



Implementing Landscape Scale Conservation across Organizational Boundaries: Lessons from the Central Appalachian Region, United States

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Abstract

Natural resources across the United States are increasingly managed at the landscape scale through cooperation among multiple organizations and landowners. United States Department of Agriculture Forest Service (USFS) agency leaders have widely promoted this approach since 2009 when Secretary of Agriculture Vilsack called for “all lands” management. Landscape scale projects have been undertaken to address multiple goals such as single species conservation, resilience to fire, invasive species eradication, and others. The West Virginia Restoration Venture (WVRV)—one of five landscape scale conservation projects funded 2014–2016 across the Northeast and Midwest and known as “Joint Chiefs” projects—was evaluated by an interdisciplinary team of USFS employees to gain insight into how cross-boundary landscape scale conservation projects are implemented in the region. In this paper, the team used qualitative interview data from project participants to explore processes related to developing a shared vision for the landscape, implementation priorities, and methods to work across institutional and property ownership boundaries. Grounded in the landscape and collaborative resource management literatures, the report shows how established inter-organizational networks, flexible approaches to management, and a “shelf-stock” of ready-to-implement projects led to on-the-ground success. The authors provide insight about factors that constrain and facilitate the implementation of landscape scale conservation projects that have multiple goals, landowners, and organizational partners.

Keywords USDA Forest Service · Restoration · Collaboration · Joint Chiefs’

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Introduction

The United States’ (US) Central Appalachian region is a predominantly forested landscape that supports diverse species, agricultural production, and many other human activities including mining, recreation, and forest products

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(Butler et al. 2015). High biological diversity is a result of the variety of geophysical and climatological zones created by mountainous terrain and intermingled geologic substrates (Anderson and Ferree 2010). NatureServe (2013) identified the region as one of North America's "biodiversity hotspots." Red spruce (*Picea rubens*) and eastern hemlock (*Tsuga canadensis*) have been recovering across regional high elevation ecosystems, which had been dominated by these species and others prior to European settlement (Thomas-Van Gundy and Strager 2012) but declined with late 19th and early 20th century land clearing and human-caused forest fires (Butler et al. 2015). Rare wildlife species, such as the Cheat Mountain salamander (*Plethodon nettingi*) and northern flying squirrel (*Glaucomys sabrinus*) depend upon these forests and are threatened by habitat fragmentation and changing climate and precipitation patterns (Butler et al. 2015). Similarly, regional water quality impairments from sedimentation and acidification have not supported fisheries, particularly Brook trout (*Salvelinus fontinalis*), at historic levels (Petty and Thorne 2005). At the same time, slowing resource extraction has changed economic conditions and challenged communities across this landscape.

In response to these changes and challenges, in 2014 the Monongahela National Forest and the Natural Resources Conservation Service (NRCS) initiated a landscape scale effort to restore watershed and terrestrial ecosystems across land ownership and institutional boundaries. This West Virginia Restoration Venture (WVRV) brought together government agencies (state, local, and federal) and non-governmental organizations (NGOs) in one of the first five Eastern US "Joint Chiefs" projects funded by USFS and NRCS to engage in landscape scale conservation (LSC). Joint Chiefs' projects are intended to coordinate restoration activities across land ownership boundaries by leveraging the ability of USFS, NRCS, and NGO partners to work on both public and private lands (Willis 2016). Considered a "successful" cross-boundary LSC project, a team of USFS staff members representing managers, scientists, and administration (Core Team), were asked by agency leaders to evaluate the project to glean lessons that could inform similar work. Members of the Core Team were not associated with the WVRV. In this paper, these lessons are discussed and linked to conservation, restoration, and collaborative resource management literatures to better understand key drivers of WVRV implementation outcomes.

Cross-boundary Cooperation, Landscape Scale Conservation, and Collaboration

Cooperating across ownership and administrative boundaries to manage natural resources is not a recent

development. In 1992, the USFS adopted "ecosystem management" as its management focus (Thomas 1996), even though there was no explicit mandate for National Forests to adopt this focus (Butler and Koontz 2005). Butler and Koontz (2005) detail six objectives of USFS ecosystem management, five of which are also included in Grumbine's (1994) ten policy objectives related to ecosystem management: collaborative stewardship, integrating multiple sources of scientific and socio-economic information into decision making, engaging in adaptive management, cooperating with other agencies, and sustainability of ecological processes. Even though cooperating across ownership boundaries was emphasized as early as the 1990s (Thomas 1996), doing so was not a focus of USFS ecosystem management at that time, nor were other, largely human-centered, themes from Grumbine's work. Perhaps for this reason, much of the research on cross-boundary cooperation has focused on cooperation across lands owned by the same types of landowners (Charnley et al. 2017), such as the rich literature on cooperation between family forest owners to reduce fire risk (Fischer and Charnley 2012) and for general forest management (Kittredge 2005; Gass et al. 2009).

