FOREST RESTORATION ON THE NATIONAL FOREST SYSTEM IN THE INLAND NORTHWEST REGION: A PATH DEPENDENCE PERSPECTIVE

A Dissertation
Presented in Partial Fulfillment of the Requirements for the
Degree of Doctor of Philosophy
with a
Major in Natural Resources
in the
College of Graduate Studies
University of Idaho
by

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August 2016

Authorization to Submit Dissertation

This dissertation of David J. Jackson, submitted for the degree of Doctor of Philosophy with a major in Natural Resources and titled "Forest Restoration on the National Forest System in the Inland Northwest Region: A Path Dependence Perspective," has been reviewed in final form. Permission, as indicated by the signatures and dates shown below, is now granted to submit final copies to the College of Graduate Studies for approval.

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Abstract

After more than two centuries of resource management and use, forests in the Inland Northwest region of the United States dependent on fire as a primary natural disturbance have experienced significant changes in structure, functions, and composition. In many areas, alterations to forests' natural range of variability have created conditions more favorable to wildfire, insects, and disease. Federal policies have been designed to alleviate these concerns, most recently Good Neighbor Authority (GNA) under the 2014 Agricultural Act (Public Law 113-79).

Immediately following passage of the Agricultural Act, 19 million hectare of national forest land were approved for restoration by the USDA Forest Service. However, fire suppression costs, which account for more than 50 percent of the agencies' budget, have limited funding for restoration, leaving unresolved many social, economic, and environmental questions. Path dependence, a theoretical concept that reveals how events from the past which transpire over long time periods can influence conditions in the present, is well-suited for contextualizing this problem.

Grounded in the path dependence literature, this dissertation evaluated the feasibility of GNA to improve forest health on national forest lands in the Inland Northwest region. Dissertation findings were derived from semi-structured interviews with natural resource management professionals and a web-based survey of engaged public stakeholders. If GNA is to increase the pace and scale of forest restoration on the NFS, natural resource management professionals said more emphasis must be placed on reliable funding, active forest management, and trust between the public and the Forest Service. Potential to

mitigate wildfire hazards, improve forest health, and reduce forest restoration costs were regarded by engaged stakeholders as GNA's most promising benefits. Results from this mixed methods study provide a fuller understanding of the influence policy decisions made at an earlier point in time can have on forest ecosystems in the future.

Acknowledgements

Financial assistance for this research was provided by the Bioenergy Alliance Network of the Rockies (BANR), a Coordinated Agricultural Project funded by the U.S. Department of Agriculture, National Institute of Food and Agriculture (competitive grant number 2013-68005-21298). BANR is a multidisciplinary research consortium that explores using forest biomass as feedstock to produce bioenergy, and provides the scientific underpinnings to support a regional bioenergy industry.

Dedication

Having completed a doctoral program once before in 1993 and learned a bit about what's involved, I doubt seriously I could ever have repeated the feat without the support of my companion and confidant, Helen M. Lowe.

Helen, this degree is as much yours as it is mine.

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Introduction

The National Forest System (NFS) in the U.S. is comprised of 78-million hectare of publically-owned land. Approximately 85 percent of these lands is located west of the 100th meridian in the continental U.S. Since 1905, the NFS has been managed and administered by the USDA Forest Service (Forest Service). Guiding natural resource management planning and activities are federally enacted policies. Those adopted in the early-20th century to control wildfire have had lasting effects on national forest lands in the Inland Northwest region. Bailey (1995) defined the Inland Northwest region as the catchment area of the Interior Columbia River Basin including all of Washington and much of Oregon east of the Cascade Mountains, nearly all of Idaho north of the Owyhee Uplands and Snake River Plains, and portions of northwestern and southwestern Montana extending to the Continental Divide.

Figure 1: The Interior Columbia River Basin

Forest establishment in North America began around 10 thousand B.C. with species of spruce (*Picea*) and larch (*Larix*) followed by ash (*Fraxinus*) and birch (*Betula*), and moved gradually from the northeast to the southwest (Burns and Honkala, 1990). For millennia thereafter, indigenous peoples in the Inland Northwest used fire as a principal technology to modify natural environments and augment food supplies (Pyne, 1982). Mixed-conifer forests were burned frequently by surface fires whose return intervals varied from low (1 to 25 years) to moderate (25 to 100 years), enriching soil nutrients, eliminating fuel ladders, and maintaining a patchy mosaic that reduced the occurrence of high-severity fires (Hessburg et al., 2005).

Subsequent to the arrival of Euro-Americans, conversion of forestland to agriculture, rural development, and urbanization all contributed to the exclusion of fire which, in turn, hastened the decline of forest functionality (Hessburg and Agee, 2003). Rather than recognized as a critical natural process and integrated into land and resource management plans, fire was anathema to forest management and extinguished as quickly as possible (Arno, 1980). Consequently, tree species such as ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and western larch (*Larix occidentalis* Nutt.) dependent on low- to moderate-intensity fire were replaced by others such as grand fir (*Abies grandis*) and western hemlock (*Tsuga heterophylla*) less resistant to fire (Hessburg and Agee, 2003).

According to Agee and Skinner (2005), excluding fire without regard to a 'context of place' has presented significant environmental challenges to natural resource managers. Active forest management, such as thinning and prescribed fire, is an important tool for restoring forest health in dry, mixed-conifer forests of the Inland Northwest (Clark and

Sampson, 1995). There is little agreement on the meaning of forest health in the forest ecology literature, prompting social scientists to point out that conditions are seen as healthy based on one's values and policy preferences (Sulak and Huntsinger, 2012), and that making this determination is the product of political or social deliberations, not scientific results (Warren, 2007). In this dissertation, forest health refers to that state where abiotic and biotic components are relatively intact, functional and dynamic, and within what is considered to be their historic range of natural variability one hundred to two hundred years prior to European settlement. Conversely, unhealthy forests are those prone to large-scale fires, insect outbreaks and disease, and, in dry ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) of the Inland Northwest, have experienced fire exclusion and heavy selection cutting over multiple entries (Hessburg et al., 2005).

In 2014, insects and disease killed 3.5 million hectare of forest on the NFS in Idaho alone (USDA Forest Service, 2014c), with an additional 680 thousand hectare categorized as vulnerable (Tidwell, 2015b). Mixed-conifer forests prevalent across these lands need active management if fire hazards are to be reduced (Agee and Skinner, 2005). But funding for fuels reduction – an active forest management operation whose cost can range from four hundred to eight hundred dollars per hectare dependent on sub-region, forest type and treatment scenario (Jain et al., 2012) – is not available due to the increasing demands of fire suppression.

This often means the funds needed must come from the market value of woody material forest restoration removes. Since this value is seldom enough to cover restoration costs, supplementary funds are necessary. However, these funds are unavailable due to the

increasing cost of fire suppression. Nationwide are 26 million hectare of national forest land requiring restoration (USDA Forest Service, 2015a). If this backlog is to be reduced significantly, feasible strategy must be developed that changes the status quo. Federal policies have been devised in this regard.

Beginning in 2002 with the Healthy Forest Initiative (HFI), administrative and regulatory barriers were relaxed to increase removal of hazardous woody fuels. In 2003, HFI was refurbished as Public Law 108-148, otherwise known as the Healthy Forest Restoration Act (HFRA), to further increase fuels reduction. The latest effort occurred in 2014 with the Omnibus Agricultural Act (Public Law 113-79). Under Title VIII of the Act are provisions that provide the Forest Service with new tools to enhance forest health and resilience. Among them is Section 8206 – Good Neighbor Authority (GNA), the focal point of this dissertation.

Under GNA, the Forest Service can now enter into cooperative agreements with individual states to conduct forest restoration activities on and off the NFS (USDA Forest Service, 2015b). Afforded to the Forest Service are opportunities to work across jurisdictional boundaries to resolve land management challenges, leverage state resources to increase institutional capacity, and strengthen the Federal/State partnership. Benefits to states include economic development potential, reimbursement for work performed, and latitude to conduct silvicultural projects to improve forest health where state and Federal lands converge.

However, questions remain that could affect the viability of GNA. One of, if not the most important involves funding. States that wish to participate in GNA must pay certain project-related costs that may not have been accounted for in their budgets. A second

question involves matters related to trust between the Forest Service and citizens who engage jointly in natural resource management decision-making. Research has shown that when trust is lacking, social tensions can disrupt agency projects and constrain managers' ability to do their jobs (Liljeblad et al., 2007). Since GNA is relatively new and untested, a third question is its lack of experimental outcomes and observations. Utilizing information obtained from semi-structured interviews and a web-based survey, attempts were made to decrease this knowledge gap. Results generated by this mixed methods approach supported conclusions drawn on the feasibility of GNA to improve forest health on the NFS.

Research Question

Allen et al. (2011) wrote that much of what we think we know about managing natural resources is wrong, and Crow (2007), that what we can know is often not what we most need to know. Regarding forests of the Inland Northwest, what is known is that two centuries of settlement, exploitation, and climate variation have transformed fire regimes, fuel patterns, and functionality on national forest lands (Hessburg and Agee, 2003), resulting in a surplus of tree species overly susceptible to disease, drought, and wildfire (O'Laughlin et al., 1993). Assuming enough is known about forest ecosystems in the region to conclude reducing fuel loads and stand densities will decrease insect outbreaks and wildfires, the research question explored by this dissertation was whether GNA is a feasible alternative.

Objective and Goal

With this question in mind, the objective of this study was to identify main differences within and among natural resource management professionals and engaged stakeholders

on the potential of GNA to increase forest restoration on national forest lands in Idaho and Montana. Hypothesized was that attitudinal and demographic variations would help explain these differences. Utilizing path dependence as a theoretical foundation, the research goal was to illustrate how policy decisions made in the past can affect natural resource management in the future.

Dissertation Format

Chapters two and three were prepared as stand-alone manuscripts and present qualitative and quantitative findings. Emphasized in chapter two are semi-structured interviews with 28 natural resource management professionals whose knowledge of forest practices and policies on public lands is relatively high. A self-administered, web-based survey completed by 141, non-targeted respondents from 32 different states is highlighted in chapter three. Conclusions from chapters one, two, and three are summarized in chapter four.

Chapter 1

Introduction

The Forest Service has statutory responsibility for managing and administering the NFS, a publicly-owned, 78-million hectare estate which comprises roughly eight percent of the total land area in the U.S. From its inception in 1905 through the majority of the Post-World War II era, the Forest Service was acclaimed as a model of efficiency an excellence (Fukuyama, 2014). Natural resource policies governing lands the agency managed were relatively straightforward and few, Forest Service officials often wrote their own rules, and social and environmental problems were negligible (Dana and Fairfax, 1980).

