

Interdisciplinary collaboration within project-level NEPA teams in the US Forest Service

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Interdisciplinary teamwork has become a foundation of natural resources planning and management in the US. Yet, we know little about the degree of interdisciplinary collaboration of natural resource planning teams. We conducted 10 case studies of Forest Service NEPA (National Environmental Policy Act) teams working on projects related to the 2005 Travel Management Rule. Although teams' critical tasks were similar, we found wide variation in interdisciplinary teamwork approaches. We propose three typologies of teamwork processes and discuss relationships between teams' work approaches and process outcomes. Rather than being easily labelled as holistically 'collaborative' or 'non-collaborative', teams may more typically move in and out of different modes of collaboration (or non-collaboration) throughout the different stages of teamwork processes. Results suggest that greater external pressure may lead teams to adopt a more internally collaborative approach and that empowering leadership styles may enhance the success of more collaborative approaches in terms of perceived outcomes. Future research on the relationships between extra-team context, team collaboration, and leadership styles may provide insight into the drivers of outcomes in natural resource planning teams.

Keywords: US Forest Service, interdisciplinary, teamwork, collaboration, National Environmental Policy Act

1. Introduction

Collaboration among disciplinary experts has become an oft-repeated and codified mandate for managing complex environmental systems, as evidenced by calls for interdisciplinary approaches in the academic literature (e.g. Pennington 2008), the National Environmental Policy Act (NEPA), the National Forest Management Act (NFMA), and other related guidelines and legislation. The US Forest Service has adopted an 'interdisciplinary team' approach to navigate NEPA planning processes,

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which involves multiple disciplinary specialists with varying expertise working together to identify key issues associated with a proposed action, develop alternatives, analyse the likely impacts of each alternative on the human and natural environment, and engage the public throughout the process.

Collaboration, and deliberation in particular, among experts with different knowledge, techniques and scientific approaches can lead to a broader and more thorough understanding of the issues at hand, enhanced learning, a wider array of potential alternatives to consider, and more sound resource management decisions (Putnam 1994, Simons and Peterson 2000, Stern *et al.* 2009, Weible *et al.* 2010). These practices also align with the principles of ecosystem management, to which the Forest Service subscribes (Phillips and Randolph 2000, USDA Forest Service 2008).

Through case study research, we examine the extent to which 10 Forest Service NEPA teams used collaborative, interdisciplinary processes over time. We identify three typologies of intra-team collaboration and examine relationships between contexts, team collaborative processes, leadership styles and team members' perceptions of process outcomes. We take an inductive approach to case study research with an end goal of building a testable theory for future research on interdisciplinary collaboration and leadership in natural resource management teams (Eisenhardt 1989).

2. Interdisciplinary collaboration

Key elements of interdisciplinary team collaboration identified in the literature include: (1) an effort to integrate, and or make cohesive, different themes shared by several professionals from several disciplines; (2) a shared vision of common goals and common decision-making process; (3) collegial inter-member relationships with open and honest communications based on mutual trust and respect; (4) mutual dependence of individuals on one another such that results in the output of the group are greater than the sum of the inputs of each member; (5) the empowerment of team members based on knowledge and experience rather than title; (6) group-oriented work process; and (7) frequent communication among team members (Garcia 1989, Hall and Weaver 2001, D'Amour *et al.* 2005). In general, enhanced collaboration within interdisciplinary teams is believed to lead to better outcomes (Hackman 2002, D'Amour *et al.* 2005).

Interdisciplinary collaboration, however, poses numerous challenges. In an agency with competing demands and limited resources, dedicated time for focused interdisciplinary discussions may be limited (Stern and Mortimer 2009). While scientists within the same discipline commonly share a similar lexicon and an overlapping suite of conceptual and methodological frameworks, very few concepts may be self-evident in interdisciplinary settings (Lewicki *et al.* 2002, Gray 2004, Gray and Putnam 2005, Pennington, 2008). This poses challenges for communications across disciplines and elevates the importance of explicit dialogue and interchange between specialists to achieve the benefits of interdisciplinary teamwork. These types of conversations may not come naturally to those trained in the traditional scientific disciplines, and these types of teamworking skills are rarely the focus of standard training (Hall and Weaver 2001, Innes 2005, Pennington 2008). As a result, teams may often find themselves working in a *multi-disciplinary* fashion instead of interdisciplinary fashion. In such instances, disciplinary specialists in a group may work on the same project but independently or in parallel, with their work connected

primarily (or only) through a team leader (Garcia 1989, Ray 1998, D'Amour *et al.* 2005, Innes 2005). This again limits the gains achieved through interdisciplinary teamwork.

Teams are heavily influenced not only by the predispositions, values and working styles of their leaders and members, but also by the contexts in which they operate (Lawrence and Lorsch 1967, Gladstein 1984, Hackman 2002, Pearce and Sims 2002, Mathieu *et al.* 2006, Taggar and Ellis 2007). Team leadership has long been recognised as a key factor in enhancing or inhibiting intra-team collaboration. Numerous researchers, for example, suggest that leaders who regularly devolve power to team members and engage in cooperative goal-setting tend to catalyse intra-team collaboration while more directive leaders who rely on the power of their position to dictate team processes tend to inhibit it (Pearce and Sims 2002, Waugh and Streib 2006, Sarin and O'Connor 2009). Forest Service NEPA teams each have a designated team leader, who is typically a disciplinary expert as well but has no formal authority over other team members. The workforce of the Forest Service has been in transition as environmental legislation and ecosystem management principles have demanded a more diverse set of skills and knowledge and various external stakeholders have expanded their roles in agency planning (Tipple and Wellman 1991, Stern *et al.* 2009, Stern *et al.* 2010). Prior research suggests that the interactions between team members and team leaders in the Forest Service may be heavily influenced by individual perspectives drawn from disciplinary training, values about science and about appropriate roles of the public, and individual abilities to interact in a collaborative fashion with internal and external stakeholders (Garcia 1989, Stern and Mortimer 2009, Stern *et al.* 2009, 2010).

External pressures, time and budget limitations and competing priorities may each also bear strong influence on the degree of collaboration within a team (Bentrup 2001). Moreover, teams in the Forest Service often shift in membership over time. Other temporal shifts may involve variations in the intensity of the work for different team members, differences in the tasks performed at different stages of the NEPA process and changing priorities of the decision maker (Cross *et al.* 2008, Stern and Mortimer 2009, Stern *et al.* 2010). As such, we recognise that a binary categorisation of an interdisciplinary team as collaborative or non-collaborative would provide an inaccurate picture (Ilgen *et al.* 2005). We prefer to focus upon trends in intra-team interdisciplinary collaboration during the life of 10 NEPA processes. We also examine team members' perceptions of team leadership styles, external contexts and process outcomes to better understand the potential implications of observed patterns in interdisciplinary collaboration.

