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Risk Tradeoffs in Adaptive Ecosystem Management: The Case of the U.S. Forest Service

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Abstract Natural resource planning processes on public lands in the United States are driven in large part by the requirements of the National Environmental Policy Act (NEPA), which dictates general processes for analyzing and disclosing the likely impacts of proposed actions. The outcomes of these processes are the result of multiple factors, many related to the manifold smaller incremental decisions made by agency personnel directing the processes. Through interviews with decision makers, team leaders, and team members on five NEPA processes within the U.S. Forest Service, this study examines those incremental decisions. Risk, in particular external relationship risk, emerged as a dominant lens through which agency personnel weigh and make process-related decisions. We discuss the tradeoffs associated with agency actors' emphasis on this form of risk and their potential implications for adaptive ecosystem management and organizational performance.

Keywords Adaptive ecosystem management · Decision making · National Environmental Policy Act · Organizational learning · Planning · Project risk

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Introduction

The National Environmental Policy Act (NEPA) of 1969 mandates all federal agencies to conduct an environmental analysis to consider and fully disclose likely impacts prior to implementing major actions that may result in a significant impact on the environment (42 USC Sect. 4321–4347). While the written goals of NEPA include language about preventing or eliminating damage to the environment (Sect. 2 [42 USC Sect. 4321]), NEPA does not enforce or prohibit any specific actions on the landscape. Rather, it prescribes a general process designed to educate decision makers (DMs), other relevant agencies, and the general public about the environmental consequences of government actions. This process is commonly referred to as "the NEPA process" (Stern et al. 2010a). NEPA processes generally involve the following tasks, not necessarily in this order: identifying a purpose and need for a project and an initial proposed action, the development of an interdisciplinary team (ID team) to conduct analyses and manage the process, public scoping to help determine issues to be addressed in analyses, the development of alternative courses of action to meet the purpose and need, analyses of the likely environmental and social impacts of each alternative, interagency engagement, the drafting of an Environmental Assessment (EA) or Environmental Impact Statement (EIS), public comments and other forms of public involvement, and a decision document signed by a responsible official expressing the rationale for the final decision.

NEPA processes pose numerous challenges to public lands managers. These challenges include staffing interdisciplinary teams with the necessary expertise to conduct NEPA analyses, performing and communicating the results of those analyses, collaboration within and between federal agencies, effective engagement with multiple stakeholders

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with diverse interests, and coping with objections, appeals, and litigation associated with the Act (Keele et al. 2006; Malmsheimer et al. 2004; Stern and Mortimer 2009). The U.S. Forest Service, in particular, has struggled with its NEPA processes, as mandated external engagement, appeals, and litigation have delayed, stalled, increased costs, or otherwise modified management approaches in ways the agency has sometimes found undesirable (Stern and Mortimer 2009; USDA Forest Service 2002).

Key agency players in the NEPA process include the ID team leader (IDTL), who is tasked with leading the ID team through the process, the DM, who is tasked with making the final decision and signing the decision document, and the ID team members, who are typically resource specialists of various disciplines who perform tasks associated with impact analyses, interagency collaboration, and disclosure (through public involvement efforts and report writing). Agency leaders and coordinators commonly serve in advisory roles to those more directly engaged in NEPA processes (Cerveny et al. 2011; Stern et al. 2010a, b; Stern and Predmore 2012). Each of these players makes decisions that influence the course of the planning process in various ways. For example, each may have at least some degree of power in determining the nature and scope of the proposed action, the design of alternatives to meet the purpose and need, the nature of public involvement, the degree of influence afforded to different stakeholders, the analytical techniques, the disclosure of analyses, and the final decision and its rationale (Hoover and Stern 2014; Stern et al. 2009; Stern and Mortimer 2009; Stern and Predmore 2011).

In this paper, we view the NEPA process from the agency perspective (of the U.S. Forest Service) as a series of incremental decisions that direct how planning activities proceed and influence the final outcomes of the process. Broad discretion afforded to individuals at each level of the agency's structure in NEPA processes suggests that the outcomes of these processes, whether social, organizational, economic, political, or environmental, may be largely dependent upon these incremental decisions (Lindblom 1959; Lipsky 1980; Stern and Mortimer 2009; Stern et al. 2009). These individuals and their decisions are subject to multiple competing influences or accountabilities, including pressures felt to satisfy or comply with professional standards, agency-wide mandates, overarching Forest Plans, public stakeholders, supervisory officials, internal norms, co-workers, or other peer groups (Stern and Mortimer 2009; Stern et al. 2010a, b). We set out to understand how these pressures may influence the decisions made during NEPA processes in the U.S. Forest Service and what impacts those resulting decisions might have on process outcomes.

We consider the results within the context of adaptive ecosystem management. General consensus within the natural resource management field, including the Forest Service, points to the need for adaptive management at the ecosystem scale to address complex natural resource problems (Butler and Koontz 2005; Christensen et al. 1996; Daniels and Walker 1996; Grumbine 1994; Nie and Schultz 2012; Predmore et al. 2008). Adaptive ecosystem management recognizes that ecosystems stretch beyond convenient political or jurisdictional boundaries, that natural resource systems include social as well as biological elements, and that learning through systematic monitoring, evaluation, and adjustment is critical to improving management practices and processes (Bjorkland 2013; Brown and Squirrel 2010; Committee of Scientists 1999; Predmore et al. 2008). Key challenges associated with adaptive management include difficulties with identifying the appropriate ecological scale for management, with effective interdisciplinary collaboration within and across agencies and with the public, and with situating adaptive ecosystem management within existing, legally mandated planning procedures, among others (Cortner and Moote 1999; Fitzsimmons 1999). Our research effort involves understanding how incremental decision-making within the U.S. Forest Service might influence the broader performance of the agency in terms of adaptive ecosystem management. We expect the results to be applicable to multiple federal agencies tasked with natural resource management, as their planning processes largely mirror those of the U.S. Forest Service.

