Perception and Management of Sociopolitical Risks on Large Fires[1]

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Abstract

This work examines the perceived impact of sociopolitical factors on large fire decision making. The study is based on a set of 74 large fires in USDA Forest Service Regions 5 and 6 for the years 2009-2013. All participants were fire managers, some as part of units affected by incidents and others associated with incident management teams. A protocol was developed and implemented to support a combination of information collection approaches, including interviews, survey-type data collection, and encoding of information from incident documentation sources. Participants were asked whether there was direct involvement from influential individuals or groups in the incident management process. Their combined responses to these questions suggests that about 50% of the time they were aware of direct involvement by influential individuals and influential groups. When queried whether or not they personally saw, heard or read media coverage associated an incident *at the time of the incident*, the majority (63%) reported that either they had not or could not recall. Overall, respondents were somewhat aware of media reporting of incidents at the time of the incidents, and their knowledge of media reporting types covered a broad range of media pathways, including the Internet.

Keywords: Career risk, media influence, risk management, social capital, wildfire decision making

Introduction

The purpose of risk management is to reduce the potential for harm associated with exposure to hazardous conditions by taking appropriate actions. In general, risk management is conceptualized as a response to the findings or conclusions of a risk assessment by which hazards are identified, exposures are assessed and risks are characterized (National Research Council 2009). Essentially, risk management is a

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problem in risk-based decision making, and the central focus of risk management is deciding between alternative risk-reduction measures. Although this process gives explicit consideration to risk-related factors associated with exposure to hazards, it gives little to no consideration to the risks emergent from the risk management process itself. Indeed, given the inherent uncertainties associated with risk management, the outcomes of risk reduction actions cannot be known with certainty. As a result, even the best-intended risk assessment and risk management plans can lead to undesirable outcomes.

To date, applications of risk management decision making have focused on the risk management problem as external to the decision maker, and is done on their behalf in support of a decision. That is, risk assessment provides the framework for the identification and implementation (including monitoring) of risk management efforts. Consider the case of wildland fire where fire managers use risk assessment as the basis for determining the potential impacts of fire on values at risk (e.g., natural resources, private property), as well as risks to those exposed to the hazards of wildland fire as part of risk management (e.g. wildland firefighters).

Two key elements receiving little attention in risk management research are related to the risk management decision maker as a personal agent, and the broader social context within which the decision maker operates. These two elements can be characterized as risk to career and risk to social capital.

Risk to Social Capital

With respect to social context, many risk-based decisions impact not only the organizations with which risk managers are associated, but also impact stakeholders outside of a risk manager's organization with potential consequences to social capital. In some risk management contexts, the impacts to social capital can have an influence beyond a specific risk management situation (e.g., wildland fire) and into other management areas where social capital is critical to the risk manager's success as a decision maker (e.g., NEPA (National Environmental Protection Act) actions). Similarly, risk managers working together on a risk management problem (e.g., line officers and incident commanders) may rely on social capital to accomplish their work with quality and efficiency, but have social capital associated with their working relationship at risk due to elements of the situation (e.g., high stress, leadership capabilities). For organizations that rely on public support to achieve their mission, as does the USDA Forest Service, a high level of social capital is critical to achieving organizational objectives, particularly in the context of fire management.

Risk to Decision Maker Image and Career

Risk managers may face potential impacts to their image and career as a function of the outcomes of risk-based decisions that they make. For example, pre-tenure academics working across traditional disciplinary lines have been found to experience career risk when they pursue research agendas that are focused on interdisciplinary problems such as climate change (Fischer, et. al. 2012). As yet, we have little in the way of models of how career risk might factor into risk-based decision making as part of risk management, though we do have some anecdotal evidence that in the domain of professional investment decision making a significant challenge for investment professionals is dealing with career risk and job protection as an investment agent (e.g., Grantham 2012). Therefore, perceptions of career risk may drive risk managers to excessive avoidance of error or negative outcomes (risk aversion), and over-attention to behaving as others have done to avoid being wrong or erroneous on their own. [4]

Study Context

Risk is inherent to fire management. Large-scale incidents, such as those that cost millions of dollars to manage and suppress, present multiple sources of risk, including risks to incident personnel as well as risks to the resource base in the form of damage from fire and from fire suppression activities. Decision making in the context of large fires is the basis for risk management, and a complete understanding of how decisions are made cannot be had without understanding the multi-dimensional characteristics of the risks associated with fire and fire management on these large-scale events (MacGregor 2006).