Nonetheless, cross-boundary cooperation to achieve LSC goals is experiencing increased attention as it may offer better solutions for addressing ecological challenges, making the need to manage across ownership boundaries even more important. Rickenbach et al. (2011), for example, advocate cross-boundary cooperation as a means of private land ecosystem service provisioning, and major NGOs are undertaking efforts to protect resources at landscape scales (Pressey and Bottrill 2009). In the Pacific Northwest region of the US, LSC work related to managing fire is common enough to support a typology of projects ranging from large scale with many types of landowners to those addressing just private homeowners (Charnley et al. 2017). Project types can also be differentiated based upon their goals, size, and source of funding, and large scale restoration projects that are funded by national programs—such as Joint Chiefs'—are one of the five project types identified (Charnley et al. 2017). These large scale projects are generally over 40,000 hectares, with many participants, diverse land ownership types, and numerous treatment areas (Charnley et al. 2017). Although this typology applies specifically to wildfire-related cooperation, it is potentially applicable to other LSC issues being addressed by large scale national program projects.

As a practice, LSC is rooted in conservation biology and represents a shift from conserving an individual species at single parcel or landowner scale to biodiversity protection across larger, multi-landowner scales (Poiani et al. 2000). Although the term "landscape" is somewhat nebulous, it has been defined as a geographic area large enough to

contribute to achieving significant conservation outcomes, yet small enough to be able to achieve implementation progress, and characterized by common human and ecological factors useful for guiding project goals (Pressey and Bottrill 2009). Processes used to plan LSC projects often adhere to traditional rational planning models, whereby a linear process is used to identify goals, objectives, and strategies, and evaluate their effectiveness (Didier et al. 2009). As Poiani et al. (2000) state, "...implementing conservation across multiple scales requires unprecedented levels of coordination among federal, state, and local institutions, both public and private," (p 141), and Charnley et al. (2017) note that this level of coordination between different landowners and organizations has not been fully captured in the cross-boundary cooperation literature. Coordination may also be constrained by institutions that are not designed to operate across scales and stakeholders (Rickenbach et al. 2011); for instance it is difficult to shift funds from a National Forest to private landowners adjacent to the Forest. Although some programs (e.g., the Cambridge Conservation Forum) have developed LSC evaluation frameworks that include social outcomes (Kapos et al. 2009) that may capture some of the complexity associated with such coordination, it can be difficult to assess LSC projects for outcomes other than species conservation (Kapos et al. 2009).

Despite these potential difficulties, using collaborative approaches for engaging in cross-boundary resource management projects and assessing projects and groups for factors other than conservation outcomes has a long history with regard to forests and watersheds. Wondolleck and Yaffee (2000), for example, compiled 10 years of multi-partner case studies and developed guidelines for successful collaboration, and their findings are echoed throughout the collaborative resource management research. Developing a shared vision with the collaborative, providing members with increased access to information and expertise, and setting the stage for initial modest group achievements to build momentum are pillars of collaborative watershed management (Floress et al. 2011). In addition, clear structures for facilitating flows of information and other resources across organizations are needed to sustain any given project (Wondolleck and Yaffee 2000; Margerum and Robinson 2015).

Collaborative efforts can be constrained by a lack of diverse skill sets, failures to clearly identify partner roles (Floress et al. 2009), and the challenge of navigating multiple, sometimes conflicting institutional cultures (Hopkinson et al. 2017). Whereas collaborative forest management can happen at site scales (e.g., one piece of property within a landscape, or one project site within a given property), watershed management nearly always necessitates cross-boundary cooperation to achieve conservation and

restoration goals. Thus, lessons from watershed management collaboration are readily applicable to LSC that crosses ownership and institutional boundaries. This is evident in Mansourian and Vallauri's (2014) forest restoration project recommendations - echoing those from the collaborative management literature - which advocate the use of an iterative adaptive management cycle where large scale implementation strategies are monitored and feedback regularly incorporated into new, adapted, strategies. Mansourian and Vallauri (2014) explicitly separate three distinct sets of projects (those with ecosystem, socioeconomic, and combined objectives), and highlight the importance of meeting the needs of both human and ecological systems through restoration activities, a message Buckley and Crone (2008) also emphasize when discussing the potential conflicts inherent to restoration projects. They determined that projects can be socially and ecologically compatible when land uses near project sites also benefit from restoration activities (for example, when wetland restoration reduces flooding on nearby agricultural lands) (Buckley and Crone 2008).

The Current Study

Because of the numerous difficulties outlined above that are associated with implementing landscape scale conservation practices, the WVRV was seen as a "successful" project funded by the new Joint Chiefs' program as they were able to meet and exceed their implementation goals. The goal of this research was to identify factors contributing to the WVRV's implementation success, barriers to implementation experienced by the partners, and to elucidate how WVRV findings could be used to facilitate other LSC projects. The primary factors associated with successful collaboration—development of a shared vision; ensuring support and coordination across partners; and developing effective communication across networks—informed the research approach, as did looking for the scale-related, institutional, and social/ecological compatibility constraints found in the conservation and restoration literature.

