometers had a reduction in value of 9.5 percent, and homes that were within fifteen kilometers had a 3.5 percent decrease in value. In dollar terms, a home

that was within five kilometers of a fire had its property value decline by nearly \$47,000 relative to any home value. A home within 10 kilometers had its value decrease by \$21000.

Living in and around the town of Whitefish, Montana had a significant impact on property values and added 42 percent (\$94,000) to the value of a home in that area relative to living in one of the other towns, not including Kalispell. The reason for this could be the fact that Whitefish has several golf courses as well as The Big Mountain, a large ski and summer resort. A home that was on a property which had a navigable waterfront, added 92 percent to the value of the property relative to not having any type of immediate water access from the property. This is likely due to the large number of homes on Flathead Lake that were in the study area. Property values decrease by roughly two percent per kilometer a home is from a National Forest boundary.

Certain styles of homes were found to be more valuable than others. For people living outside of Kalispell, log homes increased property values by 12 percent relative to the base, which was a ranch style home. Cabins added 8 percent to the property value relative to the ranch style. Perhaps as a result of the numerous condominiums and townhouses developments at The Big Mountain, and Whitefish and Flathead Lakes', willingness to pay for these home styles was 17 percent greater than the base style for homes outside of Kalispell.

These preliminary results indicate that natural amenities contribute significantly to home values in the Flathead Valley and that proximity to wildfire does reduce property values. Future research will examine the effect of canopy cover view-shed and forest fuel treatments on home values.

References

Folland, S. and R. Hough. 2000. Externalities of Nuclear Power Plants: Further Evidence. Journal of Regional Science. 40(4): 735-753.

Garrod, G. and K. Willis. 1992. The environmental economic impact of woodland access: a two-stage hedonic price model of the amenity value of forestry in Britain. Applied Economics. 24: 715-728.

Hite D., W. Chern, F. Hitzhusen and A. Randall. 2001. Property-Value Impacts of an Environmental Disamenity: The Case of Landfills. Journal of Real Estate Finance and Economics. 22(2/3): 185-202.

Huggett, R.J. 2003. Fire in the Wildland Urban Interface: An Examination of the Effects of Wildfire on Residential Property Markets. PhD. Dissertation. North Carolina State:1-136.

Loomis, J. 2004. Do nearby forest fires cause a reduction in residential property values? Journal of Forest Economics. 10(2004): 149-157.

Theobald D.M. and W.H. Romme. Article in Press. Expansion of the US wildland-urban interface. Landscape and Urban Planning.

Tyrvaainen, L. 1997. The amenity value of the urban forest: an application of the hedonic pricing method. Landscape and Urban Planning. 37(1997): 211-222.

US Census Bureau. 2007. State and County Quickfacts. <http://quickfacts.census.gov/qfd/states/30/30029.html> (accessed October 1, 2007)

US Department of Agriculture, Forest Service. 2007. Northern Region Geospatial Library Regional Office Data. <http://www.fs.fed.us/r1/gis/ThematicTables.htm#Fire> (accessed August 1, 2007)

The Link between Perceived and Actual Wildfire Danger: An Economic and Spatial Analysis Study in Colorado (USA)

Pamela Kaval

Department of Economics, Waikato Management School, The University of Waikato, Private Bag 3105, Hamilton, New Zealand, 3240. Email: pkaval@waikato.ac.nz; pam98k@yahoo.com.
Phone: +64 7 838 4045. Fax: +64 7 838 4331.

Extended Abstract:

The cost of suppression and initial attack of wildfires in the United States (U.S.) has increased significantly over the last 20 years. One way to reduce the risk of high-intensity wildfires, and also decrease the cost of wildfire suppression to U.S. taxpayers, is to reduce current fuel loads in forests by thinning. In this study, surveys were used to determine if people living in the Colorado wildland urban interface (WUI) considered their home at risk from wildfire and if they were willingness-to-pay (WTP) for wildfire prevention methods, such as thinning. Spatial analysis of surrounding vegetation, slope, and previous wildfire locations was used to determine the actual wildfire danger for each respondent's home. This allowed the comparison of actual and perceived risk of wildfire.

Colorado residents in the WUI appeared to be well aware of the wildfire danger in their area. On average, residents believed the wildfire danger in their immediate area was either higher, or the same as, the actual wildfire danger. This was especially true for the high wildfire danger classes, where 41% believed their area had a high wildfire risk of burning, while only 22% of homes were actually at a high danger risk. None of the respondents believed their area was not in danger of wildfire, but 5% actually had no wildfire danger.

Some respondents were active in trying to protect their home from wildfires by creating a defensible space, a 30 meter zone free of flammable debris. It is interesting to note that 64% of people believed their home was in danger of wildfire, but only 32% of homes had a defensible space. Perhaps more people can be encouraged to create defensible space around their homes if the lands surrounding their homes had lower fuel loads, resulting in lower intensity wildfires. This would also reduce the chances of their homes burning, even with defensible space, as well as a quicker recovery time for larger trees.

On average, respondents were willing to pay \$443 annually in their taxes for wildfire prevention in their immediate area. People who perceive their home is in danger of wildfire, or perceive that wildfire occurs more frequently in their area, have a higher WTP. People that maintained a defensible space around their home were significantly more WTP than those that did not have defensible space. This may reflect the time and effort they put in to create the defensible space.

Actual wildfire danger of the 100 meter vegetative zone surrounding their homes also had a significant effect on WTP. This result shows that people are well aware of the wildfire danger in their area, even though, as shown previously, their actual wildfire danger may be slightly less than they perceive. This perspective means that people are more likely to take precautions to protect their homes.

The hypothesis, that willingness-to-pay for wildfire prevention is linked to both perceived and actual wildfire danger, was found to be true. People's awareness of the danger from wildfire is a positive outcome, and their willingness-to-pay to reduce the danger demonstrates a proactive attitude to the problem. This also supports implementation of targeted cost recovery for wildfire prevention, based on the measured risk of wildfire for individual properties.

Acknowledgements

The author would like to thank John Loomis and Dave Theobald with their help on the project as well as with earlier versions of a similar paper; Bill Romme for both wildfire data and model creation assistance; Skip Edel, Jeff Rulli, Nate Peterson, and USGS for data; Steve Davies for statistical help; Derrick Kaval for GPS equipment; Thomas Wilding for editing assistance of the current version of the paper; Suzanne Joy and Catherine Crosier for editing assistance of previous versions; Andy Seidl for model creation assistance and Lucy, my dog, for help with data collection.

Investigation of the Properties of Smoke from Wildland Fires: The Relationship to Visual Impacts of Smoke

Christian M. Carrico, Sonia M. Kreidenweis, Jeffrey L. Collett, Jr., Gavin R. McMeeking, Amy R. Sullivan, Anthony J. Prenni, Paul J. DeMott, Markus D. Petters, Amanda Holden, Taehyoung Lee

Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523-1371

William C. Malm, Derek E. Day, Jenny L. Hand, Kristi A. Gebhardt, Bret A. Schichtel
U.S. National Park Service, CIRA, Colorado State University, Fort Collins, CO 80523-1375

Corresponding author email: carrico@lamar.colostate.edu

Additional key words: air quality, aerosol, visibility, climate, particles, PM_{2.5}

Introduction

Smoke from wildland fires is a growing societal concern for its impacts on atmospheric visibility, potential feedbacks as part of the climate system, human health and safety, and air quality regulatory compliance issues (1). Smoke from wildfires and prescribed burning contributes to visibility-reducing regional haze and may also have acute local impacts, in extreme cases impacting travel safety. National Interagency Fire Center historical data show annual wildland fire acreage in the U.S. has reached 8 to 10 million acres in each of the last four years, as compared to a 1960-2000 average of approximately 4 million acres. Furthermore, prescribed burning will continue to be used as a tool for reintroducing the role of fire in ecosystems where it has been excluded over the past century. Growing evidence shows that smoke represents a substantial fraction of the annual atmospheric particulate organic material loading in much of the western U.S. A recent study comparing air quality impacts from a recent 15 year period with a preceding period estimated that fires account for a 30% increase in atmospheric particulate organic carbon concentrations (2). Near wildland regions, local economies and cultures are intimately tied to the appreciation of surrounding natural areas. In particular, preventing visibility degradation, as contributed from a multitude of sources, is highly valued among all stakeholders in such areas.