In recent years, the focus of decision making on large fires has centered on cost and cost management. However, wildfire costs on a per-acre basis, particularly for the largest of fires, are not reliably predictable from biophysical features of the fire context alone (Canton-Thompson et al. 2006, González-Cabán 1997, González-Cabán et al. 1984, Gebert et al. 2007, McKetta & González-Cabán 1985). Some research suggests that fire costs may be associated with social factors such as media coverage (e.g., Donovan, Prestemon & Gebert 2011). However, the role of decision making in cost as an outcome of fire management remains unclear.

A feature of large fires that is commonly identified as contributing to cost is a relatively broad category of hazards that might be conceptualized as sociopolitical in nature. These include the potential damage or harm to the agency's image or the

[4] In the context of safety management, a report by the organization *Dialogos* to the USDA Forest Service has provided anecdotal evidence that in some contexts employees are reluctant to express concerns due to perceptions of career impacts. The report titled "Taking All Employees on A Safety Journey" is accessed at: http://www.reclink.us/page/taking-all-forest-service-employees-on-a-safety-journey-slp-7-saf. (Last access: 10 Jun 2015).

image of fire managers for failing to take action even if that action is not likely to achieve a positive result with respect to managing the physical properties of the fire (e.g., spread, damage, intensity). Research on the role of trust (as an element of social capital) has suggested the importance of trust in effective and efficient natural resource management (e.g., Cvetkovich & Winter 2007, Liljeblad & Borrie 2006). However, we have no research to date that identifies the pathways by which social capital (and trust) enters into fire management decisions that occur at the time of an incident. Such decisions would include those that involve the level of resources assigned, relative aggressiveness of strategies and tactics, overall efficiency of incident response, and responses to media events.

We hypothesize that the concept of risk in large fire management extends beyond the potential for physical harm and includes perceived negative impacts to social relationships, personal career, and confidence in leadership. These perceptions may lead to a generalized belief that it is better to do all that can be done even if such actions do not produce a positive physical result, but do produce a valued sociopolitical result. Thus, hypothetically, risk management can have a variety of purposes as its goal or objective; some of which can be non-physical.

The research reported here is a step toward extending our understanding of the relationship between sociopolitical factors and incident-level decision making. Although incident documentation does report on factors such as resource assignments, cost, acres impacted and values at risk, these are not accompanied by an indication of sociopolitical factors, such as media reporting and political involvement on an incident, that may have an influence on, for example, fire management strategies, tactics, suppression resource ordering and suppression resource assignment.

To circumvent these challenges, the present research focused on elements of incident decisions and called upon personnel associated with actual incidents to report on their experiences with sociopolitical influences on incidents as well as the impact of those influences on key incident decisions, including strategies, tactics and fire management objectives. The approach generally followed along the lines of previous research that used decision modeling as a basis for characterizing fire management decisions (MacGregor & González-Cabán 2008).

Study Approach

The methodology for this research was based on a combination of structured interviews and self-reports of fire managers, including agency administrators, fire management officers and incident command staff that synthesized their experiences on specific fire incidents. In addition, information was also gathered from a number

of existing fire-related databases, particularly the Fire & Aviation Management web site FAMWEB (http://www.famweb.gov), the Wildland Fire Decision Support System (WFDSS, http://www.wfdss.gov), and the on-line incident website *InciWeb* (http://www.nwcg.inciweb.gov).

A self-report protocol was developed that also served as a structured interview guide. The protocol was designed to be brief yet comprehensive with respect to the potential influences of social factors on incident decision making, including: 1) political influences and pressures, and influential groups; 2) media reporting and coverage, including type of media and timing of media reporting and actions taken in response to media reporting; and 3) actions taken to manage the risks associated with sociopolitical pressures through modification of incident strategies, incident tactics, changes in objectives, and changes in number and type of suppression resources.