Methods

We took a primarily inductive approach to examine the factors most strongly influencing incremental decisions made by agency professionals throughout Forest Service NEPA processes and their potential consequences. We began our inquiry with an examination of 21 NEPA documents (8 EIS; 13 EA) selected from a larger sample of 489 NEPA processes considered to be representative of all NEPA processes conducted in the U.S. Forest Service between January, 2007 and December, 2009 (see Stern and Predmore 2011 for detail on the sampling frame). The focus of the document review was to identify official explanations for the incremental decisions made throughout each NEPA process. As such, we aimed to review documents that would provide a wide range of potential explanations based on data collected about each process in a prior survey conducted in 2010 (see Stern and Predmore 2011). We first narrowed our sample to the 225 cases with at least a moderate degree of public controversy, as prior research suggests that cases with low levels of public interest are inherently different (Stern and Predmore 2012). We then selected 21 cases to ensure variation with regard

to subject matter, team leaders' perceptions (obtained by the earlier survey) of the degree of uncertainty associated with the project, the quality of the science conducted during the process, and whether the preferred alternative became clear early or late in the process. Two researchers read the documents and collaborated on coding written or implied justifications for all decisions documented in the reports (see Martin 2012 removed for more detail).

The document review revealed a number of apparent influences upon and justifications for incremental decisions throughout the processes. These included the professional opinions and/or experience of resource specialists on the ID teams, principles and guidelines from the Forest Plan or other official guidance documents, specific laws and regulations, other governmental agencies or governments, public feedback, and science in multiple forms. The review also provided insights that allowed us to categorize the decisions that were most commonly discussed across all of the processes. These included decisions about project scope and scale, project design, analyses, public involvement, and disclosure (Martin 2012).

While the document review provided general categories of justifications and decision types, it revealed little about how decisions were actually made in each process. Thus, we conducted interviews of team leaders, DMs, and team members of a subsample of the processes that were subject to the document review. These processes were selected in an attempt to more closely examine the processes we felt most likely to reveal the widest variety of influences upon incremental decision-making. We selected five cases based on three criteria. First, we removed processes in which the preferred alternative became clear to the IDTL prior to scoping, as early decisions leave little room for the meaningful influence of subsequent decisions (Martin 2012). Second, we selected the two processes from the remaining sample that were evaluated by the team leaders in the prior survey to have had the best and worst outcomes. Third, we aimed to select processes that seemed different in terms of the potential influences on decision-making. Three documents in particular reflected three distinctly different rhetorical emphases: reliance on the Forest Plan, emphasis on science, and emphasis on stakeholder input. The selected cases represent four different project types (recreation, fuels reduction, timber management, and timber management integrated with other uses) and a balance of document types (2 EAs and 3 EISs). Table 1 provides general information and survey responses associated with each case (see Martin 2012 for more detail). The processes selected lasted on average 2.4 years, ranging from 8 months to over 4 years in duration. Four processes ended in 2009; one ended in October, 2008.

An email was sent to the DMs and IDTLs for each selected case to request an interview about the specific NEPA process. All agreed to participate except for one retired DM, who was inaccessible by email. A second email was sent to the IDTLs to request the name of one team member they felt played an essential role in the particular NEPA process. These team members were also sent an email soliciting their participation in an interview regarding the process. All agreed to participate. Twelve interviews took place in-person, and three took place over the phone from October to December, 2011. The recorded interviews, not including introductory conversations and prior communications, averaged 1 h and 11 min in duration.

Interview guides were designed specifically for each case by incorporating specific terminology and examples relevant to each project derived from the document reviews. As such, each interview was uniquely focused upon particular decision points within each individual NEPA process. Interviews focused first and foremost on how each interviewee made decisions throughout the process. The interviewer (the second author) also asked about who made which decisions and interviewees' perceptions about how others' decisions were made. While the interviews focused primarily on the process under review, interviewees were encouraged to discuss other NEPA processes as well to provide context to their answers or comparisons to other projects. This helped to put their responses into a broader context and to access respondents' most salient beliefs about how decisions are made in NEPA processes in their broader experiences. This aspect of the interviews was also intended to further enhance interviewees' recall about the specific process under discussion. Despite the variable time periods that had elapsed between the end of the projects and our interviews, our discussions and transcripts revealed no major issues with recall that would meaningfully influence the findings reported in this manuscript.

After the first person on a project was interviewed, the researcher took the opportunity when possible to refine the question guide for the subsequent interviews on that project to better follow up on topics relevant to the research. This adjustment in the field gave the researcher the flexibility to explore topics as they emerged in the interviews and to probe these topics more deeply.

All interviews were audio recorded with the interviewee's consent and the audio recordings were transcribed verbatim. The transcriptions were uploaded into NVivo, a qualitative data analysis program, in which text can be coded by the researcher based on common topics. Data analysis followed key elements of a grounded theory approach, consisting of an iterative process of coding and memo-writing to develop and refine themes in the data that directly addressed the research question (Charmaz 2006). Interviews were iteratively coded and memos were

