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Visions of Restoration in Fire-Adapted Forest Landscapes: Lessons from the Collaborative Forest Landscape Restoration Program

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Abstract Collaborative approaches to natural resource management are becoming increasingly common on public lands. Negotiating a shared vision for desired conditions is a fundamental task of collaboration and serves as a foundation for developing management objectives and monitoring strategies. We explore the complex socio-ecological processes involved in developing a shared vision for collaborative restoration of fire-adapted forest landscapes. To understand participant perspectives and experiences, we analyzed interviews with 86 respondents from six collaboratives in the western U.S., part of the Collaborative Forest Landscape Restoration Program established to encourage collaborative, science-based restoration on U.S. Forest Service lands. Although forest landscapes and group characteristics vary considerably, collaboratives faced common challenges to developing a shared vision for desired conditions. Three broad categories of challenges emerged: meeting multiple objectives, collaborative capacity and trust, and integrating ecological science and social values in decision-making. Collaborative groups also used common strategies to address these challenges, including some that addressed multiple challenges. These included use of issue-based recommendations, field visits, and landscape-level analysis; obtaining support from local agency leadership, engaging facilitators, and working in smaller groups (sub-groups); and science engagement. Increased understanding of the challenges to, and strategies for, developing a shared vision of desired conditions is critical if other collaboratives are to learn from these efforts.

Keywords Collaboration · Ecological restoration · Desired conditions · CFLRP · Fire-prone forests · Public lands management

Introduction

Collaborative approaches to natural resource management are becoming increasingly common on public lands (Selin and Chevez 1995; Schuett et al. 2001). Collaboration is broadly defined as a process whereby diverse stakeholders (e.g., environmental organizations, industry, tribes, private landowners, and public agencies) work together to resolve a conflict or develop a shared vision (Gray 1989; Koontz et al. 2004). Although developing and advancing a shared vision is central to collaboration, it can be challenging in practice, particularly in the face of multiple resource management needs and changing societal preferences and values (Wondolleck and Yaffee 2000; Ansell and Gash 2008). Collaboratives often grapple with these challenges independently and with varying success. In this paper, we report common challenges faced, and strategies used, by collaboratives to establish a shared vision through the restoration of fire-adapted forest landscapes in the western U.S. These groups are part of the Collaborative Forest Landscape Restoration Program (CFLRP), a recent policy initiative

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designed to support collaborative decision-making in the management of U.S. Forest Service lands (Schultz et al. 2012).

Restoration of fire-adapted forests is a high management priority on public lands in the western U.S. These forests are at increased risk of mortality from insects, stress, and uncharacteristic wildfires due to long-term fire exclusion and past timber and grazing practices (Allen et al. 2002; Hessburg and Agee 2003; Noss et al. 2006). At the same time, there is a critical need to stimulate the livelihoods of forest-dependent communities through utilization of forest products and expansion of recreational and cultural opportunities (Franklin et al. 2014). The pace and spatial extent of ecosystem change in fire-adapted forests requires restoration of entire landscapes (Franklin and Johnson 2012; Hessburg et al. 2015). However, management at this scale is challenging, particularly on U.S. Forest Service lands where declining budgets, complex regulations and long-standing multiple-use conflicts have led to gridlock and litigation. Traditional public involvement to satisfy requirements of the National Environmental Policy Act (NEPA) and the National Forest Management Act have been perceived by some to focus on review and comment after agency decisions have been made (Wondolleck and Yaffee 2000; Koontz et al. 2004). In response, stakeholders adopt adversarial approaches (appeal or litigation), which can delay or halt management activities (Germain et al. 2001; Koontz and Bodine 2008).

In 2009, the U.S. Congress passed the Forest Landscape Restoration Act, establishing the CFLRP. The Act is intended to "encourage the collaborative, science-based ecosystem restoration of priority forest landscapes through a process that encourages ecological, economic, and social sustainability …" (www.fs.fed.us/restoration/CFLRP). Funds are awarded competitively to projects that are large (≥50,000 acres) and long term (>10 years with 15 years of monitoring). Proposals are developed jointly by the Forest Service and stakeholders, but require that applicants have "NEPA-ready" projects and a history of collaboration. Projects are limited to National Forest lands and funding can support implementation and monitoring, but not planning. Projects must aim to protect old growth and reduce hazardous fuels by removing smaller, but retaining larger, trees as appropriate for the forest type. To date, 23 collaboratives have received funding (10 in 2010, 13 in 2012).

A central task of CFLRP collaboratives is to develop a shared vision of desired conditions for restoration. Desired conditions are the social, economic, and ecological attributes of a landscape that management strives to attain (e.g., reduced risk of catastrophic fire, maintenance of large old trees, enhanced use of timber resources, improved recreational values). Collaboratives define priorities, identify risks, and negotiate trade-offs among these objectives to reach a "zone of agreement" on desired conditions that serves as a form of collective input to the Forest Service. Developing a shared vision for desired conditions is not easy, particularly at large spatial scales (Shindler et al. 2002; Cheng and Mattor 2006; McCaffrey et al. 2013). Fire-adapted forests are complex and dynamic systems, and there is often considerable uncertainty about responses to restoration (Larson et al. 2013). Defining a shared vision may be particularly challenging in environmentally or culturally sensitive areas or in habitats of threatened and endangered species (Collins et al. 2010; Franklin et al. 2014).

Over the past several decades, collaboration has emerged as a promising approach to address litigation and gridlock and to encourage stakeholder participation in the design, implementation and evaluation of landscape-scale restoration strategies. Collaboration can be an important component of contemporary public lands management, because many issues are site-specific and cannot be resolved easily within agencies, legislatures, or courts (O'Leary and Bingham 2003). Collaboration can work across ecological, political, and land-ownership boundaries. It can link social and scientific issues, increase the likelihood of implementing solutions, and support community building and understanding (Brunner et al. 2005; Sturtevant et al. 2005). However, critics argue that it does not ensure "better" decisions and may reinforce power disparities rather than promote inclusion and dialogue (Burke 2013). Questions have also been raised about the nature and quality of environmental outcomes from collaborative processes (Koontz and Thomas 2006; Layzer 2008).