Methods

The West Virginia Restoration Venture (WVRV) Case Description

The WVRV project area consisted of the high elevation landscapes and headwater river systems of the Central Appalachian Mountains in West Virginia. The project included four watersheds that form the headwaters of the Ohio and Potomac rivers. The landscape supports several ecosystems that are critical reservoirs of eastern North

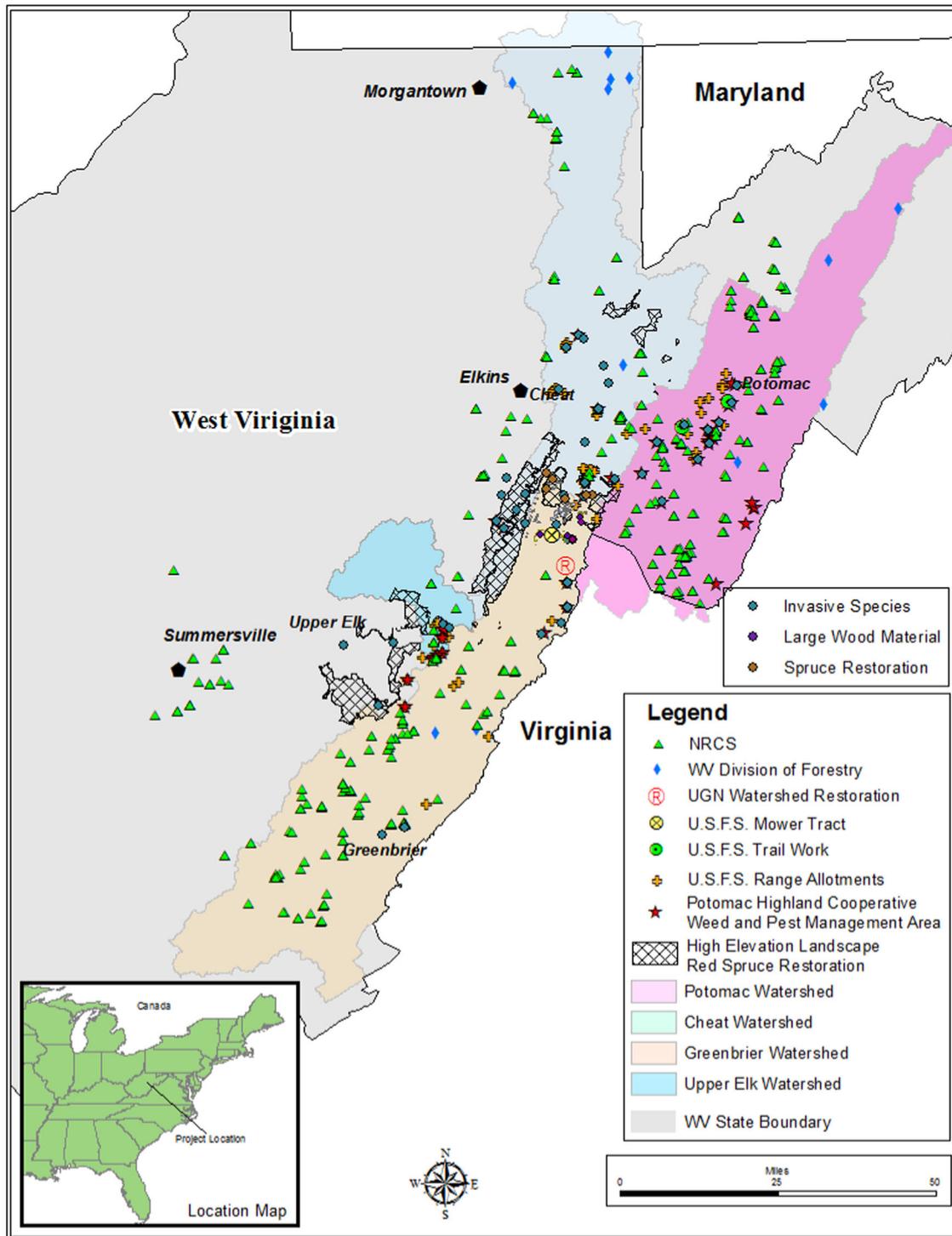


Fig. 1 Map of West Virginia Restoration Venture project area, watersheds, and treatments

American biodiversity, including coldwater trout streams, red spruce forests, northern hardwood forests, and oak-hickory forests (Fig. 1). The landscape is a patchwork of state, private, and federal lands, all sharing intensive timber and mineral extraction legacies. The Central Appalachians

form the mid-Atlantic region's wildland core, supporting a biodiversity hotspot of continental importance (NatureServe 2013). The WVRV's restoration activities focused on enhancing the recovery of these critical ecosystems from current and legacy impacts from land uses, such as impaired

Table 1 Target and achieved metrics for general implementation activities^a

Type of land receiving treatment	Types of practices	Target	Final
Federal lands	Practices measured in hectares (e.g., reforestation, habitat improved)	~8751 ha	~67,744
	Practices measured in km (e.g., stream habitat, road decommissioning)	~460 km	~555 km
	Number of wetlands	140	305
	Aquatic organism passages	4	6
Tribal/state lands	Practices measured in hectares (habitat creation, invasive species treatments)	~109 ha	~128 ha
	Landowner events	0	9 events (193)
	Conservation & Fire Education events (participants)	0	19 events (3855)
Private lands (through USDA-NRCS Environmental Quality Incentives Program)	Practices measured in hectares (participants)	0	~8188 ha (214)
	New conservation or forest management plan participants	0	4592
Private lands (through West Virginia Division of Forestry Forest Stewardship Plans)	Total participants (hectares) engaging in forest monitoring, invasive species treatment, and wildlife habitat creation	0	395 (~24,700 ha)