2.1. Methods

We conducted 50 semi-structured interviews with NEPA team leaders ($n = 11$)¹ and NEPA team members ($n = 39$) of 10 completed NEPA processes related to travel management within the US Forest Service. Thirteen interviews were conducted by telephone, the remainder were in person. Interviews focused on processes used by each team to comply with NEPA and team members' opinions of those processes and associated outcomes.

We selected projects related to the 2005 Travel Management Rule (36 CFR Parts 212, 251, 261 and 295) to provide a consistent context for comparison of projects that clearly require the input of multiple disciplines. A major purpose of the rule is to

improve recreation opportunities while reducing conflicts and environmental impacts by designating a system of roads available for motorised use. The rule stresses that designation decisions are to be made based on collaboration with multiple stakeholder groups who often have diverse, conflicting opinions (Blahna 2007).

The sample frame consisted of 27 NEPA teams involved in completed travel management projects that were the subject of a 2008 survey (see Stern *et al.* 2009). Ten cases were selected to achieve maximum variability in pairings of responses on the following survey items, each measured on a five-point agree/disagree scale: 'The process led to an excellent outcome' and 'Team members disagreed about the preferred alternative'. We felt these statements best reflected the degree of intra-team deliberation likely to have taken place in each process (Stern *et al.* 2009). Where the selection variables were otherwise equivalent, we aimed to achieve geographic diversity in the sample. The selected cases included projects from seven of the nine Forest Service regions and were of various spatial scales. Regions Five and Six were not represented in the case study. Team sizes ranged from 7 to 27 members.

We sent emails to 127 NEPA team leaders and members involved in these 10 processes followed by telephone calls to those who did not respond to the initial email request. Fifty-one of the 127 leaders and team members responded to our solicitation and 50 volunteered to participate (4 to 6 individuals per project) in a one-hour interview about their experiences. The one team leader who declined to participate provided a detailed, written narrative on his perceptions of the team experience. All other team leaders were interviewed in person.

Semi-structured interview guides were developed for team leaders and team members. Interviews with team members focused on individuals' perceptions of the teamwork process and satisfaction with the project and its outcomes. Specific topics discussed with team members included perceptions of how the team interacted as a group in and out of meetings, what went well and did not go well on the team, how the individual interacted with the team leader and other team members, individual satisfaction with the process and project outcomes and perceptions of the leader and other team members. Interviews with team leaders focused on their perceptions of the teamwork process, how they interacted with the team, how other team members interacted with each other, the process for developing and evaluating alternatives, the public involvement process, and satisfaction with the process and its outcomes.

Interviews were recorded and transcribed verbatim for qualitative analysis. Using QSR NVivo 7.0, interviews were coded and re-coded to identify themes and sub-themes relating to respondents' perceptions of team processes and outcomes. While general categories of interest were identified *a priori* (such as leadership style), additional themes and sub-themes emerged from the data to create a more complete picture of NEPA team experiences (such as the frequency of teamwork). Coded responses were used to classify team members' and leaders' overall satisfaction with the process, their perceptions of outcomes, and team leaders' leadership styles. Perceptions of outcomes and overall satisfaction with the process were subjectively categorised as either 'satisfied', 'somewhat satisfied' or 'dissatisfied'. Examples of statements used to categorise responses are included in (Table 1).

Team leaders' leadership styles were uncovered through team members' descriptions of their experiences with the team leader and team leaders' own descriptions of those same experiences and their leadership strategies and philosophies associated with the process. The narratives produced were iteratively

Table 1. Examples of respondent statements used for data analysis.

Element	Examples from respondents
<i>Perceptions of process outcomes</i>	Interviewer prompt: How satisfied were you with the decision on this project?
Satisfied	"Very satisfied ... it's amazing to get to this kind of a decision".
Somewhat satisfied	"I was pretty happy with what we got ... as a hydrologist there were a lot of things I would have liked to seen different in it, but as a team leader and knowing what we were up against in terms of [interest group conflict] ... I felt like we did a fairly good job".
Dissatisfied	"I'd say I was less than satisfied with the [end] product".
<i>Overall assessment of satisfaction with the process</i>	Interviewer prompt: Overall, how satisfied were you with this process?
Satisfied	"Very satisfied".
Somewhat satisfied	"I was satisfied. I think I'm satisfied that it was done well. I'm not satisfied that it took so long."
Dissatisfied	"Not satisfied at all. [On a scale from 1 to 10] I'd give it a 2, maybe a 3."
<i>Leadership</i>	
Directive	"My [position as team leader] is to keep them on track, to keep the side discussions to a minimum". "Some [leaders say]: 'We're getting it done by this date and we don't want you to think outside the box' ... they don't have a lot of tolerance for [team members saying]: 'Well, what if we thought about this?' ..."
Empowering	"... he doesn't come and burden you with anything that's extraneous. If he comes to talk to you, it's important and it's never more than it needs to be". "So [the team leader] started this [forest-wide collaborative process] where everybody had to submit all of their projects ... [the team leader], he tries to make it fun. It's still planning planning, but you get ideas. You do a lot of pre-work, but then in the same room you have the line officers, your forest supervisor, your rangers, and all of the specialists ... and you negotiate priorities for the year". "at these big meetings ... if anyone had something to contribute they were given a chance and no one was allowed to take over the meeting ... [the team leader was] very good about that".
<i>ITID* teamwork traits</i>	
Recognition of a common problem	"We've got a lot of roads out there that may be problems now, but at least we can stop things from getting bigger or worse or whatever. That was pretty obvious ... I think everyone bought into that".
Integrated group-oriented work process	"The 'ologists' didn't go off in room A and the timber people in B and the engineer over here in C, and concoct a plan. We all sat in the same room and discussed back and forth, what our concerns [and] issues were".
Frequent communication among team members	"There were quite a number of meetings ... I would say 50 per year [plus] 5 per year formal-type meetings. There were also one-on-ones all the time ... plus there was all the other collaboration with everybody else as well the involved different parties at different times".

(continued)

Table 1. (Continued).