Measuring and evaluating collaboratives can be difficult due to inherent variation in their structures, functions and goals (Emerson and Nabatchi 2015). However, past work suggests several factors that contribute to effective collaboration. These include diverse and inclusive participation, clear and feasible goals, adequate funding, effective leadership and organization, and trust (Leach and Pelkey 2001; Schuett et al. 2001; Conley and Moote 2003; Shindler et al. 2011). Margerum (2011) provides a comprehensive summary of the elements of effective collaboration, including the importance of "process"—the equitability, diversity of participation, and other aspects of decision-making. Recent research indicates the CFLRP's mandate to collaborate can lead to increased stakeholder attention to designing effective collaborative processes (Monroe and Butler 2016), but that barriers such as lack of stakeholder and agency capacity may limit their success (Schultz et al. 2014).

Our study focused on six CFLRP collaboratives to understand the processes used to identify and articulate a shared vision for desired conditions. Our analysis is grounded in the perspectives and experiences of a large and diverse sample of stakeholders. In this paper, we move

beyond a single case-study approach by synthesizing the challenges faced, and strategies used, by multiple groups engaged in collaboration under the same policy directive.

Methods

The collaboratives examined in our study are working in fire-adapted forests, dominated by shade-intolerant pine and characterized by high-frequency, low severity fire—and mixed-severity systems that also include Douglas-fir and true fir. Restoration treatments generally involve thinning of younger/smaller trees, prescribed burning and, occasionally, managed wildfire (Agee and Skinner 2005; Schoennagel and Nelson 2011). The "historical range of variation" (pre-European settlement and pre-fire suppression) typically serves as a guide for prescriptions and desired outcomes (Allen et al. 2002; Keane et al. 2009). Increasingly, there is a call to view desired conditions more broadly given the effects of changing climate and changing societal preferences and values (Duncan et al. 2010; Golladay et al. 2016).

Several criteria were used to select collaboratives for this study. Each received CFLRP funding in 2010, the program's first funding cycle. We selected two from each of three Forest Service regions (four in the northwest, two in the southwest) encompassing a variety of geographic, biophysical, and social contexts (Tables 1 and 2) to assess whether collaborates in different ecoregions face similar challenges. Together, they provide a rich set of experiences in how collaboratives face challenges and develop approaches to defining desired conditions for landscape restoration.

Eighty-one in-depth, semi-structured interviews with 86 key respondents (four interviews involved more than one respondent) were conducted by the first author in 2013 and 2014. Respondents included collaborative members, outside stakeholders, collaborative coordinators and facilitators, and Forest Service staff. We used a combination of chain referral (Biernacki and Waldorf 1981) and purposive sampling (Palys 2008) to ensure a diversity of perspectives (Table 3). Interviews were by phone (31 %) or in person (69 %). An interview guide with a predetermined list of questions was used to ensure that interviews covered relevant and comparable information. Questions explored respondent perspectives on the greatest challenges to, and strategies for, developing a shared vision of desired conditions. The interview guide was pilot tested and interviews were recorded, transcribed verbatim, and coded using the qualitative data analysis software, Atlas.ti version 7.5.9 (Muhr and Friese 2004). Interviews lasted 0.5–2.0 h (>79 h of recordings in total). Participants were assured that data would be treated confidentially, i.e., coded such that responses could not be linked to individual respondents.

We used an iterative process of open coding to identify challenges and strategies. First, relevant quotations from interview transcripts were labelled with a preliminary code (or concept). Preliminary codes were then consolidated into "challenge labels". We tallied the number of interviews in which each challenge was mentioned, and expressed this as the percentage of total interviews and a weighted-average percentage (weighted by number of interviews within a group). Percentages were nearly identical, thus we refer to the former. Among strategies used to address these challenges, we include those reported as particularly useful by at least one (but often multiple) respondent(s). We do not report on percentages to describe the strategies because relevant strategies might be unique, but important to report even if only mentioned by a few respondents. Additionally, we asked respondents what challenges they were experiencing and there was less congruence among the strategies. For each challenge and associated strategy, we present one or more quotes to illustrate the link between raw data and findings. We also reviewed collaborative group documents (e.g., CFLRP proposals and planning reports) to obtain background information that aided in the analysis.

Results

The six collaborative groups faced similar challenges to developing a shared vision for desired conditions. Ten challenges were identified by more than 30 % of the interviewees (hereafter, "common challenges") (Table 4). Most were mentioned by at least one individual per group, however, the frequency of reporting often varied among groups (Table 4). Below, we describe the nature of each common challenge and present examples of strategies (Table 5) reported by respondents as useful in moving forward.

Challenge 1: Moving from Agreement on Broad Ideals to Specific Recommendations

For 47 % of respondents representing all collaboratives (16–80 % within individual groups; Table 4), a principal challenge was the ability to move from agreement on broad ideals to specific recommendations—i.e., specifying desired conditions with sufficient detail to guide management prescriptions and monitoring strategies. Respondents noted that this challenge created a barrier to collaboration when they thought they had achieved agreement on desired conditions but later experienced conflict because particular conditions had not been specifically defined. This challenge was

Table 1 Characteristics of the six CFLRP landscapes in this study

Project name	Collaborative group	USFS region	State	National Forests	Area of landscape in acres (hectares)	Percent (%) of landscape in coniferous forest by LANDFIRE Biophysical Setting—Historic Fire Regime Group[a]		
						Low severity	Mixed severity	High severity
Four Forests Restoration Initiative	4FRI Collaborative (4FRI)	3	AZ	Apache-Sitgreaves, Coconino, Kaibab, Tonto	5,970,000[b] (2,415,973)	50	1	1
Selway-Middle Fork Clearwater Project	Clearwater Basin Collaborative (Clearwater)	1	ID	Nez Perce, Clearwater, Bitterroot	1,400,000 (566,560)	11	46	37
Deschutes Skyline Landscape	Deschutes Collaborative Forest Project (Deschutes)	6	OR	Deschutes	130,000[c] (104,348)	64	0.3	29
Southwest Jemez Mountains	Southwest Jemez Mountains Collaborative (Southwest Jemez)	3	NM	Santa Fe, Valles Caldera National Preserve	210,000 (84,984)	43	16	1.5
Southwestern Crown of the Continent	Southwest Crown of the Continent Collaborative (SWCC)	1	MT	Lolo, Flathead, Helena	1,449,670 (586,661)	29	24	27
Tapash Sustainable Forest Collaborative	Tapash Sustainable Forest Collaborative (Tapash)	6	WA	Okanogan-Wenatchee	1,629,959 (659,621)	30	40	14

