

Society & Natural Resources

An International Journal



ISSN: 0894-1920 (Print) 1521-0723 (Online) Journal homepage: <https://www.tandfonline.com/loi/usnr20>


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To cite this article: Jesse Abrams, Heidi Huber-Stearns, Hannah Gosnell, Anna Santo, Stacie Duffey & Cassandra Moseley (2019): Tracking a Governance Transition: Identifying and Measuring Indicators of Social Forestry on the Willamette National Forest, Society & Natural Resources, DOI: [10.1080/08941920.2019.1605434](https://doi.org/10.1080/08941920.2019.1605434)

To link to this article: <https://doi.org/10.1080/08941920.2019.1605434>

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Tracking a Governance Transition: Identifying and Measuring Indicators of Social Forestry on the Willamette National Forest

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ABSTRACT

National Forests in the United States have undergone a spatially and temporally uneven governance transition in response to social and economic pressures and contemporary policy changes, with many national forest units moving from a wholly government-led “dominant federal” model to a more collaborative “social forestry” model in which nonfederal actors have greater influence and authority. Here we report on an effort to develop a suite of indicators designed to capture some of the most tangible elements of a transition from dominant federal to social forestry modes of governance. We pilot test these data on the Willamette National Forest using data from a variety of sources internal and external to the USDA Forest Service. We assess the suitability of these indicators for tracking governance transitions and discuss their applicability to other national forest units nationwide.

ARTICLE HISTORY



Received 31 May 2018
Accepted 29 March 2019

KEYWORDS


Criteria and indicators; environmental governance; public lands policy; forestry management; public involvement and collaboration

Introduction

Patterns and practices of forest governance have undergone substantial transformations worldwide since the late twentieth century (Cashore et al. 2010). Traditional government-led models have in many instances evolved to include a wider array of public, private, and civil society actors, resulting in hybrid and networked forms of governance in response to a constellation of drivers that include changes in the capacity and legitimacy of forestry agencies and the increasing ecological complexity of management challenges (McCarthy 2005; Scarlett and McKinney 2016). These changes are reflected in the continued evolution of the USDA Forest Service (USFS) (Moseley and Winkel 2014). Despite its heritage as a highly autonomous agency (Kaufman 1960; Cortner and Moote 1999), in recent years the USFS has shown evidence of a shift toward greater reliance on outside entities in its planning and implementation (Rogers and Weber 2010; Winkel 2014).

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Past research has investigated and theorized these shifts in federal forest governance and found evidence of a transition toward collaborative and networked governance arrangements in multiple geographies (McKinney and Field 2008; Rogers and Weber 2010; Seekamp and Cervený 2010). A shift from hierarchical to networked governance is theorized to represent a more adaptive approach that incorporates learning and strengthens cross-scalar networks (Pahl-Wostl 2009; Muñoz-Erickson et al. 2016; Scarlett and McKinney 2016), though the extent to which this shift has taken place on individual national forest units across the U.S. remains unclear. Winkel (2014) identified the emergence of “social forestry,” a networked form of governance, as a predominant institutional regime on national forestlands in the Pacific Northwest. This region has been home to a highly contentious struggle regarding old-growth forest management and endangered species conservation as well as the site of a series of grassroots efforts toward greater collaboration in public land management. Through its strong reliance on non-USFS partners to provide material and symbolic resources necessary to carry out the administration of national forests, social forestry implies a contrast with what has been called the “dominant federal” approach to public land management in which federal actors make and implement decisions with relative autonomy (Babcock 1996; Johnson 2007; Winkel 2014). As explained in detail below, social forestry encompasses—but is not limited to—the presence of collaborative decision-making processes, implying a need for a more capacious set of concepts and metrics than is normally found in scholarship on collaboration.

Our purpose here is to share insights from a pilot project focused on the Willamette National Forest (WNF) in western Oregon as a means of contributing to improved conceptualization and measurement of social forestry. We draw upon social science data gathered through a long-term partnership between the Ecosystem Workforce Program at the University of Oregon and both the WNF and Region 6 of the USFS, analyze these data to determine trends over time, and propose indicators for quantitative measurement and comparison across other forest units. We assess the extent to which our chosen indicators can be measured using data already collected by the USFS or through other relatively low-investment means (Jackson, Lee, and Sommers 2004; Secco et al. 2014; Moseley and Huber-Stearns 2017). Given the novelty and potential importance of the social forestry concept, this research represents a preliminary effort to identify and measure relevant metrics.

Background

Institutional Evolution of the USFS and Emergence of Social Forestry

As of 2014, the USFS managed 155 national forest units within the National Forest System, covering approximately 193,000,000 acres spread across 42 U.S. states plus Puerto Rico (Wilson 2014). The USFS itself was founded in 1905 under the administration of Theodore Roosevelt and the guiding vision of the first Forest Service Chief, Gifford Pinchot. The early USFS instilled a culture of scientific professionalism and insulation from outside interests in service of a Progressive Era philosophy that held that society’s interests were best served by the application of scientific forestry principles to improve inefficient natural forests (Langston 1995; Cortner and Moote 1999).