Beginning in the late-1960s, landmark Federal legislation – bracketed by the National Environmental Policy Act (NEPA) of 1970 (Public Law 91-190) and the National Forest Management Act (NFMA) of 1976 (Public Law 94-588) – imposed unprecedented restrictions on the ability of the Forest Service to manage the NFS. Concurrent with this period, scientific studies began linking the effects of early, forest management policies with declines in forest health, particularly on Federal lands in the Inland Northwest region categorized as moderately- to highly-removed from pre-Columbian fire regimes (Hessburg et al., 2005). Though many definitions exist, forest health has been described as a condition that maintains ecosystem complexity while meeting human needs (O'Laughlin et al., 1993). As forest composition changed, stands densified and canopies closed, insect and disease epidemics increased, notably among ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and western larch (*Larix occidentalis* Nutt.) forests accustomed to frequent, low- to moderate-intensity surface fire (Bollenbacher et al., 2014).

Throughout the 1980s and 1990s, immense volumes of woody fuels accumulated on national forest lands (Stephens and Ruth, 2005), due in part to lack of active forest management (Franklin et al., 2008). Prompted by stand-replacement wildfires that occurred in the dry forests during the early-2000s, HFRA was passed by Congress in 2003. HFRA represented the culmination of nearly a decade of wildland fire policy reforms designed to improve the capacities of land-management agencies in the U.S. Departments of Agriculture and Interior to protect communities, watersheds and other at-risk lands from catastrophic wildland fires (Steelman, 2008). However, over the following decade, forest mortality attributed to insects and disease totaled over 30 million hectare nationwide (USDA Forest Service, 2015d).

Though progress improving forest health has been made, more than one-third of the NFS contains excessive volumes of dead woody biomass and requires restoration (USDA Forest Service, 2016). Sustaining the health, diversity, and productivity of national forests and grasslands for present and future generations is the Forest Service mission. Compatible with this mission is active forest management, particularly in the dry forests of the Inland Northwest. Carey (2006) defined active forest management as adaptive silvicultural processes such as variable retention timber harvests, precommercial thinning, and prescribed fire. Active forest management is useful in restoring and maintaining old forest structures and functions by shifting stands toward lower densities, larger mean tree diameters, and greater resistance to wildfire and drought (Buchanan and Hull, 2008). However, lack of public trust in agency proposals has stifled the use of active management on federal forestlands (Franklin et al., 2008).

Forest Restoration: The Larger Context

The greatest barrier confronting the Forest Service is the short and long-term impacts of its fire budget (Tidwell, 2015a). Cost to suppress wildland fire increased from 16 percent of total expenditures in 1995 to 52 percent in 2015, and has been projected to reach 67 percent by 2025 (USDA Forest Service, 2015c). Actual fire suppression cost in 2015 was $1.7 billion (Wilent, 2015). Yet, instead of increasing spending on restoring forests that are less vulnerable to wildfire and do not require repeated treatment (Noss et al., 2006), more than half of the Forest Service budget is spent fighting fire as forest conditions worsen.

Mitigating threats that imperil forest health is of paramount concern to the Forest Service. The most recent attempt by Congress to aid in this endeavor occurred in 2014 with passage of the Agricultural Act. Included in the Act is Title VIII – Forestry which encourages proactive forest management using innovative initiatives. New authorities granted by these initiatives include 'streamlined' environmental analysis in designated areas on forest management projects greater than one thousand hectare, and modified public notice, comment, and appeal (Chite, 2014). Beneath Title VIII is Section 8206 – Good Neighbor Authority (GNA) which is permanent and employable nationwide. GNA began in 2000 as short-term, pilot projects between the Forest Service, and the Colorado State Forest Service (CSFS) and the Utah Department of Natural Resources (DNR). The majority of projects occurred on national forest lands. In Colorado, CSFS used GNA to restore watersheds and reduce hazardous fuels at such time it was carrying out similar activities on adjacent state and private lands. In Utah, GNA was not subject to the same restrictions as

in Colorado, which allowed DNR to conduct a broader array of projects such as timber sales preparation, prescribed burning, and trail rehabilitation.

Immediately following adoption of the 2014 Agricultural Act, 19 million hectare of national forest land – 2.3 million of which are in Idaho and Montana – were approved for restoration by the Forest Service (USDA Forest Service, 2015a). However, all lands will not, at present, be treated as special funding was not appropriated by the Act. Promoted by GNA as a potential remedy to Federal funding deficits and restoration backlogs are 'cooperative agreements' between the Forest Service and states to improve forest, rangeland, and watershed health on and off the NFS.

In recent years, uncharacteristically intense wildfires have scorched forest landscapes across the western U.S. From 2005 to 2015, area burned on national forest lands in Idaho and Montana averaged two million hectare per year (National Interagency Fire Center, 2015). Fire is an ecologically important disturbance factor in many western forest types but well-defined solutions to mitigate its effects have been tenuous (Agee and Skinner, 2005). Fire-damaged forests are often attacked by invasive insects such as the mountain pine beetle (*Dendroctonus ponderosae*), spruce beetle (*Dendroctonus rufipennis* Kirby) and Douglas-fir beetle (*Dendroctonus pseudotsugae* Hopkins). Beetle infestations are a critical ecological process and have persisted in the Inland Northwest region for thousands of years (Samman and Logan, 2000). But they often leave standing and down, dead wood that can subsidize future wildfire and have adverse effects on property value and human safety, particularly in the wildland-urban interface.

Managing beetle outbreaks requires prevention and suppression, but a 'one-size-fits-all' strategy is misguided (Peterson et al., 2009). Alternatively, what may have potential is an approach tailored to individual forest types and site conditions whereby a single action is used to achieve multiple objectives: specifically, forest restoration to improve ecosystem functionality, lower fire risks, and generate raw material for commercialization. The Forest Service Planning Rule of 2012 defines restoration as the process of "assisting the recovery of an ecosystem that has been degraded, damaged or destroyed, focusing on reestablishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystems sustainability, resilience, and health under current and future conditions (U.S. Department of Agriculture, 2012)." Forest restoration in the U.S. is a sociopolitical reality and the foundation of Federal land management (Bosworth, 2006). Assuming national forests in the Inland Northwest region have the stability and vigor to withstand natural disturbances at landscape scales, they can provide sustainably an abundance of diverse amenities. Safeguarding their natural range of variability is important, especially in dry forests where ecological systems have been severely altered. In its broadest sense, active forest management can help meet this need.

Path Dependence

On national forest lands, early policy decisions regarding how wildfire was responded to and managed have had indelible effects on forest health (Stephens and Ruth, 2005). Path dependence is an organizing concept useful in characterizing such occurrences. At the center of path dependence is how historic events that unfold over long time horizons can trigger institutional patterns (David, 2007) whose deterministic properties constrain future

choices (North, 1990). Critics Raadschelders (1998) and Hay (2002) faulted the explanatory value of path dependence for not identifying the root cause of change. Thelen (1999) contended path dependence can be too retrospective and inflexible. However, Kay (2005) and Greener (2005) maintained none of these shortcomings are fatal to the concept's ability to explain certain types of temporal processes and why policies can be difficult to reform.

In 1831, French historian, Alexis de Tocqueville, may have foreseen what would later epitomize more than 70 years of Forest Service fire policy. In his seminal work, *Democracy in America*, de Tocqueville wrote that:

"Circumstances which contribute to the birth and development of nations influence the whole term of their being. If it were possible to go back and examine the effects of those circumstances, the cause of certain prejudices and habits, which now seem contrary to established principles and opinions, would be discovered (Mansfield and Winthrop, 2000)."

De Tocqueville's association of circumstances with nation-building is analogous to early, Forest Service fire policy and forest conditions it helped create, a parallel that can be sharpened when viewed through the lens of path dependency. Many path-dependent processes begin with critical junctures which herald a period of significant change that produces enduring legacies (Collier and Collier, 1991). Junctures are said to be 'critical' because they place institutional arrangements on paths or trajectories which can become very difficult to alter (Pierson, 2004). Though they may last for years, junctures tend to be relatively short periods during which there is a very good probability that agents' choices will affect the outcome of interest (Capoccia and Kelemen, 2007). By relatively short, the

authors mean the duration of the juncture is brief compared to the path-dependent process it initiates.

In the U.S., natural resource management on Federal lands is governed by policies that are typically long-lasting and inviolable. Policies are decisions made by government officials on a specific course of action. A policy may be enacted in legislation or pursued more informally through a government agency's day-to-day operations. Because institutional change is heavily rule-dependent (Ostrom, 1990), the more entrenched a policy becomes, the harder it is to replace (Lindblom, 1959). If policy choices generate increasing returns, a self-reinforcing decision pattern can become locked-in, making rule changes involving future decisions even more difficult and costly (North, 1990). This does not mean path dependence prohibits change. Rather, it suggests that payoffs from initial policy choices can lead to dominant strategies that increase the cost of alternatives (Schmid, 2004). Since rules are generally made by those in power, beneficiaries are incentivized to perpetuate the existing framework, locking-in arrangements that favor their interests (Pierson, 2004).

From its beginning, the Forest Service functioned under the Organic Act of 1897 (Public Law-2) which emphasized preservation of watersheds and forests. Wildfire, seen as antithetical to the Act, was to be prevented at all costs (Gebert and Black, 2012). Indeed, protecting natural resources from fire was the Forest Service's reason for being (van Wagtendonk, 2007). However, prior to the early-20th century, systematic protection of forests from fire was practically nonexistent. Against this backdrop, a new agency many in Congress saw as superfluous and opposed was charged with defending over 30 million hectare of highly valuable but vulnerable public forestland (Bergoffen, 1976). Scarcely five

years later, iconic forest fires in northern Idaho, western Montana, and eastern Washington burned 1.2 million hectare and claimed 86 lives (Halm, 1930). These events, compounded by several exceptionally severe fire seasons in the early-1930s, culminated in the critical juncture that prompted the Forest Service to adopt, in 1935, what became more than 40 consecutive years of path-dependent fire policy.