[a] Conifer forest types are based on Biophysical Settings and historic (pre-European settlement) Fire Regime Groups from the national LANDFIRE Program (Barrett et al. 2010). Low severity includes LANDFIRE Fire Regime Groups I and II; mixed severity includes LANDFIRE Fire Regime Group III; high severity includes LANDFIRE Fire Regime Groups IV and V

[b] This area represents the administrative project boundary of the four forests in the 4FRI project; however, the 4FRI Collaborative Proposal is for restoration of 2.4 million acres (971,246 hectares), all low severity LANDFIRE Fire Regime Group I, within those administrative boundaries

[c] The Deschutes project boundary expanded to 257,850 acres (104,348 ha) in 2013. Percentages are based on the original project area

Table 2 Characteristics of the six CFLRP collaboratives in this study

Collaborative group	Coordinator (s)	No. of interviews (respondents)	Establishment year	Facilitation	Group membership	Group size	Group structure
Four Forests Restoration Initiative Collaborative (4FRI)	Forest Service Coordinator	15 (16)	2009	Yes	Open	40+ signed charter members	Steering committee, sub-groups, revolving co-chairs from a pool of 4–8
Clearwater Basin Collaborative (Clearwater)	Forest Service Coordinator, Collaborative Coordinator, CFLRP Coordinator	12 (12)	2008	Yes	Closed[a]	23 members	Steering committee, sub-groups, two co-chairs
Deschutes Collaborative Forest Project (Deschutes)	Two Collaborative Coordinators	19 (19)	2009	Yes	Open, steering committee members are selected by the collaborative	20 members on steering committee	Steering committee, sub-groups
Southwest Jemez Collaborative (Southwest Jemez)	Forest Service Coordinator	9 (12)	2009	No	Open	2–5 members on steering committee, over 40 groups helped develop strategy	Steering committee, two co-chairs
Southwest Crown of the Continent Collaborative (SWCC)	Forest Service Coordinator, Monitoring Coordinator	12 (12)	2008	No	Open	Three-member executive committee, 11–25 voting members	Executive committee, sub-groups, two co-chairs
Tapash Sustainable Forest Collaborative (Tapash)	Collaborative Coordinator	14 (15)	2007	No	Closed, landowner based	Five landowner members on executive committee	Executive committee, sub-groups

[a] Membership was open at the time of formation

articulated by a member of the Southwest Crown of the Continent Collaborative (SWCC):

> *Originally there was a lot of concurrence on some general ideas but as the rubber hit the road and we moved from apple pie statements about the landscape down to project-level of what's going to happen there have been rifts in the collaborative.*

Strategies

Respondents described three strategies to address this challenge: use of issue-based recommendations, developing level-of-support rules, and maintaining broad focus (Table 5). First, groups were able to develop a zone of agreement around "issue-based" recommendations which are formal, written documents that convey a shared vision about particular management topics. These are recommendations

Table 3 Participant affiliations

Affiliation	No. of respondents
US Forest Service	22
NGO staff	18
University	10
Local government (state, county, city)	8
Industry	6
Tribal member and/or employee	6
Collaborative contract staff	5
Private consultant	5
Community member/volunteer	4
Other federal agency	2

Table 5 Strategies to address the ten common challenges to developing a shared vision of desired conditions

Theme	Challenge	Strategy
Management for multiple objectives	1	Issue-based recommendations
		Level-of-support rules
		Maintain broad focus
	2	Field visits
		Landscape-level analysis
	5	Take a proactive approach to socio-economic considerations
Collaborative capacity and trust	3	Support from local agency leadership
		Field visits
	4	Membership diversity
	7	Designated coordinator
		Designated facilitator
		Sub-groups
	8	Support from collaborative
		Support from local agency leadership
	10	Shift incentive structures
Integration of ecological science and social values	6	Science engagement
		Legitimize stakeholder values as a basis for decision-making
	9	Issue-based recommendations
		Field visits
		Landscape-level analysis
		Designated facilitator
		Sub-groups
		Science engagement
		Input from external scientists

Table 4 Ten common challenges to developing a shared vision of desired conditions. Values are percentage of interviews in which a challenge was identified

Challenge	4FRI	Clearwater	Deschutes	Southwest Jemez	SWCC	Tapash	Total
1. Moving from agreement on broad ideals to specific recommendations	80	50	16	44	58	43	47
2. Different perspectives on restored stand structures	73	25	58	78	8	36	47
3. Forest Service lacks a clear collaborative decision space	67	0	0	78	75	50	41
4. Threat of litigation	60	50	16	33	83	7	40
5. Socio-economic desired conditions are not well developed	47	33	11	33	8	100	38
6. Different perspectives on appropriate reference conditions	87	25	11	44	50	14	37
7. Participatory fatigue	40	42	21	11	50	43	35
8. Limited Forest Service capacity to collaborate	27	42	37	11	50	36	35
9. Moving from work in ponderosa pine to mixed-conifer forest types	33	17	37	22	67	21	33
10. Lack of stakeholder trust in the Forest Service	53	17	32	56	25	14	31

to the Forest Service intended to guide management across the CFLRP landscape. For example, the Deschutes Collaborative Forest Project (Deschutes) developed recommendations for ponderosa pine and dry mixed-conifer forest types and for management of ponderosa pine infected with Dwarf mistletoe. Due to uncertainty in treatment effects and variation in forest conditions across the landscape, issue-based recommendations need to provide flexibility in management. A Deschutes stakeholder described this as follows:

> *The hope is that we've developed a recommendation you can take from one project to the next one. They [recommendations] may change or get tweaked a little bit based on what we learned from applying it on this project.*

The 4FRI Collaborative developed issue-based recommendations to resolve stalemates over cutting of large post-settlement trees to meet ecological restoration and biodiversity objectives. One 4FRI stakeholder described this as follows:

> *The large-tree retention strategy was a fantastic stakeholder-developed document [to replace the] age-old argument that you don't cut trees above sixteen inches [in diameter].*