The USFS began to lose its independence in the second half of the twentieth century as the timber emphasis that it cultivated in the postwar years increasingly clashed with social values related to nature preservation and recreation. Congress responded to public environmental concerns and lawsuits challenging the USFS' timber harvesting program by mandating rational multiple-use forest planning (via laws such as the 1974 Resources Planning Act and the 1976 National Forest Management Act), along with more general environmental protection (via laws such as the 1964 Wilderness Act and the 1969 National Environmental Policy Act, better known as NEPA, among others) (MacCleery 2008). Consistent with other pluralist reforms of this period (Hoberg 1992), many of these laws required transparent planning processes, allowed for the involvement of interested publics, and provided “veto points” with which non-agency actors could challenge agency decisions administratively or via the courts. The rational planning, public involvement, and environmental protection institutions associated with the environmental era did not wholly replace earlier institutions associated with scientific insulation from outside interests and with aggressive timber production; rather, they were “layered” on top (Cortner and Moote 1999). As a result, the agency continues to operate under laws, regulations, and processes representing multiple disparate management and governance paradigms, leading to conflicting incentives and creating opportunities for publics to challenge many agency decisions (GAO 1997).

By the late 1980s, environmental advocates were increasingly successful in using the courts to force the USFS to comply with its environmental mandates and in using an administrative appeals process to slow and even halt the agency's timber-oriented planning and management (Koontz 2007; Winkel 2014). Among other outcomes, this increased the amount of time and resources devoted to conducting environmental analyses under NEPA prior to implementing land management projects (Stern et al. 2014). By the twenty-first century, the USFS was also burdened with increasing wildfire suppression costs, declining congressional appropriations, and reductions in timber receipts that led to substantial declines in non-fire staffing and project implementation budgets (Shannon 2004). Collectively, these changes catalyzed an increased influence of non-USFS entities on agency decision-making and project implementation, an arrangement that has been termed “social forestry” (Johnson 2007; Winkel 2014). Maier and Abrams (2018) observe that, under the contemporary governance regime, varied external entities may act as veto players and, at the same time, serve important roles in providing the legitimacy and capacity to support favored resource management projects. The latter is accomplished both through formal partnerships (typically established through partnership agreements or other formal agreements) and through less formal processes entailing the creative use of resources and capacities.

Social Forestry as an Emergent Phenomenon

In sharp contrast to the “dominant federal” ideal of professional independence, social forestry represents a networked form of policy implementation (Lemos and Agrawal 2006; Howlett and Ramesh 2014) in which elements of legitimation, funding, planning, and management are increasingly provided by, or in partnership with, a variety of non-USFS partners (Seekamp and Cervený 2010; Cheng, Danks, and Allred 2011; Larsen

2014; Winkel 2014). Multi-stakeholder collaborative decision-making to inform forest management planning may represent the most visible and well-known manifestation of social forestry on federal forestlands, but the phenomenon extends beyond collaborative processes. It can include practices such as innovating and refining new approaches to planning (Christoffersen 2011) and contracting (Sundstrom and Sundstrom 2018), developing creative funding mechanisms for project implementation (Moseley and Winkel 2014), and policy advocacy work by external stakeholders. Policy innovations are often designed to provide short-term (Abrams et al. 2017) or longer-term resources and authorities (Enzer and Goebel 2014) to engage in ecological restoration and stewardship and generate local community benefits. The network partners under these varied arrangements are not necessarily always formal collaborative groups or community-based organizations (Abrams, Davis, and Moseley 2015); they can include utilities (especially water) (Huber-Stearns and Cheng 2017), large recreation or conservation organizations (Butler, Monroe, and McCaffrey 2015), Native American Tribal agencies (Christoffersen 2011), state agencies (Charnley, Kelly, and Wendel 2017), and academic institutions (Cheng and Randall-Parker 2017).

Although the specific patterns of emergence and institutionalization of social forestry are unique to the USFS, the phenomenon shares broad similarities with new governance arrangements in other agencies and geographies (Kettl 2000; Connelly, Richardson, and Miles 2006; Lane and Morrison 2006; Osborne 2006; Leong, Emmerson, and Byron 2011; Bixler 2014). In part this is due to a set of common drivers, including: the increasing social and ecological complexity of contemporary governance dilemmas (Leong, Emmerson, and Byron 2011); declines in the legitimacy of traditional government-centric models of public administration (Robertson and Choi 2010); the declining capacity of government agencies under the pressures of neoliberalization (McCarthy 2006; Lockie and Higgins 2007); “bottom-up” calls for more direct participation of local actors in governance (Baker and Kusel 2003); and, in the United States, the proliferation of both opportunities for non-state actors to challenge agency decisions and of the veto players themselves, a pattern described by Fukuyama (2014) as a “vetocracy.”

An important dimension of this transition toward social forestry is its complex relationship with top-down policy direction. Since the late 1980s, the courts and the executive branch have expanded their influence on management direction for federal forests (the most prominent example of this trend is the Northwest Forest Plan, crafted by the Departments of Agriculture and Interior under the Clinton Administration in response to judicial injunctions against timber harvesting in the range of the Northern Spotted Owl) (Yaffee 1994). Congress has, however, passed some social forestry-oriented legislation since the late 1990s (e.g., the Collaborative Forest Restoration Program of 2000, Community Wildfire Protection Planning components of the Healthy Forests Restoration Act of 2003, the Collaborative Forest Landscape Restoration Act of 2009, as well as stewardship contracting and Good Neighbor authorities), most of which provides additional optional tools for managers and communities to use, rather than new mandates or required procedures. In many cases, these social forestry-oriented policies represent attempts to more broadly institutionalize innovative practices originally developed or refined by local organizations and their agency partners in particular geographies (Abrams, Davis, and Moseley 2015). In spite of these new tools and authorities,