^aMetrics compiled from: Aspey and Thompson (2016).

water quality, lack of habitat connectivity, and degraded streams. Project goals were to maximize partners' capacity to improve wildlife habitat, reduce water pollution sources on public and private lands, restore watersheds, restore natural fire regimes/reduce fuel loading, and develop connections to additional groups, landowners, and other stakeholders who could implement restoration/management practices on-the-ground. The initial objectives included in the project proposal were primarily implementation activities that had already been approved through National Environmental Policy Act (NEPA) procedures or which fell under the authority of NRCS programs. A comparison of initial objectives and final accomplishments can be found in Table 1.

The WVRV was the name of a specific partnership bounded in time and funded by a specific source. As described more fully in the results, many of the partners engaged in this project had worked with each other on previous projects. By nature of the source of funding, lead agencies for the project were the Monongahela National Forest and the NRCS, with Monongahela staff primarily coordinating efforts. Seven additional partners from NGOs and state agencies were involved from the beginning of the project. Partner organization representatives met quarterly throughout the three year project to share project progress, updates, and to discuss and provide support for implementation activities.

Interview Participants

Monongahela National Forest staff were asked to identify key WVRV participants to potentially participate in interviews. Twenty-two people were interviewed: one from state and 16 from federal agencies (USFS, NRCS, US Fish and

Wildlife Service), and an additional five interviewees represented NGOs. Half the interviewees ($n = 11$) were USFS employees, predominantly from the Monongahela National Forest ($n = 9$); the other two were from the USFS's State and Private Forestry branch. Five representatives from three major NGOs participating in the WVRV were interviewed, but the NGOs are not identified here to protect interviewee confidentiality. Most project participants and interviewees were federal agency personnel. These results may therefore reflect more of a federal agency management perspective than NGO or state agency view. Also note that no private landowners (e.g., farmers or forest owners) directly collaborated in the process of the WVRV, though they did engage in land management strategies through NRCS and NGOs that addressed WVRV goals. Thus, the purpose and findings of this paper are limited to cross-organizational collaborations rather than those that directly engage citizens.

Interview Protocol

The interviews were designed to evaluate the WVRV in the context of key lessons regarding collaboration and implementation and therefore explored the following broad questions: *what* are the vision and goals of the WVRV and the organizations involved, *why* are they focusing on those goals, and *how* are they going about implementing a project at this scale. Initial questions were developed using a combination of published literature (Floress et al. 2011), data collection instruments shared with the first author by Susan Charnley, and USFS guidance (USFS 2014). Two initial interviews were conducted with WVRV participants by the first author via conference call, with all members of the Core Team—who crossed disciplinary boundaries—

Table 2 Types of stakeholders and their involvement in project stages

	Pre-Joint Chiefs' proposal	Proposal development	Implementation
Private landowners (farmers, forest owners, residents)	Not engaged directly in planning, seen as having interests met by agencies charged with serving them and through mandated public involvement processes.	Not engaged directly, seen as having interests met by agencies charged with serving them.	Engaged directly with NGOs, NRCS, state agencies, and neighboring landowners. Some became advocates for restoration. Farmers engage regularly in planning with NRCS at county level.
Non-governmental organizations	Some engaged directly in previous project scoping/development with other organizations. Some had formal agreements with federal and state agencies.	Some directly engaged in developing the proposal. Some provided match for federal dollars.	Engaged directly in implementation activities. Made decisions within organizations to benefit the landscape, though individual organization decisions were not formalized at the WVRV partnership level. Used federal funding and own budgets to hire staff to support project goals.
State agencies	Some engaged directly in previous project scoping/development with other organizations.	Some directly engaged in developing the proposal.	Engaged directly in implementation activities. Made decisions within organizations to benefit the landscape, though individual organization decisions were not formalized at the WVRV partnership level.
Federal Agencies (Natural Resources Conservation Service, Forest Service)	Local (i.e., near the Monongahela National Forest) federal agency staff had cooperated on other initiatives prior to the WVRV with each other, state agencies, organizations.	NRCS and USFS seen as the proposal development leaders.	USFS engaged directly in implementation activities on national forest land. NRCS prioritized landscape and engaged directly with private landowners for implementation projects. Shifted funds to partners to support implementation goals.

listening for training purposes. The Core Team had debriefing sessions after each interview, with some interview questions revised based upon interview responses and feedback from the Core Team. Data from the two initial interviews were included in analysis. Interviews were conducted in-person or via telephone and took anywhere from 30 min to 2 h, with the average interview taking approximately 1 h. The final interview guide is found in the supplementary material, and consisted of background information, group process, information and cooperation, implementation, and closing sections. Informed consent was obtained from all participants included in the study.

Project Documents and Field Tour

Project documents, including the WVRV project proposal, briefing papers, and annual reports, were reviewed to examine consistency between interview themes and written documentation of the project. Notes taken by the first author on a two day field tour of WVRV-related treatment sites on public and private land were also used to supplement and provide context for interview findings.