Methods

Our research has focused on a variety of laboratory and field campaigns examining the chemical and physical properties of smoke fine particulate material (PM_{2.5}, or particles having diameters smaller than 2.5 micrometers) and its relation to atmospheric optical effects. An important goal with these measurements is to distinguish smoke contributions to PM_{2.5} from other sources such as industry, agriculture, and transportation using chemical marker species. Combustion products of the sugars contained in the plant material, primarily levoglucosan, serve as chemical markers of smoke. Comparison of source profiles measured directly in biomass smoke with ambient samples helps determine the fraction of the ambient aerosol attributable to smoke. Additional measurements focus on physical properties such as atmospheric light extinction, particle size, and particle affinity for water. These fundamental properties of interest play a large role in determining outcomes, including visibility impairment and the role of smoke in cloud formation and thus climate. In 2002 we performed an aerosol study at Yosemite National Park to test these methods. We have further refined the methods with laboratory measurements at the Missoula

Fire Science Lab of fresh smoke from a variety of forest fuels and combustion conditions. The latter data has allowed the development of appropriate smoke source profiles for U.S. fuels.

Results

A few salient points are discussed here regarding an overview of findings from our smoke-related studies. Source apportionment from our summer 2002 study at Yosemite showed a strong influence of smoke from the 2002 fires in southwest Oregon (e.g. Biscuit Complex), also confirmed by transport modeling (3). The aerosol at Yosemite was dominated by particulate organic material. Furthermore, smoke properties evolved as the smoke was transported, mixed, and reacted in transit to downwind sites. After several days of aging as the smoke was transported over approximately 500 miles, secondary organic material condensed on the smoke and represented a large contribution to PM_{2.5}. These particles showed limited water uptake, an important consideration to the visual impacts of smoke in varying humidity conditions (4). Air quality impacts of such large wildland fires, which can persist for many days after fires, extended over broad regional geographic scales (5). The spatial and temporal extent of smoke widens the impacts of fires well beyond local communities proximate to fires. These findings also have importance beyond visibility, as the same smoke particle sizes that persist in the atmosphere causing haze are also of concern for fire worker and public health impacts and climate interactions.

In our laboratory work on fresh smoke, we observed that both fuel type (e.g. conifers, chaparral, grasses, deciduous trees) and combustion conditions (e.g. flaming vs. smoldering) greatly affected smoke properties, that in turn influenced optics and visibility impairment. For example, uptake of water with increasing relative humidity by fresh smoke varied from nearly zero to strongly hydrophilic. The latter result translates into approximately a factor of three difference in the light extinction caused by a smoke aerosol depending on humidity response. Also, the “darkness” of the smoke, which is controlled by the light absorbing versus light scattering properties of the smoke, varied considerably with fuel and burn condition. These properties play a primary role in determining the visibility and climate impacts of smoke.

Building on this work, we recently developed a mobile air quality laboratory to aid in field studies. The mobile lab will be deployed during an upcoming wildland fire smoke campaign, likely a prescribed burn in the Western U.S., in 2008. This will allow testing of smoke marker profiles developed in the laboratory and further characterization of “real world” smoke properties.

Literature Cited

1. A. L. Westerling, H. G. Hidalgo, D. R. Cayan, T. W. Swetnam, *Science* **313**, 940-943 (2006).
2. D. V. Spracklen *et al.*, *Geophys. Res. Letts.* **34**, L16816 (2007).
3. G. Engling, P. Herckes, S. M. Kreidenweis, W. C. Malm, J. L. Collett, *Atmos. Environ.* **40**, 2959-2972 (2006).
4. C. M. Carrico *et al.*, *Atmos. Environ.* **39**, 1394-1404 (2005).
5. G. R. McMeeking *et al.*, *Agr. Forest Meteorol.* **137**, 25-42 (2006).

The Potential Health Effects of Smoke from Wildland Fires: Acute and Long-term Impacts on Wildland Fire Fighters and the General Public

Jennifer L. Peel, PhD, MPH

*Assistant Professor, Epidemiology, Colorado State University
Department of Environmental and Radiological Health Sciences
Environmental Health Building -- Room 152*

*1681 Campus Delivery
Fort Collins, CO 80523-1681
Phone: 970-491-6391
Fax: 970-491-2940*

*Jessica Fluck; Tiffany Lipsey; Christian M. Carrico; Sonia M. Kreidenweis;
Jeffrey L. Collett, Jr.*

Smoke from wildland fires has the potential to adversely affect the health of both the wildland firefighters as well as the general public in nearby communities. The acute respiratory health effects of smoke exposure in structural firefighters have been documented; recent work has begun to focus on smoke exposure and cardiovascular impacts. Cardiovascular disease, primarily coronary heart disease, is responsible for 45% of on-duty deaths among firefighters compared to 22% of deaths for police officers and 15% of deaths in the general population. There are several hypotheses postulated to explain the high mortality from heart disease in firefighters, including smoke and other pollutant exposure, physical exertion, heat stress, disruptions in circadian rhythms due to shift work, psychological stress, and a high prevalence of cardiovascular disease risk factors. Wildland firefighters are exposed to smoke that differs in composition and quantity compared to structural firefighters; additionally, wildland firefighters rarely wear the respiratory protection worn by structural firefighters. Few studies have examined the health effects of these exposures in wildland firefighters or the long-term health effects in this population. Wildland fire smoke contains many pollutants that are present in the ambient air, although at much higher levels. Exposures to indoor biomass smoke (e.g., indoor cookstoves) are often more comparable to those experienced by wildland firefighters. This allows us to use the rich literature on the health effects of ambient air pollution and indoor biomass smoke to gain insight regarding the potential health effects of wildland smoke exposure. An overview of the literature on the health effects of wildland fire exposure in both firefighters and the general public will be presented along with evidence from related studies on the acute and long-term health effects of ambient air pollution and indoor biomass burning. We will present a summary of an ongoing pilot study examining the short-term and longer-term pulmonary and inflammatory changes in wildland firefighters. Additionally, we will discuss the potential impact of wildland fires on regional levels of ambient pollutants in relation to regulatory compliance issues. Discussion will focus on research needs in relation to the health and economic impacts of wildland fires.

World Leaders in Risk Management: An Action-Research Agenda

Jim Saveland

USDA Forest Service, Rocky Mountain Research Station, 240 West Prospect Road, Fort Collins, CO 80526
Email: jsaveland@fs.fed.us

There are three topics embedded in the title of this talk: risk management, leadership and an action-research agenda. Talks given later today will explore risk management in-depth. I touch on it briefly here to set the stage. I will present only a couple of thoughts on an action-research agenda towards the end. For the majority of my time I pursue the topic of leadership.

The complex world of fire management is fraught with great challenges: dramatically improve firefighter and public safety, reduce the costs of large wildfires, and restore fire-adapted ecosystems across large landscapes while minimizing the nuisance of smoke and the chance of escaped fires. And do this in a polarized political environment, while the wildland-urban interface grows rapidly, and the climate changes. To rise to these great challenges requires assuming the mantle of world leaders in risk management.

Our concepts of good leadership are constantly evolving. Think of this as the beginning of a conversation about leadership and an inquiry into what the next stage of evolution might be. I invite you to join in the conversation.

I make no claims to being a great leader. However, I have been a serious student of leadership ever since I left high school for the leadership laboratory just down the road from here known as the U.S. Air Force Academy. In this paper I will provide an overview of current theories of leadership, then look at historical figures from history (the 1800's) to see what qualities are important, and then inquire into how to integrate pre-modern and modern notions of leadership for application in our emerging post-modern world.

Back in the 1840's academia first began to study leadership, and the dominant paradigm of the time was that leaders were born, not made. Research endeavored to discover the traits of the "Great Man," for women weren't even considered at the time. Soon after the counterargument arose – that leaders could be made and that they rise to the situation. After awhile, contingency theories of leadership arose which attempted to synthesize trait and situational models of leadership. The modern era of scholarship on leadership has focused on transactional models, which look at how influence is gained and maintained.