Sustaining such a path requires phenomena that restrict other alternatives. Convinced fire eradication was their moral duty, Forest Service firefighters were supported enthusiastically by the public (Pyne, 1996). Fire suppression expenses the Forest Service incurred were often reimbursable under the Forest Fires Emergency Act of 1908 (Public Law 60-136). Unwilling to relinquish these boons, research discoveries that verified the cultural acceptance and beneficial effects of fire in specific regions were withheld by the Forest Service for decades (Schiff, 1962). Fire protection had become an established Forest Service institution – whatever the agency did or wanted to do was paid for by firefighting (Pyne, 1996). Considering its incentives, the likelihood the Forest Service would move voluntarily off a path of suppression-at-all costs and onto one incorporating fire as a management tool was poor since switching paths could have resulted in high replacement costs and loss of returns (Arthur, 1994). Through the mid-point of the agencies' development, circumstances involving fire policy – similar to those de Tocqueville associated in 1831 to nation-building – had not yet become fully apparent. In the coming decades, however, they would have acute effects on forest health.

Paraphrasing Sewell (1996), path dependence suggests that prior events can influence those in the future, an observation consistent with early Forest Service fire policy and its

aftermath. In the late-1800s, millions of hectare of large, old ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and western larch (*Larix occidentalis* Nutt.), well-adapted to frequent low- to moderate-intensity surface fire, were abundant across much of the Inland Northwest region in Idaho and Montana (Losensky, 1995). By the early-1900s, only remnant stands remained, most of which were managed deliberately to exclude fire (Arno et al., 1997). As unregulated logging and livestock grazing, introduction of non-native insects and pathogens, and human encroachment increased, altered radically were stand structure, species composition, and volume of live and dead fuels, amplifying the severity of and area burned by wildfire (Baker et al., 2007). Yet, fire was not recognized by the Forest Service as a critical natural process or integrated into agency land and resource management plans (Stephens and Ruth, 2005). Granted, breaking decisively with the past can be difficult, even under opportune conditions (Orren and Skowronek, 2014). But trained government and academic scientists correlated increasingly wildfire and human-induced disturbances such as those mentioned previously (Carroll et al., 2007). Why, then, did the Forest Service not heed their warnings and modify its fire policy?

Path dependence theorists would argue a self-fulfilling decision style that required progressively more resources to maintain had become locked-in. As long as resources were available, fire managers continued to spend on suppression if damage was decreased by even a small increment (Holmes et al., 2008). Not until the 1970s did the Forest Service accept that further investment in its existing fire policy was unwarranted and begin veering away from exclusion, though its efforts were mainly a policy ideal seldom practiced in the

field (Ingalsbee, 2000). Finally, in 1978, Forest Service decision-makers acknowledged the ecologic importance of fire and allowed its limited use for fuels reduction (Arno, 1980).

Forest Service fire policy was justified by desire to avoid future conflagrations reminiscent of those that consumed western forests in the early-20th century. But denying fire-prone forests the very process needed to promote their functionality and health disrupted ecosystem heterogeneity (Agee and Franklin, 2003) and created conditions more conducive to fire, setting the Forest Service on a path that guaranteed risks at variance with its mission. Case in point was the Bitterroot National Forest in western Montana where inordinate fire suppression and even-aged silviculture were denounced by Bolle et al. (1970) as contrary to holistic forest management. Instead, had the Forest Service been more attentive to the effects its management policies were having on forest ecosystems, forest health Title VIII was designed to improve may not have become so unwell.

When customs from the past no longer agree with conditions in the present, expectations can become unsettled and critical junctures occur (Orren and Skowronek, 2004). At such moments, institutional arrangements are believed to evolve, much as Forest Service fire policy did in 1978 when exclusion of fire was replaced by limited use. Not that outright dismantling took place, but that temporally-connected acts – which had been reproduced continuously to mitigate threats of catastrophic wildfire – were converted to new purposes, mirroring what de Tocqueville spoke of in 1831.

Good Neighbor Authority

Under GNA of the 2014 Agricultural Act, states can now improve forest health on national forest lands within their borders. Thinnings can be conducted to increase mean

stand diameter and shift forest composition toward fire and drought-tolerant species (Franklin and Johnson, 2012). Partial cuttings to renew spatial heterogeneity, create openings and tree clumps, and improve the survivability of older conifers can be employed (Larson and Churchill, 2012). And prescribed fire can be utilized to reestablish historic levels of understory vegetation and woody fuels, and lower wildfire risks (Franklin et al., 2008). Engaging in GNA requires signing a cooperative agreement – a legal instrument to accomplish work for the Federal government – whose objective is to increase the pace and scale of forest restoration using active forest management (Tidwell, 2015a).

Subsequent to signing an agreement, states must choose a GNA template; three options are available. The simplest is a Stand-alone Agreement which requires a joint Statement of Work and financial plan for a single project. The second is a Master Stewardship Agreement (MSA) which can span a 10-year period and include many small and large projects, each of which requires a Supplemental Project Agreement. Third is a Supplemental Project Agreement which requires a Statement of Work and a financial plan for each project performed under the MSA. Of the three templates, a MSA has the greatest utility as it provides a framework which can accommodate numerous Supplemental Projects.

In 2013, the Department of Natural Resources and Conservation (DNRC) in Montana signed a MSA with the Forest Service to perform restoration activities at landscape scales on and off national forest lands within the state (USDA Forest Service, 2013a). The DNRC, a state land management agency similar to the Forest Service, manages forestlands and protects rural communities while promoting a viable forest products industry. In Montana,

state law permits the governor to reallocate monies from the state's fire budget to fund forest restoration (Montana Legislative Services Division, 2013) and, in 2014, DNRC received three million dollars for this purpose.

Under the Montana MSA, 16 projects in nine counties on Federal, state, and tribal lands have received state investments (Montana Forests in Focus Initiative, 2015). Projects could encompass an unestimated number of hectare and were subject to a collaborative review process to ensure restoration activities benefit the Forest Service, DNRC, and any other participating entities. The MSA allows DNRC to seek additional funding from nongovernmental organizations, forest industry, and tribes (USDA Forest Service, 2013a). As of July 2016, however, the State of Montana had not chosen to participate in GNA.

Unlike Montana, in May 2016, the state of Idaho entered into GNA by signing a MSA with the Forest Service (Idaho Department of Lands, 2016). This action provides authority for all national forests within the state to engage with the Idaho Department of Lands (IDL) to implement forest management projects. The Forest Service and IDL have begun drafting plans for the first GNA project to occur in Idaho. Emphasized will be forest restoration and timber salvage on the Nez Perce-Clearwater National Forest. Bringing GNA to fruition in Idaho required a concerted effort from the State Legislature for new budget authorities, IDL for administrative and technical services, and forest industry for start-up funding. Periodic reviews will be conducted to evaluate program performance. Anticipated are improved forest and watershed health, increased employment for those who will process raw material removed by restoration treatments and serve indirectly in support roles under the State's MSA, and a financially sustainable program (Ibid, 2016).

The goal of GNA on the NFS is to increase the pace and scale of forest and watershed restoration. According to the Forest Service this will improve forest health, reduce threats from catastrophic wildfire, and create economic benefits. However, increasing restoration pace and scale has an additive connotation, implying new projects will supplement those that are part of an existing work plan. Between 2000 and 2015, Forest Service personnel who manage the national forests decreased 39 percent (Bonnie, 2015), and the agencies' budget, skewed disproportionately toward fire suppression, has been flat or declining for years (Wilent, 2015). In 2014, hazardous fuels were reduced on 690 thousand hectare of national forest land (USDA Forest Service, 2014b) but, during the same year, forest mortality in Idaho and Montana totaled 5.3 million hectare, and 26 million additional hectare require restoration nationwide (USDA Forest Service, 2015a).

Limits

Other concerns could also hamper the effectiveness of GNA. This point will be illustrated using, as examples, the State of Idaho which contains 8.2 million hectare of national forest land, and IDL, the state's lead agency for management of one million hectare of endowment trust lands. The first limit involves policies governing forest management.

In Idaho, the guiding document used to regulate management of all Non-Federal forestland is the Idaho Forest Practices Act (FPA). If an agent such as invasive insects or forest pathogens threatens forest health on endowment trust lands that IDL wishes to mitigate using a management activity not federally funded or restricted by Federal law, IDL need only comply with the FPA. Under GNA, if forest health on endowment trust lands is

threatened by similar agents that originate on adjacent national forest land, IDL can enter into a cooperative agreement with the Forest Service to conduct mitigation activities on national forest land (USDA Forest Service, 2015b). Only in this case, Federal policies such as NEPA will apply.

Few policies have presented more challenges to Federal land managers than NEPA (Hoover and Stern, 2014). Praised by some as the most important environmental legislation Congress ever passed (Friesema and Culhane, 1976), NEPA has been vilified by others as one of the largest impediments to accomplishing work on the NFS (Auer et al., 2011). Rather than enforce or prohibit, NEPA prescribes and educates, balancing competing positions on matters related to natural resources and the environment, and enabling public involvement in the decision-making process (Hoover and Stern, 2014). Adoption of NEPA in 1970 occurred as a reaction to increasing public concern about human-caused environmental impacts. Advocates argued that, without a specific policy, Federal agencies were disinclined to consider the environmental effects of their actions (Luther, 2005). Detractors countered, saying that NEPA was unduly expensive and seldom arrived in time to guide decision-making (Clark and Canter, 1997).

Under NEPA are three levels of scrutiny to which all Federal agencies must adhere when assessing the environmental effects of their proposed actions. Any action expected to have a significant environmental impact requires an Environmental Impact Statement (EIS). An Environmental Assessment (EA) is required when it is unclear whether an EIS or a Categorical Exclusion (CE) is appropriate. Lastly, if a proposed action is thought not to have a significant environmental effect, NEPA allows the use of a CE. Agencies' response to NEPA

has varied. However, those that have had the greatest difficulties have been the most often litigated against (Malmsheimer et al., 2004).

Authorized by Title VIII is 'streamlined' environmental analysis in designated areas larger than one thousand hectare (USDA Forest Service, 2014b). Defined as making something more effective or productive (Merriam-Webster, 2016), streamline is appealing insofar as helping advance GNA's goal. But, in streamlining NEPA, the pre-decisional objection process, available formerly to the public under Section 428 of the Consolidated Appropriations Act of 2012 (Public Law 112-74), was repealed on projects designed for a CE. Curtailing public involvement by streamlining environmental analysis may increase the number of GNA projects implemented but it could also have undesirable social consequences. However, if streamlined NEPA and GNA can be melded in ways that society accepts and that increase forest restoration beyond levels achieved prior to the 2014 Agriculture Act, a new path could emerge allowing the Forest Service to amend the effects of its early fire policy.