Interview Data Analysis

All interviews were digitally recorded and transcribed for analysis in QSR Nvivo 10. Responses were first coded by question, and then all responses to a single question were coded as a set through open and axial coding (Strauss and Corbin 1998). Open coding consisted of assigning codes to text representing themes or phenomena (e.g., red spruce restoration, barriers to restoration), and any given piece of text could be assigned multiple codes when applicable. Codes were not specific to a single question. That is, any mention of a theme was assigned the same code, regardless of the question to which the person was responding. A total of 294 open codes were assigned to chunks of interview text, including codes to bin 33 questions and 37 potential prompts and follow-ups (not all prompts and follow-up questions were asked of all participants). For this paper, a subset of codes were further explored to fulfill our overarching goal of identifying why those engaged in the project felt it was important, what their vision was for the future, how they went about making decisions within their organization and across the partnership with regard to achieving the landscape vision, and what made it possible to implement practices so quickly after receiving funding. Codes were examined that may have constrained, rather than facilitated, implementation. A variety of queries were conducted to explore relationships among codes for the axial coding process that informed findings. Examples of queries included examining goals by organizational affiliation, which issues were discussed concurrently, and how

information was discussed in relation to other codes. Quotes presented in the paper were selected to either represent statements made by multiple participants or to illustrate how participants differed in how they discussed the same theme.

Results

Overall, this study's findings indicate that the presence of existing relationships among individuals and organizations that led to having aligned goals, formal and informal sharing of resources among partners, extensive networks beyond the group, and support from leadership all facilitated swift implementation. Barriers interviewees identified included uncertainty related to funding amounts and duration, lack of flexibility associated with specific funding sources and budget categories, the ability to quickly respond to needs for practices across ownership boundaries, and insufficient resources or time for monitoring.

Process

The WVRV was a formal partnership aligned with a specific funding opportunity to accomplish landscape scale conservation, but built upon relationships that existed before and have continued beyond the three-year implementation cycle associated with the WVRV. In this section, how the WVRV partners came together to develop the funding proposal are briefly discussed, as are characteristics of the partnership's meeting and decision making process.

Developing the funding proposal occurred on an accelerated timeline due to the timing of when the funding opportunity was disseminated and when proposals were due (approximately one month). Because formal and informal collaborative relationships already existed among organizations (e.g., partner organizations had submitted unsuccessful proposals for other funding opportunities), key focus areas had already been identified across the landscape by those with formal decision making power within their organizations. During proposal development, interview participants who played important roles during implementation but had less authority to make prioritization decisions, or those with decision making power but limited time to dedicate to developing the proposal, discussed their roles as being less important to making decisions for the proposal. As one NGO leader said, "I trusted [project partners] enough to say, 'Call me when you need me, I'm there for you.' And let them take the lead because we all have similar goals... [They] would bring me in when they needed our input [for the developing the proposal]". Two interview participants noted the absence of private landowners, specifically agricultural producers, from direct

participation in the WVRV. Table 2 includes the time at which landowners or organizations (by type) who had implementation responsibility were involved in the WVRV.

As mentioned in the case description, the partnership met quarterly. In addition, staff within partner organizations increased the frequency with which they communicated with each other informally and some attended other meetings that were not directly related to the WVRV (e.g., Monongahela staff provided WVRV reports at NRCS quarterly State Technical Committee meetings on the Farm Bill).

What and Why: The Vision and Goals for Central Appalachian Forested Ecosystems

The overarching vision that emerged from the interviews was that the WVRV was aiming to build a restoration economy that supported resilient ecosystems and social and ecological benefits. This vision, although not directly stated in planning documents, was directly tied to how people discussed the goals of the project, and why those goals were important. Project goals were discussed on their own and in conjunction with other goals, the vision, and methods used to achieve outcomes. One participant, for instance, said, "... we've created a very tiny restoration economy by...moving money to our partners so they hire the people to do the surveys, the work, the construction, and so forth...and sometimes that results in long-term jobs through our NGO partners." One Monongahela National Forest staff specifically discussed the role of WVRV funds in putting several people with large landscaping equipment that had been sitting idle to work on the Forest, while an NGO participant stated,

My vision is that we have viable, healthy watersheds with really healthy agriculture, really healthy timberlands that are conducive to healthy watersheds, streams, hydrological systems. The sign that it is all working is that that we have more habitat for trout that are able to freely run between the headwater streams where they spawn and the fluvial systems in the valleys. I've seen two foot brook trout in the wild. I know they exist. I know they can grow that big if they have the habitat to do so. If we get the systems so they are interrelated and accessible by native trout, we've met all of our fishable/swimmable goals. We've created a destination fishery. And we have a robust economy based on natural resources.

The goal to establish resilient ecosystems included restoring natural processes, thus reducing dependence upon regular management interventions. As one person said, "We're really focused on looking at things that we can

affect that can be self-sustained once we do our work, then we can more or less walk away and feel pretty confident that the natural processes will take over and help sustain those conditions.” Another, however, noted that invasive species treatment would require ongoing intervention until eradicated. The ecosystem goals identified by participants included red spruce restoration; fish and wildlife populations/habitat (terrestrial and aquatic); improving water quality; and flood and erosion control. Approaches to achieving these goals included managing/eradicating non-native invasive species, working with private landowners, restoring reclaimed mines, and road decommissioning. Watershed management, both to identify the landscape across which work would take place and from hydrological, ecological, and social perspectives, was discussed as the overarching approach.