Table 1 Case study selection

Project name**	Reason included	Description	Survey responses
Pest Salvage EA	*Best perceived outcomes:* this process had the most positive outcomes and efficiency scores from the IDTL survey.	Occurred after the discovery of a tree pest outbreak. It proposed salvage treatment on approximately 1,300 acres to capture economic value of dead and dying trees. Public comment was used to create issues and additional alternatives. The methods, data origins, and assumptions for analysis are clearly stated for every resource studied, and the document repeatedly expresses compliance with the Forest Plan and other legislation.	Perceived overall outcome: high Perceived efficiency: high Perceived quality of science: high Perceived uncertainty: low
Vegetation management EA	*Worst perceived outcomes*: this process was perceived to have had the worst outcomes and efficiency scores from the IDTL survey.	This process proposed around 1,600 acres of hazardous fuel reduction treatments to decrease the possibility of high severity fire in the project area. Written as a concise EA, it barely mentions the Forest Plan. All supporting literatures and justifications for analysis are cited to the resource specialist reports, and though scoping was conducted, the use of public input is not specified in the document.	Perceived overall outcome: low Perceived efficiency: low Perceived quality of science: low Perceived uncertainty: high
National Forest Motorized Travel EIS	*Forest plan emphasis:* compliance with the Forest Plan is highly emphasized. Verbatim goals from the Forest Plan are included in the text.	This project fulfilled the requirements of the Travel Management Rule by designating a Forest-wide sustainable system of roads, motorized trails, and areas open for public motor vehicle use.	Perceived overall outcome: high Perceived efficiency: high Perceived quality of science: high Perceived uncertainty: low
Forest Resiliency Plan EIS	*Stakeholder input emphasis:* this process had a high degree of public comment. It also had a community proposed alternative, which was selected over other alternatives.	The project area resides on a municipal watershed. It proposed over 7,000 acres of various vegetation treatments to reduce hazardous fuels and promote forest resiliency, including protecting old growth forests and a domestic water supply.	Perceived overall outcome: high Perceived efficiency: high Perceived quality of science: high Perceived uncertainty: high
Fire recovery EIS	*Science emphasis:* some documents relied on scientific explanations far more than others. In this document, science was not only used to explain the analysis, but it was also used to respond to public comment and to support the desired conditions in the Forest Plan.	This project occurred after an approximately 40,000 acre fire. It proposed treatments to recover economic value, reestablish burned conifer stands, and reduce fuel continuity on approximately 9,000 acres.	Perceived overall outcome: mediocre Perceived efficiency: low Perceived quality of science: low Perceived ucertainity: high

The names of the projects have been altered to reflect the actions entailed in the project

developed by the second author to identify influences upon the incremental decisions made throughout the processes and perceptions of their impacts on process outcomes. These were reviewed by the first and third authors and followed by group discussions of their meanings. While numerous codes and themes were developed in the process (e.g., different forms of accountabilities, the role of science, and the public), the concepts of risk and risk management emerged as primary determinants of decision-making in all interviews. This spurred an examination of the literature associated with project risk to compare and contrast key themes in the data with those present in other theory and research. It simultaneously spurred a re-examination of both the interview transcripts and the documents (following Eisenhardt 1989). Examining the literature on "project risk" helped us to organize the interview data into coherent categories of conceptual and practical significance.

To ease the interpretation of our findings, we first describe in detail the theoretical concept of "project risk," illustrating four distinct forms and sources of risk we feel are most relevant to the research context. We also discuss the concept of "risk management" and place it within the context of natural resource management. We then share the results of our analyses, which reveal how risk identification, analysis, and management generally took place within

the NEPA processes studied. We conclude with a discussion of the potential implications of our observations for natural resource planning processes in the U.S. Forest Service and other natural resource management agencies.

Defining Project Risk

Risk is generally conceptualized in terms of two components: a potential consequence or loss, and the probability or likelihood that the potential loss will occur. While risk in the natural resources and environmental fields has been studied extensively in terms of vulnerability and behavior related to pollution, fire, and other hazards, a thorough treatment of *project risk* in natural resource planning processes has yet to surface (see MacGregor and Seesholtz 2008; Stern et al. 2013 for preliminary efforts). We define project risk as the probability of the occurrence of an undesirable event and the significance of that occurrence within the context of a specific project or process (Pritchard 1999; Stern et al. 2013). In the context of U.S. Forest Service NEPA processes, these undesirable events could include public protest, appeals, litigation, suboptimal resource management decisions with negative effects on the landscape, project delays, or other forms of conflict.

Risk Outcomes

Project risk may be conceptualized according to its likely outcomes or its sources. In the case of natural resource management, we distinguish four types of risk outcomes: *resource*, *process*, *personal*, and *organizational*. *Resource risk* refers to risk to natural resources that can emerge from different decisions, actions, or inactions resulting from a planning process. *Process risk* refers to the likelihood that the process itself will fail for any number of reasons (MacGregor and Seesholtz 2008). The relevance of these categories of risks lies in the challenges they present to agency actors to balance each. For example, in some cases, making compromises that address risks to a process might result in suboptimal outcomes for the resource. In other cases, failing to do so might cause an entire process to fail, leading to no active management of the resource.

We use the term *personal risk* to characterize risks that an individual feels to his or her own position or well-being. Schein (2010) explains related concepts in his discussion of barriers to organizational change. He describes *survival anxiety* as a feeling that pushes change or innovation by influencing an individual to feel that unless he or she changes, something bad will happen. *Learning anxiety*, on the other hand, may inhibit change, innovation, or other actions, as individuals feel challenged to change their behaviors for any number of reasons, including self-doubt in their ability to accomplish challenging tasks, fear of punishment for incompetence, fear of loss of personal identity, fear of loss of group membership, or fear of loss of position or power. Each of these same fears may account for decisions about risk-taking behaviors in natural resource planning processes as well.

The work of Kahneman and Tversky (1979, 2000) further illustrates the importance of *personal risk* assessments. Their research on the framing of risk-related decisions suggests that individuals' decisions are not necessarily based on rational considerations of likely outcomes. Rather, their work revealed that people are more likely to go to greater efforts to avoid a loss than to achieve a gain. In the case of natural resource planning processes, we might expect, based on this research, that decisions may more commonly be based on avoiding undesirable outcomes, whether they be related to process, resource, or personal impacts, than on achieving optimal results.

The process, resource, or personal outcomes of any project can also have ripple effects on future projects and future internal and external relationships for an organization. These *organizational risk* outcomes can include future public relations challenges, cost escalation, fluctuating agency morale, and additional risk aversion on future projects (Stern and Mortimer 2009).

Risk Sources

Much of the research on the sources of project risk resides within the fields of management and information technology. We focus on four main sources that we feel are particularly relevant to natural resource planning processes. We refer to these as *programmatic*, *structural*, *technical*, and *relationship* risk sources (Stern et al. 2013).