A second limit is funding. Whenever IDL wishes to conduct restoration treatments on endowment trust lands, budgeted revenue generated mainly by its timber sales program is utilized. But if IDL entered into a cooperative agreement with the Forest Service to conduct similar activities on national forest land, Federal funding may be less certain as appropriations received by the Forest Service are allotted by project *type*, which is not necessarily the same as *need*. The only way this can be modified is if a project type that has funds does not use them, in which case the funds can be reassigned for other uses (Sholty, 2015). Moreover, were IDL to enter into a cooperative agreement to conduct restoration

projects on national forest lands, it would be obligated to pay planning and administrative costs outside its normal budget structure. To avert problems this could cause, GNA allows state agencies to act as proxies for the Federal government by, for example, setting up commercial timber sales on the national forests and bundling them with those on state-owned lands (Ibid, 2015). Costs for timber sale design and appraisal would be borne by IDL, and those related to NEPA by the Forest Service. Receipts yielded from timber sold would revert to the Forest Service. Any profits realized from selling timber for more than its appraised value would be held by IDL to complete work under its cooperative agreement, or to create new projects.

A third limit is trust. Federal agencies and citizens who engage in natural resource management decision-making have histories with each other predicated on whether trust or distrust has been normative (National Research Council, 2008). Since agencies perceived as having low credibility are less likely to gain public support for their initiatives (Watson and Borrie, 2006), the Forest Service has placed increasing priority on the participatory process to cultivate public trust (Predmore et al., 2011). Administrators that have committed to this process have realized greater success maintaining trust-based relationships with their Non-Federal counterparts (Shindler and Cramer, 1999).

As much as 42 percent of the NFS requires forest restoration (USDA Forest Service, 2016). Lacking budgeted funds, national forests wishing to install restoration projects must generate new revenue, oftentimes from commercial timber sales. Whenever this option is utilized, it will behoove the Forest Service to take all reasonable precautions not to jeopardize public trust. Though revoked by Title VIII on projects where a CE is employed,

the pre-decisional objection process is still in effect on Federal lands where an EIS or an EA is utilized. In Idaho, if the boundaries of a timber sale were to overlap Federal and state-owned lands, the pre-decisional objection process would apply to Federal land but not state land as public review of forest operations in Idaho is not permitted. Thus, questions could arise as to whether the Forest Service, as lead agency, is truly invested in considering evenhandedly all available options, or its preferred alternative.

Bioenergy Alliance Network of the Rockies

Forest restoration is capable of satisfying multiple objectives; one of which is generation of raw material for commercial use. The National Institute of Food and Agriculture (NIFA), Bioeconomy-Bioenergy-Bioproduct (B3) Program sponsors research and development on national energy security, leading ultimately to private investment in the bioeconomy sectors of biofuels, biopower, and other bio-based products (National Institute of Food and Agriculture, 2014). NIFA pursues this vision through partnerships with Federal agencies, private industry, and academia. The Biomass Research and Development Initiative (BRDI), a collaborative effort between the U.S. Departments of Energy and Agriculture, fills a significant gap in the continuum of technology development while meeting the requirements of Section 9008 – Biomass Research and Development under Title IX of the 2014 Agricultural Act. The objective of BRDI is to develop technologies that attract private or public financing to produce commercial quantities of biomass-based energy (Ibid, 2014).

Launched in 2013, the Bioenergy Alliance Network of the Rockies (BANR) – a NIFA grantee and BRDI affiliate – is a multidisciplinary research consortium composed of the

Forest Service, the renewable fuels industry, and land-grant universities in Colorado, Idaho, Montana, Oregon, and Wyoming (Bioenergy Alliance Network of the Rockies, 2016). Commensurate with the NIFA B3 Program, BANR objectives are to investigate the social, economic, and environmental implications of utilizing woody biomass sourced primarily from national forest lands as feedstock to produce renewable biofuel and other bioenergy products, and provide the scientific underpinnings to support a regional bioenergy industry.

However, as down and dead woody material (DWM) is vital to most biotic processes in forest ecosystems, the scientific community is divided on using it to produce bioenergy (Stokland et al., 2012). Biomass supplies are plentiful, but concerns are that an established bioenergy market could be detrimental to site productivity, particularly in the arid, Inland Northwest where reduction of DWM occurs endemically (Covington and Sackett, 1984). Only in recent decades have the material's ecologic contributions been better understood. Because of their integral role in regulating ecosystem processes, major alterations could have cascading effects on other ecosystem functions, such as nutrient retention and cycling, carbon storage, and biodiversity (Berger et al., 2013).

Woody biomass from forest management activities is suitable for bioenergy production and could help offset dependence on fossil fuels, forest restoration costs, and the effects of climate change (Perlack et al., 2005). Proponents maintain energy produced from woody biomass lowers greenhouse gas emissions and the incidence of wildfire; skeptics dismiss these notions as unreliable and outdated (Sovacool, 2011). Though social opposition to biomass utilization has complicated forest management where Federal landownership is

high, producing thermal energy from woody biomass at relatively small scales has gained popularity (Sundstrom et al., 2012).

As scale increases, however, so do costs. A coal-burning facility in Wisconsin converted in 2008 to woody biomass closed in 2015 due to the effects decreased value of renewable energy had on transportation costs (Global Data Point, 2015). If demand rises, costs can be diluted somewhat. But as long as forest industry continues to regard woody biomass as low-grade residue, market availability and price are unlikely to improve (Adams and Latta, 2005). This does not mean fuels reduction treatments are unrealistic economically. Identified by Skog and Barbour (2006) were 5.7 million hectare of Federal forestland in 12 western states capable of paying for themselves. Over two-thirds of the area is in California, Idaho and Montana, and at least 50 percent of biomass harvested would come from merchantable trees equal to or greater than seven inches in diameter at breast height (Ibid, 2006).

The Mountain Pine Beetle Response Project on the Black Hills National Forest (BHNF) in western South Dakota and northeastern Wyoming has confirmed woody biomass can be reduced cost-effectively. From 2000 to 2012, several million dollars in funding provided by state and county governments and nongovernmental organizations was used to treat over one hundred thousand forested hectare (Bobzien and Van Alstyne, 2014). Ancillary research on the BHNF found that partial-cuttings in unmanaged stands of ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) minimized tree damage caused by the mountain pine beetle (*Dendroctonus ponderosae*), an insect linked to forest mortality on national forest lands in excess of nine million hectare since 2000 (USDA Forest Service, 2013b).

While bioenergy from woody biomass can be produced sustainably without risking our current energy system (White, 2010), harvesting and transportation costs can make recovering woody biomass from forest operations more expensive than the resulting bioenergy benefit (Kirkland and Nicholls, 2015). Technology improvements and increased consumer demand could strengthen woody biomass' market competitiveness, but businesses are unlikely to build processing facilities unless biomass supplies can be guaranteed over the long-term (Keegan et al., 2005). Research by Silverstein et al., (2006) showed that, on national forest lands in western Montana, mechanical fuels reduction treatments could achieve this goal through 2050. However, removing huge quantities of woody biomass from public lands raises social and environmental questions that have not been resolved.

Based on what has been learned from previous energy shifts, any new form of energy production system that lacks the elaborate production, processing, and distribution networks of its predecessor will operate initially at a disadvantage (Smil, 2014). Before the new system can become competitive, disadvantages must be overcome and a duplicate infrastructure created. More than 50 years were needed for coal to replace wood, and another 50 years for oil to overtake coal (Klare, 2015). Since fossil fuels supply more than 80 percent of the total energy demand in the U.S. (U.S. Energy Information Administration, 2015), switching from fossil fuels to renewables is unlikely to be an exception.

Progress promoting the use of renewables is being made, however. Forecasts are that upgraded, domestic fuel-efficiency standards will reduce consumption of fossil fuels by 12 billion barrels over the next 10 years (Klare, 2015). China, the world's leading consumer of

fossil fuels, has pledged to cap its carbon emissions by 2030 and increase to 20 percent its use of non-fossil fuels in primary energy consumption (Institute for Energy Research, 2015). In 2013, renewable energy sources supplied about 12 percent of total energy consumed in the U.S., with liquid biofuels being about 10 percent of total renewables (U.S. Energy Information Administration, 2015). But if liquid biofuels are to make inroads as an energy mainstay and vie economically with more traditional competitors, Federal subsidies and production tax credits for fuel manufacturers and distributors, and methods to document emissions benefits will be mandatory (Ter-Mikaelian et al., 2015). Otherwise, that the U.S. has recoverable reserves of at least 36 billion barrels of petroleum, 338 trillion cubic feet of natural gas, and enough coal to last for centuries will likely ensure fossil fuels remain the nation's primary energy source for many years to come (U.S. Energy Information Administration, 2015).

Conclusions

Where path dependence is causally-based and deterministically-oriented, the effects of early policy decisions can create legacies that constrain future policy choices (Weir, 1992). Forest and land management policies of the early-20th century have contributed significantly to what has become difficult-to-treat, fire-intolerant stands found across much of the Inland Northwest (Hessburg and Agee, 2003). Anthropogenic activities policies condoned enabled widespread physiologic stresses that, over time, degraded forest structure and functions, and abetted exogenous disturbance such as larger, more intense wildfires (Perry et al., 2008).

Aligned for decades with utilitarianism, public attitudes on forest management in the 1960s began leaning more toward an environmental ethos. Regarding public lands, this transition was quickened by highly polarized controversies sparked by the deleterious effects certain management practices were having on forest and aquatic ecosystems (Yung et al., 2010). GNA is capable of tempering these effects, not by returning ecosystems to their predisturbed condition but by setting their evolutionary clocks ticking again (Falk, 1990). However, research has shown that new forestry initiatives are not well-received by the public if it lacks the knowledge needed to evaluate initiatives' benefits (Wright, 2000). Moreover, if large, healthy trees are removed from national forest lands under the guise of fuels reduction, public trust in the Forest Service could wane (Brown, 2000). But the most salient worry overshadowing GNA is the prospect of 'stop and go' funding (Moser, 2005) which could stall project implementation.

On the other hand, GNA can assist in building new relationships with state agencies confronted by natural resource management challenges identical to those of the Forest Service. Applied judiciously, GNA can also bolster public trust – the most significant issue obstructing active forest management on Federal lands (Franklin and Johnson, 2012). Perhaps GNA's greatest potentiality is to facilitate forest restoration in accordance with what *should*, rather than what *could*, be done (Cawley and Freemuth, 2007) which, if successful, would lend considerable currency to the path dependence concept by demonstrating how earlier practices can be reconfigured to form new arrangements more in keeping with prevailing sentiments.