Incidents were selected over a five-year period, beginning in 2009 and ending with the 2013 fire season for USDA Forest Service Region 5 (Pacific Southwest – California), and Region 6 (Oregon & Washington). Only incidents that were wholly (or primarily) on lands under USDA Forest Service jurisdiction or were managed by a USDA Forest Service agency administrator; were managed by either a Type I or Type II incident management team (IMT); and had a cost of $2,000,000 or more.[5]

For each incident, an Incident Time Line was prepared based on information from the various information documentation sources discussed above. To the degree possible, fire managers were contacted as soon as practical after the incident to solicit their responses to the protocol.

Several challenges were encountered in conducting a study of this type: 1) large fires generally occur during the most active part of the fire season and fire managers are not readily available; 2) the14-day personnel rotation that results in a given incident being managed sequentially by a number of different incident management teams; and 3) line officers and fire management officers unavailability because of the high workload during fire season. To circumvent some of these problems, if possible, individuals were identified and contacted by e-mail to solicit their participation. If agreeable, they received an electronic copy of the research protocol. Though incident documentation does not generally contain electronic addresses for relevant personnel, line officers and their staff are generally located with the land management unit on which an incident occurs, making them more readily identified and contacted. However, incident management team personnel are drawn from a number of units and participation on an incident management team constitutes an additional duty.

[5] Fire years 2009, 2010 and 2011 were relatively slow in Regions 5 and 6 and fire costs were somewhat lower than average.

Contact by e-mail was accomplished when possible and respondents were provided a copy of the protocol to complete and return. If not possible, we engaged participants by telephone to administer the protocol by personal telephone interview. Because of the difficulty of interviewing them during the fire season most interviews were delayed until fire season had abated.

Incident-specific details collected from the sources discussed above were used to describe the incident and to establish a context for responding that focused on the particular incident on which the individual had participated. In addition, other venues provided opportunities to conduct interviews with fire management personnel, and these venues provided a substantial number of respondents. Often times this yielded additional individuals to engage as study participants. `

Finally, on large and sometimes long-running incidents a particular incident management team may spend only two weeks (or even less). Local management staff may change responsibility for a fire incident on their unit as the incident changes in size, scope and complexity. As a result, it is relatively rare on large incidents for a single individual to have a complete picture of all aspects of an incident, and particularly those elements that are not a part of the standard process by which incident management is documented and reported.[6] Our approach gives, at best, a glimpse into how sociopolitical factors are perceived by fire managers and the role that those factors may play in risk-based decisions on an incident.

To improve candidness of responses, all respondents were assured of their anonymity and all identifying information was removed from survey and interview protocols.

Results

A total of 74 incidents occurred in Regions 5 (n=46) and 6 (n=28) for the years 2009 – 2013 that met the criteria outline above. A total of 173 protocols were obtained through the combination of methods described in the study approach. Some individual respondents appeared more than once in the resulting dataset because they were associated with more than one of the 74 incidents. This can occur, for example, when a particular forest had more than one incident that met the selection criteria during the five years of the study. Likewise, incident command staff may serve on a number of different assignments not only over a five-year period, but even within a given fire season.

[6] An exception to the 14-day duty cycle for incident management teams is NIMO (National Incident Management Organization) that was established in part to provide on-going incident management without rotation on long-running fires.

The first three study years (2009-2011) had unusually slow fire seasons, particularly Region 5 for the years 2010 and 2011. Incidents ranged in acres burned from a low of 142 acres to a high of 257,135. The range in Region 6 was narrower than that for Region 5. Ignition cause tended to be toward human causation, but with a large difference between regions. Human caused fires accounted for over 76% of the incidents in Region 5, but only about 21% of those in Region 6. Numbers of incidents by year were too small to draw a reliable comparison of causation on a yearly basis.