Programmatic risk sources stem from the interaction between the initial project design and the pre-existing project environment (Stern et al. 2013). As such, they set the baseline conditions from which all other risks may emerge throughout the project. Programmatic sources of risk include the scale, scope, and subject matter of the project in addition to the social and political climate in which the project is proposed (Datta and Mukherjee 2001; Ward 1999). For example, projects involving timber harvest may be predisposed to greater external relationship risks in the form of appeals or litigation from environmental interest groups (Laband et al. 2006; Mortimer et al. 2011; Stern et al. 2013). Prior research has revealed that the clarity of the original purpose and need of the project, or lack thereof, can also be a strong driver of subsequent challenges (Stern and Mortimer 2009; Stern and Predmore 2012). Decisions about the initial scale and scope may be made to minimize the ripple effects of programmatic risk, particularly regarding assumed technical challenges or

external relationship risks associated with larger and more complex projects (Mortimer et al. 2011; Stern and Mortimer 2009).

Structural risk sources emerge from the availability, or lack thereof, of the resources necessary to complete the project effectively (Stern et al. 2013). These resources include staff time, materials, and sufficient budgets to complete tasks (Reed and Knight 2010; Royer 2000; Tesch et al. 2007). Prior research has revealed that competing tasks, turnover on the ID team, and the degree of prioritization of the process by the DM can each have meaningful impacts upon process outcomes (Freeman et al. 2011; Stern and Mortimer 2009; Stern and Predmore 2012; Stern et al. 2013).

Technical risk sources are most closely related to competence and individual and group performance on tasks relevant to the project (Dey 2001; Pritchard 1999). Within the NEPA process context, technical risk sources may emerge from challenges related to project design, impacts analyses, procedural compliance, and disclosure tasks. The particular expertise of team members may also contribute to technical risk through constraining available tools for problem-solving. Learning anxiety (Schein 2010) and general risk aversion (Kahneman and Tversky 1979, 2000) may further challenge the development of new skills or applications of new techniques that might be appropriate to address technical challenges.

Relationship risk sources can emerge from both internal and external relationships (Datta and Mukherjee 2001; Tesch et al. 2007). External relationships have been well-studied in natural resource management, with multiple studies focusing on public involvement, conflict, collaboration, and their outcomes (Innes and Booher 2004; Leach 2006; Lewicki et al. 2002; McCool and Guthrie 2001; Predmore et al. 2011a; Stern 2008; Wondolleck and Yaffee 2000). Prior studies have demonstrated that a strong fear of appeals and litigation can drive some behaviors of U.S. Forest Service personnel in NEPA processes (e.g., Mortimer et al. 2011; Stern and Mortimer 2009; Predmore et al. 2011a, b). Stern and Predmore (2012) have demonstrated the importance of relationships internal to the agency as well in Forest Service NEPA processes. Elements of team harmony, intra-team collaboration, IDTLs' leadership styles, and communications between the ID team and the DM were each predictive of process outcomes.

Risk Management

Risk management, regardless of the entities involved, generally involves three steps: risk identification, analysis, and response (Dey 2001; Pritchard 1999; Project Management Institute 2004; Reed and Knight 2010; Ward 1999). The identification of risk may be formal or informal and is dependent first and foremost on its detectability (Carbone and Tippett 2004). Once a risk source is identified, risk managers have the options of taking actions to minimize the probability of a risk event occurring, to minimize the impact of the event, to accept the consequences, or to avoid acknowledging the risk altogether (Pritchard 1999, Kutsch and Hall 2005). This decision may be based, in part, on the perceived degree of controllability of the risk. Controllability refers to the degree to which agency personnel can influence the probability of an unwanted outcome's occurrence (Fan et al. 2008). If a risk has high controllability, then preemptive risk management strategies can be taken to prevent or minimize the likelihood of the risk event occurring. If there is low controllability, the risk manager may accept the consequences of the risk or possibly design strategies to reduce the severity of the damage of its occurrence. Risk managers can also ignore or deny risks. Kutsch and Hall (2005), for example, found that officials might choose to ignore risks to preclude deficiencies in their likely responses from being exposed.

Different entities may be responsible for managing different forms of risk at different stages within a planning process. Studies on governmental and other forms of bureaucracy, for example, examine the appropriate degrees of discretion to grant to field agents, also known as "street level bureaucrats," under different circumstances (e.g., Lipsky 1980; Wilson 1989). Efforts to reduce uncertainty associated with technical risks can involve increased standardization of procedures and internal reporting to supervisors (Cyert and March 1963). Too much standardization, however, can lead to lower morale, disenchantment with project goals, increased tensions between employees and managers, conflict between the agency and external stakeholders, and reduced motivation and creativity (Adler and Borys 1996; Gouldner 1954; Landau and Stoudt 1979; Merton 1940; Wilson 1989).

Appropriate degrees of empowerment of the resource specialists on ID teams to manage risk in NEPA processes may be dependent on internal agency relationships and cultures. Wilson (1989) argues that agencies with strong internal consensus about their critical task(s) benefit from empowering field agents. Meanwhile, in organizations where critical tasks and agency goals are ill-defined or highly debated, discretion granted to field agents can be detrimental to mission achievement. In the first case, field agents are free to pursue flexible, context-appropriate strategies to meet a common goal. In the latter, field agents may pursue goals at odds with others in the agency. Prior research has identified a general lack of consensus on critical tasks associated with Forest Service NEPA processes (Stern et al. 2010a).