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Chapter 2

Expert Opinion on Good Neighbor Authority as a Forest Restoration Tool in Idaho and Montana

Abstract

The National Forest System (NFS) in the U.S. is comprised of 78 million hectare of forestland managed and administered by the USDA Forest Service. Maximum variation sampling was used to narrow the scope of this study to lands in the Inland Northwest region of Idaho and Montana. Across much of the region, declining forest health is an outgrowth of earlier decisions regarding how wildfire was responded to and managed. Forest restoration to ameliorate the problem has been deprived funding by fire suppression. Consequently, millions of hectare of national forest land require restoration treatments. Interviewed were 28 natural resource professionals whose knowledge of public land management is relatively high. Explored were professionals' views on Good Neighbor Authority under the 2014 Agricultural Act (Public Law 113-79) as a policy tool for forest restoration.

Management and Policy Implications

On national forest lands in Idaho and Montana are 2.3 million hectare requiring forest restoration (USDA Forest Service, 2015a). Utilizing for bioenergy woody biomass restoration treatments remove was endorsed in 2016 by the North American Energy Security and Infrastructure Act. However, depending on site conditions, forest type and treatment scenario, restoration costs in the region range from four hundred to eight hundred dollars per hectare (Jain et al., 2012). Given shrinking Federal budgets, the most

plausible treatments may be those capable of funding themselves. Still, treatments must be designed, implemented, and monitored which the Forest Service often lacks the capacity to perform. A potential remedy is GNA under the 2014 Agricultural Act (Public Law 113-79). GNA affords the Forest Service opportunities to work collaboratively with states to increase the pace and scale of forest restoration on the NFS beyond what the agency alone can accomplish. Utilizing this approach a multiplier effect can be created, enabling Federal and state agencies to increase critical mass and work across ownership boundaries to restore forest health and resilience in the context of desired future conditions.

Introduction

Eighty-five percent of the NFS, or about 66 million hectare, is located west of the 100th meridian in the contiguous U.S. Recognizing that more information is not necessarily more complete information (Wilson et al., 2012), maximum variation sampling was used to pare this study to lands in the Inland Northwest region of Idaho and Montana. The Inland Northwest region in the contiguous U.S. was defined by Bailey (1995) as the catchment area of the Interior Columbia River Basin. All of Washington and much of Oregon east of the Cascade Mountains, nearly all of Idaho north of the Owyhee Uplands and Snake River Plains, and portions of northwestern and southwestern Montana extending to the Continental Divide are included (Ibid, 1995).

Maintaining forest health throughout much of the Inland Northwest has been problematic due to the lingering effects of early forest management policies, particularly involving the exclusion of fire (Hessburg et al., 2005). Prior to this policy becoming successful, temperature and precipitation patterns combined with natural and human

ignitions allowed fire to burn at relatively frequent intervals (Graham and Jain, 2005), aiding long-lived, fire-dependent species such as ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and western larch (*Larix occidentalis* Nutt.) (Hessburg et al., 2005). Excluding fire altered natural succession, attracting insects and disease that modified forest composition and structure and weakened forest health (Dennison et al., 2014). As tree growth slowed and mortality increased, woody fuels accumulated, heightening the prospect of larger, more severe wildfires. By 2015, cost to suppress wildfire on four million hectare of national forest land burned totaled $1.7 billion, or about 52 percent of the Forest Service budget (USDA Forest Service, 2015c). Fire is vital to the dry, mixed-conifer forests of the Inland Northwest but its true cost accrues over time and is much higher than the public realizes, or is reported in government assessments (Association for Fire Ecology et al., 2015). Explored by this study was whether GNA under the 2014 Agricultural Act can mitigate these concerns.

Good Neighbor Authority

Immediately following passage of the Act, 19 million hectare of national forest land – 2.3 million of which are in Idaho and Montana – were approved by the Forest Service for restoration (USDA Forest Service, 2015a). However, as the Act did not appropriate the necessary funds, only some lands will be treated at present. To facilitate forest restoration on lands that can be treated is GNA under Title VIII – Forestry. With the exception of wilderness areas and wilderness study areas, GNA can be utilized on all Federal lands and on Non-Federal lands not adjacent to Federal lands (USDA Forest Service, 2015b). Only states can enter directly into GNA with the Forest Service to perform natural resource

management activities on the national forests. The Forest Service cannot perform comparable activities on state lands. Native American tribes and nongovernmental organizations can participate in GNA, but only as third parties subordinate to states. Cost-sharing is encouraged but not mandatory. Working across jurisdictions with state agencies can assist the Forest Service increase capacity on Federal lands, and strengthen Federal and state relationships. States can realize new, economic development opportunities and conduct forest management projects in proximity to their boundaries with Federal lands.

Cooperative Agreements

Participation in GNA requires a 'cooperative agreement' between the Forest Service and states. Forest Service officials envision cooperative agreements as a way to increase restoration activities on the national forests (Sholty, 2015). States such as Idaho and Montana that contain large Federal landholdings can benefit from GNA. Forest thinnings can shift forest composition toward fire and drought-tolerant species (Franklin et al., 2008). Partial cuttings to renew spatial heterogeneity, create openings and tree clumps, and improve the survivability of older conifers can be employed. Prescribed fire to reestablish historic levels of understory vegetation and woody fuels can also be utilized (Ibid, 2008).

Engaging in a cooperative agreement requires choosing a GNA template. Three options are available. The simplest is a Stand-alone Agreement which requires a joint Statement of Work and financial plan for a single project. A Supplemental Project Agreement requires a Statement of Work and a financial plan tiered to individual projects under a Master Stewardship Agreement (MSA). Last, a MSA can include many small and large projects performed over a period up to 10 years.

Active Forest Management

Overcrowded, dry forests in the Inland Northwest where the use of fire has been absent are compatible with active forest management (Buchanan and Hull, 2008). Franklin et al. (2008) described active forest management as adaptive silvicultural operations such as variable retention timber harvests and precommercial thinning that move stands toward lower densities and larger tree diameters. A reasonable restoration target in the dry forests is to renew the synchrony that once existed between forest vegetation and fire regimes (Hessburg et al., 2005). Active forest management can further this objective while yielding enormous volumes of woody biomass. The Mountain Pine Beetle Response Project on the Black Hills National Forest in western South Dakota has demonstrated woody biomass can be produced cost-effectively by forest restoration activities (Bobzien and Van Alstyne, 2014). Similar projects are either underway on the Colville National Forest in northeast Washington and the Payette National Forest in central Idaho, or scheduled to begin in 2016 on the Flathead National Forest in western Montana and the Nez Perce-Clearwater National Forest in north-central Idaho.

Methods

Expert sampling was used to select a panel of 28 natural resource management interviewees known to have in-depth familiarity with forest practices and policies on Federal and Non-Federal lands in Idaho and Montana. Interviewees' tenure in the region ranged from three years to 45 years. Expert sampling relies on the judgement of the researcher (Patton, 2002) and is useful in gaining access to information where empirical

evidence is sparse, uncertainty high, and long periods of time may elapse before research findings are uncovered (Bernard, 2000).

Individuals were selected purposefully to represent a diversity of occupations, ranging from scientific research and environmental analysis to tribal liaison and forest planning. This approach is especially effective for exploring positions on which there may be multiple opinions and no agreed upon solutions (Yung et al., 2010). Represented were Federal and state natural resource management agencies, Native American tribes, and environmental advocacy. Sixty-four percent of interviewees were male and 36 percent female. Interviews were conducted during May and June of 2015 using a set of 10 semi-structured, open-ended questions. The main topics on which questions focused were GNA as a forest restoration tool on national forest lands, and whether it could assist the Forest Service deal with related issues of local and regional concern. Interviews were recorded and transcribed verbatim. Analysis involved reading and rereading transcripts to link information reported with the main topics.

Interview Questions

All interviewees were asked some form of the following questions:

1. Under Title VIII – Forestry of the 2014 Agriculture Act is Section 8206, Good Neighbor Authority (GNA) which promotes cooperative agreements between the Forest Service and state agencies to increase pace and scale of forest restoration on the NFS. In what way(s) do you think such agreements can help achieve this goal?
2. What incentive(s) do you think are needed to induce state agencies to enter into cooperative agreements with the Forest Service?
3. Special funds needed to conduct projects under GNA were not appropriated by Congress. What impact(s) do you think this will have on its effectiveness?
4. How do you think the necessary funds needed to conduct such projects might be obtained?

5. GNA authorizes the use of 'streamlined' environmental analysis in designated areas on forest restoration projects up to one thousand hectare per project. What do you think the public's reaction to this option will be?
6. The U.S. Department of Agriculture, National Institute of Food and Agriculture supports collaborative partnerships to investigate the potential of producing renewable biofuels from woody biomass, an example being the Bioenergy Alliance Network of the Rockies. What are your views on using this approach as a forest restoration tool?
7. What do you think are the most significant policy challenges confronting this approach?
8. What social effects do you think utilizing woody biomass to produce renewable biofuels could have on rural communities?
9. What economic effects do you think utilizing dead, woody biomass to produce renewable biofuels could have on wildfire suppression costs?
10. What ecologic effects do you think utilizing dead, woody biomass to produce renewable biofuels could have on forest health?

Quotations were selected for inclusion based on relevance to the topic, representation of both typical and atypical views, and depth and clarity of ideas conveyed. Following completion of the interviews, responses were condensed into major themes. Contextualizing these themes allowed conclusions to be drawn on the efficacy of GNA as a forest restoration tool.

Discussion

Across much of the Inland Northwest region, early forest and land management policies contributed to what has become more fire-prone forest conditions (Hessburg et al., 2005). To alleviate this problem, two hundred million dollars per year – for each fiscal year from 2014 to 2024 – was authorized by the 2014 Agricultural Act for forest restoration. However, since the funds were not disbursed, national forests wishing to implement forest restoration projects under GNA must rearrange their existing budgets or generate funding by some other means. Interviews began by asking professionals about this contradiction.

Funding Uncertainties

Expressed frequently was that Congress could fix this problem by changing the way fire suppression on the NFS is funded. Aware of the economic effects fire suppression has on the Forest Service budget, Congress chose not to address this issue in the 2016 Appropriations Act (Public Law 114 – 113), inertia several interviewees characterized as showing a lack of commitment to Federal restoration goals. However, while changing the way fire suppression is funded could eventually free more dollars for forest restoration, in the interim the backlog of lands requiring treatment continues to grow. Unanimity among interviewees was that, without more funding, restoration projects will not increase.