Involvement of Influential Individuals and Groups

Respondents were asked to indicate the direct involvement of influential individuals and groups on the incident in question. Direct involvement was defined as "expressing a direct interest in the incident through contact with fire managers either in person or on the telephone". Influential individuals included various government elected officials and/or their delegate(s). Influential groups included cultural or tribal groups as well as broad categories of groups that included public groups, government groups and other concerned groups. In all cases, respondents were free to give more than one response since more than one influential individual or group might have been involved.

In the majority of cases (52.5%) respondents indicated "don't know" or the question about influential individuals directly involved in the incident was not answered. Most of the influential individuals involved were at the state or lower governmental levels, comprising 81% of the responses for which at least one influential individual (or delegate) was indicated. Higher-level involvement (i.e., governor or congressional level) was relatively infrequent though present on some incidents at some time.

With respect to influential groups, about 67% responded "don't know", which is higher than that for influential individuals. Of the specific groups mentioned, "public groups" received the highest response rate (13%), followed by "cultural/tribal" (9%).

Taken together, the results suggest that respondents were about half of the time aware of the direct involvement of influential individuals and (to a lesser degree) influential groups. However, it is important to remember that respondents varied in terms of the stage of an incident where they might have been in a position to directly know whether influential individuals or groups were involved in some way. In general, it appears that at some time during some incidents respondents did have knowledge of influential parties who were directly involved with incident personnel.

Media Reporting and Coverage

Fire events, and particularly large fires, have the potential to attract media attention. Typically, incident management teams have as part of their staff either a Public Affairs Officer (PAO) or a Public Information Officer (PIO), and sometimes both. Local management units (e.g., Forest, Ranger District) may also have public affairs staff and information officers that provide information to the media upon request.

Respondents were asked to indicate through a set of items their experience of media reporting and coverage on the specific incident(s) in which they were involved, including the type of reporting that occurred, presence of media personnel on the incident, and their personal engagement with media personnel.

The majority of participants (63%) reported that either they had not or could not recall when asked whether or not they personally saw, heard or read media coverage associated with an incident *at the time of the incident*. Of those who reported (37%) they personally saw, heard or read media coverage at the time of the incident, the most common response was for print media (92%), followed by television (65%), radio (52%), and Internet (41%). Overall, respondents were aware of the media associated with an incident at the time of the incident and in its diverse forms; including the Internet and the use of social media to provide not only public information but also to provide opportunities for the public to respond to the progress of an incident and their perceptions of incident management through mechanisms such as *Twitter* and *Facebook*.

When asked about the presence of media personnel on the incident, either at the offices of unit management (e.g., Forest supervisor's office, Ranger District office) or at the Incident Command Post (ICP), respondents were unaware of media personnel at either location (72%) or they responded "don't know" (19%). From these responses it appears that actual media personnel presence on-site at incidents, does not occur very frequently.

Overall, respondents were somewhat aware of media reporting of incidents at the time of the incidents, and their knowledge of media reporting types covered a broad range of media pathways, including the Internet. Most respondents were either unaware of media personnel present on-site or did not know. Again, however, respondents varied in terms of the time of their engagement on an incident and their responses cannot be taken to mean that media personnel were not present on a given incident during its entire duration. A relatively small percentage of respondents reported participating in actual interviews with media personnel, either in-person or over the telephone. When they did, the tone of the resulting media interviews were reported to be either supportive or factual. Though in the case of the Station Fire (2010) media reporting took a critical tone (Pringle, 2009).

Media Reporting and Incident Decisions.

Respondents were asked about the potential influence of media reporting on incident decisions both in general terms and specific to the incident in question (*table 1*).

Table 1. Media Reporting and Incident Decisions

Query	Percent Indicating
Did media reporting caused you to feel pressured to question or change incident decisions?	
No	77.5%
Yes	9.8
Don't know/Not answered/Unsure	12.7
In general, do you believe that media reporting of large fires influences incident decisions?	
No	57.2%
Yes	13.3
Don't know/Not answered/Unsure	29.5

As seen in the table, in the general case, respondents were less inclined to see media reporting as an influence on decisions than in the specific case (57% vs. 78%). In addition, in the general case, about twice as many respondents failed to answer the question or were unsure about making a response than for the specific case (30% vs. 13%). Also in the general case, respondents were more inclined to feel pressure from media reporting to question or change decisions (13%) than in the specific incident (10%).