The fire management community has a long history of close ties to the military. In the military, the term leadership commonly refers to people in positions of command, who show the way. Leadership, in the military, aims to draw forth a person's highest qualities by influence more than coercion. The definition of leadership in the fire leadership training: "Leadership is defined as the act of influencing people in order to achieve a result."

Recently, there have been a few forays into looking at leadership as the management of meaning. Perhaps the pinnacle of current scholarship on leadership is Heifetz's definition: "leadership is mobilizing people to accomplish adaptive work." Adaptive work is defined as "the learning required to address conflicts in the values people hold, or to diminish the gap between the values people stand for and the reality they face. Adaptive work requires a change in values, beliefs, or behavior."

The links between culture and leadership as well as theories of leadership development are explored next. Grounded in theory, I then move on to examine historical figures from the 1800's.

In 1805 Lewis and Clark were traversing the continent, making their way to the Pacific coast. They met up with the Nez Perce on the Weippe prairie after coming out of the Bitterroot

mountains. In Europe, the Napoleonic War was underway. Admiral Nelson defeated the French and Spanish fleets at Trafalgar where he lost his life. His command presence that endeared him to his men is known to this day as “the Nelson touch.” For three weeks in October of 1806, Napoleon decimated the Prussian army, which would lead to the reforms starting in 1808 called *Auftragstaktik*, “mission-type tactics.” We know the germination of this seed of thought today in the fire community, as “Fire Suppression Doctrine.” Carl von Clausewitz, the great Prussian military theoretician, was held prisoner in France from 1807 to 1808.

Clausewitz would die in 1831, and his military treatise *Vom Kriege* (On War) would be posthumously published in 1832. It would still be studied by cadets at military academies, such as myself in the 1970’s. In 1830 the Indian Removal Act was passed. In August of 1832, there was the Bad Axe massacre in Wisconsin marking the end of the Black Hawk war and the last Indian “battle” east of the Mississippi. In 1836 there is the battle of the Alamo and the Spalding’s begin a mission among the Nez Perce at Lapwai. In 1838, there is the forced relocation of the Cherokee, the “trail of tears.”

In 1863, there is the “thief treaty” that splits the Nez Perce into the “treaty bands” and the “non-treaty bands.” Also in 1863 is the battle of Gettysburg, the decisive battle of the Civil War. Lessons that I learned from studying Gettysburg as part of the Federal Executive Institute’s flagship course for senior leaders in the federal government, Leadership for Democracy, were the importance of vision and middle management. Both Buford and Longstreet had a clear and tangible vision of the upcoming battle. One vision was honored, one ignored, and that made all the difference. It was the initiative of middle management (Greene and Chamberlain) that was decisive.

The Nez Perce War of 1877 provides a rich context to study leadership. On the military side there is Howard, Gibbon, Sturgis, and Miles. Miles, a Congressional Medal of Honor recipient at Chancellorsville and who would go on to become the last Commanding General of the Army, epitomizes the successful military model of leadership at the time. He was an outspoken critic of many policies, yet remained loyal and rose through the ranks based on achievement. Chief Joseph, completely misunderstood by white society at the time, is perhaps the greatest embodiment of Robert Greenleaf’s concept of “servant-leadership.” The Nez Perce were never defeated in any battle of the War of 1877, in large part due to their innate wisdom of “auftragstaktik,” and their decentralized command and leadership model.

To Nelson Miles and Chief Joseph, I add Alexandra David-Neel (born in 1868), Pierre Teilhard (born in 1881), and Helen Hunt Jackson to look at the paradoxical nature of leadership. Ms. David-Neel would make the seemingly impossible “forbidden journey” to Lhasa in the 1920’s initiating the revelation of Tibetan culture to the world. Father Teilhard’s writings on the evolution of spirit would be condemned by the Catholic Church and published posthumously. Ms. Jackson published “A Century of Dishonor: The Classic Expose of the Plight of the Native Americans,” back in 1881. Speaking truth to power, yet remaining loyal; servant and leader; myth of the lone hero and taking heroic action; humility and professional will; are but some of the facets of the paradox of leadership

Harney Peak lookout, built by the Civilian Conservation Corps in 1940, sits atop one of the most sacred sites of the Black Hills of South Dakota. Crazy Horse and Black Elk went on vision fasts in the area. Harney Peak symbolizes the need to integrate modern science and fire suppression on the one hand, with native wisdom and fire use on the other. As we inquire into the paradoxical nature of distributed leadership in the future, we must integrate the knowledge of our past. I conclude with the image of a Roerich painting depicting the Tibetan legend of Chintamani, a horse carrying sacred fire down from the mountain heights to illumine the consciousness of humanity during a time of great darkness. The world is calling on the wildland fire management community to lead the world in risk management.

Public Viewpoints on Fire Management in New Jersey and New South Wales

Stentor Danielson

Graduate School of Geography, Clark University, 950 Main St., Worcester, MA 01610 USA
stentor.danielson@gmail.com

Keywords: Cultural theory, discourse, risk perception, pine barrens, Sydney

Introduction

Wildfire policy is increasingly stressing public involvement, both because of a moral commitment to democratic policymaking, and because it is a practical necessity for protecting homes in the wildland-urban interface. But in order to involve the public, we must first understand how they already think about fire management.

Rather than looking at individual beliefs or values one by one, this study examines *discourses* (1) – overall ways of thinking or talking about an issue (aka “viewpoints” or “worldviews”). Understanding the different discourses that exist can help fire managers, WUI residents, and other stakeholders understand where the others are coming from and to frame their response accordingly.

This research focused on two locations that are broadly similar in their biophysical landscapes and WUI development, but which are located in countries with different histories of fire policy and culture: the Pine Barrens of southern New Jersey, USA, and the outer suburbs of Sydney, NSW, Australia.

The starting point of this research is cultural theory, in particular the “grid-group cultural theory” of anthropologist Mary Douglas (2). Cultural theory holds that people’s discourses about various issues are intimately connected to their ways of life. Discourses serve to solve the problems raised in the discourse-proponent’s relations to other people and the physical environment. These problems may be related to basic physical needs and economic gain; or of social integration, stabilization, and transformation; or of psychological needs for comprehension, identity-formation, and recognition by others.

Douglas’ grid-group cultural theory proposes that there are four cultural orientations present in any society, which form the basis of disagreements over any particular issue: Individualism, Fatalism, Hierarchy, and Egalitarianism.

Methods

Two methods were employed in each case study area: Q method (3) and a mail survey (4).

Q method is a way of identifying the existing discourses on an issue by having individuals sort a set of statements, then factor analyzing the correlations between the people (rather than between the statements). The factor analysis reduces the many individual viewpoints of the participants to a smaller number of shared discourses. This study used 56 statements about wildfire management drawn from background interviews and the literature. Each person sorted the statements to describe what they thought should be done about wildfires.

The mail survey was sent to 400 people in each case study area. The respondents in New Jersey were selected from property tax records, while those in New South Wales were selected from the phone book and voting rolls. The response rate in New Jersey was 47%, and in New

South Wales 56%. The survey asked about people's experience with fire, their views on wildfire management, their general cultural orientations, various actions they might have taken to make their home more fire-safe, and sociodemographics.

Results

The Q method study found five discourses in New Jersey (A-E) and four in New South Wales (F-I). These discourses are not well described in grid-group cultural theory terms. With the partial exception of discourses C and D, every discourse could be described as non-Individualist, non-Fatalist, pro-Hierarchy, and pro-Egalitarianism. This is in contrast to the ideal, in which each case study area would have one discourse that is strongly associated with each cultural orientation.

The cultural orientations measured in the survey proved to be poorly associated with variables relating to fire. Correlations were examined between the culture variables and measures of perceived risk to one's community, perceived risk to one's own household, trust in fire managers (NSW only), Q-sort items associated with each culture (NSW only), measures of the discourses, and number of risk-reducing actions taken at one's home.

Overall, cultural theory appears to be a poor way of understanding how people think about the risk of wildfire. It's possible that this may be due to poor measurement or flaws in the particular version of cultural theory used in this research. However, there is a potential deeper explanation, which I call "the detachment hypothesis."