Element	Examples from respondents
<i>ITMD** traits</i>	
Emphasis on individual work	“We had no feedback. No interdisciplinary team feedback to each other as to what we considered important [with other’s analyses]”.
Primary interaction with the team leader	“If [there was an issue with my resource the leader] was calling me every day . . . if there was something in hydrology, he’d bug [the hydrologist] and leave me alone for a couple of months”.

Notes: *ITID ideal-type interdisciplinary; **ITMD ideal-type multidisciplinary.

analysed qualitatively in concert with our literature review on leadership styles. We were only able to categorise leadership by those traits and actions that were directly reported by our respondents. As a result, other styles may have been present beyond our simplistic categories. While many categorisations of leadership styles exist (e.g. Lewin *et al.* 1939, Vroom and Yetton 1973, Burns 1978), the qualitative data suggested some clear divisions most concisely defined by Pearce and Sims (2002) as *empowering* and *directive*. *Empowering* leadership was identified by leaders power-sharing with team members through strategies such as collaborative goal setting and encouraging teamwork and independent action. *Directive* leaders, in contrast, rely on the power of their position to issue instructions and assign goals and tasks to team members.

To characterise the nature of collaboration throughout a NEPA process, we make use of the conceptual notion of ‘ideal types’. Ideal types are conceptual models composed of the essential characteristics of a phenomenon and are often used in comparative research (Weber 1915, Babbie 2007). The term ‘ideal’ is not meant to imply an evaluation of one model as better than another (Gerth and Mills 1946). Rather, ideal types are built as a basis for comparison to observed phenomena and do not necessarily reflect any particular context-specific reality.

We find ideal types useful to clearly distinguish between different teamwork styles. We make use of two ideal types: ideal-type interdisciplinary (ITID) teams and ideal-type multidisciplinary (ITMD) teams. ITID teams exhibited, to at least a moderate degree, the seven traits of interdisciplinary collaboration discussed above. Conversely, ITMD teams are characterised by (1) an emphasis on individual work typified by team members working in parallel rather than together (Ray 1998) and (2) team members who primarily interact with the team leader and/or with team members in the same discipline as opposed to other team members from other disciplines (Garcia 1989, Ray 1998, Hall and Weaver 2001). In this study, no team was entirely representative of what one would expect from an ITID team or an ITMD team for the entire life of a process. Instead, we use the ITID and ITMD constructs as a basis of comparison for our observed team typologies. In addition, to avoid confusion, we refrain from using the term ‘interdisciplinary team’ to describe Forest Service NEPA teams, although that is the common term in use within the agency.

To identify patterns in interdisciplinary collaboration over time, we distinguish between distinct phases of process. NEPA processes generally begin with the identification of a purpose and need followed by a scoping period during which internal and external stakeholders identify key issues associated with a proposed

action. We term this stage 'Problem definition and scoping'. Following this phase, alternative courses of action are developed and likely impacts of each alternative are then analysed. We term this phase 'Analysis'. Finally, analyses are disclosed in an environmental document and a public comment period ensues prior to a final decision being made. We term this phase 'Document preparation and comment period'. While multiple steps occur within each phase, we found this delineation to be helpful in understanding differences in intra-team interdisciplinary collaboration throughout the process.

3. Results

3.1. Forest Service team typologies

Three team typologies emerged from our interviews based on the primary patterns of teamwork we observed: primarily-collaborative work teams, periodically-collaborative work teams and primarily-disciplinary work teams. We present these typologies below and describe the contextual situations in which each typology emerged. All teams exhibited traits of either ITID teams or ITMD teams in at least one point in their process; most teams exhibited traits of both (Figures 1 to 3).

We coded four teams' mode of work as collaborative throughout the majority of their processes. Teams of this type behaved in an ITID manner more often than an ITMD manner. These *primarily-collaborative work* teams met together as whole units more often than other teams. During these meetings, team members would give input on issues unrelated to their discipline. Team members had a great deal of input in defining the team task and goals. Throughout the process, leaders solicited input from each team member about their disciplinary foci and about issues unrelated to their disciplines. Team members generally reported that they respected and valued opinions in conflict with their own.

Figure 1 reflects the general work patterns of primarily-collaborative teams. The x-axis represents the time from project initiation to the submission of the final

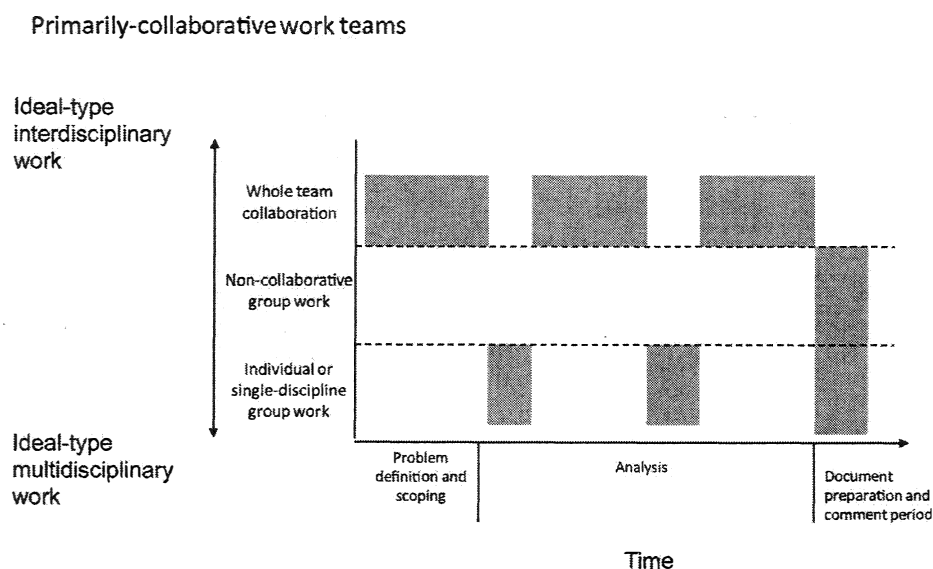


Figure 1. Generalised work patterns of primarily-collaborative work teams.

analysis to the decision maker. The y-axis represents the mode of work reported throughout the process. The shaded area indicates our interpretation of the nature of teamwork at time x . For the purposes of these typologies, the peaks and troughs illustrated in the figures are representative of the *general* pattern of work processes that were observed across all teams that fit that typology and do not explicitly describe any *specific* team that was observed. Whole-team collaboration means that the whole team assembled to collaborate in a group-oriented, integrated manner, discussing issues not explicitly related to their own disciplines. Non-collaborative group work is characterised by team members meeting together, but not working in a manner that included cross-disciplinary discussion and co-operation. For example, some teams assembled to discuss how to define the problem, but team members limited their contribution to discipline-specific issues. Individual or single-discipline group work is characterised by team members working individually on discipline-related work or working in disciplinarily-homogeneous groups.