the fundamental legislative framework for USFS management has remained essentially intact since its last major overhaul via the National Forest Management Act of 1976; further, the adoption of new tools and procedures may be alternately hindered or encouraged by the persistence of institutional incentives such as performance measures (e.g., volume of timber harvested or acres treated for fuel reduction) that do not themselves reflect a collaborative or network-oriented approach (Cortner and Moote 1999; Shannon 2004; Steelman and Tucker 2005). The net result of this institutional history is an unclear and sometimes self-contradictory constellation of legislative and executive mandates, case law, new tools and authorities, performance measures, and networks of practice whose influence spans from local to national scales, overlain on a decentralized agency that still retains a culture of professional independence. As a result, contemporary national forest governance represents a “hybrid” of government-centric and networked governance models (Keast, Mandell, and Brown 2006). Indeed, Winkel (2014) observes that social forestry is not hegemonic and competes for legitimacy with timber- and scientific expert-oriented paradigms of forest governance, both of which continue to be reflected in the institutional legacies of contemporary federal forest decision-making and management.

In this context, social forestry manifests not as the implementation of clear top-down policy direction but rather as a spatially variable suite of practices that reflects the evolving relationships between the USFS and non-USFS partners, antagonists, and other players within particular geographies. For example, Maier and Abrams (2018) found that two national forests in close proximity and operating under a common managerial framework (the Northwest Forest Plan) nevertheless exhibited divergent engagements with social forestry: whereas the Siuslaw National Forest had long embraced a collaborative approach focused on ecological restoration, the Willamette National Forest retained a more government-centric approach in which timber targets remained predominant as drivers of decision-making and had only recently begun experimenting with collaboration. The combination of the emergent nature of social forestry and its spatial variability contribute to the complexity of measuring the extent to which it represents the prevailing governance model in any given forest unit.

Prior research has recommended ideal indicators for measuring collaboration (Conley and Moote 2003; Koontz and Thomas 2006; Ferreyra and Beard 2007; Muñoz-Erickson, Aguilar-González, and Sisk 2007; Emerson, Nabatchi, and Balogh 2012) and resource governance more broadly (Cundill and Fabricius 2010; Secco et al. 2014), yet many of these indicators either require intensive investments of resources in original data collection or measure the quality of collaborative governance alone rather than the presence of depth of a more complex set of governance changes. Our intent here is to develop and assess the applicability of a suite of quantitative indicators that can be applied across diverse national forest settings to measure the institutionalization of social forestry using already existing or easily obtainable secondary data. The central aim is to be able to track the presence of a new governance regime within the agency by taking advantage of the large amount of USFS performance data and related information that is available on agency databases or via other relatively low-investment means. The identification of suitable governance indicators would serve as an important tool for comparative research on public lands and contribute to the development of internal

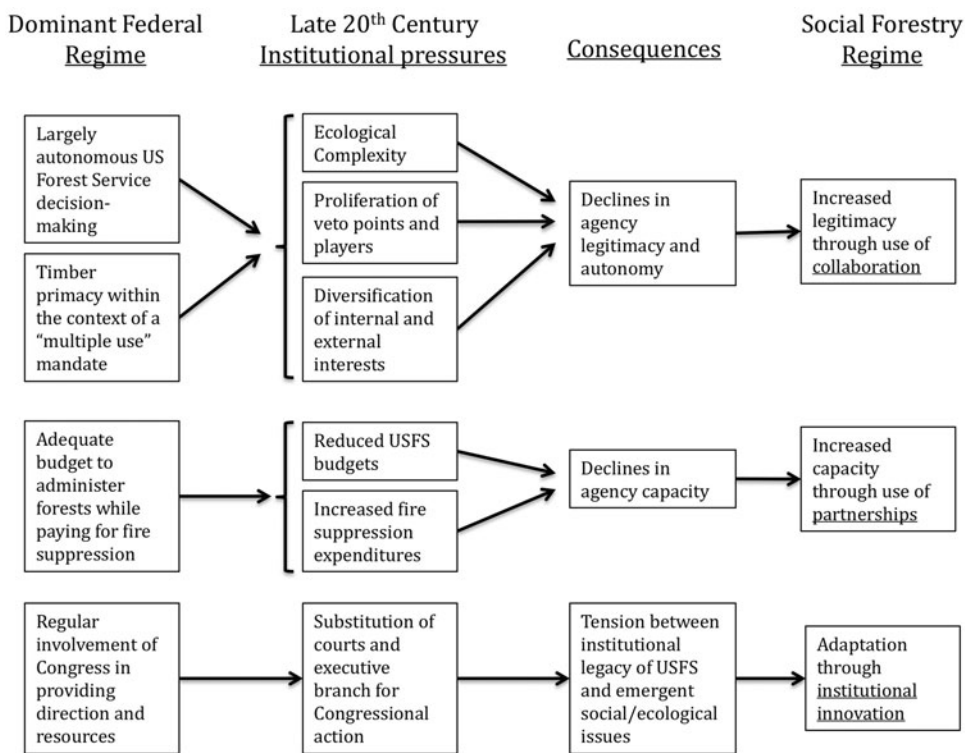


Figure 1. An ideal-type conceptual model of the transition from dominant federal to social forestry on national forests in the United States.

performance measures for USFS initiatives concerned with increasing collaboration, partnerships, and related objectives. Developing consistent metrics could also help to illuminate the connections between changes in governance and consequent changes in landscape patterns and processes (Cannon et al. 2018; Harris 2018), which has been a longstanding interest of natural resource collaboration scholars (e.g., Conley and Moote 2003; Koontz and Thomas 2006; Scott 2015).