Second, collaboratives relied on pre-determined level-of-support rules to develop recommendations on issues for which there was not a clear full consensus. Level-of-support rules are a decision-making procedure by which collaboratives seek full consensus but resort to popular vote when full consensus is not possible. Members that express reservations allow the effort to move forward, but can submit a "minority report" or "dissenting opinion." Having these rules helped to clarify disagreements, gauge support for proposed desired conditions, and resolve impasses so the groups could move forward without achieving a full consensus. Level-of-support also indicates to the Forest Service the degree to which they can expect collaborative backing on a particular issue. A Deschutes stakeholder described this process:

> *I feel like the group is able to move forward when we get to a level of agreement where we can get a final document in place and have people carefully share where they stand within that recommendation. Usually, that document might have 95 % consensus, but then you have a fraction of our group that still is uncomfortable with it and they have a chance to articulate why they're uncomfortable with it and we can show where we sit on the overall spectrum of the full group agreeing. We rarely get the entire group to fully agree but I think it's good to be able to clearly document our recommendations and any disagreement on those recommendations … I think that it's the most accurate final picture on where the group has gone, but it also allows us to move forward.*

Third, rather than develop specific recommendations, stakeholders from the Clearwater Basin Collaborative (Clearwater) decided to maintain a broader focus. They chose to "tackle all the big issues" (e.g. rural economics and legislative and resource barriers to restoration) rather than "debate the fate of individual trees" or spend time disputing forest management details on specific projects. A Clearwater stakeholder described this process:

> *What we try to do is build the social license and build the vision … and then we try to work with them [the Forest Service] to remove barriers to being able to put it on the ground … I hope we don't divert that attention to arguing over which tree to leave and which tree to cut. There's pluses and minuses but that's definitely the side of the spectrum that we operate on.*

Challenge 2: Different Perspectives on Restored Stand Structures

47 % of respondents (8–78 % within individual groups; Table 4) reported that differing perspectives on the nature of restored stand structure posed a challenge. Central was the perceived trade-offs among cutting trees to restore historic structure, reducing fuel loadings and generating income, and the benefits of a multi-layered forest canopy (as habitat for threatened or endangered species). There was often a lack of full consensus on what constituted a "large" tree or on the desired stand density or canopy openness. A 4FRI stakeholder described this challenge:

> *The conservation community is concerned about large-tree protection and maintaining enough dense forest for canopy-dependent species … So the trick is how you balance wildlife and old-growth protection with fire and community protection.*

Strategies

Respondents mentioned the benefits of field visits and landscape analysis (Table 5) to reconcile differing perspectives on the question of forest structure. Field visits grounded stakeholder discussions and provided a specific context for decision making, rather than engage in principled arguments over management practices. A 4FRI stakeholder described this benefit:

> *We've had a lot of difficulty coming up with desired conditions everybody agrees with. Then there were a*

couple of field trips that were fascinating because even the groups that really disagreed could look at [the forest] and say, "Well, yeah. This tree should go. This tree should go. … We should clear this whole section out and leave all of these 5 trees here." It seems that [we find greater agreement] when we stand out in the woods together and discuss what we would do on the ground.

Landscape analysis was also used as a tool to address perceived trade-offs among restoration, fuels reduction, and retention of wildlife habitat. A Tapash Sustainable Forest Collaborative (Tapash) stakeholder described this benefit:

If you want to accomplish every objective on every acre you're going to struggle between fuels and owls. If you can step back and think about a landscape where you accommodate certain things on different parts of your landscape you're going to have a lot more options.

Challenge 3: Forest Service Lacks a Clear Collaborative Decision Space

41 % of respondents, with large variation among groups (0–78 % of respondents; Table 4), reported that ambiguity about the role of stakeholder groups presented a challenge. This challenge produced tension and mistrust when the Forest Service interpreted recommendations different from the intent of the collaborative. A 4FRI stakeholder described this as follows:

What the CFLRP calls collaboration is not really collaboration but more like informed *decision making because the Forest Service holds all decision-making power.*

This challenge may reflect perceptions of overlapping mandates regarding the role of stakeholder groups, risk aversion stemming from negative past experiences, and reluctance to initiate the significant public participation requirements under the Federal Advisory Committee Act (FACA), as described by a Southwest Jemez Mountains Collaborative (Southwest Jemez) stakeholder:

They [Forest Service] said they're scared of FACA … and we could be a collaborative *if we wanted, but that they weren't going to do it … That really deflated us. We kind of walked away with that … I would say we became two parallel universes.*

Strategies

Respondents described two primary strategies to address this challenge including support from local agency leadership and field visits (Table 5). For example, quotes from two Clearwater stakeholders described how Forest Service support fostered relationship building, a shared commitment, and a culture of appreciation and respect among collaborative members and agency staff:

The Forest Supervisor actually made collaborating a mandatory part of their [Forest Service staff] job.

We are blessed with an incredible team here in the Clearwater, they are very engaged and supportive so it all comes together.

Respondents also mentioned the importance of field visits to confirm that the Forest Service had incorporated their recommendations into actions, as described by a Deschutes stakeholder:

We always have that caveat that the Forest Service makes the final decision and so it's, "These are strong recommendations, please integrate them." Lucky with this group too, it seems like it doesn't stop at that level because then, we will go out and visit the site the following year and we'll see what actions were done on the ground and we'll see how the Forest Service carried those recommendations out.

Challenge 4: Threat of Litigation

40 % of respondents (≥50 % in three of six groups; Table 4) identified threat of litigation as a challenge. Two principal sources were identified: particular members of the collaborative, or outside parties that declined participation in the collaborative as a means to influence decisions. When potential litigants were collaborative members, some perceived this leverage as creating an unequal distribution of power. A 4FRI stakeholder described this challenge:

One of the biggest challenges was that we had the more litigation-accepting groups at the table who in the past would not actually participate in a collaborative group … they were coming to the table at the cost to a collaborative of an uneven or unequal level of power and influence. That was an unspoken dark cloud overhanging the group.

Threat of outside litigation occurred when interest groups excluded themselves from collaboration. For example, some environmental groups declined participation on ideological grounds, preferring to engage in litigation. A Clearwater stakeholder external to the collaborative described this decision:

That's a problem I have with it is that they take the public out of public lands. NEPA is actually a very

democratic law in which everyone has an equal footing. The collaborative process divides citizens into two groups: those that are on the inside and those on the outside.