In Figure 1, the mode of work is most often characterised by whole-team collaboration. Team members regularly worked to integrate their analyses with the work of others, working in an individual or single-discipline group manner only for relatively short periods of time. At the end of the analysis, teams used non-collaborative group work and individual or single-discipline group work to assemble the document and respond to comments. This final stage was typical of all teams in our study.

Two teams worked in a whole-team collaborative manner more periodically (Figure 2). Compared to primarily-collaborative work teams, these *periodically-collaborative work* teams functioned more often in an individual or homogenous group manner, characterised by team members or disciplinary groups working primarily independently from each other, connected primarily by the team leader (Figure 2). The team members or disciplinary groups in these cases focused on their portion of the analysis and did not intervene in the affairs of other disciplines. These teams met less often as a whole group and had less input defining the task. Team

Periodically-collaborative work teams

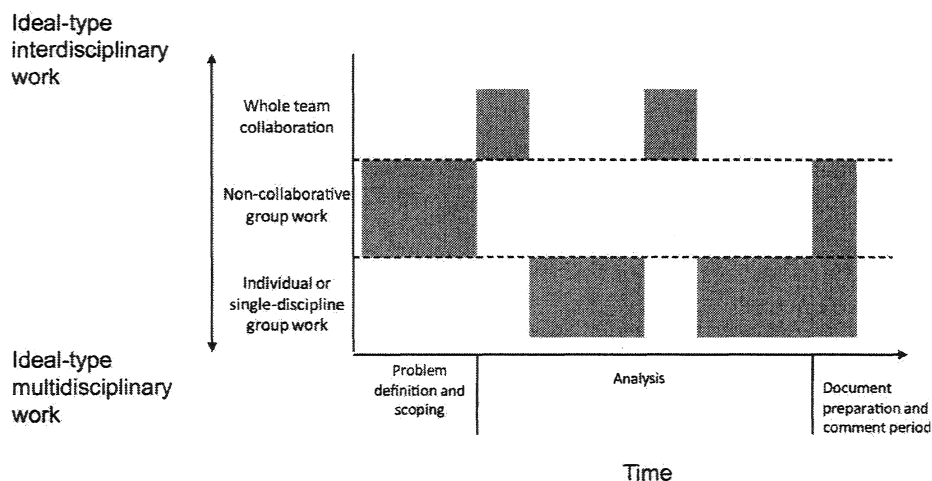


Figure 2. Generalised work patterns of periodically-collaborative work teams.

members commonly explained that their interactions with the team leader were typically (or always) one-on-one and that project-related interactions with other team members were rare. For example, one team member on a periodically-collaborative team, when asked about working with other members of the team, explained: "I came in just ... to write the specialist report on the preferred alternatives ... Just one area ...".

Periods of individual or disciplinary group work were punctuated by several periods where the majority of the team met to 'gather their bearings,' when team members from different disciplines would have input on others' analyses and then go back to work on their individual portions of the analysis. These larger collaborative meetings, respondents indicated, were sometimes brought on by deadlines.

Four teams worked in an individual or single-disciplinary work group manner throughout most of the process (Figure 3). These *primarily-disciplinary* teams used either a non-collaborative group or individual or single-discipline group approach during problem development and scoping and engaged in non-collaborative group work or individual or single-discipline group work during document preparation and response to comments. Throughout these team processes, there was a specific lack of behaviours that would characterise ITID work. A majority of team members worked on their own or in small, disciplinarily-homogeneous groups throughout the analysis process, without input from other disciplines, after the initial development of alternatives and up to the assemblage of the final document and public comment period. Non-collaborative group meetings would occur to respond to comments from the public (dividing up the comments) or to review work that was done by contractors (in two cases). Figure 3 reflects the typical work pattern of these teams.

3.2. Context and interdisciplinary collaboration

Collaborative typology appeared to be largely driven by team-related external and internal context. External context refers to the environment in which the team

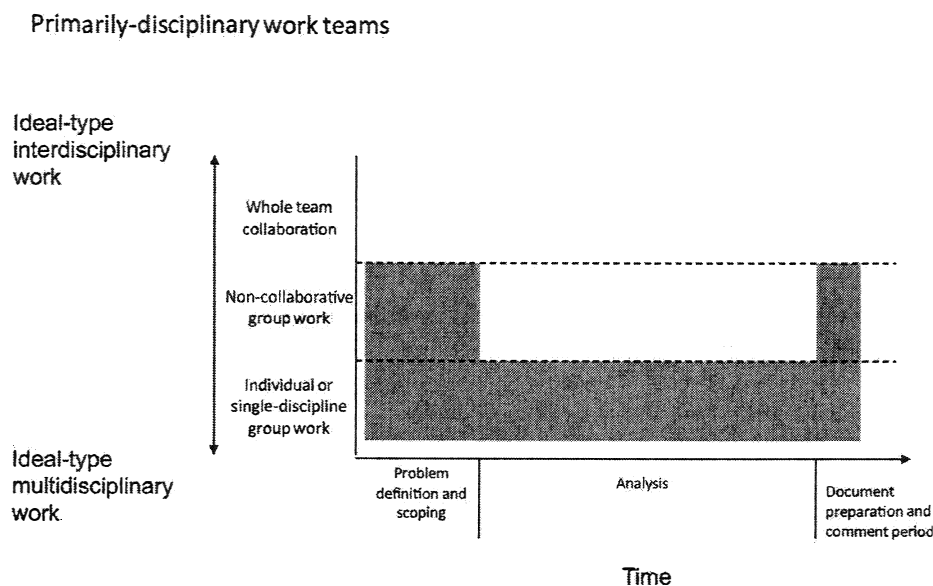


Figure 3. Generalised work patterns of primarily-disciplinary work teams.

operated, as opposed to internal context which could be described by experiences and activities created by the team and its members (Gwizdka 2000). We identified several elements of internal and external context reported by respondents that appear to play a role in determining team collaborative typologies: external interest in the project, proximity of team members to each other, intra-team conflict and other phenomena that lead to what we refer to as 'responsibility release'. Responsibility release is similar to that of Bandura's (1999) responsibility displacement, which occurs when individuals view their actions as resulting from something for which they are not personally accountable. While Bandura's displacement implies a purposive distancing of oneself from accountability, we use the term 'release' to attribute less agency to the individuals and more to circumstance. In the Forest Service case, responsibility release was associated primarily with external contracting, budget constraints or a lack of prioritisation of team-related tasks by superiors. In these circumstances, team members felt released from direct accountability on NEPA process tasks. Each of these contexts are noted in (Table 2) alongside the typology rating and assessments of perceptions of process outcomes, overall satisfaction and team leaders' leadership style.