We operationalize our measurement of social forestry along three broad categories that, we contend, represent the three broad adaptive categories of response to various pressures placed on the “dominant federal” model of national forest administration (Figure 1): *Collaboration*, representing an adaptive response to the loss of agency legitimacy and autonomy in decision-making processes; *Partnerships*, representing an adaptive response to declines in traditional sources of agency capacity for analysis, planning, implementation, monitoring, and related activities; and *Institutional Innovation*, representing an adaptive response to the tensions between the formal USFS institutional framework and the emergent management priorities identified by governance networks at local to regional scales. We identify greater engagement in each of these categories as evidence of the institutionalization of social forestry in particular geographies. These categories are described in greater detail below.

Indicator Development

The current analysis grew out of a series of cooperative projects between the Ecosystem Workforce Program and Region 6 of the USFS that entailed developing indicators for socioeconomic monitoring as well as accessing, analyzing, and compiling internal agency performance and accountability data for the purposes of public outreach and communication. These efforts resulted in multiple rounds of indicator development and piloting and also produced a master database of USFS budgets, activities, accomplishments, and related metrics that brought together data previously located only within separate subunits of the agency's internal tracking and reporting systems (see Ecosystem Workforce Program (2016, 2018) for more detail on these systems and data). The research team recognized an opportunity to utilize the collected data to go beyond outreach and communication to monitor trends in governance.

To identify indicators of social forestry, we combined the indicators developed internally (via the aforementioned process) with indicators developed by other researchers working on topics related to collaborative, community-based, or adaptive resource management (see supplemental online material). Although there has been a great deal of prior scholarship centered on measuring collaborative governance, much of it emphasizes the qualities of "good governance" that make a given collaborative process successful and sustainable (e.g., Conley and Moote 2003; Cundill and Fabricius 2010; Lockwood et al. 2010; Secco et al. 2014). In contrast to these prior efforts, our intent here is to develop indicators of the institutionalization of a more multifaceted set of practices associated with social forestry, implying a somewhat distinct set of necessary metrics. In other words, the emphasis here is on indicators of the *presence* and *extent* of new governance arrangements rather than on indicators of their *quality*.

Starting with the collective set of potential indicators drawn from the existing literature, we took a progressive series of steps to arrive at our final set (cf. Breslow et al. 2017). First, if an indicator was both specific and related to at least one of the three categories of collaboration, partnerships, and institutional innovation, we included it in a master database and classified it under one or more categories (see supplemental online materials). These indicators were checked for overlap and redundancy and reduced or, in some cases, combined. We developed additional indicators, in part based on the availability of data already collected through partnerships with Region 6 and WNF (Ecosystem Workforce Program 2016, 2018) to fill any gaps left by the existing suite. We then evaluated each indicator according to the ease of collecting data to measure it, divided into three levels of difficulty: (1) data are already collected by the USFS and possibly available through existing agency databases; (2) data are not collected by the USFS but can be acquired relatively easily through other databases or primary data collection (e.g., via internet research or review of internal documents); and (3) data are not collected by the USFS or other agencies and acquisition would require relatively large investments of time and/or resources (e.g., surveys or social network analyses). Ranking the indicators according to ease of data access or production was critical in light of our overriding interest in identifying indicators that can be tracked consistently and easily across diverse USFS locations and contexts. Finally, we selected a subset of indicators for each category that we believed struck the optimal balance between construct validity (i.e., representing a meaningful measure of the phenomenon under study), data

Table 1. Indicators selected for piloting the measurement of governance changes on national forestlands.

Indicator	Difficulty of Accessing Data ^a	Possible Data Sources
<i>1. Collaboration</i>		
1.1 Principled Engagement		
1.1a Number of collaborative organizations active on the forest unit	Medium	Web data collection; State or NGO databases
1.2 Capacity for Joint Action		
1.2a Value of federal funding awarded to collaborative organizations	Medium	NGO documents; Select federal databases
1.2b Value of state funding awarded to collaborative organizations	Medium	NGO documents; State grant records
1.3 Outputs		
1.3a Number and proportion of appeals, objections, and litigation of management projects	Easy	USFS PALS (Planning, Appeals, and Litigation System) database; Lexis-Nexis Academic Database
<i>2. Partnerships</i>		
2a Number of distinct partners represented in formal Partnership Agreements	Easy	USFS Grants & Agreements (G&A) module in I-Web
2b Value of financial and in-kind contributions made by partners participating in formal Partnership Agreements	Easy	USFS Grants & Agreements (G&A) module in I-Web
2c Number and acres/miles of Good Neighbor Authority projects proposed/implemented	Easy/Medium	State or federal partnership data
2d Number of volunteer hours by activity category	Easy	USFS Volunteer Accomplishment 1800 Reports
<i>3. Institutional Innovation</i>		
3a Number/proportion of projects and acres/miles completed through stewardship contracts	Easy	USFS PALS database; Databases managed by USFS regional coordinators
3b Number and acreage of Collaborative Forest Landscape Restoration Program (CFLRP) project proposals submitted and awarded	Easy	USFS nationwide CFLRP records
3c Number and acreage of Joint Chiefs Landscape Restoration Program proposals submitted and awarded	Easy	USFS and NRCS records
3d Number, acreage/miles, and dollar value of projects funded under the Wyden Authority	Easy	USFS contracting records

^a“Easy” = based in data already being collected by USFS; “Medium” = based in other secondary data or low-investment primary data collection techniques (e.g., web research); “Difficult” (not represented here) = requires large investment in primary data collection (e.g., surveys).

accessibility, meaningfulness (i.e., easily understood by decision-makers, members of the public, and scholars), and content validity (representing diverse dimensions of the category under study). The final list of indicators is presented in [Table 1](#).