Different entities might have differing officially designated responsibilities, such as staffing an ID team,

communicating with the public, or determining a project's purpose and need. How individuals, in their various roles, respond to risk may be dependent upon both survival and learning anxieties, how they perceive trade-offs between process and resource risk, and their perceptions of their own degree of responsibility for achieving particular outcomes. Kutsch and Hall (2010) examined how some identified risks are dismissed or otherwise categorized as irrelevant. Risks can be dismissed due to a lack of agreement about them on the work team, purposeful denial, or other forms of over-simplification. Kutsch and Hall (2010) argue that dismissing risks as outside the scope of the project is particularly common when assigning responsibility for who should deal with a particular risk. In some cases, risks may fall into the category of *taboo*, where actors may fear disclosure of the risk for any number of reasons. Avoidance of taboo subjects can cloud risk identification discussions early in a process. Failure to act upon identified risks might also result from a "suspension of belief" (Kutsch and Hall 2010), akin to basic responsibility denial or avoidance (see Freeman et al. 2011). Kutsch and Hall (2010) argue that this is likely to be most common in overburdened teams which choose to deal with only the most pressing issues, ignoring, or discounting others. Doubts about personal abilities to effectively address risk can also hinder risk management efforts.

In the remainder of this paper, we discuss how perceptions of risk influence incremental decisions throughout NEPA processes in the U.S. Forest Service, identify tradeoffs in the management of different forms of risk, and consider potential implications for adaptive ecosystem management and agency performance. The findings result primarily from our inductive analysis of interview transcripts, though they are also informed by the document review. The discussion of implications draws upon other related research as well.

Results: Project Risk in U.S. Forest Service NEPA Processes

External relationship risk dominated interviewees' explanations of their incremental decision-making processes throughout the case studies. While risk management strategies also incorporated other risks, these other risks typically emerged as a result of perceived external relationship risks. Strategies included narrowing project scope or scale (programmatic), changes in analytical techniques (technical), the addition of extra mitigations (technical), changes to the nature of public involvement and disclosure (external relationship), and the massaging of internal relationships (internal relationship).

Changes to project scope, scale, and locations were made to avoid and/or minimize process risks, in particular from external relationship risk sources expected to emerge later in the process. In some cases, interviewees explained dropping an area from consideration in a project due to expectations of external pressures in the form of appeals or litigation. In other cases, the entire nature of the purpose and need would change to avoid expected appeals or litigation. One IDTL explained,

> This DM was very good at saying, 'Okay, if I make this decision, I best meet the purpose and need; however, I have a very high likelihood of appeals and litigation… Appeal and litigation affect time. I therefore cannot take that risk… so it is best to back off in the beginning and less meet my purpose and need instead of not at all.

Other common responses to external relationship risks included conducting analyses that agency personnel believed to either be unnecessary or far more detailed than necessary for understanding or predicting resource impacts. While all interviewees professed a clear sense of duty to perform analyses sufficient to protect the resource and effectively analyze potentially significant impacts, fears of public opposition, appeals, and litigation could also drive analytical decisions. One DM explained,

> If you think that a project is going to be generally supported and not opposed [by the public], you're probably going to do a little less detailed work, but you still want to do it well enough… but on a project like this, we knew we'd have a lot of interest. There was a lot of work put into this project, a lot of work, very detailed.

In three of the examined processes, interviewees described performing analyses that they considered to be unnecessary to understand likely impacts or to protect the resource. In each case, they described a pressure to prove to the public that the Forest Service had been thorough enough to avoid appeals or litigation. Multiple interviewees explained this to be a common practice on other NEPA processes in which they had participated as well.

In addition to the quantity of analyses, analytical techniques could also be driven by fear of public opposition or litigation. Interviewees explained that though resource specialists typically would have discretion in this sense, supervisors would sometimes request specific adjustments to minimize the likelihood of public scrutiny or opposition. One IDTL explained the importance of standardized analytical techniques for certain resource analyses to protect the process from additional scrutiny that might result from using different techniques in different areas, noting,

> If you publish a document on [another] District and the hydrologist has done an analysis this way, and you publish a document here, and the hydrologist has done it a certain way here, and it is not consistent – we just don't think that is good for credibility, because the appellants zoom into that.

Multiple interviewees noted that prior court decisions could drive analytical choices. In one case, for example, an IDTL asked the Regional Office whether they could use a particular watershed model that had been used elsewhere. Personnel in the Regional Office instructed the team not to use the model because it would represent a departure from the traditional approach used on the specific forest and could expose the process to additional external scrutiny by setting a new precedent. The IDTL described the response from the Regional Office after the ID team submitted their preliminary report, which did not include the model.

> It was like [from the Region], 'Hey, you need to run some models because there was this court decision, and it was up-held because they had model information, so you got to run the model for this.' [laughing] It was kind of like, 'okay that's a 180 from what you told us initially.' And then after the model was run, and we sent the document out, [the Region came back and said], 'Oh jeez, maybe you shouldn't have run the model because… the court case was reversed.' [laughing] And I was like, 'you can't have it both ways.'

While these reversals were clearly frustrating for the team, interviews on this case and others indicated a consistent desire to minimize any risks that could delay or halt implementation of projects—in particular appeals and litigation. As such, even though most interviewees noted that analytical choices were sometimes not what they would have chosen in terms of efficiency for adequately assessing likely impacts, they would move forward for fear that if they did not, their work up to that point would have been in vain.

The disclosure of analyses was also influenced by perceptions of project risk based on external relationships. Despite calls for shorter NEPA documents in the Forest Service, most IDTLs and team members felt pressure to include what they considered to be otherwise unnecessary information in their NEPA documents. Interviewees described pressure from the DM in some cases to do so. In other cases, this was attributed directly to a general fear of the public pointing out that something was missed and re-opening the NEPA process.

> Sometimes you take the approach, well, if the public can see it, then they are not so, I guess, quick to be questioning other things. I mean a lot of times it's just easier if you got it out there for the public to see it. Then, maybe they feel more comfortable with your analysis, and they wouldn't tend to come in and look at your project record or FOIA[1] a specialist report or things like that if it is just kind of all laid out there.

Public involvement techniques were also sometimes based on assessments of external relationship risks. In particularly controversial cases, interviewees described that strategies designed to minimize public engagement would sometimes be employed, similar to what Predmore et al. (2011a, b) describe as "containment."