Insofar as cultural theory works to explain people's views about an issue, it is because that issue is strongly "attached" to people's way of life. An attached issue is connected to other aspects of a person's life and thus plays an important role in the fulfillment of their material, social, and psychological needs. And in the same way, an attached issue will be subject to the "discipline" of cultural forces.

The detachment hypothesis holds that for a significant number of people in New Jersey and New South Wales, the issue of wildfire is *detached* – it's a concern they're aware of, but it's not intimately linked into their lives and sense of who and where they are. So they have not formed detailed, consistent views about fire. Thus attempts to explain people's views of fire through a cultural theory that presumes attachment will fall flat.

The detachment hypothesis implies that it is important to consider not just what people think but how much they think. And it implies that outreach efforts must go beyond merely trying to "educate" people, to find ways to reattach concerns about fire into people's way of life.

Literature Cited

- 1 J S Dryzek, J Berekijian, *Am. Pol. Sci. Rev.* **87**, 48 (1993)
- 2 M Thompson, R Ellis, A Wildavsky, *Cultural Theory* (1990)
- 3 S R Brown, *Political Subjectivity* (1980)
- 4 D Dillman, *Mail and Internet Surveys* (2000)

This material is based upon work supported by the National Science Foundation under Grant No. 0526381. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

Inhaling Air Toxics from Australian Bushfire Smoke – Effect of protective filters on fire fighter respiratory health during simulated bushfire smoke exposure

A. De Vos^{A,C}, B. Devine^A, A. Cook^A, P. Thompson^B, P. Weinstein^A

^ASchool of Population Health M431, The University of Western Australia, 35 Stirling Highway, Crawley Western Australia 6009.

^BLung Institute of Western Australia, Ground Floor E Block, Sir Charles Gairdner Hospital, Hospital Avenue, Nedlands Western Australia 6006.

^CCorresponding author. Email: annemarie.de.vos@uwa.edu.au

Key words: bushfire smoke, fire fighters, occupational exposure, respiratory health, respirators, protective filters

Introduction

Bushfire fighters are potentially subject to risk from inhaling bushfire smoke (Reinhardt and Ottmar 2000; Betchley et al. 1997; Slaughter et al. 2004). Although many different respirators and filters are available for use during bushfire suppression, it is not clear which is the most effective from a health and safety perspective. This study investigated the effect of three different types of filters on the respiratory health of Western Australian fire fighters under simulated conditions and during prescribed burns.

Methods

Sixty-four healthy career fire fighters from the Fire and Emergency Services Authority of Western Australia (FESA) were subjected to simulated bushfire smoke in a smoke chamber for 15 minutes. During the exposure trials, the fire fighters were allocated one of the three types of filters on their respirators using a double-blind randomised procedure. The filters assessed were (1) Particulate (P) filter; (2) Particulate/organic vapour (P/OV) filter; and (3) Particulate/organic vapour formaldehyde (P/OV/F) filter. Spirometry, oximetry and self-reported symptom data were collected at baseline and at two time intervals after the smoke exposure. Personal air sampling inside the fire fighters' respirators completed the assessment. Field trials during prescribed burns with sixty-seven career fire fighters were undertaken to validate the findings from the smoke chamber.

Results

A significantly lower number of participants assigned to the P/OV/F filter group reported an increase in coughing, wheezing, and shortness of breath following smoke exposure compared to the number in the P and P/OV filter group. Odds ratios showed that participants in the P filter group were 12 times more likely to report an increase in respiratory symptoms following smoke exposure, compared to participants in the P/OV/F filter group. Air sampling inside the fire fighters' respirators demonstrated a significantly higher level of formaldehyde and acrolein inside the respirators fitted with the P filters compared to the P/OV filter and the P/OV/F filter. Comparable results were found in the field validation trials during the prescribed burns. As a result of this research, the Fire and Emergency Services Authority of Western Australia has endorsed the use of the particulate/organic vapour/formaldehyde filter for their approximately 1,000 career fire fighters to be used during bushfire suppression. Further research is now needed

to determine the effectiveness of the filters and respirators over longer time periods and in more realistic situations.

This research was funded by the Bushfire Cooperative Research Centre, Melbourne, Victoria.

Literature Cited

Betchley, C., Koenig, J. Q., Van Belle, G., Checkoway, H. and Reinhardt, T. 1997. Pulmonary function and respiratory symptoms in forest firefighters, *Am J Ind Med*, 31: 5:503-509.

United States Department of Agriculture Forest Service Pacific Northwest Research Station 2000, *Smoke Exposure at Western Wildfires*, Report prepared by Reinhardt, T. E. and Ottmar, R. D., United States Department of Agriculture Forest Service Pacific Northwest Research Station,

Slaughter, J. C., Koenig, J. Q. and Reinhardt, T. E. 2004. Association Between Lung Function and Exposure to Smoke Among Firefighters at Prescribed Burns, *J Occup Environ Hyg*, 1, 1, 45-49.

Behavior Trends and Mechanisms to Evaluate the Efficacy of BLM's Community Assistance and Hazardous Fuel Programs in California

David J. Ganz¹ and David S. Saah²

¹ TSS Consultants, 3922 Magee Avenue, Oakland, CA 94619 tel. (415) 602-1395 fax (510) 336-0809, Email : Dganz@tssconsultants.com

² University of San Francisco, San Francisco, CA Email: dssaah@usfca.edu

In this study, we have provided a framework for assessing the social and environmental benefits and public education outcomes associated with BLM's Community Assistance and Hazardous Fuel Programs in California. As an integral part of the larger efficacy study, this poster presented results from a phone survey conducted to document the behavioral changes associated with the BLM's outreach efforts. Survey results indicated that the public perception is still that the fire risk is "not on my property" and "not in my backyard". The majority of homeowners surveyed, despite having experience wildfires recently, did not believe the wildland fire situation to be serious. One relevant finding is that Californians value their environment just as much as they value their structures. This further demonstrates the need for the BLM to account for ecosystem goods and services in their management decisions.

In order to assess successful behavioral changes associated with the BLM's Community Assistance projects, we have conducted a stratified public opinion survey in three geographical areas. Zip codes were chosen as the study unit for this behavioral change assessment. This study examined behavioral changes in households after participation in a phone survey assessment. In order to maintain quality control, we generated our own survey, used in-house technicians, and performed the statistical analyses required on the responses. The first step in the survey was to obtain descriptions of BLM's Community Assistance Program during the study period (2002-2004). The geographic areas were identified by selecting the appropriate zip codes where outreach efforts and hazardous fuel treatments had been implemented. Upon surveying the targeted population, we computer recorded the results, and ran the statistical analysis on the resulting responses.

The three counties selected for performing the phone survey are Napa, Humboldt and San Bernardino Counties. We did a thorough analysis of the socio-economic conditions of these three counties to determine the transferability of the results to other parts of the State. Although the three phone survey case study counties were surveyed separately to assess behavioral responses in distinct parts of the State, the results demonstrated similar trends amongst all three counties.

432 (12.74%) of the people called completed the phone survey out of 3390 calls initiated. Only 55% of the phone survey respondents indicated that they own or rent any property in an area where wildfire is a concern. Of all of the respondents across the three counties, only 20% of these homes are adjacent to federal lands. The adjacent federal agencies are the Forest Service (55%), the BLM (19%), and others (26%). Of the 55% that responded that they live in a wildfire area, 90% of these properties can be characterized as primary homes, 7% secondary homes, and 3% as undeveloped. The majority of these homes have been owned for more than ten years (50%). These demographics are statistically significant across the three counties with respondents in each county having the same pattern.

In all three counties, 64% of the respondents have experienced wildfire on their properties. The majority of these experiences have been in the last year (35%) and in the last five years (52%) with the remaining experiences taking place over five years ago (13%). 36% of the respondents have taken some actions after the wildfire to better protect themselves from future wildfires; 13% did nothing and 51% said that they had already taken action prior to the event to protect their property. While the majority of the actions

centered around creating defensible space (73%), many respondents focused their actions on watering systems, generators for pumping water, and knowing the evacuation routes.