Indicators for Collaboration

We define “collaboration” following Gray (1989 p. 227) as “a process of joint decision making among key stakeholders of a problem domain about the future of that domain,” as contrasted with the more traditional technocratic and adversarial processes of “public involvement” (Selin, Schuett, and Carr 1997). Collaboration generally involves the efforts of formal or informal multi-stakeholder organizations designed to build

relationships (between and among agency and non-agency stakeholders), engage in collective learning, and reach agreement on approaches to resource management. These entities are seen as providing the place-based legitimacy necessary to carry out a program of management on federal forestlands and, at least potentially, reducing the exercise of veto power by partners involved in collaborative efforts (Selin, Schuett, and Carr 1997).

For the purposes of classifying indicators of collaboration, we utilize Emerson, Nabatchi, and Balogh's (2012) framework, which divides the collaborative governance regime into the themes of "principled engagement," "shared motivation," and "capacity for joint action," along with a separate theme for the outputs of collaborative actions. Out of a total of 24 possible indicators derived from the literature and from our own creation, we selected four indicators that, in the authors' subjective assessment, were judged to be clear, understandable, and relatively easy to measure (Table 1; also see supplemental material). These represent the themes of "principled engagement" (the number of collaborative organizations active on the forest unit), "capacity for joint action" (the value of federal funding awarded to collaborative organizations and the value of state funding awarded to collaborative organizations), and "outputs" (the number and proportion of appeals, objections, and litigation of management projects); we did not select any indicators for "shared motivation" as the possible measures under this theme were more reflective of the quality than the presence of collaboration, and because none of the potential indicators could be easily measured. The indicator that represents what may be the highest construct validity—the proportion of USFS projects developed using collaborative input—is not included in our list; its absence reflects the relatively complicated procedure that would be required to measure it. While this would no doubt serve as a fitting indicator for one or a small number of forests, the heavy investments of time and resources required to measure it over large numbers of national forests precludes its inclusion in our list.

Indicators for Partnerships

The category of "partnerships" pertains to relationships between the USFS and non-agency entities that are distinguished from collaboration by being "product-oriented" mutual benefit arrangements (rather than process-oriented as in the case of many collaborative arrangements) designed "to address a specific objective" through leveraging the capacity of non-USFS entities (Seekamp and Cervený 2010, p. 4). Partners can contribute capacity to plan, execute, or monitor forest management activities as well as to support or perform other duties that broadly help to meet agency objectives. Reliance upon a network of trusted non-agency partners to contribute to the implementation of agency mandates is a departure from the classic USFS managerial model and is emblematic of "New Public Governance" approaches (Osborne 2006). Partnerships may be of particular importance given steady declines in both overall staffing levels and the proportion of staff available for non-wildfire duties on many national forests (Larsen 2014).

Ideal indicators would track the number of partnerships established, their financial contributions, and their contributions to achieving outcomes. Although partnership

outcomes are difficult to measure using simple methods, it is possible to measure indicators such as the number of unique formal partners and their financial contributions using data already collected by the USFS. From a list of eleven potential indicators, we selected four that represent multiple dimensions of partnerships and are relatively straightforward to measure (Table 1; also see supplemental material): the number of distinct partners represented in formal partnership agreements; the value of financial and in-kind contributions made by partners participating in formal partnership agreements; the number and acres or miles of Good Neighbor Authority projects proposed and implemented; and the number of volunteer hours by activity category. Note that the last of these indicators measures volunteer contributions, which is distinct from formal partnerships but may fill a similar niche in filling in for gaps in agency capacity in critical program areas (Seekamp and Cervený 2010).

Indicators for Institutional Innovation

The category of “institutional innovation” is here conceptualized as the experimentation and establishment of new funding, planning, contracting, and implementation approaches that represent alternatives to the classic “dominant federal” approach. The inclusion of this category reflects the fact that USFS line officers (e.g., forest supervisors and district rangers) maintain substantial latitude to experiment with, adopt, or reject a variety of tools and resources associated with collaborative governance, use of partnerships, and interagency coordination (Steelman 2010; Moseley and Charnley 2014). Thus, the institutionalization of new tools may vary across management units in terms of both the degree of utilization and the particular ways in which non-agency actors are engaged in their use.