Actions Taken to Manage Sociopolitical Risks

Respondents were asked to indicate the types of actions taken to manage sociopolitical risks and objectives (*table 2*). Potential actions included changes to incident strategies, tactics and objectives, as well as changes to ground and aviation resources.

Table 2. Actions taken in the interests of managing sociopolitical risks.

Query	Percent Indicating
To the best of your knowledge, what actions were taken with respect to Incident Strategies in the interests of managing sociopolitical risks?	
More aggressive	7.5%
Less aggressive	0.0
No change in strategies	76.9
Don't know/Not answered	15.6

Incident Tactics?	
More aggressive	17.3%
Less aggressive	0.0
No change in tactics	67.6
Don't know/Not answered	15.0
Incident Objectives?	
Broadened existing objectives	6.4%
Narrowed existing objectives	0.0
Eliminated (some) incident objectives	0.0
Added incident objectives	9.2
No change to incident objectives	49.7
Don't know/Not answered	22.5
Incident Ground Resources?	
Added ground resources	3.5%
Reduced ground resources	0.0
No change in ground resources	72.8
Don't know/Not answered	23.7
Incident Aviation Resources?	
Added aviation resources	15.0%
Reduced aviation resources	0.0
No change in aviation resources	54.3
Don't know/Not answered	30.6

Overall, only a small percentage indicated that in response to sociopolitical pressures more aggressive response were applied in: strategies, incident tactics, broadened incident objectives, and adding incident objectives. By and large most respondents reported no change in any of these categories.

With respect to changes in suppression resources, only a small percentage indicated an increase in ground resources and a slightly higher percentage indicated an increase in aviation resources. Once again, respondents for the most part indicated that there were no changes in either ground or aviation resources in the interests of managing sociopolitical pressures.

Sociopolitical Pressures and Perceptions of Incident Risk

Respondents were asked to indicate their perceptions of the influence of sociopolitical pressures on incident operational risks and the degree to which increases in risk (if any) were mitigated.

Responses here were generally in line with early responses pertaining to changes in incident factors such as tactics and resources: only 19% of respondents indicated that operational risk on the incident increased as the result of sociopolitical pressures, while 47% indicated no effect on risk. For the subset of respondents (n=32) that

indicated an increase in risk, the majority thought that the increase was somewhat mitigated. However, responses here were mixed with percentages indicating that risks were fully mitigated (59%) while others either (19 %) did not know or did not answer the query. None of the respondents indicated that risks were not mitigated.

With respect to cost, most respondents (68%) either did not respond or did not know the effect of sociopolitical pressures on cost. The remaining respondents indicated that the cost either increased (18%) or there was no effect on cost (14%).

Perception of Career Risk

Decision maker concerns about career risks associated with the outcomes of decisions they make has received relatively little to no research attention in the context of fire management decision making, and initial responses to the research protocol indicated a high level of non-responding to probes relating to the concept of career risks. Subsequent reviews with a small set of respondents revealed that although personnel sometimes refer to career risk in conversation, the concept itself is complex, and highly personal. "Career" can be interpreted in a number of ways depending upon an individual's aspirations and desire to advance in their work life, which is affected by their inherent abilities to achieve such advancement. Thus, a career risk to one individual may not be a risk to another simply because they have different objectives with respect to their career and place a different value on career as an element of their overall life satisfaction. In addition, the notion of career risk carries with it some type of loss, which could take on a number of personally defined forms ranging in severity depending upon career objectives. Finally, personnel sometimes apply the referent "career-ending event" to describe an action or outcome that is catastrophic in nature with respect to one's career. In actuality, career-ending events are extremely rare and interviews with upper-level managers have identified few cases in which an Agency employee has been terminated with cause for an action they took. Nonetheless, the nomenclature exists and, in all likelihood, forms at least part of the psychological basis for perceiving the potential for personal career-related losses associated with risk management in their role as decision maker.