> It was clear that some people [in the public] felt so strongly about this [project] that there wasn't anything we were going to say or do short of no action that they weren't going to appeal and litigate. So why go through all that? So we restricted it to a pretty formal process. We had a couple meetings early, public field trips and a public meeting or two, and then after that, it was just exchanging paper, which is a little unfortunate. But it was just the way we thought we needed to proceed here.

In other cases, heightened perceptions of external relationship risks resulted in more public engagement. In one case, the public developed an alternative that was selected for implementation by the agency through a collaborative process. The DM reflected,

> [It produced] a better project, and in the end, it engendered wide support for the project. So, if we had just kind of done our own thing, produced a document, asked for comments, and didn't really engage with the community when they wanted to engage, then they're going to be suspicious and not trust what we're doing out there and probably would have ended up with lots of lawsuits. We still got a lawsuit on this… but they didn't ask for an injunction.

Interviewees also reported that DMs would typically become more engaged directly with public involvement on more controversial projects, particularly as the process progressed closer to the final decision stage. The intent would be to diminish external relationship risks and avoid unwanted outcomes, such as appeals and litigation. One DM explained,

> The county commissioners were not keen on us [doing a specific project activity] …They were

[1] The Freedom of Information Act (FOIA) provides citizens with the right to request access information from the federal government. Agency personnel use the term "FOIA" as a verb indicating the action of submitting a FOIA-related request for information.

> working it through the governor's office, so we just had one delay after another… The rhetoric was well, you're not listening to us. Well, is it that we're not listening or that we're not coming up with the answer that you want? Those are two different things, and so we spent a lot of extra time courting those relationships. We could have made that decision long before…but we needed to spend, we needed to make sure our primetime players [e.g., county commissioners and government representatives] were, I don't want to say comfortable, that might be too strong, but we, I wanted to minimize the threat of appeal and litigation and so that meant spending a little extra time courting, making sure that they felt that they truly were involved.

In most interviewees' experiences, the DM would become more directly involved not only with public engagement, but also with other NEPA process tasks in situations where greater public controversy was perceived. In some cases, changes made by the DM were accepted and even welcomed by ID team members. In other cases, team members clearly felt frustrated. One resource specialist explained how a DM's intervention went against what the team felt was best for the resource. In this case, the changes motivated by the DM's fear of external relationship risks may have heightened risks emerging from internal relationships between the DM and ID team.

> I mentioned that the line officer was involved in the alternative development, but also the specialist [be]cause you are representing a resource. And so, you have ownership, and when you make an alternative [as the ID team], it is almost, I won't say compromise, but sometimes there are compromises. And you feel that's a good balance, but then when things start getting broken out [by the DM's changes], that package becomes eroded. And some of the compromises then become eroded, and they don't necessarily mean the same as they did before…

In other cases, the DM would make efforts to directly address internal relationship risks that might emerge from his or her interventions. One ID team member explained,

> I remember a few specific things that I had fought pretty hard for. I felt pretty passionate about treating a specific unit, but they had issues with other resources. And I remember in decision [the DM] came and said, 'Listen here's how I am going to go. How do you feel about that? Can you live with it? You know if you can't live with it, we will do something different.'

Despite attempts by DMs to address the feelings and opinions of ID team members, concerns about external publics seemed to bear at least equal weight (if not greater in some cases) at the decision-making stage. For example, one DM explained,

> It's [the final decision] ultimately my responsibility, and I'm the one that signs my name. But I think if they [ID team] feel like I've asked what their thoughts are and what their concerns are – is this the decision you want me to make? Now I may have to go back and say, 'I really would like to do that [the decision the ID team wants], but let me tell you, there's this and this and this. And I've got to deal with those [public issues], and you guys know it. So this is what we are going to do.'

According to IDTLs and team members, the balancing act between what they thought was best for the resources and what the DM would deem politically feasible was a continual source of frustration that would negatively affect the morale of the entire team.

To further understand how agency personnel navigate the NEPA process, we asked each of the interviewees in the study about what they felt would be the best way to improve their performance in Forest Service NEPA processes. The prevalent answers consisted of consulting NEPA advisory personnel within the agency, attending appeal proceedings, and monitoring court rulings for analyses and project design modifications that make a project more defensible in court. Similar to other studies (Mortimer et al. 2011; Stern et al. 2010a), our interviews revealed strong sentiment that a successful NEPA process is one in which a project actually gets implemented. One IDTL explained,

> [W]e have a NEPA workshop every year. And we try to bring back, you know our attorneys are down there, and they suggest to us certain ways to be doing things. So, we try to bring that back to the specialist every year and say, 'Hey, you need to be doing it this way. You need to be taking on and maybe using this model because of the court cases.' I mean we are pretty good as far as having the attorneys engaged, and we have a monthly conference call with the attorneys in the Regional Office and the Regional Planners, so that helps keep us abreast of the issues.

In summary, risk-related decisions were made at each stage of the NEPA processes we examined in the study, often at the expense of what interviewees considered to be the most appropriate techniques to ensure optimal natural resource management. Interviewees explained how these types of decisions were common on other NEPA processes they had worked on as well. While all forms of risk were clearly present within the cases we examined, agency personnel

regularly discussed decisions they made at each stage of the NEPA process primarily in terms of external relationship risks. Even in cases where internal agency supervisors demanded certain actions, the ultimate understanding of the interviewee was that these actions would help to manage external relationship risk. Interviewees also focused on navigating external relationship risk as the most important element of learning how to do a better job. Employing better science or investigating new resource management approaches as a strategy for improving their processes were not central themes in any interviews.

Discussion

Our cases demonstrated a particularly strong emphasis on managing process risk, in some cases, in exchange for potentially elevating resource (and organizational) risk, by removing a critical area or going against their own expert judgment. Though some decisions clearly had elements of personal risk associated with obeying superiors within the agency, most risk that interviewees discussed ultimately emerged from perceptions of external relationships.