Threat of litigation frustrated participants when decisions were delayed by analysis or appeal. Despite investing time in the collaborative process, in some cases the Forest Service still had to defend against litigation. This challenge was evident at SWCC (83 % of respondents; Table 4), which faced litigation on a CFLRP-sponsored project. The experience led some to question the time and resources invested in collaboration:

I think it [collaboration] has tremendous value and I'm a big supporter, but I also think that people's belief that we're going to get more done is just false, and they really should know that, because at the end of the day, NEPA and other litigation and appeal pathways are still there, and so what it does is add more time and it actually slows things down. I'm still comfortable with it because more people are more engaged, in different ways, and that's good.

Strategies

To address the threat of litigation, respondents described the importance of broad and balanced representation of stakeholder interests (membership diversity; Table 5). Inviting a diversity of stakeholders at the outset was described as critical to improving the quality of collaborative recommendations and to cultivating broad support for a project. A Deschutes stakeholder described the benefits of membership diversity:

It's been absolutely key. When you have [a timber representative and conservation representatives] saying the same things and they have trust within their circles, those people carry the message back. So, once you have that shared vision, taking that back to your sphere of influence and spreading that message. It's taken a lot of behind the scenes work by people to say we can obstruct some other project somewhere else because we really want to see this project go forward.

Challenge 5: Socio-Economic Desired Conditions Are Not Well Developed

38 % of respondents (8–100 % within individual groups; Table 4) reported that socio-economic objectives did not receive adequate consideration compared to ecological objectives in discussions of desired conditions. A stakeholder from Southwest Jemez shared the following:

The Forest Service has had so many challenges associated with the biological side of things that they felt like they needed to get all the biology straight … and they spent a lot of time on that and to me it's great … But they haven't done as much on setting the desired conditions for social or economic. And so the list of social and economic are all pretty much the same generic stuff.

Lack of well-defined, socio-economic objectives posed a challenge when expectations for economic benefits were not met. Lack of local markets and infrastructure for forest products were hurdles in several collaboratives, including Tapash, where all respondents reported this challenge. Three factors were perceived as reducing the economic viability of fuels treatments: low forest productivity, legal constraints (including harvest restrictions under the Northwest Forest Plan), and operational challenges on steep slopes or in remote settings. Failure to receive viable bids on treatment units had a demoralizing effect for some collaborative members who joined with the promise of economic benefit:

We thought that funding to the CFLRP projects would go in a large part towards restoration projects that would provide us with a certain level of economy to the local area … It hasn't materialized.

Strategies

Groups addressed this challenge by taking a proactive approach to socio-economic considerations, including them in discussions of desired conditions early in project development (Table 5). For example, the Tapash targeted market opportunities through an economics sub-group and industry outreach prior to timber sale bidding. A stakeholder described this process as follows:

We're trying to push forward and get economics in there with the other analysis of the ecological aspects and not wait till the 11th hour and then be surprised if this project isn't going to sell. There's no mills interested. That shouldn't be a surprise. We should know that early on … we'll all talk about ecological, social and economic together, rather than being segregated.

Challenge 6: Different Perspectives on Appropriate Reference Conditions

37 % of respondents (11–87 % within individual groups; Table 4) identified differing perspectives on reference conditions as a challenge. Reference conditions (e.g.,

historical conditions or contemporary relatively, intact forests), serve as guideposts or sideboards for desired conditions. Differing perspectives reflected concerns about use of historic conditions as models for current landscapes or climates, conflicting science and beliefs on what constitutes reliable reference information, inappropriate generalization of reference data across the landscape, and debates on the importance of reference conditions versus stakeholder values.

Respondents explained that most available data on historic (pre-European settlement) conditions apply to dry frequent-fire forests. However, collaboratives in landscapes with greater prevalence of more mesic, mixed-severity regimes (Table 1), struggled with lack of historical data and the tendency to generalize from that of frequent-fire forests. A member of Tapash expressed this challenge as follows:

> *When we get going in rhetoric and discussions about reference conditions I think we have this urge for this oversimplification of it, we are really good at talking about that open ponderosa pine stand … but we are terrible at talking about the fact it was messy, it was mesic and it was never exactly like the simplified version we keep presenting to the public.*

However, sites with an abundance of data also experienced this challenge. The 4FRI landscape is rich in information on pre-settlement forest structure, yet 87 % of respondents described an underlying conflict between reference-condition science and social values:

> *Do you know how loaded that term is here?.. Restoration and pre-settlement and looking at evidence does not line up with other people's values. So I think we definitely use reference conditions to help develop those desired conditions but we're very aware and sensitive to the fact that this could not ever be a successful project and make it through if we merely focused on pre-settlement conditions.*

Strategies

Collaboratives approached this challenge through science engagement and legitimizing stakeholder values in decision making (Table 5). For example, the Deschutes is fostering scientific engagement through shared learning about historic conditions, their application to restoration, and collaborative involvement in research products. A Deschutes stakeholder described the process as follows:

> *We've been very intentional about the science process so that is open and transparent and it has multiple different mechanisms for checking in, both in the field and the conference room, so that people at the end say, you know what, I understand the research process, that I understand how you got statistically significant results and things like that without making it overly complicated.*

A 4FRI stakeholder described the importance of legitimizing stakeholder values as a means to move beyond conflicts between reference-condition science and human values:

> *It took us a while but I think we did get there and worked really hard to try and make our [recommendations] encompass a value that was brought out. I think that it would have been good to have a discussion earlier on about where values versus where data was going to be sufficient and to be a little more sensitive to people's values rather than always try to respond to everything with factoids or attack the value that was brought out … That's not collaborative… It took a lot of time and effort to regroup because we didn't [initially] embrace values, we drew lines in the sand and dismissed values in favor of science. So it's definitely been a learning opportunity.*

Challenge 7: Participatory Fatigue

35 % of respondents (11–50 % within individual groups; Table 4) identified participatory fatigue, or diminished enthusiasm for collaboration over time, to be a challenge. This was expressed by a 4FRI stakeholder:

> *Exhaustion is a part of this. I mean it's a marathon. It's like four marathons. Everybody gets tired … because it takes a long time and that wears on people. And I think that maybe takes away from some of the collaboration because people get frustrated.*

Strategies

Respondents described several strategies to address participatory fatigue, including delegating specific tasks and responsibilities to coordinators and facilitators and using sub-groups (Table 5) to keep the decision-making process on track.