We recognize that much of the activity that rightfully belongs in the category of “institutional innovation” is not only not captured by existing data, but arguably not able to be captured by most quantitative metrics given its deeply emergent, creative, and qualitative nature (Steelman 2010). Therefore, content validity is likely to be lower with this category than with the others. However, the advent of social forestry-oriented authorities and tools developed since the late 1990s provides an opportunity to measure multiple indicators of adoption of innovative practices. The four policies we include as indicators of institutional innovation were developed as means of advancing collaborative and cross-boundary restoration and stewardship objectives that are difficult to address using traditional reductionist and government-centric approaches (Robertson and Choi 2010). For three policies (stewardship contracting, the Collaborative Forest Landscape Restoration Program, and Joint Chiefs’ Landscape Restoration Program), collaboration or interagency coordination of some kind is required, and for one other (the Wyden Authority, which allows USFS to spend money on private land stewardship if there is a net benefit to USFS lands), it is strongly encouraged (Schultz, Jedd, and Beam 2012; Moseley and Charnley 2014; Cyphers and Schultz 2019).

Application to the Willamette National Forest

We piloted our twelve chosen indicators using data from the WNF as a means of determining their measurability and assessing data quality to inform their use more broadly

in measuring social forestry across national forest units. Located on the west slope of the Cascade Range, the WNF is among the largest national forest units in the country, with over 1.6 million acres spread across four watersheds. The WNF is dominated by Douglas-fir (*Pseudotsuga menziesii*), which has been harvested and replanted for decades for its tremendous timber value. Stands of old-growth Douglas-fir are still present, which helps explain some degree of the ongoing conflict around management that is characteristic of this forest. The WNF was the top timber-producing national forest in the country for much of the twentieth century; even after steep reductions on the order of 80% associated with the Northwest Forest Plan, it has remained one of the top-timber producing forests in the nation. Maier and Abrams (2018) observed that the WNF was still in the early stages of establishing collaborative processes when compared to other forests in the Pacific Northwest.

We selected the WNF for our pilot both because of its relatively late transition to social forestry (allowing for potential measurement with recent indicator data) and in consideration of our access to diverse data about this forest. Indicator data come from multiple sources both internal and external to the USFS (Table 2). Internal USFS sources include: PALS (the Planning, Appeals, and Litigation System), which tracks the planning of projects along with any subsequent appeals, objections, and lawsuits; the USDA Grants and Agreements database, which maintains records of the authorities and instruments the agency uses to work in partnership and collaboration with communities, individuals, and organizations—relationships which, depending on the work to be done and the type of funding, are formalized through either a grant or agreement; and USFS Volunteer Accomplishment Reports (known as 1800 reports), which are filed during any activity that includes the contributions of volunteers. External sources include data from the Oregon Department of Forestry, Oregon Solutions at Portland State University, the National Forest Foundation, and the Lexis-Nexis Academic database (for litigation data). Additional details on the indicator data are provided in the supplemental online materials.

Table 2 shows that WNF indicator data were not consistent in terms of their temporal extent, with USFS data generally not available prior to 2004–2006. In some cases, (e.g., indicators 3b and 3c), no data were available because the WNF had not yet attempted to use the applicable authorities at the time of our data collection. We were able to collect most of the relevant indicator data through existing USFS databases or simple secondary data analysis, though in some cases the data were available only through direct communication with WNF staff (Table 2).

We created an index of change over time for each of the three social forestry categories (Figure 2). The indices were created by comparing the indicator metric for each year with the baseline year (with baseline defined as the first year with available data) and combining the four components of each category into a composite index¹. These indices provide a snapshot of the overall trends in each category. For example, Figure 2 indicates that the WNF has shown modest increases in its collaboration index over time (Pearson's $r = .8074$, $p < .001$), clearer and more consistent increases in its partnership index over time (Pearson's $r = .9439$, $p < .001$), and an inconsistent pattern of institutional innovation over time (Pearson's $r = .2136$, $p = .5536$) during the periods for which data were available. The direction and rate

Table 2. Pilot indicators measured on the Willamette National Forest. Pearson's coefficients marked with an asterisk (*) are significant at $p < .001$. Indicators with "N/A" listed in the Pearson's r column have insufficient data for statistical testing.

	Data sources		Years available	Pearson's r with Year	Trend
	Primary data collection (internet); Oregon Solutions database				
1.1a. Number of collaborative organizations active on the forest unit	National Forest Foundation Collaborative Capacity and Landscape Stewardship (CCLS) Program records ^a	Oregon Department of Forestry grant records ^b	1993–2017	.8927*	The number of both watershed councils and forest collaborative organizations increased from 1993 to 2014; one organization stopped operating by 2017
1.2a. Value of federal funding awarded to collaborative organizations			2012–2017	–.5769	No clear trend; WNF collaborative organizations received CCLS funding in 2012, 2013, 2016, and 2017
1.2b. Value of state funding awarded to collaborative organizations			2012–2017	N/A	No clear trend; WNF collaborative organizations received and state funding in 2015 and 2016
1.3a. Number and proportion of appeals, objections, and litigation of management projects		USFS Planning, Appeals, and Litigation System (PALS) database ^c ; Lexis-Nexis Academic database	2006–2016	–.1035	No clear trend; most years show between one and four appeals/objections; two litigated projects in 2007 and 2010
2a. Number of distinct partners represented in formal Partnership Agreements		USFS Grants & Agreements (G&A) module in I-Web	2008–2017	.9280*	Clear upward trend in both federal and nonfederal partners
2b. Value of financial and in-kind contributions made by partners participating in formal Partnership Agreements		USFS Grants & Agreements (G&A) module in I-Web	2008–2017	.9278*	Overall upward trend in both federal and nonfederal contributions, with biggest increase in 2013–2014
2c. Number and acreage of Good Neighbor Authority service projects proposed and implemented		Primary data collection (direct communication with Oregon Department of Forestry GNA coordinators)	2018	N/A	Two separate GNA contracts were signed in 2018 with implementation planned by 2019
2d. Number of volunteer hours by activity category		USFS Volunteer Accomplishment 1800 Reports	2014–2016	–.4296	No clear trend
3a. Number and proportion of projects and acres completed through stewardship contracts		USFS PALS database; Data provided by USFS regional coordinator	2004–2017	.2009	No clear trend; generally one stewardship contract every 2–3 years
3b. Number and acreage of Collaborative Forest Landscape Restoration Program (CFLRP) project proposals submitted and awarded		USFS CFLRP online report repository	N/A	N/A	The WNF has not proposed any CFLRP projects to date
3c. Number and acreage of Joint Chiefs Landscape Restoration Program projects submitted and awarded		JCLRP database	N/A	N/A	The WNF has not proposed any JCLRP projects to date
3d. Number, acreage, and dollar value of projects funded under the Wyden Authority		Primary data collection (direct communication with WNF staff)	2005–2018	N/A	No clear trend; two projects funded in 2005 and one in 2012