3.2.1. *External interest in the project*

Respondents on the four primarily-collaborative work teams indicated that the projects they worked on had high levels of external interest, much of it based upon high levels of both motorised and non-motorised use in the analysis areas. For example, one respondent explained, "People are very passionate about their uses and their values about the national forest". Because of high levels of use, team members anticipated high levels of public interest and worked proactively to involve external stakeholders. The team members cited lessons from past experiences that involving these stakeholders throughout the NEPA analysis could save time and effort.

We knew it needed to be more intensive with the public than what we would have done for other work, and we knew that we were really talking about people's values, and it made it very volatile.

As a result, these teams explicitly worked together to strategise about how to address external interest.

Periodically-collaborative work teams faced lesser external pressure. Respondents on these teams pointed out that the spatial areas for their projects were confined to one relatively small section of the forest. While the users of these areas of the forest may have been as vocal as users on a larger forest or area, there were fewer of them. Respondents on each project indicated that in these particular settings, members of the general public were less inclined to get involved in Forest Service processes unless it was on a one-on-one basis. A respondent on a periodically-collaborative team highlighted how a user group who was likely to be affected by the agency's decision was not involved in the process.

It's always pretty informal when you're dealing with [ranchers] ... passing them in a pickup, you say, "hey, this is what's going on ... what's your story, what do you think?" ... They're not going to go to a public meeting. You can't get any information out of them. It's tough. They just don't want to piss anybody off ... I always tried to

Table 2. Contexts, leadership styles, and outcome assessments by team typology.

Team	Contexts of note	Assessment of team leader's leadership style	Assessment of perceptions of process outcomes		Overall assessment of satisfaction with the process	
			Team	Leader	Team	Leader
Primarily-collaborative 1	High external interest and short distance between team members	Empowering	Satisfied	Satisfied	Satisfied	Satisfied
Primarily-collaborative 2	High external interest and short distance between team members	Empowering	Satisfied	Satisfied	Satisfied	Satisfied
Primarily-collaborative 3	High external interest and short distance between team members	Directive	Satisfied	Dissatisfied	Satisfied	Dissatisfied
Primarily-collaborative 4	High external interest and short distance between team members	Directive*	Four satisfied, one dissatisfied	Somewhat satisfied	Four satisfied, one dissatisfied	Somewhat satisfied
Periodically-collaborative 1	Low external interest and long distance between team members	Empowering	Satisfied	Satisfied	Satisfied	Satisfied
Periodically-collaborative 2	Low external interest and long distance between team members	Empowering	Satisfied	Somewhat satisfied	Satisfied	Somewhat satisfied
Primarily-disciplinary 1	Responsibility release (lack of priority)	Directive	Two satisfied, two somewhat satisfied	Somewhat satisfied	Satisfied	Satisfied
Primarily-disciplinary 2	Responsibility release (external contractors)	Directive	Satisfied	Somewhat satisfied	Satisfied	Satisfied
Primarily-disciplinary 3	Intra-team conflict	Empowering	One dissatisfied, one somewhat satisfied, two satisfied	Satisfied	Three somewhat satisfied, one dissatisfied	Satisfied
Primarily-disciplinary 4	Responsibility release (budget)	Absent	Dissatisfied	Dissatisfied	Dissatisfied	Satisfied

Note: *Team had multiple leaders, primary was directive.

say, "Look, we need your comments, written comments, not just verbal informal stuff. . . . That helps our case." . . . but you just don't get it from that group.

Contrary to primarily-collaborative teams, periodically-collaborative teams did not indicate that they strategically considered how external pressure would affect their processes. Interviews revealed no added impetus from external pressure on these teams to collaborate across disciplines.

Levels of external interest varied on the projects with teams that worked in a primarily-disciplinary manner. On these teams other factors appeared to have been more important drivers of teamwork processes.

3.2.2. *Intra-team proximity*

On all four primarily-collaborative work teams, a majority of the team members either worked in the same office or close to each other geographically (less than 20 miles away). This enabled these teams to easily hold impromptu meetings, which were highly valued by respondents for exchange of ideas, informal progress updates and discussing problems and potential solutions.

On periodically-collaborative work teams, most team members were not within 20 miles of each other. In fact, both teams had at least one-third of the members in a location at least one hour away. One team's members were separated by a 4+ hour car ride. These team members noted that it was inconvenient for them to get together, and that if they had been closer they may have worked together more.

Team member proximity was variable in the primarily-disciplinary teams. Two of these teams had team members all in the same office, and two had team members separated by multi-hour drives. Again, other factors appear to have had greater influence on these teams' processes.

3.2.3. *Factors that may lead to primarily-disciplinary collaboration*

Respondents from three of the four teams that worked in a primarily-disciplinary fashion suggested circumstances that led to a 'let's-just-get-it-done' attitude on the project. One team experienced high levels of intrapersonal conflict between team members. The other three teams each exhibited circumstances, in particular using external contractors, budget constraints and a lack of prioritisation of the project by superiors that appeared to release team members from direct personal accountability for the processes.

In the first team, team members suggested a 'hostile' working environment prior to the start of the process, manifesting in distrust among team members, friction with the line officer and a culture that emphasised individual work over teamwork. One team member shared a story about his personal property being vandalised in response to a disagreement with co-workers about land management ideologies. The respondent believed this stemmed from his refusal to sign-off on an analysis that he believed to be flawed. He indicated that hostility toward others was "part of the area mentality".

On the other three primarily-disciplinary work teams, it was apparent that respondents felt that they were less responsible for the outcomes of the project due to circumstances beyond their control. On one team, the decision had been made to

contract the project to an out-of-state contractor. A contract was drawn up, a contractor was selected, and a 'shadow team' of Forest Service employees was formed to oversee work on the project. Team members felt the contract was managed poorly and, ultimately, the contractor failed to return an acceptable product to the agency. This failure to deliver caused the agency to rush to re-do much of the analysis. Team members indicated that they were frustrated with the burden of having to re-do the analysis and wanted to get the project done. "It was a long road ... it just got to be little things ... we just needed to get this damn thing done", said one respondent.