To bypass some of these difficulties a subset of respondents was selected to engage in an interview-based approach, either in-person or by telephone. An interview protocol was developed that utilized both open-ended and structured response formats, thereby allowing respondents to more freely discuss their perspectives on career risk while at the same time eliciting their views in a structured format where possible. Open-ended responses to the interview protocol were coded and categorized. A total of 39 respondents (from the total respondents in the study, n=173) participated in this aspect of the study.

In general, respondents saw career risk as referring to any event or outcome that affects them personally and negatively in the context of their work life. Expressions like “bad things that happen” or “possible loss of credibility” characterized some of the mentions. When asked if there was a time (or times) in their career when they felt exposed to career risk, 100% of respondents indicated that they were exposed to career risk. Situations in which they were so exposed varied and respondents sometimes had difficulty characterizing them. Some of the more common situations had to do with risks associated with the situation itself (26%), perception of legal liability issues (23%), unclear or conflicting management directions (56%) and complex sociopolitical situations (78%).

When asked their perceptions of the consequences associated with career risk, responses were varied and generally focused on loss of either leadership image or trust and credibility. About 36% perceived psychological impacts included regret and blame. Others mentioned potential impacts to career motivation (23%). Some (18%) perceived career risk consequences in terms of loss of promotion opportunities, while a fairly large portion perceived the consequences in terms of greater difficulty doing their job (62%).

What fire managers do to manage these risks is an important consideration. Given the range of expressions that respondents gave to the consequences of career risk (above), it is to be expected that risk management along these lines would focus on either reducing exposure or behaving in ways that either call upon or build social capital. Deciding as others have decided in the past (“herding”) was fairly common risk management strategy for dealing with career risk (41%), as was limiting responsibility (36%). Others, however, reported doing nothing to manage career risk and considered it a part of the job that can’t be avoided (33%).

Respondents were then asked to turn their thoughts toward the specific incident associated with their participation in this study. When focusing on the particular incident they reported on this study, the category of experienced career risk dropped considerably to only15%. It appears that although relatively large numbers of respondents had experienced career risk, on a given incident the likelihood was fairly low. From a psychological standpoint, this suggests that career risk experiences are impactful and, therefore, memorable. Accordingly they may have the ability to influence attitudes and behaviors for a significantly long period of time (e.g., months or years). More focused study of career risk with respect to types of management situations in which it occurs might reveal useful information on how to improve practices for contexts that produce perceptions of career risk.

Discussion and Conclusions

This was a challenging study on several counts. First, the intention was to move away from general impressions that fire managers have about sociopolitical factors and their relationship to incident factors and move toward more incident-specific judgments based on personal experience with a given incident of sufficient size to potentially attract sociopolitical attention. By focusing on key fire managers who are likely to have played at least some role in overall incident decision making, a perspective on the bigger picture of the incident is potentially obtainable. On the other hand, no single individual on a large fire completely defines and represents the decision making on the fire.

We see the present study as an entrée into developing a greater understanding between social context within which fire management occurs, and the relationship of social contextual factors on incident decision making. In this spirit, the study seeks to open avenues by which a deeper awareness can be gained of the myriad of psychological factors that play a role in incident management and associated risk-based decisions.

Although we are cautious about what we have learned here, we can offer some interpretations and speculations based on the results obtained. We note that for many of the queries put before respondents relatively high levels of imprecise responses were obtained. These were along the lines of "don't know", "unsure" or "no response." We do not take this as uncooperativeness, but rather as a potential indicator of the difficulty fire managers have with a complete understanding of how social context influences their own decision making processes. Furthermore, and to be fair, some of the queries posed in the research protocol may have probed topics that were either uncomfortable given the specifics of an incident, or relatively novel given that many had not been asked before in a structured and research-oriented context. In this context, we note that the influence of sociopolitical factors *on* incident decisions goes hand-in-hand with the influence of incident decisions *on* sociopolitical factors.. To date, we have not developed models that illuminate this relationship in much detail. And, without this deeper understanding of the complexities of the sociopolitical environment we may always be at risk of managing risk with a limited ability to account for the multiplicity of factors that both drive incident decisions and related outcomes including costs.