> "In the 1960s and 1970s, hundreds of thousands of acres in Idaho and Montana that were clear cut are now populated by dense, young stands that badly need thinning. Jobs could be created for those who would reduce woody fuels, process raw material, and serve indirectly under a State's cooperative agreement. But the dollars to jump-start the process just aren't there."

Stressed by the Forest Service is that GNA will enable the agency to increase the pace and scale of forest restoration (Tidwell, 2015a), suggesting that new projects will be added to those already part of a work plan. But between 2000 and 2015, the Forest Service workforce decreased by 39 percent (Bonnie, 2015), and the agencies' budget, dominated by fire suppression, has been flat or declining for years (Wilent, 2015). In 2014, forest restoration occurred on 1.9 million hectare of national forest land (Buford et al., 2015) but, during the same year, forest mortality in Idaho and Montana totaled 5.3 million hectare, and at least 26 million additional hectare on the NFS require restoration (USDA Forest Service, 2015a). "Additive projects are the problem," said one interviewee, "If fire suppression costs continue to rise, less restoration will get done. As things now stand,

more, faster isn't feasible." Many interviewees felt that forest restoration on an additive basis is a foregone conclusion because states, like the Forest Service, lack the necessary funds.

"All net income our agency generates goes to beneficiaries; there isn't anything left for restoration on national forest lands. Without additional funding, there's no incentive for us to partner with the Forest Service as we have budget and capacity problems of our own. There are many bottlenecks to accomplishing work within proposed treatment areas on the national forests. Additional capacity for environmental analysis and data collection are main factors, but there are also other challenges at the Congressional level such as a ban on earmarks."

Native American tribes face similar difficulties. Stated one tribal interviewee, "the Forest Service has much better funding than we do; why can't it (Forest Service) get more done with the staff and funds it has?" Tribes are among the largest owners of timber resources in the U.S., yet funding they receive for forest management has historically been about one-third of that received by the Forest Service (National Congress of American Indians, 2014). Title VIII requires the Forest Service to work with tribes to develop and implement restoration projects that reduce insect and disease-related risks. But tribal interviewees that participated in this study were indifferent toward GNA, concerned they could become embroiled in protracted and costly Forest Service processes that could jeopardize their relationships with agency personnel.

Funding Possibilities

Over the past 25 years in Montana, lack of active forest management on national forest lands has caused dramatic declines to forest health (Montana Forests in Focus Initiative, 2016). Thus, in 2013, the state entered into a Master Stewardship Agreement (MSA) with the Forest Service to improve forest conditions on and off Federal lands. As allowed by

state law, monies from the state's fire budget were reallocated to fund forest restoration. In 2014, 16 projects on state, private and tribal lands, and 14 projects on national forest land received three million dollars for forest restoration (Ibid, 2016). However, as of June 2016, Montana had not chosen to participate in GNA.

In Idaho, insects and disease threaten forest health across all ownerships. Thus, in May 2016, the state elected to join California, Colorado, Michigan, Minnesota, Oregon, Wisconsin, and Texas as a participant in GNA by signing a MSA with the Forest Service. The Idaho Department of Lands (IDL), the state's lead agency for management of one million hectare of endowment trust lands, will administer the MSA. Anticipated are improvements in forest and watershed health, increased employment for those who will process raw material removed by restoration treatments and serve indirectly in support roles under the state's MSA, and a financially sustainable program (Idaho Department of Lands, 2016). New appropriations from the State Legislature, administrative and technical assistance from IDL, and funding from forest industry enabled Idaho to enter into GNA.

Available under GNA is a third funding possibility whereby states can function as proxies for the Federal government by performing work on its behalf (Sholty, 2015). For example, a state can partner with the Forest Service to setup commercial timber sales on national forest lands. Revenues yielded from timber sold revert to the Forest Service as dictated by the National Forest Management Act of 1976 (Public Law 94 – 588). Any profits gained from selling timber for more than its appraised value would be held by the state to complete work under its cooperative agreement. Some interviewees were intrigued by the

timber sales option but the majority were not convinced it would solve their funding problems.

Using woody biomass from forest restoration treatments to produce wood-based biofuels could constitute a fourth funding possibility. However, response from one interviewee reflected broad sentiment: “Woody biomass for bioenergy will be entirely market driven – no market, no potential.” For years, local governments have attempted to incentivize contractors to perform fuels reduction treatments on their lands. Though wood processing facilities may have been present, either they were uninterested in purchasing the material, or supplying material to them was cost-prohibitive. Some national forests in Idaho and Montana have received Federal subsidies to offset fuels reduction costs. Had there been no financial assistance, interviewees said projects would not have occurred. If treatment sites are close to markets, other energy costs are high and the public is supportive, using woody biomass for bioenergy may be feasible (Miller and Essen, 2016). Otherwise, the cost to harvest, collect, and transport woody biomass can make its recovery from forest operations more expensive than the resulting bioenergy benefit (Kirkland and Nicholls, 2015).

Social Considerations

Under the 2014 Agricultural Act, GNA was designed to improve forest, rangeland, and watershed health. To help realize this objective, allowed is ‘streamlined’ environmental analysis in designated areas on projects encompassing 1.2 thousand hectare – an area that, if square, has sides 7.5 kilometers in length. Streamlined environmental analysis refers to the use of a Categorical Exclusion (CE), one of three levels of environmental review

introduced in 1970 by Public Law 114 – 38, the National Environmental Policy Act (NEPA). Whenever a Federal agency proposes an action expected to have a significant environmental effect, it is compulsory that the agency prepare an Environmental Impact Statement (EIS). If it is unclear whether the action warrants an EIS, an Environmental Assessment is usually sufficient. Only if the proposed action will not have a significant environmental effect does NEPA allow a CE.

Several interviewees saw streamlined environmental analysis as a way to avoid complying fully with NEPA, arguing that forest restoration projects at landscape scales would likely have significant environmental effects, disqualifying them under a CE. Others agreed the public will not accept CEs on forest restoration projects as large as those allowed by the 2014 Agriculture Act. Supporting this position, one interviewee pointed out that:

"If the Forest Service is sued because the CE is overused, and the judge finds that it (CE) fails to meet NEPA requirements, the agency will have gotten nowhere in making progress toward avoiding litigation. Conducting restoration projects at landscape scales scares people."

Opposite views were also voiced. One Federal official commented they welcomed litigation because only then would Federal agencies have a clearer understanding of the legal threshold a CE must meet on GNA projects. A similar stance was taken by others:

"Most people will approve of forest restoration projects in their communities, and projects are a 'win/win' for the Forest Service and forest health. Citizens in forest-dependent communities will welcome the economic benefits provided by woody biomass utilization because they understand natural resources must be actively managed. This is not an issue where some want what others don't."

Some interviewees linked these issues in a trust-related context. An environmental advocate stated “the Forest Service has reneged on its promises to perform certain actions so many times that it can no longer be trusted.” Research has shown that removing mature, healthy trees under the pretense of forest restoration can erode public trust (Becker et al., 2011). While many national forests in the study region contain massive volumes of dead woody biomass, removing huge quantities from public lands may not be socially acceptable as public opinion on such matters is often based on the level of trust the public has in resource management agencies, and is more complex than a simple ‘for’ or ‘against’ a specific forest treatment (Shindler and Toman, 2003). But trust is fragile and can fade quickly if the public concludes its lands are not being cared for responsibly (Liljeblad et al., 2007).

Conclusions

Interviewed were 28 natural resource professionals highly knowledgeable of and actively engaged in forest management practices and policies on Federal, state, and tribal lands. Interviewees were asked questions designed to gather informed opinions on whether GNA can improve forest health on national forest lands in Idaho and Montana. All interviewees agreed that restoration objectives will not be met without more funding. Policy alternatives at the state level can ease funding shortfalls. But Congressional appropriations such as those authorized by the 2014 Agricultural Act, or changing the way fire suppression is paid for, have greater potential.

Excluding fire from forest landscapes undermined forests’ resistance to exogenous disturbance in dry forests of the Inland Northwest region (Hessburg et al., 2005).

Consensus among interviewees was that increased investment in active forest management can help rectify the problem, interrupting the displacement of fire-resistant tree species by those less tolerant of fire. The most common active management strategies mentioned by interviewees were thinning to decrease tree density and prescribed burning to reduce volumes of woody fuels and fire hazards. Given the problem's magnitude, a multi-pronged approach must be utilized.

At the heart of any policy to improve forest health are matters involving trust. When trust between citizens and Federal agencies is normative, the public is more likely to accept large-scale forest restoration projects and grant managers leeway in their decisions (Liljeblad et al., 2007). As long as agencies do not lose sight of this relationship, GNA as a forest restoration tool has realistic potential. However, a number of interviewees observed that if modifying environmental laws to increase the pace and scale of restoration treatments becomes the preferred path on national forest lands, public support for GNA could languish.

Two centuries of human intervention have transformed fire regimes, fuel patterns, and forest functionality in the Inland Northwest (Hessburg et al., 2005). Views expressed by interviewees on the value of lessons learned from past experience confirmed this finding. Restoring forest dynamics and disturbance regimes in the context of desired future conditions can check certain problems impacting forest health in the region. However, the extent to which GNA can further this process will depend primarily on individual states and their abilities to invest proactively over the long term.

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Chapter 3

Public Opinion on Good Neighbor Authority as a Forest Restoration Tool on the National Forest System

Abstract

The National Forest System (NFS) in the U.S. consists of 78 million hectare of publically-owned land overseen by the USDA Forest Service. West of the 100th meridian in the contiguous U.S. is 85 percent of this land, 22 percent of which is in Idaho and Montana. Prolific are overcrowded, dry forests lacking old forest components and resistance to fire and disease, a consequence of active forest management and frequent, low- to moderate-intensity surface fire having been absent. Good Neighbor Authority (GNA) under the 2014 Agricultural Act was designed to improve these conditions. A self-administered, web-based survey was developed to evaluate individuals' views on the capability of GNA to achieve this objective. Generated were 141 replies from 32 different states. Ninety-three percent of respondents strongly agreed or agreed the public will support the use of GNA on national forest lands if it reduces wildfire hazards.