On another team, team members indicated that from project initiation, the forest leadership team was unengaged during most of the process, leading to an absence of team direction. The team members did not know how to focus their analysis and consequently did not give the project much time or energy. Eventually, the team leader approached the forest leadership team to request priority for the project. The team was told to finish the project quickly, and the team worked in more of an individual manner to expedite their analysis.

In the last year and a half we [approached] the forest supervisor and said "Look, this is never going to get done unless we get the district rangers to lead us". The Forest Supervisor said, "Rangers, get engaged. We're going to get this done this year. This is what you're going to be doing ... " Everything else got dropped, and things got done. It worked wonderfully ... There was still a little bit of kicking and screaming ... but we got it done.

The last team had a successful contracting process. Contracting was chosen as the approach to the NEPA process to save time and money by freeing team members to do other tasks. The contract was completed acceptably, and the team was called in to work on the final review of the document and to respond to public comments in a non-collaborative, small group, or individual manner. Team members never felt fully involved in the NEPA process.

3.3. Team leadership

Two leadership styles emerged clearly in our discussions with team members and leaders: *empowering* leadership and *directive* leadership. Empowering leaders tended to encourage team members to think creatively and share their ideas throughout the process. They also valued discussion and disagreement when it occurred. Team members on teams with empowering leaders in particular reported being more involved in strategic decisions early in the process. One team with an empowering leader reported an exercise near the beginning of their NEPA process where they were encouraged to develop their 'ideal' alternative.

We crafted an alternative where every resource specialist was supposed to go to the mat for their resource ... "from a wildlife perspective I need X, Y, and Z for this to be the best alternative from this critter's perspective". We tried to be all things to all resource issues in an alternative ... it was the place where people had more license to put aside the collective good and focus more specifically on what they felt was the most beneficial outcome for their particular specialty.

One respondent suggested that the exercise helped 'daylight' some issues that may not have been obvious to other team members and felt that it enhanced team

collaboration throughout the process. In general, team members were more commonly satisfied with team processes with empowering leaders (Table 2).

Directive leaders created more variable team environments. Often, they felt driven to keep team members on task. In some teams, they served as an intermediary for communication between team members, thus maintaining control over most communications. This inhibited interdisciplinary collaboration in these cases. One team member attributed the following attitude to one of these team leaders.

We're getting it done by this date and we don't want you to think outside the box ... they don't have a lot of tolerance for [team members saying]: "Well, what if we thought about this?"

Directive leaders were also at the helm of primarily-collaborative teams. In these cases, the leaders maintained control of group situations by serving as a central facilitator of collaborative group interactions. Rather than allowing team members to formulate and act upon their own solutions to problems, they would filter these ideas themselves and delegate more specific tasks than empowering leaders. While directive leaders did not always inhibit intra-team collaboration, they created a different form of it that did not consistently satisfy all team members with the process (Table 2).

Empowering leaders seemed better suited to teams with collaborative processes, as indicated by perceptions of team process and process outcomes. The only primarily-disciplinary team with an empowering leader yielded mixed levels of satisfaction among team members. In this team, respondents expressed that the long duration of the project negatively influenced their satisfaction.

4. Discussion

Our case studies reveal that teams may commonly move in and out of collaborate phases such that binary labelling of teams as interdisciplinary vs. multi-disciplinary or collaborative vs. non-collaborative obfuscates reality. Our case studies indicate that teams' working styles are probably driven by multiple factors and that empowering leadership styles may be most appropriate for maximising the benefits of interdisciplinary collaboration. We summarise the relationships between the constructs we have operationalised in Figure 4 and discuss our key propositions in greater detail below.

4.1. *Consistencies in teamwork styles*

While the three typologies of teamwork identified in this study vary considerably, they each share some common components. None of the teams exhibited whole-team collaboration during the preparation of the final document and the final comment period, and each of the teams relied at least partially on individual or single-discipline group work during the analysis phase of the NEPA process. The study raises the question about whether ITID work is appropriate for particular aspects of NEPA processes. Future research with a broader selection of cases could further address this question.

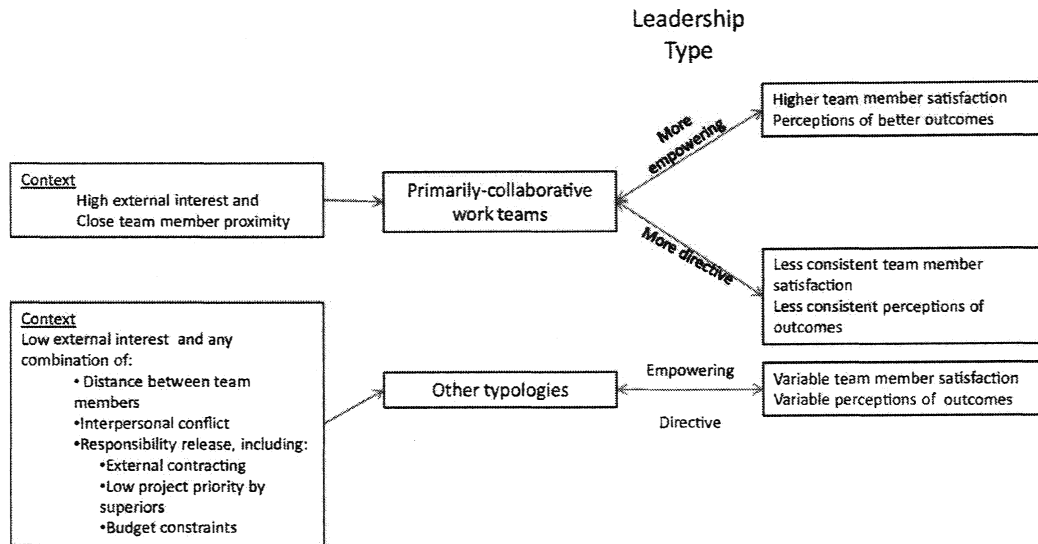


Figure 4. Relationships between context, teamwork typologies, and outcomes.

4.2. The benefits of collaboration and empowerment

While the literature is replete with reports of the importance of and the benefits of collaboration for improving decision making, learning and relationships among stakeholders (Daniels and Walker 1996, Pennington 2008), our study raises the question of whether true interdisciplinary collaboration is always a necessary component to produce successful Forest Service NEPA processes. Based on team members' views alone, processes with greater amounts of interdisciplinary collaboration, as we have defined it, tended to turn out better than less collaborative processes. The results are inconclusive, however, not only based on our limited and nebulous measures of success, but also due to our small sample size and mixed perceptions of outcomes of the same processes. The question would benefit from future research on the conditions under which greater or lesser interdisciplinary collaboration may lead to different types of outcomes. This would test Forest Service employees' own hypotheses about the importance of NEPA team collaboration for project success (Stern *et al.* 2010).