How: Conditions and Methods Facilitating Implementation

Presence of existing partnerships

The concepts that were related to virtually all others were the presence of existing partnerships between the various individuals and organizations involved, and the ability to take immediate action because of the presence of “NEPA-ready” (National Environmental Policy Act) projects that had already gone through applicable review processes required by NEPA and were simply in need of funding for implementation (see Table 3). Receiving Joint Chiefs’ funding was overwhelmingly seen as a catalyst for extending the work that was already occurring in the area, as participants had already agreed upon project goals through NEPA and other planning processes, and successful implementation on the broader scale was seen as a result of having plans and projects already approved. Here is how one participant from USFS conveyed this: “And it wasn’t WVRV that sparked this. This has been going on for a long time...so the issues and priorities were already there, they just needed the money to do the work. And this money allowed them to hit the ground running, I think, quicker and on a larger scale.” There was agreement across all participants that funding enhanced the work that was already happening and made it possible to carry through on existing plans.

Finally, existing partnerships fostered participant trust that their organization’s needs would be met, if not through the current project, then certainly in future work. One NGO partner stated, “We have a pretty direct line with all of the partners here, we necessarily spend time in the field together, look at problems, discuss solutions. So it’s not necessarily just WVRV, but all of the collective work that we have done together builds a pretty good line of

communication that makes it easy to discuss all of these topics with each other.”

Sharing institutional and financial support across networks

These open lines of communication also fostered resource sharing. Both formal and informal support were provided within and across participating agencies and organizations. The primary funding source that catalyzed WVRV work, though certainly not the only source, was Joint Chiefs’ allocations over 2014–2016. The WVRV final report shows that the NRCS contributed approximately \$6 million, USFS nearly \$4 million, and nine additional partners together contributed approximately \$2 million.

Interview findings show formal and informal institutional support came from all project partners, most often through sharing information and expertise across organizations. The NRCS, in particular, was mentioned as an important source of information and expertise with regard to maps, soils, and their knowledge of practices on the landscape. The essential contributions of soils knowledge and information to spruce restoration was stressed by several participants, with soils data driving choices about restoration site priorities. As one Monongahela National Forest participant mentioned, “There’s no spruce above ground, we’ve looked at the soils and what used to be there. We’re letting science drive where spruce should be.”

An NGO participant highlighted the role of information and information sharing in the adaptive management cycle. “...There’s an opportunity for some of these things to be tried out pretty quickly, as far as releasing different kinds of insects to see if they were effective on the hemlock... We regularly communicate [when] we see something going on as far as defoliation adjacent to these properties...” Another, referencing both past partnerships and the impact of WVRV said,

There’s always been an ability to interact with these different organizations individually and get their reports. And now with the RV and through the leadership of the state conservationist in West Virginia, there’s quarterly meetings in which the various groups are all present—federal, other state agencies, and NGOs that are involved with the WVRV.

Finally, when Monongahela National Forest staff were asked about information sharing and sources of scientific knowledge, all generally agreed that access to the results of research from USFS, universities, and NGOs was important, but not all agreed that directly partnering with researchers during an actual management cycle for a specific purpose was important or feasible. Two Monongahela

Table 3 Themes, subthemes, and participant counts from interview coding

Theme	Sub-themes	Number of interviewees discussing
Build restoration economy supporting resilient ecosystems and social/ecological benefits	Restore natural processes, resiliency	11
	Red spruce restoration	11
	Fish and wildlife populations/habitat (terrestrial and aquatic)	18
	Manage/eradicate non-native invasive species	9
	Assist private landowners (farmers, family forest owners)	14
	Watershed management	16
	Restoration economy/jobs	9
Conditions and methods facilitating implementation	Impact of past partnerships	14
	National Environmental Policy Act—ready projects	13
	Funding catalyzed existing work	12
Information sharing, institutional support	Soils information, maps	6
	For adaptive management, general project	15
	Partnering (or not) with researchers/USFS R&D	8
Missing participants	n/a	4
Leadership support	n/a	4
Institutional barriers	Actions across lands/funding constraints	13
	Importance of partners (to overcome institutional constraints)	9
	Uncertainty/short vs. long term funding	9

National Forest participants explicitly mentioned the importance of USFS Fernow Experimental Forest's provision of findings related to spruce and watershed restoration, particularly because of Fernow's ongoing Central Appalachian research and the close proximity of their study sites to the Monongahela National Forest. Forest Service researchers contributed to WVRV activities through consulting on watershed and red spruce restoration and through provision of more rigorous scientific support for specific management actions. In contrast, other interviewees stated that there were few direct connections between USFS researchers and national forest managers. For instance, one person said, "It's such a shame. We don't work that closely with [USFS researchers]. I don't know why we don't, but we don't." Another believed any lack of research/management partnerships is a result of managers' perceptions that research takes too long, when they, "...need answers now to adapt well."