Collaboratives employ various types of coordinators in administrative support (Table 2). These include (1) Forest Service Coordinators (Forest Service staff) who serve as liaisons with the collaborative and coordinate activities across administrative units within the agency, (2) Collaborative Coordinators (contractors) who work on issues beyond the CFLRP, (3) CFLRP Coordinators (contractors) focused solely on CFLRP projects, and (4) Monitoring

Coordinators (contractors) who support groups' monitoring efforts. Coordinator roles also vary widely, and include meeting planning, field trip coordination, grant or report writing, science delivery, design of outreach and communication strategies, liaison with Forest Service, membership support, collating/summarizing stakeholder opinions, developing process rules, identifying issues for discussion, and organizing expert visits.

Several groups contracted with third-party facilitators trained in conflict resolution to help stakeholders communicate more effectively. A 4FRI stakeholder emphasized the importance of dedicated funding for facilitation at the outset:

> *In retrospect I think it would have been good money spent by the federal government. I hope at some point too there's a federal review internally, they're like, "Where did we spend money we maybe shouldn't have, where did we spend where we could have gotten a bigger bang for our buck up-front." Facilitation for new CFLRPs should be one of the very first things, part of the package.*

Collaboratives used sub-groups (working groups or subcommittees)—typically representative of the overall membership—to focus on specific topics. By participating in smaller groups, individuals can contribute to issues that matter to them most; this also reduces the time and cost of convening all members. For example, Deschutes has a Restoration Planning Sub-Committee that addresses desired conditions for different forest types. Other sub-groups focus on monitoring or media and communications. Collaboratives using sub-groups crafted decision rules to guide membership and coordination within the larger group. Key to success was building trust for sub-group decisions within the larger collaborative. A Clearwater stakeholder described this relationship:

> *Then once you've done that in the committee you've got to go to the full group and convince them what you've come up with is correct. That, again, has to build trust, but those people have been going to committees too so they understand the process. It does not happen overnight.*

Challenge 8: Limited Forest Service Capacity to Collaborate

Limited capacity of the agency to collaborate was mentioned by 35 % of respondents (11–50 % within individual groups; Table 4). Collaboration places new demands on Forest Service staff and resources. Lack of capacity was perceived to result from insufficient time and resources to undertake additional work, as a Deschutes stakeholder described:

> *There's a lot of work for the collaboratives, and we've had a lot of people from our team spend a lot of time making maps and talking, right down to the nitty gritty, about how they're going to do the treatment in that particular stand or area. It's time-consuming, it's exhausting.*

Limited capacity to collaborate was also attributed to the perception that some agency personnel lack the skills to engage with collaborative partners, as expressed by a Tapash stakeholder:

> *Something for upper management leadership to look at is how we select different people for different roles when we're talking collaboration and partnerships … we do have certain individuals that have no interest in doing this and they can hold up the process. I would say to take a new look at how we form teams and personalities and that's kind of a new thing for the Forest Service.*

Strategies

Obtaining support from the collaborative and agency leadership (Table 5) was described as important strategies to address the limited capacity of agency staff. For example, Clearwater made a strategic decision to work cooperatively with the Forest Service, to learn about agency timelines and processes, and to encourage community support for collaboratively endorsed projects:

> *We made a decision very early in the collaborative that we were going to be a friend to the agency. That we were going to work with them, support them, all of our actions were going to be in support of the agency. I think that has served us well, served our relationships well and we've honored it. It doesn't mean that we don't ever disagree or question, or work with the agency like why and how, and can't we do this differently.*

At Deschutes, commitment and support from the Forest Supervisor was seen as critical to the capacity of managers to garner the time and resources necessary to work effectively with the collaborative:

> *Our Forest Supervisor is very collaborative … He's got the right personality to keep us moving forward and keep people thinking in the right mindset. Without that leadership at the top, setting the tone and pushing the right kind of policy, you're not going to get the work done in the lower echelons that you need to have done.*

Challenge 9: Moving from Work in Ponderosa Pine to Mixed-Conifer Forest Types

The landscapes considered in this study vary in representation of historically low fire severity and mixed-severity forests (Table 1). However, in all collaboratives, initial discussions focused on the former, where restoration was perceived as more straightforward and less controversial. In contrast, 33 % of respondents (17–67 % within individual groups, Table 4) described the move to mixed-conifer forests as challenging for several reasons: limited scientific information, greater site productivity (thus greater density of larger shade-tolerant trees and greater economic incentive to harvest), historically greater frequency of high- and mixed-severity fire (thus inherent conflict in reducing fire hazard and restoring pre-settlement conditions), and greater social controversy in reintroducing historic fire regimes. A stakeholder from SWCC described this tension:

> *It's pretty clear in the low-elevation ponderosa pine, dry Doug-fir. There's a strong zone of agreement. The reason there's a zone of agreement is because the treatment for that is relatively unified … they don't have mixed-severity… What's important [in mixed-severity conifer forest] is to distinguish between restoration for vegetation treatment, restoration for fire management, allowing fire to run its course in the landscape, and fire safety. These are different things, fire management from a restoration standpoint and fire safety are not the same thing.*

Strategies

At the time of the interviews, several groups were planning restoration of mixed-severity systems using many of the strategies described earlier: issue-based recommendations, field visits, landscape analysis, coordination and facilitation, subgroups and science engagement (Table 5). Respondents also described the value of input from external scientists (Table 5), including representatives of science-based conservation organizations and faculty and students at local universities who helped translate relevant research but were not perceived as advocating for a particular outcome. For example, with planning support from coordinators, the Deschutes conducted field trips, used science engagement, and conducted facilitated meetings of the Restoration Planning Sub-Committee to develop issue-based recommendations for restoration of mixed-conifer forests. Subsequent discussions about desired conditions benefited directly from these learning experiences, as described by one Deschutes stakeholder:

> *There's often been links with the collaborative and current research. We have either a professor or a graduate student share the latest research. Sometimes their presentations are directly integrated in the collaborative. Most of the time, it's a side experience that we're encouraged to attend. It's great, to be able to have people in the room learning about research that's coming out about historic conditions and then have the chance to dialog about our shared visions for the future and what we're hoping to achieve.*