We noted a distinct lack of an emphasis on technical or structural risk within the case studies. We expect that the lack of discussion of elements of structural risk might be the result of the particular cases selected. In prior research, high degrees of turnover of key personnel have been linked to less positive outcomes (Stern and Predmore 2012; Stern et al. 2013).Though there were instances of turnover, this did not appear to be the case on these processes. The low level of concerns about technical risks may be more reflective of larger trends in the Forest Service. Over 90 % of IDTLs in our prior survey agreed with a statement that the best available biophysical science was employed on their projects, and only 4 % felt a high degree of uncertainty in the likely effects of their proposed project (Stern et al. 2013). Our interviews support earlier hypotheses that high quality science may be more or less taken-for-granted by resource specialists in the U.S. Forest Service as the expected norm (Stern et al. 2013).

As such, we focus the remainder of our discussion on the potential implications of agency personnel's focus on external relationship risk. External relationship risk management requires large commitments of time and effort (Hoover and Stern 2014). In an era of increasing demands and tightening budgets, the expenditure of this energy involves tradeoffs, consciously or otherwise, between managing other forms of risk and other activities, such as learning, relationship-building, and adaptive ecosystem management. The adaptive ecosystem management paradigm promotes holistic ecosystem approaches that stretch beyond convenient political or jurisdictional boundaries, collaborative deliberation between stakeholders, and interdisciplinary learning through systematic monitoring, reflection, and adjustment (Bjorkland 2013; Brown and Squirrel 2010; Committee of Scientists 1999; Predmore et al. 2008). We consider the tradeoffs associated with the focus on external risk management strategies upon project scope, internal and external relationships, and efforts to learn within an adaptive ecosystem management framework.

We begin with a consideration of programmatic risk associated with project scope. Similar to prior studies (MacGregor and Seesholtz 2008; Stern and Mortimer 2009; Stern et al. 2010b), interviewees in this study conveyed that it was common in their experience for the scope or scale of a particular project to be narrowed early in the process to avoid unwanted public controversy or opposition. Interviewees lamented that in some cases this meant suboptimal natural resource management. However, narrowing the scope of the project, or removing particular areas, was generally seen as necessary to eliminate obvious points of contention that could be raised by external interests. While ecosystem management can still theoretically occur in these cases through disaggregation and sequential implementation of sets of projects, we uncovered no evidence of this in our sampled cases. In some cases, interviewees expressed a clear opinion that active management in certain areas was just not worth pursuing at all due to the inevitability of external opposition. We have no evidence to suggest what would have happened if these areas were included or if the scope of projects was not reduced. Thus, the impacts on the landscape of narrowing the scope of proposed actions are not fully understood. We can only assume that less expansive active management is taking place contemporaneously as a result of this practice wherever it occurs.

The likely impacts of the emphasis on external relationship risks upon social and organizational learning may be more apparent. Social learning is believed to contribute to enhanced natural resource management by encouraging active exchanges between the agency and its stakeholders which result in shifts in understanding in each (Daniels and Walker 1996; Cundill and Rodela 2012). As a component of adaptive ecosystem management, social learning seeks to establish lasting learning relationships between agency personnel, scientists, and other stakeholders that can foster mutual, ongoing learning and understanding (Stankey et al. 2005). Organizational learning takes place within an organization and can emerge not only from organizational culture, training, and internal communications, but also, like social learning, from sharing and deliberating diverse knowledge and perspectives, deliberate experimentation, monitoring, and reflective practice (Cundill and Rodela 2012; Molnar and Mulvihill 2003).

Opportunities for social learning may be embedded within the public involvement strategies employed by the

agency. Perceptions of external relationship risk can lead to multiple public involvement strategies according to our interviewees. At least one interviewee in each case described public involvement as a defensive strategy intended to decrease controversy and avoid appeals or litigation, as opposed to increasing greater understanding among the individuals involved. In some cases, our interviewees had been part of a clearly adversarial response to public pressures, explicitly limiting public engagement. In these cases, efforts were focused most strongly on creating a "bullet proof" document that could survive appeals and litigation. Prior research suggests that such efforts may have detrimental effects on public relations (e.g., Innes and Booher 2004; Predmore et al. 2011b; Stern et al. 2013). Moreover, they strongly limit positive social learning about effective resource management, which occurs primarily through the open sharing of diverse forms of knowledge and perspectives in trusting environments (Cundill and Rodela 2012).

In other cases, external relationship risk management strategies included substantial public engagement which contributed directly to meaningful social learning. In one case, for example, explicit efforts to build common understandings of the problem and desired future conditions reportedly improved external relationships considerably and reduced concerns about public opposition to management proposals into the future. Our interviews support previous suggestions that differential responses are largely driven by the value systems of the agency personnel involved and how they perceive public involvement (Hoover and Stern 2014; Predmore et al. 2011a, b).

Organizational learning through adaptive management entails using natural resource management actions as learning opportunities or purposeful experiments through which to adjust future actions and/or policies (Brown and Squirrel 2010; Stankey et al. 2005). Our cases suggest that a form of organizational learning is occurring. However, the primary focus of the learning was about better procedural compliance and defensibility in appeals or in litigation, not necessarily better natural resource management directly. Agency personnel involved in NEPA processes consult NEPA advisory personnel, attend appeal proceedings, and monitor court rulings for analysis and project design modifications that may make a project more likely to be implemented. Through these efforts, agency personnel learn how to better manage process risks, which is undoubtedly useful in completing processes. The time and effort associated with these efforts, however, may preclude time for focusing on other important elements of adaptive ecosystem management.