Diverse stakeholders involved in planning, implementation, and monitoring

The final report for the WVRV states that 13 public agencies and NGOs contributed quantifiable financial support for some type of implementation activity, and 278 private

landowners (family forest owners, agricultural producers) participated in technical or financial assistance programs such as the Environmental Quality Incentives Program and forest management planning. Each of the 13 organizations were mentioned by interview participants at least once, in addition to 21 other organizations. Several interview participants described the Central Appalachian Spruce Restoration Initiative, a partnership in the region with similar participants that arose in the mid-2000s, as having been an important influence on the WVRV and its participants.

Interview participants were asked which stakeholders or organizations were missing from the WVRV, in addition to those who were present. The West Virginia Department of Transportation was mentioned by one person as participating to a small extent, but it was also noted that additional participation would be valuable to control the spread of invasive species. One person mentioned having more representation from within their own organization, and two interviewees noted the lack of direct participation in the partnership by producers, with one person stating:

The groups I think would be beneficial in the long-run that were not necessarily engaged in the process have to do more with the farm and agriculture side of the equation. So perhaps some of the groups involved

with economic development, or the Farm Bureau, or others that have a significant presence in this landscape and impact on the resources we're most interested in protecting.

Leadership support

Good, often transformational, leadership was seen as vital to the project's success by several interviewees. They noted risks associated with changing leadership during or after project completion, particularly loss of institutional memory and relationships that have been built over time by current leaders. As one person said,

If [the Monongahela National Forest] doesn't get another forest supervisor [with the current supervisor's] kind of vision, and that kind of boldness, and the kind of relationships that he already had with people, I'd fear to think what would happen to this initiative...if you had leadership that was too conservative and not trusting enough in staff and wanted to hold the reigns tight and control, control, control, this would not happen.

How: Implementation Needs and Barriers

Institutional barriers

Barriers related to funding sources and management practices were discussed by participants. Limitations on how certain pots of money from federal sources could be used or even shared were seen as a barrier. One person said, "If the Forest Service or USDA in general can figure out how to move money even between NRCS and Forest Service that would make it a lot easier. It's incredibly difficult even to move internal money from one agency to the other."

With regard to practices, the inability to engage in actions across ownership boundaries on an effective time-scale was also a barrier to implementation. From an NRCS partner, "There are some particular restraints in some of the programs that the federal government provides...One that comes to mind is treatment of herbaceous invasives and the lack of being able to do some annual treatments on those to really be able to eradicate those problems."

Long-term funding

Some participants highlighted the need for long-term funding to ensure projects are successful. One staff member from USFS said it would be easier to implement the project if there was more certainty, noting that,

Three years [of funding] is what we have been told and that's enough for folks to get engaged in year one or year two. This year three, I'm feeling people are pulling back a little bit... next year, we go to nothing. It's going to be a hard situation to sell, because we have these partners that are all ramping up and getting things going. So do you just keep on going forever? I don't think that's the answer. I think we need to commit to a landscape and say yes. Nobody ever asked me how long it's going to take to get the 4000 acres done...Nobody asked me to say, 'What is the game plan?' If you started from the ground up instead of the top down, then you probably would have asked me, 'Does it make sense to give you three years of funding, or does it make sense to give you five years of funding?'

Similarly, an NGO representative said, "If there were long-term funding in place, we would probably staff up [for that project] because we think it's so important." Uncertainty from year to year or

Resources for monitoring

Having sufficient resources to monitor project outcomes was discussed as a need by interview participants. When asked about the monitoring information they had available, there was a range of opinions on whether and how much monitoring was occurring regarding implemented practices.

Illustrating the role of monitoring in adaptive management, an NGO partner said,

It's difficult for us to make good, adaptive management decisions sometimes, or to understand where we have done something very well, or where we have not done something very well. Some of that is anecdotal, but I think one of the goals in the future needs to be a better mechanism to monitor the work that we're doing, how we're doing it, and using that to adaptively manage the work that we do in the future.

Another said, "Some of the management...decisions that we are forced to make are often done so with limited information. So sometimes it's an educated guess...that's where the monitoring comes in, and it would be very beneficial to have more of that information." Another NGO representative said that, through a related initiative, they used a monitoring subcommittee to "fine tune" their approach. However, monitoring may also have unintended consequences, as one person noted: "...if we said it didn't work, then would there be more money to fix it? I don't know." Finally, a USFS participant said, "We do a lot of adaptive management monitoring. The example with mine

land restoration, each project we've done has been incredibly iterative." It's possible that all interview participants were not aware of the extent of monitoring in the project, or that there is not an agreed upon definition of monitoring. For example, the USFS participant who discussed the mine land restoration also said, after describing the type of information s/he was referencing, "That's not a real rigorous monitoring, but it's a great example of adaptive management."