With respect to career risk, it appears from the results that fire managers are not only aware of this aspect of risk management, but also have some articulated perceptions of the consequences of career risk on them personally. Whether these

perceptions are matched by actual effects on the careers of fire managers is another matter. Nonetheless, we take the difficulties some respondents had in expressing their views about career risk as at least a partial confirmation that the topic requires further research with an eye toward clarifying the root causes of career risk as well improving our understanding of career risk perceptions and incident-related decisions.

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References

Canton-Thompson, J., Thompson, B., Gebert, K., Calkin, D. Donovan, G. Jones, G. 2006. Factors affecting fire suppression costs as identified by incident management teams. Res. Note RMRS-RN-30. Missoula, MT: Rocky Mountain Research Station, Forest Service, U.S. Department of Agriculture; 10 p.

Cvetkovich, G.T., Winter, P.L. 2007. The what, how, and when of social reliance on cooperative risk management. In: M. Siegrist, T.C. Earle, & J. Gutscher (Eds). *Trust in cooperative risk management: Uncertainty and skepticism in the public mind.* (pp 187-209). London, UK: Earthscan.

Donovan, G.H., Prestemon, J.P., Gebert, K. 2011. The effect of newspaper coverage and political pressure on wildfire suppression costs. Social & Natural Resources, 24:8, 785-798.

Fischer, E.V., Mackey, K.R.M., Cusack, D.F., DeSantis, L.R.G., Hatsell-Nichols, L., Lutz, J.A., Melbourne-Thomas, J., Meyer, R., Riveros-Iregui, D.A., Sorte, C.J.B., Taylor, J.R., White, S.A. 2012. Is pretenure interdisciplinary research a career risk? *Eos Trans. AGU*, 93:32, 311-312. (DOI: 10.1029/2012EO320004)

Gebert, K.M., Calkin, D.E., Yoder, J. 2007. Estimating suppression expenditures for individual large wildland fires. West. J. Appl. For. 22(3), 188-196

González-Cabán, A. 1997. Managerial and institutional factors affect prescribed burning costs. Forest Sci. 43(4), 535-543.

González-Cabán, A., McKetta, C.W., Mills, T.J. 1984. Costs of fire suppression forces based on cost-aggregation approach. Res. Paper PSW-171. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 16 p.

Grantham, J. 2012 . Jeremy Grantham on investment management career risk. *The Reformed Broker*. Retrieved from: http://www.thereformedbroker.com/2012/07/31. Last retrieval: 28 August, 2012

Liljeblad, A., Borrie, W.T. 2006. Trust in wildland fire and fuel management decisions. *International Journal of Wilderness*, 12, 39-43.

MacGregor, D.G. 2006. The future of fire in environmental management. *Futures*, 38, 505-518.

MacGregor, D.G., González-Cabán, A. 2008. Decision modeling for analyzing fire action outcomes. Res. Paper PSW-RP-258. Albany, CA: Pacific Southwest Research Station, U.S. Department of Agriculture; 67 p.

MacGregor, D.G., Seesholtz, D.N., Potash, J. 2014. A system dynamics approach to modeling the NEPA process at the forest level. Pacific Northwest Research Station.

McKetta, C.W., González-Cabán, A. 1985. Economic costs of fire suppression forces. Journal of Forestry 83(7), 429-432.

National Research Council, 2009. *Science and decisions: Advancing risk assessment.* Washington, DC: The National Academies Press. p. 424.

Pringle, P. 2009. Station fire's strength was miscalculated. Los Angeles Times, September 27, 2009.

Rodríguez y Silva, F. González-Cabán, A. 2010. "SINAMI": A tool for the economic evaluation of forest fire management programs in Mediterranean ecosystems. International Journal of Wildland Fire, 19, 927-936.