Another Deschutes stakeholder described the important role of science-based conservation organizations in bridging between ecological science and collaborative values, particularly for new management topics such as restoration of mixed-conifer forest:

> *I think it's critical. They are outside the agency. They have ecological training. They can be kind of neutral. They bring other resources and a different perspective. That's a key piece of the collaborative in my opinion…You need technical skills to be able to produce the desired conditions and I can bounce my thoughts off them too and that's a good thing.*

Challenge 10: Lack of Trust in the Forest Service

31 % of respondents (14–56 % within individual groups; Table 4) identified lack of trust in the Forest Service as a challenge to developing a shared vision for desired conditions. Whereas respondents typically trusted managers engaged within the collaboratives, there remained mistrust of the agency and of decisions made by leadership. This often reflected perceptions that administrative or bureaucratic mandates trump decisions based on ecological objectives or stakeholder values. For example, several respondents expressed concern that the agency reward structure and budget system remained tied to timber production, promoting unsustainable harvest under the guise of "restoration." A Tapash stakeholder described this perception as follows:

> *The agency is funded and spoken to by the volume it's creating out there in the landscape and it is always this unspoken and, if you ask about it, a very apparent truth that they have got to deliver a certain level of board feet. They are not honored for the acreage that is more resilient on the landscape. Time and time again that ends up being a big issue.*

A stakeholder from SWCC described a similar concern about the transparency of intended outcomes of treatments:

> *The point of that discussion was if this is a restoration project, it doesn't look like a restoration project. It looks like a timber sale. That's okay … Tell us or say it's a timber sale. Don't disguise this as something*

else. Let's talk about what that is and let's talk about our definitions of restoration and resiliency.

Strategies

To address this challenge, respondents described the need to shift agency incentive structures (Table 5) so that Forest Service managers are rewarded for non-commodity values (e.g., restoration, acres treated, or production of ecosystem services). For example, in 2012, the Forest Service promulgated a new National Forest System Land Management Planning Rule (U.S. Forest Service 2012), replacing a 1982 rule. It changes how Forest Service units plan for wildlife management, watershed management, monitoring, and climate change response; it also changes expectations for public participation. There was hope that this new rule would also lead to changes in the reward structure, as described by a Deschutes stakeholder:

I would love to see a Forest Plan that is written in a way it doesn't create the tension of measuring your desired outcomes as rigid outputs that aren't necessarily capturing the true intent of what restoration can be.

Discussion

Despite considerable variation in the landscape context and group characteristics of collaboratives, we identified ten common challenges to developing desired conditions and strategies to address them. To aid in synthesis and discussion of our findings, we organize the common challenges into three overarching themes: management for multiple objectives, collaborative capacity and trust, and integration of ecological science and social values (Table 5).

Management for Multiple Objectives (Challenges 1, 2 and 5)

Previous research suggests that having clear and feasible goals aids effective collaboration (Schuett et al. 2001; Conley and Moote 2003). Collaboratives working under the CFLRP have the complex goal of balancing multiple objectives that include encouraging ecological, economic, and social sustainability. Defining these objectives with sufficient detail to guide management and monitoring, but allowing for sufficient flexibility to encompass uncertainty and variability, is inherently challenging. Collaboratives use multiple strategies to address these challenges, as discussed above. For example, written issue-based recommendations establish a permanent record and reduce the potential for misunderstanding of past decisions. In an analysis of the Colorado Front Range CFLRP group (not considered here), Cheng et al. (2015) identify the importance of written recommendations as boundary objects that serve as critical links between the collaborative and Forest Service. These documents provide "durable mechanisms through which collaborative learning, knowledge, and ideas are absorbed and acted upon by the agency" (Cheng et al. 2015). However, it is important to clarify at the outset how the agency will use these recommendations (Moote and Becker 2003). When recommendations were not interpreted or implemented as expected, the resulting tension led to loss of trust. Additionally, literature on collaborative processes highlights the importance of consensus decision-making (Wondolleck and Yaffee 2000; Margerum 2002). In our study, tiered level-of-support rules provided a standardized approach to characterizing, documenting, and communicating agreements and to moving forward when full consensus was not achievable. Alternatively, respondents from the Clearwater Collaborative described a strategic decision to address broad institutional and resource barriers to restoration, rather than provide the Forest Service with specific management recommendations. Maintaining a broad view may help to avoid pitfalls of overly precise resource targets and planning paralysis as stakeholders debate the details of desired conditions (Matonis 2015).

Field visits and landscape analysis were used frequently to navigate multiple objectives. Previous studies have also found that field trips provide important opportunities for collaboratives to engage in concrete discussions about alternatives (Shindler et al. 2011). Landscape analysis allowed groups to assess perceived or actual trade-offs in management objectives at multiple spatial scales, and to avoid having to meet every objective on every acre. For example, fuels reduction treatments that may adversely affect wildlife at the stand scale may have a benefit at the landscape scale by reducing the probability of high-intensity fire.

Our findings also highlight the challenge and importance of integrating socio-economic considerations in discussions of ecological desired conditions early in project development. Despite these challenges, CFLRP projects report considerable economic benefits for local communities during the first five years of the program (U.S. Forest Service 2015). Individual collaboratives continue to explore novel ways to generate economic opportunities.

Collaborative Capacity and Trust (Challenges 3, 4, 7, 8 and 10)

It is noteworthy that similar challenges to collaborating with the Forest Service were described two decades ago (Wondolleck and Yaffee 1994; Carr et al. 1998) and that these

limitations persist despite increased agency investment in collaboration. An inherent tension lies in the fact that collaboratives do not have binding legal authority (Koontz et al. 2004; Butler 2013). Thus, stakeholders may see few incentives to participate when agency decisions do not reflect the collaborative's recommendations on desired conditions. Several groups have addressed this challenge by effectively engaging with Forest Service staff and through post-implementation site visits to verify that recommendations are being incorporated. These experiences established effective means of accountability in which collaborative contributions to decision-making are evident to all parties and there are feedback mechanisms so that groups can see how those contributions are manifest. However, this challenge was difficult to overcome in the absence of support from Forest Service leadership. When decisions by agency leadership contradicted conversations within the collaborative, local managers were placed in a difficult position.