4.3. Drivers of collaborative processes

While prior research suggests the importance of the values of individual team members, our study builds upon a contingency theory approach to work in organisations (Lawrence and Lorsch 1967), stressing the influence of external context on intra-team interactions. Higher external interest tended to produce more collaborative teams (Figure 4). We posit that perceptions of risk associated with enhanced public interest in a project may have led teams to collaborate in order to better respond to the public. Fear of litigation and other normative pressures have been shown to drive other decisions within NEPA process as well (Stern and Mortimer 2009). Collaboration could be a strategy for mitigating perceived risk caused by external pressures through group problem solving (Logson 1991).

Public interest may have also been an indicator to team members that the task at hand was meaningful to the public. Perceptions that a task is valuable and

meaningful have also been associated with greater motivation for a team to work together (Hackman 1987). External pressure could reinforce that association. McKenzie and van Winklen (2004) suggested that external interest may increase incentives to maintain relationships with other team members in order to facilitate complex tasks. Teams with members within close proximity to each other also collaborated more (Figure 4). While collaborative communications are certainly possible through technology, impromptu face-to-face communications were particularly valued by case study respondents. The ability to discuss issues as they arise and to build relationships through in-person conversations allows not only for enhanced fluidity of collaborative interchanges, but also for potentially more meaningful relationship-building between collaborators (Herbsleb *et al.* 2000).

4.4. *The influence of leadership style*

In more collaborative teams, we observed greater consensus of more positive outcomes when teams had more empowering leaders (Figure 4), suggesting that this might be a more appropriate leadership style when interdisciplinary collaboration is deemed important to the success of a process. In a study of 71 change management teams, Pearce and Sims (2002) also found that empowering leadership styles more positively influenced team outcomes than directive leadership styles. Other research has also shown that leaders who exhibit traits of empowering leadership tend to encourage collaboration in team settings (Sarin and O'Connor 2009), whereas directive leadership tends to discourage collaboration (Vaughn and Streib 2006). While collaboration still appeared to have taken place in cases with directive leaders, the process was facilitated in a more structured manner and the outcomes filtered by team leaders.

We posit that the influence of leadership on outcomes may vary based on the specific context of the project and other variables at play. In other words, empowering leadership alone cannot guarantee positive outcomes. We also speculate that the link between leadership styles and positive outcomes might just as well be a matter of matching leadership style to team members' predispositions or preferences (Bjugstad *et al.* 2006). Further research would be necessary to more clearly determine the plausibility of each explanation.

5. Conclusions

We have undertaken an exercise in theory development through case study research. As such, we do not attempt to generalise to any specific population, but rather propose hypotheses for further research. Our results describe a set of teams in which greater external interest appeared to drive greater collaboration in NEPA teams, possibly more so than leadership style. The research also suggests that, regardless of the level of external interest, internal issues of conflict and responsibility displacement could frustrate work processes. While members of collaborative teams with more empowering leaders reported greatest satisfaction with process outcomes, the small sample size limits this pattern, and others, to theoretical propositions for future research. The study also suggests broader avenues of exploration regarding the relationships between a larger suite of leadership styles, different modes of intra-team collaboration, and outcomes of team processes.

In Forest Service NEPA processes, leaders are commonly selected based on staff availability, previous NEPA experience and subject matter expertise (Stern and Mortimer 2009) in addition to line officers' perceptions about an individual's leadership abilities. If future research were to determine that leadership styles are predictive of certain desired outcomes either across or in specific contexts, the agency might adjust both training and selection processes for team leaders. The agency may also wish to examine whether team leader selection and contexts drive teams to work in manners that allow for the level of collaboration necessary to address complex environmental issues that are more or less consistent with NFMA guidance on proper interdisciplinary teamwork as outlined at 36 CFR 219.5(a), and that align with the principles of ecosystem management.

In our case studies, teams with higher external interest and closer proximity of team members to each other tended to behave in a manner more consistent with ITID teamwork. In addition, teams that exhibited failed contracting, lack of project priority, interpersonal conflicts and budgetary constraints behaved in a manner more consistent with ITMD work. If these trends held true across a broader array of projects, it could lead to adaptations of processes to account for some of these particular challenges. A broader study could also reveal the types of contexts in which more or less collaborative teamwork is appropriate or necessary given agency objectives.

The ITID and ITMD teams discussed herein exist only at snapshots in time within NEPA team processes. Variation from these ideal types may be more or less useful and necessary depending on the unique situation (subject matter, social, ecological contexts, etc.) of the team at any given time. Further research is necessary to examine if the typologies of teams extend beyond this case study, what causes variation in teamwork approaches, and what impacts these different work styles have on outcomes in different contexts. In addition, our case studies do not rule out alternative theories for reported levels of collaboration and perceptions of outcomes, such as the inherent abilities or dispositions of team members to engage in interpersonal collaboration or differential definitions of appropriate outcomes (Stern *et al.* 2010). A large-n study would be useful to assess whether these typologies extend to other types of NEPA projects, if these typologies reveal any other possible trends, and to test the relationships that we have hypothesised. Future study could also examine the interactions between contexts, team collaboration and leadership styles that may differentially affect team outcomes.

Note

1. One team changed leaders twice. We spoke with two of the leaders. The assessment of leadership is based on the leader who was with the project for the longest.

References

- Babbie, E., 2007. *The practice of social research*. Belmont, CA: Thomson Wadsworth.
- Bandura, A., 1999. Moral disengagement in the perpetration of inhumanities. *Personality and social psychology review*, 3 (3), 193–209.
- Bentrup, G., 2001. Evaluation of a collaborative model: a case study analysis of watershed planning in the intermountain west. *Environmental management*, 27 (5), 739–748.
- Bjugstad, K., *et al.*, 2006. A fresh look at followership: a model for matching followership and leadership styles. *Journal of behavioral and applied management*, 7 (3), 304–319.