Introduction

The focus of this research is GNA as a forest restoration tool on national forest lands in the Inland Northwest region of Idaho and Montana. Bailey (1995) defined the region as the catchment area of the Interior Columbia River Basin in the contiguous U.S. Included are all of Washington and much of Oregon east of the Cascade Mountains, nearly all of Idaho north of the Owyhee Uplands and Snake River Plains, and portions of northwestern and southwestern Montana extending to the Continental Divide (Ibid, 1995). In Idaho and

Montana are 14.5 million hectare of national forest land, with Idaho having slightly more than 50 percent of the total. Mixed-conifer forests – ranging from early-seral lodgepole pine (*Pinus contorta* var. *latifolia*) and mid-seral western redcedar (*Thuja plicata*) to late-seral Douglas-fir (*Pseudotsuga menziesii* var. *glauca*) – populate the region.

Early fire policies have had lingering effects on regional forest health such that extant, dry forests no longer appear or function as they once did (Hessburg et al., 2005). Ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and western larch (*Larix occidentalis* Nutt.), well-adapted to frequent, low- to moderate-intensity surface fire, have been displaced by more shade-tolerant species such as grand fir (*Abies grandis*) and western hemlock *(Tsuga heterophylla)*. Forest restoration capable of mitigating the problem has been denied funding by fire suppression. While progress improving forest health is being made, a more comprehensive strategy is necessary. Survey respondents were queried on whether GNA can fill this void.

Good Neighbor Authority

Signed into law in 2014 was the Omnibus Agricultural Act (Public Law 113-79) containing Section 8206 – Good Neighbor Authority (GNA). Shortly thereafter, 19 million hectare of national forest land, 2.3 million of which are in Idaho and Montana, were approved for forest restoration by the Forest Service. However, as the Act did not appropriate special funding, only a portion of these lands will be treated. Facilitating work on lands that can be treated is GNA. Only states can enter directly into GNA with the Forest Service to perform forest management activities on the NFS. Participants must choose a GNA template. Three different options are available: a Stand-alone Agreement, a

Supplemental Project Agreement, and a Master Stewardship Agreement (MSA). Engaging with states in GNA is beneficial to the Forest Service, helping it strengthen Federal and state relationships, and leverage state resources to increase Federal capacity. Beneficial to states are new, economic development opportunities and the ability to conduct forest management projects in proximity to Federal lands.

Methods

A web-based survey is an electronic instrument that resides physically on a network server connected to the Internet and accessed through a web browser, and was used by this study to collect research data. Web-based surveys can save time, reduce costs and enable broad access, but they can be disadvantaged by non-response bias if the population sampled has very different attitudes or demographic characteristics than those who were not represented (Fleming and Bowden, 2009). Depending on the population and survey emphases, web-based surveys can also have low response rates, which can increase potential for error (Millar and Dillman, 2011).

Developed by Likert (1932), a summated scale is a way of asking people how much they agree or disagree on a particular topic, and a common ratings methodology for web-based research. Using a measure having five or seven response alternatives, respondents rank their level of agreement with a given statement. 'Likert-type items' are stand-alone questions whose responses are not combined to produce a single composite score. They are, however, used in conjunction with a summated scale to ask a respondent to which of several ordered alternatives they belong (Clason and Dormody, 1994). Responses to Likert-type items generate ordinal data which indicate a 'greater than' relationship, though how

much greater cannot be discerned as the distance between responses is not measurable (Boone and Boone, 2012).

Whenever data are on ordinal scales, parametric analyses are inappropriate as they can misrepresent survey findings (Allen and Seaman, 2007). Many scholars agree inferential statistics are not suitable for analyzing ordinal data produced by Likert-type items (Vigderhous, 1977; Clason and Dormody, 1994; Blaikie, 2003; Wu, 2007). This is because inferential statistics focus on generalizability to make predictions about a population from observations of a sample, but the sample must be representative of the group being generalized. Nothing is wrong in applying any statistical operation to analyze data from Likert-type items, but what may be wrong is that what is said about the results of the operation will not be empirically meaningful (Adams et al., 1965). Since the study survey did not attempt to generalize across the entire population, followed were recommendations by Boone and Boone (2012) for analysis of ordinal data from Likert-type items emphasizing descriptive statistics such as mode for central tendency, frequencies for variability, and graphs.

From October through December 2015, a web-based survey was posted on the web site of a 501 (c) (3) nonprofit corporation located in the study region. Its objective was to quantify respondents' views on GNA as a forest restoration tool on national forest lands. Respondents were not pre-tested, offered monetary incentives, or in any way targeted. Instead, any individual who visited the web site could participate in the survey. Individuals registered their responses to survey questions by clicking on answer boxes provided by drop-down menus. Basic computer skills and 10 to 15 minutes were required to complete

the survey. Internet plug-in tools were used to monitor and record the Internet Protocol address of every survey, and store completed surveys in a third-party database. Subsequent to expiration of the survey period, surveys were retrieved from the database and saved on a computer hard drive.

Demographic Background

The survey consisted of two parts. Part one asked respondents the following nine questions on their demographic background:

1. What is your gender?
2. What 10-year range includes your age?
3. In what state do you live?
4. What is your zip code?
5. Are you employed by the USDA Forest Service?
6. Are you employed by a state forest management agency?
7. With whom do you identify as a peer group?
8. Which of the following best represents your political philosophy?
9. What is your highest level of education?

Likert-type Items

Part two contained 10 closed-ended, Likert-type items emphasizing GNA on national forest lands. Each item offered five response alternatives (strongly agree, agree, neutral, disagree, and strongly disagree) for a total of 50 discrete answer choices. The following seven terms were defined to assist respondents answer items in Part two:

1. *Woody biomass* is non-merchantable, woody material generated by timber harvest operations.
2. *Biofuel* is liquid fuel made from renewable woody biomass rather than nonrenewable natural gas, petroleum or coal.
3. *Cooperative agreement* is a legal instrument that reflects a relationship between federal and state government to achieve mutual benefits.
4. *Cooperative agreement project* is a project entered into between the USDA Forest Service and state government to carry out authorized, forest restoration services.
5. *Peer group* is people who share similar backgrounds, interests and views.

6. *Streamlined environmental analysis* is analysis that complies with federal environmental regulations but cannot be appealed by the public.
7. *Modified public notice, comment and appeal* are actions allowed on projects that do not require an environmental impact statement or environmental assessment.

Preceding all Part two items was the clause – Will the public support GNA projects if:

1. They improve forest health?
2. They reduce forest restoration costs?
3. They reduce wildfire hazards?
4. State government helps fund them?
5. Commercial timber harvests increase to help fund them?
6. Streamlined environmental analysis is utilized?
7. Modified public notice, comment and appeal are utilized?
8. They are used to produce woody biomass to make liquid biofuel?
9. Biomass utilization creates economic development opportunities?
10. Biofuel utilization reduces greenhouse gas emissions?

Discussion

Part 1

The 100th meridian bisects the contiguous U.S. approximately equally, and was used to group states as 'western' or 'eastern'. With the exception of Hawaii, only states located entirely west of the meridian were categorized as western (n = 10). All other states were eastern (n = 22). Figures 2 and 3 depict survey participation by group.

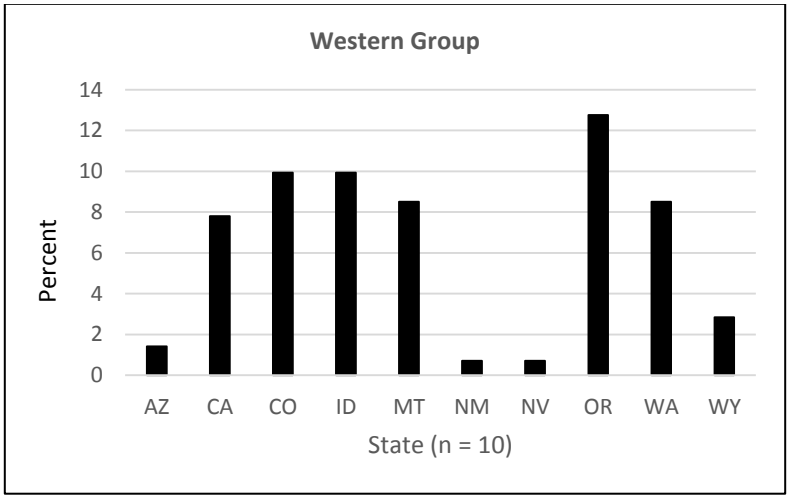

Figure 2: Western group

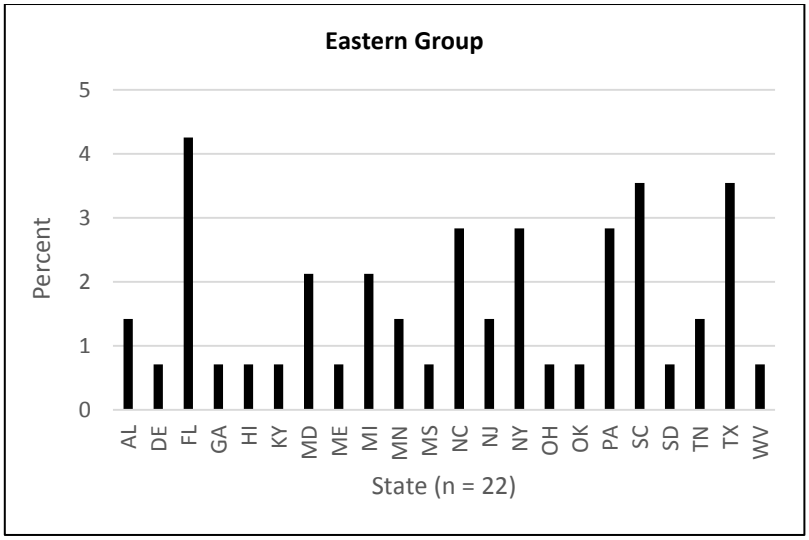

Figure 3: Eastern group

Seventy-five percent of all surveys were received in October, 17 percent in November, and eight percent in December. Of the total individuals who completed the survey (n = 141), 63 percent lived in a western state (n = 89) and 37 percent in an eastern state (n = 52). Among the western group, representation was highest in Oregon (20 percent), Colorado (16 percent), and Idaho (16 percent). At four percent each, representation among the eastern group was highest in Florida, South Carolina, and Texas. Desired was a broad sampling frame. However, states such as Utah in the west and Wisconsin in the east, both of which contain large amounts of national forest land requiring restoration, were not represented.