^aCCLS currently exists in Regions 5, 6, and 10 of the National Forest System.

^bState grants captured are unique to Oregon's Federal Forest Restoration Program.

^cAppeals, objections, and lawsuits appear in the year the project was signed, not necessarily the year the appeal, objection, or lawsuit was filed. Projects limited to those with purpose listed as Forest Products, Fuels Management, Land Management Planning, Recreation Management, Road Management, or Vegetation Management.

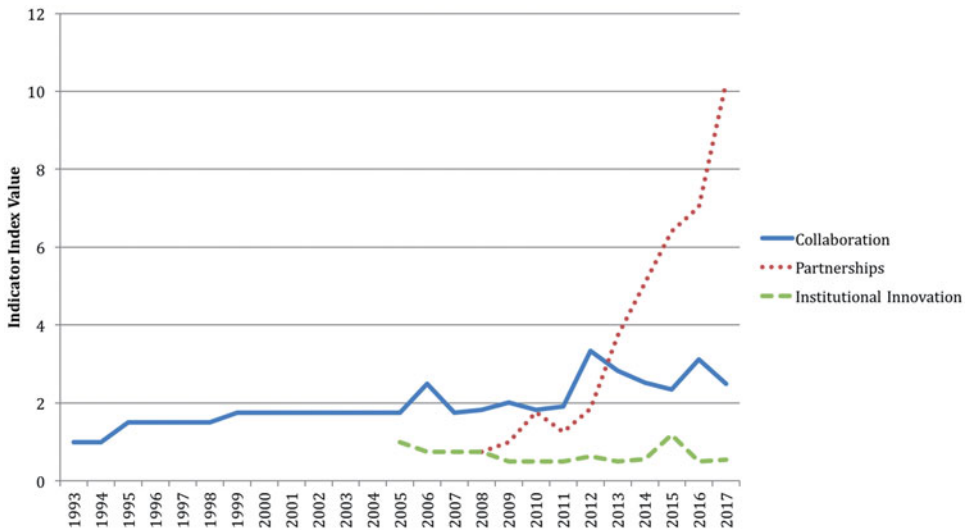


Figure 2. Indices of the three categories of collaboration, partnerships, and institutional innovation created by combining constituent indicators and measuring change from the baseline.

of change of these indices may be more valuable than the raw indicator values for inter-forest comparison, given that there are likely substantial differences in baseline capacity and activity among individual national forests. Further testing and refinement of these indices would help to improve the comparison of trends across forest units.

Discussion: Assessment of the Value of Piloted Indicators

The indicators included in this analysis were chosen to be easily accessible, to represent multiple dimensions of a shift to social forestry-oriented governance, and to be sensitive to changes over time. Our three dimensions—collaboration, partnerships, and institutional innovation—should not be seen as exhausting the possibilities for conceptualizing social forestry; rather, this tripartite model suggests an alternative to analyses that emphasize a single dimension (such as collaboration) in isolation. Conceiving of national forest governance in this way provides an opportunity to map changes in governance patterns of individual forest units (e.g., national forests or ranger districts) along multiple axes over time. It also allows for an exploration of the relationships between emergent processes of building legitimacy, capacity, and the institutional “infrastructure” necessary to shift from traditional forest management approaches to more integrative and stewardship-oriented practices that meet recent policy direction related to “resilience” and “ecological integrity” in the face of climate change (Timberlake and Schultz 2017). Further research is needed to understand the linkages between governance patterns and ecological outcomes (Cannon et al. 2018).

We piloted these indicators using data from the WNF, a forest that has only recently begun to move away from a pattern of “dominant federal” decision-making at the time of this writing (Maier and Abrams 2018). Data for growth in WNF-relevant collaborations and partners suggest trends toward greater engagement between the WNF and

non-agency partners. This may expand the range of entities engaged in substantive planning and problem-solving and to increase the forest's capacity to pursue management objectives. These trends, which are broadly consistent with a move toward what Winkel (2014) terms "social forestry," appear to have begun in roughly 2011–2012.