Discussion

The WVRV vision to build a restoration economy that would provide multiple social and ecological benefits in the region has largely been successful to date because it represents ecological and social goals supported by participating organizations. Unlike Mansourian and Vallauri (2014), who determined that some projects can include both types of goals (e.g., forest restoration projects with soil, water, or carbon related objectives included social goals, whereas those related to wildlife were primarily ecosystems centered), this relationship between goals was somewhat more nuanced in this case. For example, even those WVRV objectives that appear to be purely ecosystem-related, such as habitat restoration for the northern flying squirrel, are closely tied with socioeconomic goals since restoration activities are also intended to support economic revitalization in the region through increased employment in restoration. Buckley and Crone (2008) identified conditions under which social and ecological restoration processes are compatible—primarily when people present on the landscape perceive the outcomes of restoration activities to support their land uses (e.g., residential, agricultural). Although benefits of stream restoration activities improve flood control, water quality, and recreational fishing opportunities for residents and thus would be classified as "mutually beneficial," other activities that Buckley and Crone (2008) provide as potentially socially incompatible with restoration, such as forestry in the presence of endangered species, were found to promote cooperation rather than conflict in the WVRV as they aided in achieving economic goals.

Although numerous agricultural producers and family forest owners implemented practices or developed land management plans on their land that were driven by or related to the WVRV, the WVRV partnership itself did not include any of these landowner participants. Instead, agency and organization staff acted as conduits to these landowners through their positions and the ways in which they prioritized landscapes and landowners in their daily decision making. This is similar to what others have noted with regard to watershed groups comprised predominately of

agency/organization members (Moore and Koontz 2003; Floress et al. 2011). While the focus of this paper was on factors WVRV partners perceived as having contributed to implementation success, it bears drawing attention to the fact that landowners were seen as having their interests for their own lands represented by other groups (NGOs, NRCS) during the planning process and their decision making role primarily limited to their own lands, and all citizens as having opportunities to participate in public land decision making through NEPA-mandated processes. The view of NEPA as being a means of managing relationships and improving decisions is consistent with what others have found, particularly with regard to USFS projects (Predmore et al. 2011). In-depth discussion of these issues are beyond the scope of this paper, but exploring how public land management agencies engage in collaboration with citizens as landscape scale projects become more prevalent would be a valuable research pursuit.

The certainty long-term funding provides for engaging in restoration and other management has been noted by social and natural scientists (Mansourian and Vallauri 2014; Fischman and Ruhl 2016) and its lack was seen as a barrier by WVRV participants. Further, resources—funding, staff, and otherwise—for additional monitoring were also seen as deficient, and monitoring was needed to close the adaptive management loop. Fischman and Ruhl (2016) would term the WVRV "passive adaptive management" or "adaptive management lite", where hypothesis testing and scientific experimentation are absent, and learning is "...a byproduct rather than an essential component of the management decision," (p. 269). Even though ecosystem management has been promoted for nearly 30 years by USFS, adapting management approaches using the results of monitoring data is not as common (Fischman and Ruhl 2016). Monitoring is viewed as "...the weakest link..." in the adaptive management processes (Benson and Stone 2013, p 32), and the costs associated with monitoring have been identified as a major barrier (Butler and Koontz 2005). Models for sustained funding that support long-term implementation and incorporate monitoring are a critical gap, and the applicability of such models across different types of projects would benefit from being tested.

Conclusion

This study's findings indicate that the presence of existing relationships among individuals and organizations, formal and informal sharing of resources among partners, extensive networks beyond the group, and support from leadership all facilitated swift implementation. Barriers interviewees identified included uncertainty related to funding amounts and duration, lack of flexibility associated with specific

funding sources and budget categories, the ability to quickly respond to needs for practices across ownership boundaries, and insufficient resources for monitoring.

This evaluation of the WVRV represents one of the first attempts to describe in-depth a cross-boundary LSC project that was funded by the Joint Chiefs' program. Although funding for this program and others promoting LSC is never certain, documenting how different types of LSC projects operate and achieve project goals can contribute to developing best practices based on research and also help agencies and organizations show the impact of their work to constituents, elected officials, and administrators. The larger landscape within which the WVRV was situated is the 20 state area comprising the Northeastern and Midwestern US—an area bounded by an ocean and an international border; wholly encompassing the entirety of the Ohio River and a major portion of the Mississippi; the entirety of Lake Michigan and the US portions of Lakes Erie, Superior, Huron, and Ontario; and which crosses multiple administrative, political, social, and ecological boundaries—provides important services to human populations, including food, water, timber, and recreation. Landscape scale conservation across these boundaries is the most recent resource management framework intended to restore and protect natural resources vital for human and ecological health and well-being, and initial successes in this realm suggest it has the potential to be among the most promising.

Finally, since the time of this evaluation, the Monongahela National Forest has gone on to receive a second round of Joint Chiefs' funding to continue their LSC work. Although research-management partnerships are often based in the natural sciences, the value of incorporating social science more explicitly throughout the adaptive management process is increasingly recognized, and a long-term, interdisciplinary approach to managing this landscape is being undertaken. Private landowners, residents, and communities comprise key stakeholders in this region that have been and will continue to be important contributors to and beneficiaries of restoration activities. Continuing research in Central Appalachia enabled by the second round of funding focuses on these stakeholders through the lens of building a regional restoration economy.

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Compliance with ethical standards

Conflict of interest Several authors are employed by the USDA Forest Service, though rigorous processes were used to ensure the trustworthiness of this research.

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