Multiple scholars and practitioners highlight mechanisms for effective adaptive management to enhance organizational learning about ecosystem management in NEPA processes. Bjorkland (2013), for example, discusses the importance of ecological monitoring and the apparent lack of it in federal natural resource agencies. Lack of funding for monitoring, as well as an over-emphasis on making accurate and defensible predictions in the face of external relationship risks, has worked to preclude extensive monitoring in the Forest Service (Bjorkland 2013; Stern and Mortimer 2009). As a potential solution, Nie and Schultz (2012) discuss the concept of "triggers" in Forest Service NEPA processes. Triggers involve building conditional commitments into NEPA documents for cases in which predictions of likely impacts of management actions don't match monitoring efforts. Theoretically, these "triggers" and resulting management actions could potentially enhance public relations in the long run if collaborative monitoring and joint learning were to take place for mutually agreed upon outcomes (Cundill and Fabricius 2009; Nie and Schultz 2012). However, our interviews suggest that fears of innovating within the NEPA process may be holding some agency NEPA personnel from experimenting with the idea, thus forgoing opportunities to address resource risk directly and both technical and relationship risk sources.

The focus on external relationship risk further diminishes organizational performance by diverting attention from potential organizational and internal relationship risks. Recent research has revealed the importance of internal team functioning in producing positive planning outcomes. The empowerment of the IDTL, positive relationships between the ID team and the DM, and elements of team harmony and intra-team collaboration were among the strongest predictors of NEPA process outcomes in a recent survey of 489 NEPA processes in the U.S. Forest Service (Stern and Predmore 2012; Stern et al. 2013). Studies from multiple fields have strongly associated the quality of internal relationships and team morale with improved performance (Gordon and DiTomaso 1992; Schein 2010; Wilson 1989). Risk management strategies aimed at addressing internal relationship risks, however, were sporadic and unmistakably secondary to strategies employed to address external relationship risks. Examples of such strategies that could contribute to enhanced organizational learning and performance include team-building activities, encouraging collaborative dialog and deliberation on the ID team, and empowering and supportive leadership styles, among others (Stern et al. 2009; Stern and Predmore 2012). While interviewees discussed internal challenges, disagreements, and frustrations with peers and superiors, risk management strategies almost exclusively focused on addressing perceived pressures brought to bear by stakeholders external to the agency.

Kutsch and Hall's (2010) explanations of why people sometimes avoid addressing risk might help to explain the

lack of attention to internal relationship risk management. The hierarchical organization of the Forest Service may preclude comfortable bottom-up exchanges with supervisors. The long history of this structure (Kaufman 1960) may in effect contribute to a categorization of internal relationship risks as taboo. Moreover, at the ID team level, the IDTL may not feel sufficiently empowered to address issues on the team, which is usually made up of individuals at the same level of hierarchy as the IDTL. Kutsch and Hall (2010) also argue that risk avoidance is particularly common in overburdened teams which choose to deal with only the most pressing issues, ignoring or discounting others. As such, structural risk sources (whether detected or not) may be contributing to the under-utilization of internal risk management strategies. In other words, competing tasks and limited resources may preclude teams from focusing on internal relationship enhancement. Moreover, natural resource specialists may often not be trained in addressing interpersonal issues and thus might not feel comfortable or capable of handling them. These issues may also be difficult to detect as particularly important, given the overwhelming organizational focus on external relationship risks.

In summary, while multiple risk sources can emerge within any planning process, our interviews revealed a strong emphasis on risk management strategies addressing one form of project risk – external relationship risk. While managing this form of risk may be necessary to complete obligatory processes, the time and energy spent may come at the expense of ignoring other important risks to the process, to the resource, to public relations, and to agency morale and performance. Moreover, the potential benefits of adaptive ecosystem management approaches appear to be constrained by this emphasis. We expect that examining a broader sample of cases would reveal a wider array of risk management strategies than we uncovered in our selected cases. However, the collective experiences shared by the agency personnel we interviewed suggest that the primary emphasis on external relationship risk may be prevalent across the agency. Other data suggest this may be the case as well (MacGregor and Seesholtz 2008; Mortimer et al. 2011; Predmore et al. 2011a, b).

Conclusions

While the official intent of NEPA is to "promote efforts which will prevent or eliminate damage to the environment" while encouraging "a productive and enjoyable harmony between man and his environment" (42 USC Sect. 4321), the law only requires an environmental analysis and the full disclosure of its results for all major federal actions with the potential to significantly impact the environment (Stern et al. 2010a). As such, the only mechanisms by which to achieve its substantive goals are through pressures brought to bear by those participating in NEPA processes and/or reviewing NEPA documents (Dreyfus and Ingram 1976; Lindstrom and Smith 2008). Once agency personnel have developed preliminary proposed actions, these pressures seem to predominantly come from external entities. As such, our findings regarding a strong emphasis on managing external relationship risks may indicate that this particular mechanism of NEPA is in fact alive and well. However, it is unclear whether the mechanism is actually leading to better outcomes for the environment or any entity involved. As such, the tradeoffs we have described between process risk and resource risk may be cause for concern. Natural resource management is an inherently complex challenge. While attention to the policy and social dimensions of natural resource problems is critical, we question whether the foci on procedural compliance and "bulletproofing" is beneficial to any party involved. We observed that these emphases can divert attention away from adaptive ecosystem management, social learning, and internal organizational effectiveness.

We thus urge resource managers within the Forest Service and other land management agencies to consider the full suite of risk sources in their project planning and deliberately weigh the potential consequences of different forms of risk management or avoidance. While the fear of risks associated with innovating appear to be dominant within the agency, the risks associated with failing to innovate may be even greater. Comparing current approaches to those conceptualized within adaptive ecosystem management might be particularly revelatory and help resource managers to reconsider the benefits of social learning and adaptive monitoring. We urge external stakeholders to consider the costs incurred by the agency in response to the pressures they bring. Which strategies are most likely to result in more collaborative responses from the agency as opposed to defensive responses? We urge researchers and practitioners to make use of the theoretical categories of risk we have described in this paper to continue to study their interactions and contribute to finding an appropriate balance for effective natural resource management.

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