There was significant variation among collaboratives in the extent to which they were challenged by Forest Service capacity or stakeholder trust. This variation likely reflected the idiosyncrasies of local leadership and individual actors. The benefits of dedicated, energetic champions and strong local leadership are well established in the literature on collaboration (Wondolleck and Yaffee 2000). That capacity and trust hinge on individuals or their relationships, raises uncertainty, however, about collaboration at a national scale, particularly where local leadership is lacking (Cheng 2006). High turn-over among Forest Service staff can be a barrier to strong and consistent local leadership within the agency (Davenport et al. 2007). Respondents also recommended the agency shift its reward system away from production metrics to those that acknowledge ecological functions and ecosystem services, as reflected in the multi-resource values of 2012 Planning Rule (U.S. Forest Service 2012). The results of our study suggest that, depending on how local agency leadership implements the planning process, the new rule offers the potential to increase trust in agency decision-making among some stakeholders.

Despite variation in governance structure (e.g., open vs. closed membership, facilitation, use of sub-groups; Table 2) threat of litigation remained a challenge and led some respondents to question the incentives for engagement in the collaborative process. CFLRP is designed to facilitate collaborative restoration within the existing legal framework of national forest management and conflict resolution (Nie and Metcalf 2015). Whether collaboratives reduce rates of objection or appeal remains an open question (Schultz et al. 2012). The results of our study support previous research highlighting the benefits of early and proactive involvement of diverse interests: it facilitates understanding and trust, fosters acceptability to a broader range of interests, and reduces the likelihood of controversy and litigation (Wondolleck and Yaffee 2000; Lowe and Moote 2005; Imperial and Koontz 2007; Nie and Metcalf 2015). Collaborative members with different interests also serve as local champions, sharing the goals of the collaborative with their respective communities. Membership diversity can also enhance collaborative legitimacy—the perception that decision-making is unbiased and representative of multiple viewpoints—a critcal factor in gaining public support of outcomes stemming from the collaborative (Cash et al. 2003, Posner et al. 2016).

Considerable time and energy are often required to develop a shared vision, and participatory fatigue was a prominent challenge for some of the collaboratives in this study. There is an important distinction between time required to establish an inclusive process of consensus-based deliberation, and shared learning and time spent on bureaucratic inefficiency or unproductive communication (Wondolleck and Yaffee 2000; Margerum 2011). The former may require that groups maintain realistic expectations about the pace of deliberation. However, an important strategy to gain efficiency is to delegate roles and responsibilities to individuals (collaborative coordinators or facilitators), and smaller working groups. In a study of the second (2012) cohort of CFLRP collaboratives, Antuma et al. (2014) similarly describe the value of designated coordinators and facilitators. Still, constraints on CFLRP funding present a challenge because they can only be used for implementation and monitoring, not planning. Several forests reported that funding was inadequate to plan new CFLRP projects, and several collaboratives lacked funding for daily administration and project planning. Other groups, including the Clearwater (considered here) and the Southern Blues (2012 cohort), acquired non-profit status to secure funding to hire contract staff (Antuma et al. 2014).

Integration of Ecological Science and Social Values (Challenges 6 and 9)

The goal of collaboration in the CFLRP is to develop approaches to restoration that are scientifically credible and socially acceptable. We identified a core tension between the role of ecological science and social values in decision-making. Collaboratives addressed this tension by establishing legitimacy to both science and social values in setting desired conditions. Science legitimacy was gained through science engagement and by involving respected experts to translate the research, while maintaining distance from the decision-making process. In several collaboratives, science-based conservation organizations served an important bridging role in facilitating fair exchange of ideas on the contributions of ecological science, local knowledge and social values in collaborative decision-making. Recent research has highlighted the functions of boundary

organizations as communicators, translators and mediators of multiple knowledge systems while maintaining a position of neutrality essential to developing trust among diverse interests (Cash et al. 2003; Osmond et al. 2010; McCaffrey et al. 2013). Our interviews make clear that scientific knowledge is necessary, but not sufficient, for social learning in the process of identifying and articulating desired conditions. Even sites with an abundance of scientific data experienced challenges in decision-making. A focus on ecological science without consideration of social values can alienate stakeholders. Although it may not be possible to optimally solve for trade-offs in social values, clear articulation of trade-offs is important in framing issues, identifying risks, and analyzing alternatives. These strategies fostered social leaning—well established to be a key step in finding a common vision through collaborative management (Daniels and Walker 1996; Wondolleck and Yaffee 2000; Schusler et al. 2003).

Summary and Conclusions

The CFLRP offers a rich and informative set of experiences in how collaboratives develop a shared vision of desired conditions through restoration of fire-adapted forest landscapes. Despite differences in their ecological and social contexts, collaboratives face many of the same challenges in attaining this goal and are developing multiple strategies to overcome them. Highlighting both the challenges and solutions is critical if other collaborative restoration projects are to learn from these efforts.

Several strategies were noteworthy in their relevance to multiple challenges. Field visits provide a real-world platform for collaborative members and agency staff to develop a shared understanding; they also provide direct evidence of how collaborative recommendations were incorporated into management decisions. Having support from local agency leadership was another critical strategy that helped with limited Forest Service capacity and ambiguity in the role of collaboratives in the decision-making process. There was striking variation among collaboratives in their perceived roles in providing input to the Forest Service; for those not challenged by this ambiguity, supportive leadership at the Regional, Forest, and District levels was mentioned repeatedly.

In addition, many strategies for addressing common challenges were also used to expand zones of agreement on desired conditions into different forest types—a context in which there was greater scientific and social uncertainty. Issue-based recommendations; field visits; landscape analysis; designated coordinators, facilitators, and sub-groups; and science engagement all came into play as groups moved from the familiarity of forests historically characterized by frequent low-severity fire regimes to the uncertainty of mixed-severity fire regime forests. An underlying assumption of collaborative approaches to public lands management is that, over time, increasing levels of trust and collaborative capacity will enable groups to expand zones of agreement into new and potentially more complex and controversial areas. However, there is a limited literature that examines the conditions that support this expansion. Our study highlights some of the processes, tools, and resources that groups draw upon to achieve this goal.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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