In all three counties, 62% of those respondents that own or rent a property where wildfire is a concern know what the term “community at risk” means. Only 18% knew what the term “Urban/Wildland Interface” means. The experiences of the respondents and their actions taken are statistically different across the three counties with each county following the same response pattern. San Bernardino ranked the highest in terms of the perceived risk to both an individual’s property and to the larger community but only the property risk was significantly higher than Napa and Humboldt (at 5% and 1% error level respectively). For the perception that the community is at risk, San Bernardino scored significantly higher than Humboldt (at 1% error level) but did not score significantly higher than Napa. This indicates that even though 45% of the respondents do not think there is a fire problem in their county, those that do believe that fire is of some concern rated their county as more at risk than the other two counties surveyed in this assessment. Napa did not score significantly higher risk than Humboldt and San Bernardino San Bernardino did not score significantly higher than Napa.

Results for San Bernardino are surprising given the high level of completed surveys (15%) and general interest in the fire issue since the Grand Prix Fire and Old Fire of 2003. These findings are consistent with earlier studies (Monroe 2002; Gardner et al 1987; Gardner et al 1988) which found that recent wildfire survivors tend to discount future wildfire risk because they are convinced that fire won’t strike twice in the same place. These studies demonstrated the similar tendency where residents whom believe fire is a random event are also less likely to support protective measures or actions to reduce risk.

When asked if respondents could differentiate between the outreach materials from the various federal and state agencies, the local fire districts and Fire Safe Councils tended to be more distinct accounting for 42% of the outreach efforts (24.5% and 17.5% respectively). 56.5% of the respondents indicated that the outreach effort has contributed to them changing their behavior in some way. 7% indicated that they did not take action to protect themselves from future wildfires while another 36.5% had already taken action prior to receiving outreach materials. Given federal and local outreach efforts, the level of success have been characterized by the amount of assets (including ecosystem goods and services) potentially saved by these behavioral changes in the three study counties.

References

- Gardner, P.D., Cortner, H.J., Widaman, K. 1987. The risk perceptions and policy response toward wildland fire hazards by urban home-owners. *Landscape and Urban Planning* 14:163-172.
- Gardner, P.D., Cortner, H.J. 1988. An assessment of homeowners’ perceptions of wildland fire hazards: A case study from southern California. In: Whitehead, E.E. et al., eds. *Arid lands: Today and tomorrow*. Boulder, Westview Press. pp.643-657.
- Monroe, M.C. 2002. Fire in the wildland-urban interface. In: Macie, E.A.; Hermansen, A.L.. eds. *Human influences on forest ecosystems: the southern wildland-urban interface assessment*. Gen. Tech. Rep. SRS-55. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 159 p.

The National Database of State and Local Wildfire Hazard Mitigation

Programs -- www.wildfireprograms.usda.gov

Terry K. Haines^{A,C}, Cheryl R. Renner^B, and Margaret A. Reams^B

^A USDA Forest Service, Southern Research Station, New Orleans, LA

^B Department of Environmental Studies, Louisiana State University, Baton Rouge, LA

^C Corresponding author email: tkhforest@gmail.com

Keywords: wildfire mitigation; defensible space; regulation; risk assessment.

Introduction

Escalating losses and increased wildfire risk in the wildland-urban interface has prompted fire officials to adopt a wide-range of strategies to protect residents, property and natural resources. Furthermore, National Fire Plan funding to states and local governments has enabled officials to be more aggressive in their approach to reducing wildfire risk. To create more firesafe communities, wildfire managers are implementing a broad spectrum of homeowner incentives, educational tools, and regulatory mechanisms.

To facilitate a broad dissemination of ideas, researchers have developed a central location describing wildfire protection programs that communities across the country have adopted -- the national database of state and local wildfire hazard mitigation programs website, www.wildfireprograms.usda.gov.

Methods

The database presents a synthesis of a large body of information about state and local governments' wildfire risk-reduction efforts in a user-friendly searchable website, www.wildfireprograms.usda.gov.

Several approaches were used to obtain information. Contacts included state, county, and local government fire officials and National Fire Plan grant recipients. Information collected included grant proposals and accomplishments reports; wildfire hazard assessments; regulations and guidelines; and educational materials including publications, Powerpoint presentations, and videos used in workshops. In addition, legal searches of state statutes and county codes of three states—Florida, California, and Colorado were conducted.

Results

The website facilitates a broad dissemination of information to fire protection officials, natural resource professionals and community leaders. The website currently describes 237 programs in 37 states.

The website search options include: keywords, program type, state, administrative jurisdiction - state, county, city/town, or fire district; or a combination of these options. Descriptive profiles for programs includes: purpose and goals, implementation methods, funding mechanisms, collaborating agencies and organizations, and highlights of the programs most significant activities. Search options by program type include:

Community Planning - Many high-risk communities are creating wildfire protection plans that take a comprehensive approach to wildfire mitigation. The plans are formulated with the collaboration of the affected agencies and stakeholders. The plans generally include many of the elements listed below.

Assessments of Wildfire Risk and Designation of High Risk Areas- Assessments and mapping of wildfire risk using factors such as fuel loading, topography, fire history, climate, housing density, and infrastructure for fire fighting are being conducted at varying spatial scales;

Public Outreach and Educational Programs- Educational efforts include demonstration homes, defensible space guidelines, fire-resistant landscaping species lists, public displays, media outlets, videos, interactive games, classroom/teachers' programs, neighborhood meetings, and workshops for developers;

Homeowner Assistance- Fire protection agencies are offering evaluations of individual homeowner's wildfire risk, providing cost-share assistance for fuel reduction projects, and chipping debris and disposing of slash for residents;

Fuelbreaks- Fuel reduction in common areas and between wildlands and subdivisions are often a component of fire agency and community efforts;

Property Insurance-Insurance availability and cost are factors considered in some wildfire mitigation programs; and

Regulatory programs- State laws, local ordinances, and regulations often require developers to design subdivisions in ways that reduce wildfire risk. Some regulations also require maintenance of defensible space standards for existing homes.

Program profiles include the administrator's contact information and links to pertinent websites related to the program. As officials seek new strategies to reduce wildfire risk, information about existing programs can greatly enhance planning efforts, while reducing time and cost in implementing new programs.

Wildfire Risk Management by Municipal Governments in Alberta, Canada

Lauren M. Harris^{A, C}, Dr. Tara K. McGee^A, Dr. Bonita McFarlane^{A, B}

^A University of Alberta, Earth & Atmospheric Sciences, Edmonton, Alberta, Canada

^B Natural Resource Canada, Canadian Forest Service, Edmonton, Alberta, Canada

^C Corresponding Author Email: lmharris@ualberta.ca

Keywords: Wildfires, Local/Municipal Government, Wildfire Risk Management, Wildfire Measures, Wildfire Implementation Process, Alberta Canada.

Introduction

Wildfires (forest fires, grass fires, and brush fires) occur extensively throughout the world including in Alberta, Canada. Alberta is at high risk of wildfires because of the expanse of boreal forest and other vegetation and the increasing population migrating into these areas. Municipal governments need to focus on wildfire risk management measures rather than waiting and reacting to a wildfire. This study examined four research questions:

- 1) *What* wildfire risk management measures have been adopted by a sample of Alberta's municipal governments?
- 2) *Why* are some wildfire risk management measures more frequently implemented than others?
- 3) *What* is the municipal process for implementing wildfire risk management measures, and *how* is the process implemented?
- 4) *What* factors influence the implementation process, and *how* do these factors affect the process?

Methods

This study used a two phase quantitative and qualitative methodology. Phase one included a brief written survey followed by telephone interviews with 38 municipal officials (fire chief/deputy fire chief, the mayor/reeve, planner and chief administrators) from 18 Alberta municipal governments. Phase two involved selecting two municipal governments from phase one and conducting in-person interviews with 16 individuals. These individuals included municipal and provincial officials, and potentially affected parties such as residents, environmental groups, businesses, and industries.

Results

Seven wildfire measures were being implemented: emergency preparedness plans, infrastructure measures, communication, wildfire hazard assessments, vegetation management, land-use planning, and structural measures on government buildings.