- Blahna, D.J., 2007. Introduction: recreation management. In: L.E. Kruger, R. Mazza and K. Lawrence, eds. *Proceedings: national workshop on recreation research and management*. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station *General Technical Report PNW-GTR-698*, 101–113.
- Burns, J.M., 1978. *Leadership*. New York: Harper and Row.
- Cross, R., et al., 2008. Managing collaboration: improving team effectiveness through a network perspective. *California management review*, 50 (4), 74–98.
- D'Amour, D., et al., 2005. The conceptual basis for interprofessional collaboration: core concepts and theoretical frameworks. *Journal of interprofessional care*, May (Supp 1), 116–131.
- Daniels, S. and Walker, G., 1996. Collaborative learning: improving public deliberation in ecosystem-based management. *Environmental impact assessment review*, 16, 71–102.
- Eisenhardt, K.M., 1989. Building theories from case study research. *Academy of management review*, 14 (4), 532–550.
- Garcia, M.W., 1989. Forest Service experience with interdisciplinary teams developing integrated resource management plans. *Environmental management*, 13 (5), 583–592.
- Gerth, H.H. and Mills, C.W., 1946. *From Max Weber: essays in sociology*. New York: Oxford University Press.
- Gladstein, D.L., 1984. Groups in context: a model of task group effectiveness. *Administrative science quarterly*, 29, 499–517.
- Gray, B., 2004. Strong opposition: frame-based resistance to collaboration. *Journal of community and applied psychology*, 14, 166–176.
- Gray, B. and Putnam, L.L., 2005. Means to what end? Conflict management frames. *Environmental practice*, 5 (3), 239–246.
- Gwizdka, J., 2000. *What's in the context: an extended position paper for CHI 2000 workshop 11: The what, who, where, when, why, and how of context-awareness*. Citeseer. [online] Available from: <http://citeseerx.ist.psu.edu> [Accessed 22 November 2009].
- Hackman, J.R., 1987. The design of work teams. In: J.W. Lorsch, ed. *Handbook of organizational behavior*. Englewood Cliffs, NJ: Prentice Hall.
- Hackman, J.R., 2002. *Leading teams: setting the stage for great performances*. Boston: Harvard Business School Press.
- Hall, P. and Weaver, L., 2001. Interdisciplinary education and teamwork: a long and winding road. *Medical education*, 35, 867–875.
- Herbsleb, J.D., et al., 2000. Distance, dependencies, and delay in a global collaboration. In: *Proceedings of the 2000 ACM Conference on computer supported cooperative work*, 319–328.
- Ilgen, D.R., et al., 2005. Teams in organizations: from input-process-output models to IMOI models. *Annual review of psychology*, 56, 517–543.
- Innes, J.L., 2005. Multidisciplinarity, interdisciplinarity and training in forestry and forest research. *The forestry chronicle*, 81 (3), 324–329.
- Lawrence, P. and Lorsch, J., 1967. *Organization and environment*. Boston: Harvard Business School.
- Lewin, K., Lippitt, R., and White, R.K., 1939. Patterns of aggressive behavior in experimentally created social climates. *Journal of social psychology*, 10, 271–301.
- Lewicki, R.J., Gray, B., and Elliot, M., 2002. *Making sense of intractable environmental conflicts*. Washington, DC: Island Press.
- Logson, J.M., 1991. Interests and interdependence in the formation of social problem-solving collaborations. *Journal of applied behavioral science*, 27 (1), 23–37.
- Mathieu, J.E., Gilson, L.L., and Ruddy, T.M., 2006. Empowerment and team effectiveness: an empirical test of an integrated model. *Journal of applied psychology*, 91 (1), 97–108.
- McKenzie, J. and van Winklen, C., 2004. Exploring e-collaboration space. In: E. Truch, ed. *Leveraging corporate knowledge*. Burlington, VT: Gower Publishing, 43–54.
- Pearce, C.L. and Sims, H.P., 2002. Vertical versus shared leadership as predictors of the effectiveness of change management teams: an examination of aversive, directive, transactional, transformational, and empowering leader behaviors. *Group dynamics: theory, research, and practice*, 6 (2), 172–197.
- Pennington, D.D., 2008. Cross-disciplinary collaboration and learning. *Ecology and society*, 13 (2), 8.

- Phillips, C.G. and Randolph, J., 2000. The relationship of ecosystem management to NEPA and its goals. *Environmental management*, 26 (1), 1–12.
- Putnam, L.L., 1994. Productive conflict: negotiation as implicit coordination. *International journal of conflict management*, 5, 285–299.
- Ray, M.D., 1998. Shared borders: achieving the goals of interdisciplinary patient care. *American journal of health-system pharmacy*, 55 (13), 1369–1374.
- Sarin, S. and O'Connor, G.C., 2009. First among equals: the effect of team leader characteristics on the internal dynamics of cross-functional product development teams. *Journal of product innovation management*, 26, 188–205.
- Simons, T.L. and Peterson, R.S., 2000. Task conflict and relationship conflict in top management teams: the pivotal role of intragroup trust. *Journal of applied psychology*, 85 (1), 102–111.
- Stern, M.J. and Mortimer, M.J., 2009. *Exploring NEPA processes across federal land management agencies. General Technical Report PNW-GTR-799*. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Stern, M.J., et al., 2009. Visions of success and achievement in recreation-related USDA Forest Service NEPA processes. *Environmental impact assessment review*, 29, 220–228.
- Stern, M.J., et al., 2010. From the office to the field: areas of consensus and tension in the implementation of the National Environmental Policy Act within the US Forest Service. *Journal of environmental management*, 91 (6), 1350–1356.
- Taggar, S. and Ellis, R., 2007. The role of leaders in shaping team norms. *The leadership quarterly*, 18, 105–120.
- Tipple, T.J. and Wellman, J.D., 1991. Herbert Kaufman's Forest Ranger thirty years later: from simplicity and homogeneity to complexity and diversity. *Public administration review*, 51 (5), 421–428.
- USDA Forest Service, 2008. *NEPA/NFMA forest plan implementation training course (1900–01) instructors guide*. Washington, DC.
- Vroom, V.H. and Yetton, P.W., 1973. *Leadership and decision-making*. University of Pittsburgh Press.
- Waugh, W.L. and Streib, G., 2006. Collaboration and leadership for effective emergency management. *Public administration review*, 66, 131–140.
- Weber, M., 1915. Religious rejections of the world and their directions. In: H.H. Gerth and C.W. Mills, eds. *From Max Weber: essays in sociology*. New York: Oxford University Press, 1946, edition, 323–362.
- Weible, C.M., Pattison, A., and Sabatier, P., 2010. Harnessing expert-based information for learning and the sustainable management of complex socio-ecological systems. *Environmental science and policy*, 13 (6), 522–534.