There is no clear trend toward greater use of innovative policy mechanisms over time on the WNF, however. This may reflect the fact that tools such as stewardship contracts are often more attractive tools in places with relatively low timber values (i.e., where the cost of performing forest restoration work is often high compared to the value of timber removed), a situation that does not apply on the fertile terrain of the WNF. Alternatively, it may reflect the relative novelty of collaborative capacity on this forest and the continued adherence to a more traditional model of project planning and implementation. Thus, while acknowledging the limitations of the data piloted here, it would appear that the WNF has shown moderate to strong increases in collaborative capacity and in the utilization of partnerships since 2012, but little to no increase in the use of many of the newer planning and contracting tools such as stewardship contracting, Collaborative Forest Landscape Restoration projects, and Joint Chiefs' Landscape Restoration Partnership projects (although WNF managers reported that they were planning more stewardship projects for the coming years). These data collectively indicate movement toward social forestry along two of the three primary dimensions considered here. Our pilot effort suggests both that these indicators are promising for measuring governance changes along multiple axes and that it is imperative to provide a rich contextual understanding of individual units in order to interpret the resulting trends.

Data Limitations and Applications to Other National Forests

The application of our indicators to the WNF illuminates possible challenges in moving forward with comparisons between forest units and point to challenges common to using existing data to measure collaborative conservation outcomes. Data for some of our indicators (e.g., 1.2a, 1.2b, 2c, 2d) were available or reliable for only a small number of years, complicating both the calculation of internal validity metrics and the detection of long-term trends. Continued tracking of these indicators in future years may reveal patterns that are not apparent from looking at a more limited span of data. For several of our indicators, we relied upon data from programs that are limited to the State of Oregon or to a subset of USFS regions. Although roughly parallel programs may exist in other geographies, the fractured nature of these programs also creates challenges for consistent nationwide comparison.

Another challenge relates to the accessibility of relevant USFS data, most of which are maintained internally within the USFS; as such, the process to gain access as an outside researcher is complex. Accessing some of these data for the WNF required long-term relationship building and depended on the labor of willing partners within the agency. This poses a challenge to the systematic tracking of consistent indicators across multiple forest units at regional to national scales. Research on public land governance—and possibly the quality of collaborative governance itself—would be enhanced by greater public and researcher access to such data. We recommend that the USFS

make their internal databases more accessible to external publics, including researchers, partners, critics, and others.

Moseley and Huber-Stearns (2017 p. 1) noted that another challenge in using these kinds of data is that “Forest Service performance measures have largely focused on outputs associated with land treatments, rather than ecological, social, and economic outcomes, in part because outputs are much more easily measured than outcomes.” One finding from this pilot project is that the kinds of data necessary to accurately track governance changes on national forests over time are often difficult to access, do not exist over a sufficiently long temporal span, or do not exist at all. This suggests that the USFS, their partners, and researchers would benefit from the consistent collection of additional data by the agency, particularly related to the frequency, degree, and results of their engagement with collaborative organizations and processes. Consistent tracking of projects that were planned and monitored with and without use of a collaborative process, as well as projects implemented in partnership with non-USFS entities, would help to clarify trends in agency engagement with various non-agency publics.

With these caveats in mind, we nevertheless recommend continued testing and refinement of indicators such as those presented here to measure and compare shifts in national forest governance over time and across space. At a minimum, tracking the number and capacity of collaborative organizations, the number and contributions of formal partners and volunteers, and the utilization of new planning, contracting, financing, and implementation mechanisms should serve as bases for the consistent measurement of national forest governance via quantitative indicators. Given a larger dataset, it would also be possible to test the internal validity of the categories suggested here and refine as needed. These efforts would greatly benefit from grounded case-study research to understand why, how, and to what effect such practices are adopted in particular geographies.

Conclusions

The approach presented here represents a modest first step toward systematically measuring and tracking governance transitions within and across units of the USFS. Our hope is that this effort will spark continued development of both conceptualization and measurement of the kinds of networked governance approaches characteristic of social forestry on the federal forestlands. A deeper understanding of the specific motivations of, challenges to, and outcomes resulting from changing governance patterns in individual geographies will continue to rely on in-depth, place-based research, much of which will necessarily be qualitative in nature. However, the effort presented here demonstrates that it is possible (if not always straightforward) to measure multiple dimensions of forest governance change via quantitative indicators. Data reflecting our three primary dimensions of social forestry presented here were available for collection and analysis with relatively limited need for primary data collection, and the USFS and other agencies could take steps to make such data more easily accessible to researchers. Further development of these dimensions and their respective indicators would go a long way toward clarifying the complex landscape of governance changes across the federal forest estate nationwide. Governance changes could then be measured against

landscape pattern and process data derived from remote sensing efforts or field data collection to better understand the crucial linkages between governance and ecosystem conditions. Despite the challenges posed by the limitations identified here, this remains a promising field for further exploration.

Note

1. Data limitations did not allow us to conduct statistical tests of internal consistency on these indices. Future work with larger datasets would create opportunities to do so.

Acknowledgements

We would like to sincerely thank our partners on the Willamette National Forest, Regions 4 and 6 of the USDA Forest Service, Oregon Department of Forestry, and the Southern Willamette Forest Collaborative for their assistance in accessing the data used here. Special thanks to Jennifer Sorensen, Cheryl Friesen, Bruce Andersen, David Seesholtz, Emily Jane Davis, Sarah Altemus-Pope, and Johan Hogervorst.

Funding

This research supported by the HJ Andrews Experimental Forest research program, funded by the National Science Foundation's Long-Term Ecological Research Program [DEB 1440409], US Forest Service Pacific Northwest Research Station, and Oregon State University.

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