The results show that emergency preparedness plans were most frequently implemented because each municipal government was required by provincial law to have this plan in place. Infrastructure measures (ensuring adequate road widths and water supplies), was the second most frequently implemented measure because this measure could be incorporated into municipal development plans, and in some cases it was implemented for reasons other than wildfire risk management. Communication was the third most frequently implemented wildfire measure because of its' perceived ease to initiate, particularly one-way communication

techniques. Wildfire hazard assessments and vegetation management were the next most frequently implemented wildfire measures. Wildfire hazard assessments were used prior to vegetation management so areas of high risk could be identified. Vegetation management was implemented because it was perceived to be one of the best ways to reduce a wildfire threat. However, these measures required considerable municipal resources (e.g. personnel and equipment) and were therefore implemented less than communication techniques. Land-use planning was infrequently used because some planners were not involved in the wildfire risk management process. Structural measures (using fire resistant building materials) on government buildings was the least frequently implemented wildfire measure, possibly because of cost to update the structural materials on government buildings.

This study identified a complex six-stage process, and if municipal governments completed each of these six-stages they increased their effectiveness in implementing wildfire risk management measures and reduced potential setbacks. The six stages in this process were: 1) initial identification of a potential wildfire problem, 2) gain internal support for municipal wildfire management, 3A) collect resources for implementation, 3B) update the wildfire proposal, 3C) acknowledge the need for external support, and create an awareness of wildfire risk management measures, 4) communicate proposal with residents, environmental groups, businesses, and industries, 5) implement municipal wildfire risk management measures, and 6) update, assess, and maintain wildfire risk management measures.

The results of this study indicate that there were six factors that influenced municipal governments' implementation of wildfire risk management measures: 1) wildfire experience, 2) risk perceptions, 3) communication, 4) support, 5) resources, and 6) geography. Wildfire experience influenced the implementation process because municipal governments that did not have municipal officials with wildfire experience knew little about wildfire measures and how to implement them. Low perceptions of wildfire risk among municipal officials and potentially affected parties (e.g. residents, environmental groups, businesses and industries) meant that these individuals may not have been aware of the importance of implementing wildfire measures, resulting in them being a low priority. Both one-way and two-way communication was critical during every stage of the implementation process, and without communication delays in the process would occur. Support is also important because without support the implementation process can be hindered if municipal government representatives and the public do not accept and understand the need to implement wildfire risk management measures. Resources were important because without access to sufficient resources (funding, time, personnel, and equipment) wildfire risk management measures cannot be implemented. Geography also influenced the wildfire implementation process because if a municipality was isolated, than municipal officials needed to ensure that they were self-sufficient to suppress a wildfire should one occur, as mutual aid may not arrive in time.

Therefore, municipal governments should use a combination of one-way and two-way communication techniques between municipal officials and the public. They should also regularly identify the risk perceptions of their residents, acknowledge that public support is critical, and promote wildfire risk management measures with other municipal activities. Municipal governments should also increase their use of land-use planning measures to mitigate the wildfire risk, and ensure that wildfire risk management is a collaborative endeavour involving the public and higher government levels.

Success in Collaboration – Community Wildfire Protection Plans (CWPP)

Cheryl R. Renner^{A,C}, Terry K. Haines^B and Margaret A. Reams^A

^A Department of Environmental Studies, Louisiana State University, Baton Rouge, LA

^B USDA Forest Service, Southern Research Station, New Orleans, LA

^C Corresponding author email: Shoodancer@gmail.com

Keywords: Fire planning, community wildfire protection plans, CWPP, fuels reduction, collaborative planning, firesafe planning, community at risk

Introduction

There are many crucial aspects for a rural area planning for wildfire. Preparations need to include both fire suppression capability and the protection of people and property. The first step for a locality in Wildland Urban Interface (WUI) areas to reduce wildfire risk is to create a Community Wildfire Protection Plan (CWPP). Title I of the Healthy Forest Restoration Act (HFRA, 2003) defined and authorized CWPPs. Creating a CWPP is a collaborative process which brings local citizens together with state and federal land managers to prioritize fuel reduction projects to protect communities at risk from wildfire. The CWPP benefits the community by giving it the opportunity to influence fuel reduction decisions on federal land, and priority for funding of fuel reduction projects within and around the community. While many agencies have been preparing wildfire reduction plans for years, 2005 was the first year for CWPPs.

Methods

The National Wildfire Programs Database, www.wildfireprograms.usda.gov, is a clearinghouse of information on vegetation management projects to reduce wildfire risk on private lands in all 50 states. Since 2005, the CWPP has been the focus of at-risk communities and counties, giving the website's researchers an opportunity to review CWPPs and post many good examples to the website. CWPPs were selected based on the recommendations of state wildfire program managers. The Success in Collaboration poster shows how a rural county or community can use information on the www.wildfireprograms.usda.gov website to create a CWPP.

Results

The poster reviews the legislative background of the CWPP, the goals of a CWPP as defined by HFRA, the definition of a community at risk (CAR), and describes the three required elements and six recommended steps of a CWPP. The required elements under HFRA are: collaboration of state and local representatives, federal agencies and interested parties, prioritization of hazardous fuel treatments to protect communities at risk, and treatment of structural ignitability. The recommended steps are:

Step 1. Convene decisionmakers;

Step 2. Establish a community base map designating the WUI zone;

Step 3. Develop a Community Risk Assessment;

- Step 4. Establish community hazard reduction priorities;
- Step 5. Establish community priorities for reducing structural ignitability;
- Step 6. Finalize the CWPP and communicate CWPP to the community.

The poster shows online resources for creating a CWPP, including: The California CWPP Simplified Template; Sierra Nevada Community and Conservation Wildfire Protection Plan; Utah CWPP Guidance Document; Handbook for Wildland-Urban Interface Communities.

The poster highlights the newest approach to reducing structural ignitability, California's Ignition-Resistant Building codes. The new codes will take effect January 1, 2008 in the State Responsibility Area and take effect July 1, 2008 in the Local Responsibility Area. New Fire Hazard Maps of State Responsibility Areas and Local Responsibility Areas show up-to-date fire risk assessments and will be used for enforcement of the new building codes. The codes can be found on the CALfire website: http://www.fire.ca.gov/wildland_codes.php.

The following ignition resistant standards will make homes and businesses more resistant to wildfire: decks enclosed with ignition resistant material to within six inches of the ground; eaves protected on the exposed side with ignition resistant material; roof built to Class A fire resistant standards in state responsibility areas and in very high Fire Hazard Severity Zones in local responsibility areas; all under-floor areas enclosed; dual-paned tempered glass for all exterior windows; ignition-resistant materials for exterior doors; all exterior vents designed to prevent ember intrusion.

Literature Cited

California Fire Alliance, Community Wildfire Protection Plan Guidance, California Simplified CWPP Template, [cited 2007, Nov 1]. Available from: <http://www.cafirealliance.org/cwpp/>.

California Department of Forestry and Fire Protection, CALfire, Wildland-Urban Interface Building Codes, October 9, 2007 [cited 2007, Nov 1]. Available from: http://www.fire.ca.gov/wildland_codes.php.

Forever Green Forestry, Sierra Nevada Community and Conservation Wildfire Protection Plan, [cited 2007, Nov 1]. Available from: <http://www.forevergreenforestry.com/SierraConservationCWPP.html>.

Society of American Foresters, A Handbook for Wildland-Urban Interface Communities, March 2004. [cited 2007, Nov 1]. Available from: <http://www.safnet.org/policyandpress/cwpp.cfm>.

Utah Division of Forestry, Fire and State Lands, Utah CWPP Guidance Document, January, 2006 [cited 2007, Nov1]. Available from: <http://www.ffsl.utah.gov/firemgt/WUI/CFP/communityfirepln.htm>

USDA Forest Service, Southern Research Station, New Orleans, National Wildfire Programs Database [cited 2007, Nov 1]. Available from: <http://www.wildfireprograms.usda.gov>.

Wildland Firefighting and its Impacts Upon the Personal Relationships of Firefighters

Charles G. Palmer, The University of Montana (charles.palmer@umontana.edu)

Steven Gaskill, The University of Montana

Arthur Miller, The University of Montana

Firefighters, relationships

Introduction

Wildland firefighting places a variety of demands upon those who engage in it. Previous research utilizing firefighter (FF) subjects has focused primarily upon physical areas, investigating such things as energy expenditure and the role of carbohydrates (Ruby et al, 2003), energy supplements (Sharkey et al, 2004), nutritional attitudes (Kodeski et al, 2004), immune system functioning (Gaskill & Ruby, 2004), and dietary needs (Sharkey et al, 2002). To date, little to no research has focused upon the psychological and social demands that wildland fire suppression presents to those who engage in it. The present study is an attempt to address this deficiency, with the hope that it helps lead to considerable more research into not only this specific area of personal relationships, but also the broader social and psychological impacts that wildland fire suppression has upon firefighters.

Methods

Subjects included 249 American wildland firefighters (216 Males, 33 Females), recruited from various L-380 Fireline Leadership and L-381 Incident Leadership courses held throughout the United States. Data collection progressed over a two year period. Survey respondents possessed a diverse level of firefighting experience, from as few as two years to well over 30 years of fire service. A wide variety of resource types were surveyed, including hotshots, smokejumpers, engine personnel, helitack, helirappel, type II crews, dispatchers, and miscellaneous overhead. The Firefighter Relationship Survey was constructed by the primary author, and was comprised of both quantitative survey-type questions, as well as qualitative essay-type questions aimed at finding out what strategies FF's have used to mitigate these relational impacts.

Results

Descriptive statistics and Chi-Square analyses revealed the following results:

- 92% of male FF's and over 82% of female FF's noted that the job negatively impacts their relationships with close friends
- Male FF's were significantly more likely ($p < .05$) to report that firefighting impacts their relationships with family members when compared to the responses of female FF's
- Over 83% of all FF's reported that the job has made it difficult to maintain an intimate relationship
- Over 73% of all FF's noted that a significant other has had difficulty adapting to their firefighting schedule
- Male FF's were significantly more likely than Female FF's ($p < .05$) to respond "yes" to the question: My spouse/significant other wishes that I had a job which allowed us to spend more time together.

- Currently married FF's were significantly less likely ($p < .001$) to report difficulties with their intimate relationships when compared to non-married FF's, were less likely to note that their spouse has difficulty adapting to the FF schedule ($p < .05$), and were significantly less likely to report that their spouse wished they had a job which allowed them to spend more time together.

Results from the study indicated that the personal relationships of wildland firefighters are significantly impacted by the unique scheduling demands of the profession.

Those who have managed to maintain intimate relationships in the face of these difficulties listed a variety of different coping strategies, including educating a partner early in the relationship about the schedule demands of the profession, establishing relationships only with another firefighter since this person understands the time demands, looking for partners with the qualities of independence and self-confidence since they will be better able to handle the time apart, and maximizing time off opportunities to build and solidify the relationship. Further research is needed in this area to better understand this dynamic, and to identify what types of support can be provided to firefighters to help them with these challenges.

References

Gaskill, S. & Ruby, B. (2004). Relationship of work to salivary IgA and fatigue in wildland firefighters. *Wildland Firefighter Health and Safety Report*, No. 8, Spring, 5.

Kodeski, K., Ruby, B., Gaskill, S., Brown, B., and Szalda-Petree, A. (2004). Nutritional attitudes of wildland firefighters. *Wildland Firefighter Health and Safety Report*, No. 8, Spring, 7.

Ruby, B. & Gaskill, S., Lankford, D., Slivka, D., Heil, D., and Sharkey, B. (2003). Carbohydrate feedings increase self-selected work rates during arduous wildfire suppression. *Wildland Firefighter Health and Safety Report*, No. 6, Fall, 6.

Sharkey, B., Ruby, B., & Cox, C. (2002). Feeding the wildland firefighter. *Wildland Firefighter Health and Safety Report*, No. 6, Fall, 2-5.

Applying Measures of Capacity in a Community Wildfire Protection Plan

Ryan Ojerio^A and Kathy Lynn^B

^A Masters Degree Candidate in Community and Regional Planning, Department of Public Policy and Management, University of Oregon, Eugene, OR 97403, USA

^B Associate Director, Resource Innovations, University of Oregon, Eugene, OR 97403, USA
Corresponding Author: Telephone: (541) 346-0467, Email: rojerio@uoregon.edu

Introduction

Community Wildfire Protection Plans (CWPPs) consistently include an assessment to identify areas of high risk using biophysical data including vegetation type, topography, historical fire data, climate and the distribution of people and property. However, few CWPPs include a similar comprehensive analysis of the ability of a community to prepare for, respond to and recover from wildfire. Yet, community capacity in this regard, is central to the successful implementation of these plans.

Community capacity is the ability of communities to mobilize the resources necessary to address issues that affect the community. In the context of wildfire, this includes a variety of strategies including creating defensible space, funding fuels reduction projects, and enhancing emergency response capacity. We investigated the utility of several sociodemographic indicators as measures of community capacity in developing a community wildfire protection plan.

Methods

Through a literature synthesis, the Forest Guild identified four dimensions and nine indicators of community capacity that are particularly relevant to wildfire planning. (Evans et al. 2007)

Social Capital

- Age Dependency Ratio
- Percent with disabilities
- Female only headed households

Human Capital

- Percent with High School Diploma
- Percent Employed
- Percent of English Speakers

Financial Capital

- Median Income
- Percent above poverty line

Political Capital

- Voter turnout

We investigated the utility of these indicators at a local scale using Curry County as a test case. We interviewed 17 individuals who work for social service providers in Curry County. We queried participants about their clients to understand the types of factors that limit capacity in their communities. We combined these findings with a county wide structural vulnerability assessment, comprehensive risk assessment and stakeholder surveys to develop action strategies that seek to support low capacity communities.

Results

Interviews with social service providers indicated that the challenges their clients face with regard to wildfire preparation, response and recovery are most often the result of physical disabilities or financial constraints. Many clients are elderly, a finding consistent with Census data that indicate that Curry County has the highest percentage of seniors (ages 65+) in the state. Based on the input from interviews we isolated three indicators of community capacity from the list developed by the Forest Guild (age dependency, income and percent disability). We combined these indicators into a single index and mapped the index by census block groups.

By comparing our sociodemographic data with the findings from the county-wide structural vulnerability assessment, we determined that there is a high concentration of low capacity communities with many residences lacking adequate defensible space in the southern portion of the county.

Our interviews also revealed that many individuals in low capacity communities lack means for transportation and adequate emergency communication. The draft CWPP includes these action items aimed at assisting low capacity communities, by decreasing structural vulnerability and creating a resource for a coordinated all-hazards evacuation plan. 1.) Provide funding and assistance in low capacity communities to create and maintain defensible space. 2) Institute free brush collection days to assist in the removal of woody debris. 3.) Create a vulnerable populations database linked to GIS for emergency response and planning purposes.

Our experience indicates that community capacity measures are useful in local planning processes if they can be linked to specific locations and effective strategies to assist those communities. Because there are many possible measures of community capacity, local knowledge is useful for determining which indicators are most relevant.

One of the limitations of our project is that our set of sociodemographic indicators did not reveal the level of organizational capacity and social capital present in these communities. Rather, our interviews with social service providers highlighted the importance of partnerships and collaboration to meet their clients' needs. Undoubtedly if partnerships and collaboration at a county level are required to serve the daily needs of low capacity communities, they will be equally important in effective wildfire planning.

Our experience suggests areas for further research. Many federal and state programs seek to build capacity and/or support low capacity communities. (Steelman and Burke 2007) Yet there is little consensus on what measures to use to evaluate capacity and measure program success. Describing and validating useful measures of community capacity, including organizational capacity and social capital may improve the allocation of resources at the state and federal level.

Literature Cited

- Evans, A., M. DeBonis, E. Krasilovsky & M. Melton. 2007. Measuring Community Capacity to Resist and Repair After Wildfires. Forest Guild.
- Steelman, T. A. & C. A. Burke (2007) Is Wildfire Policy in the United States Sustainable? *Journal of Forestry*, 105, 67-72.

Understanding the Extent of Community Preparedness for Wildfire after Participation in National Fire Plan Grant Programs: Part I. Developing the Survey Instrument, Sample and Study Protocol

Menka Bihari, Robert L. Ryan, and Elisabeth Hamin
Department of Landscape Architecture and Regional Planning,
University of Massachusetts, Amherst,
109 Hills North,
Amherst, MA 01003-9328
Tel. (413) 545-6633
Fax (413) 545-1772
e-mail: bihari@larp.umass.edu

Introduction:

Wildfire preparedness has increasingly emphasized the need to engage residents and to form partnerships to enable communities to take greater responsibility for their own safety. It is now widely recognized that fire services are unlikely to be able to provide protection to every property during major incidents and that effective community response is essential to ensure protection of life and property (Dasgupta, 2000). Communities across the country are being told that they can take steps to improve their preparedness for wildfire. Social capital becomes very prominent in this scenario wherein actions to increase wildfire preparedness are affected by decisions made by individuals and the community (Jakes & Nelson, 2002). To help mitigate wildfire damage, there is a need for a combined effort from local, state, and federal governments, fire agencies and residents. There is no single approach to dealing with wildfires. Everyone shares in the responsibility of mitigating wildfire damage. This includes implementing development design standards to help mitigate fire damage, and engaging and educating residents on their role in preventing wildfire damage (Booher & Innes, 2001).

The extent of wildfire destruction depends on a number of development decisions, including building and subdivision design, landscaping and land-use regulations, and management of fuel loads. Planners and communities need to examine the risks presented in new development proposals. More communities are now shifting their focus from responding to disasters to mitigating the impact beforehand through community plans and ordinances. This is where the input of planners is vital. The main issue to explore is how can planners and related professionals use environmental education efforts and other outreach to develop the necessary social capital to sustain wildfire preparedness efforts (Agarwal & Monroe, 2003).

This study is a part of a larger project funded under the National Fire Plan grant and will investigate the factors that influence community preparedness for wildfire, such as community and individual resources, degree of collaboration, and physical setting. The main focus of inquiry is the extent to which participation in National Fire Plan funding increased community preparedness for wildfires. The amount of community capacity that has resulted from planning for wildfires will also be explored along with ways in which community preparedness efforts vary geographically in different ecosystems, forest types and US Forest Service regions (Stelman & Kunkel, 2004).

Methods:

To understand these issues, a close-ended survey instrument has been developed to measure perceptions of community preparedness for wildfire, including wildfire planning meetings, published plans, forest thinning operations and demonstration projects. Community preparedness will look at actions that are undertaken at both the community and individual level. The survey

instrument will also ask participants about their perceptions of the effectiveness of these actions to minimize wildland fire hazard. An important aspect of preparedness deals with the impact of developing community capital; thus,, the survey instrument will also use measures of community social capital or conditions by reviewing previous studies to determine the most relevant measures, such as the number of community groups, leadership capacity, and social networking. This will be conducted at two levels. Firstly, a survey of residents will assess the degree to which they have undertaken defensible space efforts at their own home, as well as their perceptions of general community preparedness.

At the second level, for each community, surveys will also be mailed to people in the administrative capacities whose jobs make them responsible, in part, for wildfire preparedness, including the federal, state, county and municipal fire officials and land managers. In addition, people who are involved in other community leadership or land development positions will be included, such as real estate agents, insurance agents, and developers.

Results:

The relevance of studying social capital in the context of natural resource management is very crucial as success of any environmental management initiative, to a large extent, depends upon the efforts of a well informed and conscious community. For this, understanding the multiplicity of resource issues is critically important to making defensible decisions at all levels.

The study will provide a detailed understanding about the prevailing attitudes of communities towards the issue of wildfires in their region as well as information about the existing efforts on the part of the authorities and individuals towards increasing community preparedness. Eventually, it would also create a foundation for preparation of community wildfire protection plans (CWPP). The final outcome of the study will aid land managers, program leaders, and others who are promoting community preparedness in the face of wildfire danger.

References:

- Agarwal, S. & Monroe, M, K. 2003. The Palm Coast Community, Florida: steps to improve community preparedness for wildfire. Case Study #4. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station.
- Booher, D. E., & Innes, J. E. 2001. Network Power in Collaborative Planning. *Journal of Planning Education and Research* 21(3)
- Dasgupta, P. 2000. Economic Progress and the Idea of Social Capital, pp. 325-424 in P. Dasgupta and I. Serageldin (eds.), *Social Capital: a multifaceted perspective*, World Bank, Washington DC
- Innes, J. E., & Booher, D. E. 2003. Collaborative Policy Making: Governance through Dialogue. In M. W. Hajer, Hendrik (Eds.), *Deliberative Policy Analysis: Governance in the Network Society*. Cambridge: Cambridge University Press
- Jakes, P. & Nelson, K. 2002. The Gunflint Trail, Minnesota: steps to improve community preparedness for wildfire. Case Study #1. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station, 4.
- Steelman, T.A. & Kunkel, G.F. 2004. Effective Community Responses to Wildfire Threats: Lessons from New Mexico. *Society & Natural Resources* 17 (8): 679-699.

Acknowledgements

The funding for this study was provided by the U.S. Forest Service, North Central Research Station under Cooperative Agreement No. 05- JV 11231300-042.

The role of trust relationships in fire management strategies in Southeast Australia

Emily Sharp^{A,B}, Rik Thwaites^A, Joanne Millar^A, Allan Curtis^A

^A Institute for Land, Water and Society; Charles Sturt University, Albury, NSW, Australia

^B Corresponding author. Email: esharp@csu.edu.au

South-eastern Australia is one of the most fire-prone environments in the world. In 2003, and again in 2006-07, wildfires burnt over one million hectares of public land in the south-eastern state of Victoria, resulting in considerable social disruption and loss of property in neighbouring communities. The fires also escalated on-going contentions regarding management of wildfires and prescribed burning.

Fire management activities on public land in Victoria are undertaken in compliance with the Code of Practice for the Management of Fire on Public Land (COP). The COP states that fire management must be planned and conducted in partnership with the community to maximise fire management outcomes. Trust is important to understand in this context because it is thought that when it is present, members of partnerships are more likely to agree to maintain relationships and less likely to attempt to subvert the partnership process (1). Without trust, it is easy for the public to become disenfranchised and withhold their support for fire management decisions, regardless of the decisions' merit (2).

Previous studies have highlighted the importance of trust between individuals and government agencies in the social acceptance of fire management strategies (3-5). However, these studies often are limited by their singular focus on identifying trustee characteristics (ie. the person/organisation being trusted) or treating trust as a static construct. Conceptual models from organisational behaviour theory describe trust as a context-dependent, multi-dimensional, evolving process (6). These models propose that the trust process consists of internal relationship components and external contexts (eg. institutional structures) which influence a relationship's evolution (7).

This poster outlines an in-progress project exploring how trust shapes relationships in the development and implementation of fire management strategies in the state of Victoria, Australia. Semi-structured interviews, workshops, document analysis and a literature review will identify which trust components are most important in different types of relationships (eg. between neighbours, between citizens and agency staff, etc.) and which components are most subject to influence by external contexts. The research adopts a conceptual model from the organisational behaviour discipline in which trust is considered as an evolving and multi-dimensional process (8). The model explicitly recognises risk from external contexts and from within the relationship itself. Exploring trust in this way will illustrate those components and processes that are important in facilitating community-agency partnerships and provide a greater understanding of how to develop, maintain or repair trust relationships.

1. F. Six, in *The trouble with trust: The dynamics of interpersonal trust building*

- F. Six, Ed. (Edward Elgar, Cheltenham, UK, 2005) pp. 1-10.
2. B. Shindler, M. Brunson, G. H. Stankey, "Social acceptability of forest conditions and management practices: A problem analysis" *Tech. Report No. Gen Tech Report PNW-GTR-537* (U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 2002).
 3. A. Liljeblad, W. T. Borrie, *International Journal of Wilderness* **12**, 39 (2006).
 4. J. J. Vaske, J. D. Absher, A. D. Bright, *Human Ecology Review* **14**, 223 (Winter, 2007).
 5. G. J. Winter, C. Vogt, J. S. Fried, *Journal of Forestry*, 15 (2002).
 6. R. J. Lewicki, E. C. Tomlinson, N. Gillespie, *Journal of management* **32**, 991 (2006).
 7. G. Mollering, R. Bachmann, S. H. Lee, *Journal of Managerial Psychology* **19**, 556 (2004).
 8. R. C. Mayer, J. H. Davis, F. D. Schoorman, *Academy of Management Review* **20**, 709 (1995).