Regarding online activity, a study by Tomei (2008) found males to be more interested in seeking information and females in informational exchange. If true, this could explain why 68 percent of all respondents were male, and support the possibility of there being a causal link between response and gender. Shown in Figure 4, males between the ages of 60 and

69 years (19 percent) and females between 20 and 29 years (14 percent) had the highest rates of representation.

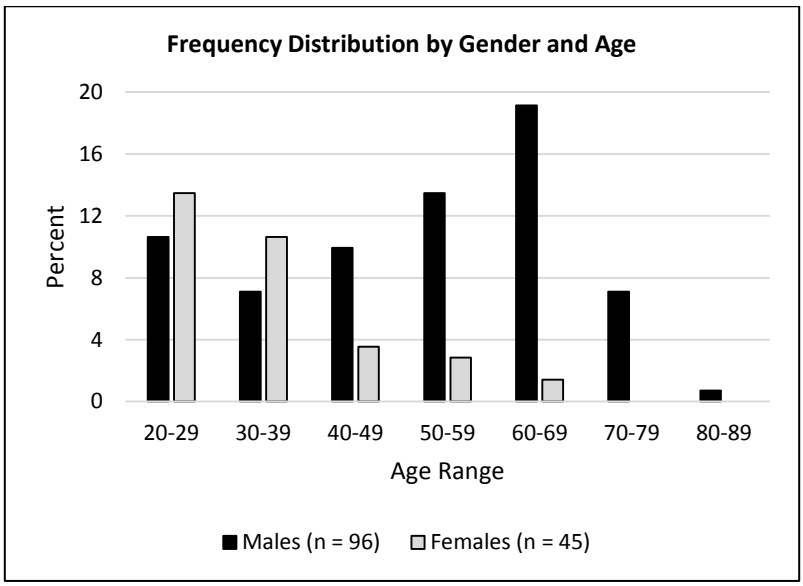

Figure 4: Gender and age

Regarding political philosophy, parties represented most frequently were Democratic (42 percent), Republican (23 percent), and Other (18 percent). Eastern states led western states across all political philosophies.

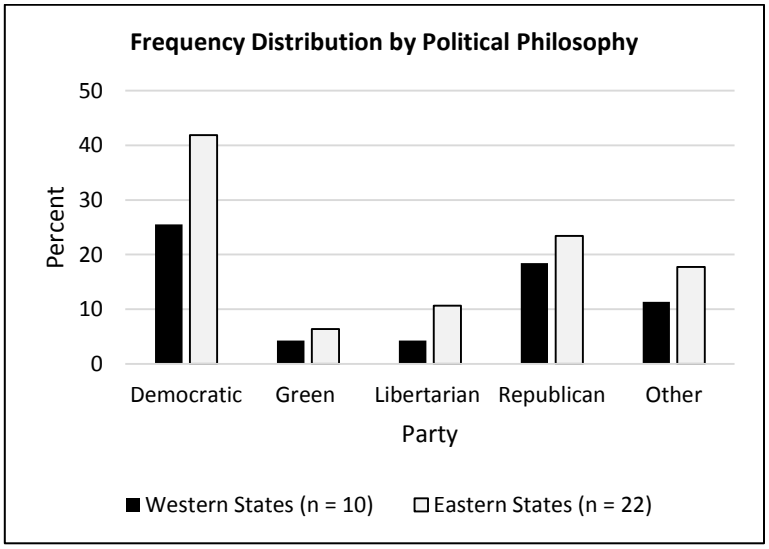

Figure 5: Political philosophy

Ninety-five percent of all respondents reported having an undergraduate (28 percent) or graduate (67 percent) education. Individuals employed by the Forest Service comprised seven percent of the sample, compared to nine percent by a state agency. Indicated by Figure 5, response by peer group was highest among individuals affiliated with academic institutions (29 percent), followed by forest industry (28 percent) and government agencies (16 percent). Other groups such as environmental organizations (eight percent) and Native American tribes (one percent) may have been equally well-informed on survey topics, but were underrepresented in this study.

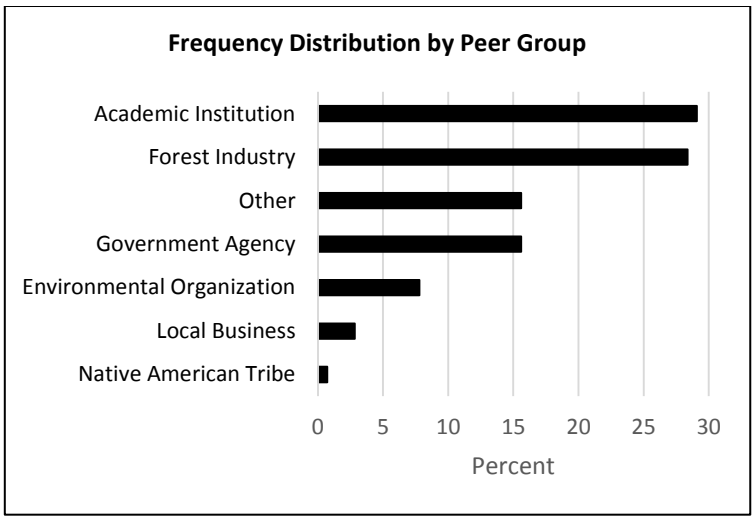

Figure 6: Peer group

With respect to tribes, this finding has particular significance as lands tribes own, especially in western states, border for thousands of kilometers lands managed by Federal agencies. Thus, tribes were mentioned specifically in Title VIII of the 2014 Agricultural Act as opportune beneficiaries of GNA. While tribes cannot enter directly into GNA, they can participate in a MSA. Some, such as the Klamath Tribe in southern Oregon and the Pit River Tribe in northern California, have signed MSAs with the Forest Service to conduct forest

and watershed restoration projects on national forests in proximity to their ancestral homelands. However, tribes from the study region were indifferent to GNA, citing concerns they could become embroiled in protracted and costly Federal processes.

Part Two

The objective of the survey items was to better understand respondents' perceptions of GNA. Emphasized by all items were contemporary issues at the forefront of forest management on national forest lands. Shown in Table 1 are summary statistics by response category for each item.

	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
Will the public support GNA projects if:	N	%	N	%	N	%	N	%	N	%
1. They improve forest health?	61	43	63	45	14	10	1	1	2	1
2. They reduce forest restoration costs?	60	44	54	38	24	17	2	1	1	1
3. They reduce wildfire hazards?	101	72	30	21	8	6	1	1	1	1
4. State government helps fund them?	34	24	43	30	49	35	12	9	3	2
5. Commercial timber harvests increase to help fund them?	52	37	32	23	23	16	25	18	9	6
6. Streamlined environmental analysis is utilized?	52	37	23	16	40	28	20	14	6	4
7. Modified public notice, comment and appeal are utilized?	45	32	30	21	37	26	21	15	8	6
8. They are used to produce woody biomass to make liquid biofuel?	35	25	42	30	44	31	13	9	7	5
9. Biomass utilization creates economic development opportunities?	62	43	54	38	12	9	10	7	3	2
10. Biofuel utilization reduces greenhouse gas emissions?	54	38	47	33	25	18	9	6	6	4

Table 1: Summary statistics for 10 Likert-type items

Applying measures of magnitude from five for strongly agree to one for strongly disagree, frequency distributions for the Likert-type items generated ranked results shown in Table 2. Items three, one, two, and nine yielded the highest weighted scores, and will be discussed in descending order.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Rank
Will the public support GNA projects if:	Score						
3. They reduce wildfire hazards?	505	120	24	2	1	652	1
1. They improve forest health?	305	252	42	2	2	603	2
2. They reduce forest restoration costs?	300	216	72	4	1	593	3
9. Biomass utilization creates economic development opportunities?	310	216	36	20	3	585	4
10. Biofuel utilization reduces greenhouse gas emissions?	270	188	75	18	6	557	5
6. Streamlined environmental analysis is utilized?	260	92	120	40	6	518	6
4. State government helps fund them?	170	172	147	24	3	516	7
5. Commercial timber harvests increase to help fund them?	260	128	69	50	9	516	8
8. They are used to produce woody biomass to make liquid biofuel?	175	168	132	26	7	508	9
7. Modified public notice, comment and appeal are utilized?	225	120	111	42	8	506	10

Table 2: Weighted, ranked scores by item

Wildfire Hazards

Fire is a critical natural process in many forest ecosystems. However, on the NFS, more than 70 years passed before fire was integrated into land and resource management plans (Carroll et al., 2007). In the Inland Northwest, this allowed species such as grand fir (*Abies grandis*) and western hemlock (*Tsuga heterophylla*) to invade sites occupied previously by ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and western larch (*Larix occidentalis* Nutt.) more dependent on fire. As stand density and canopy closure increased, so, too, did woody fuels and wildfire hazards. The potential of GNA to address this concern received a higher ranked score than any other item in the survey. Ninety-three percent of respondents strongly agreed (72 percent) or agreed (21 percent) the public will support GNA if it can achieve this objective.

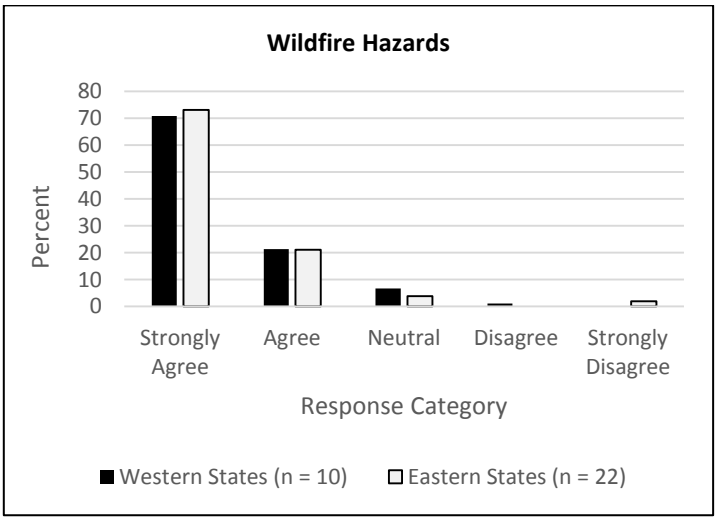

Figure 7: Wildfire hazards by response category

In the west, the highest weighted score across all five response categories occurred in Oregon (84), followed by Idaho (68) and Colorado (58). However, in Washington, the strongly agreed (86 percent) and agreed (14 percent) response categories comprised 100

percent of the total score. Similarly, in Montana, 100 percent of the total score was in the strongly agreed (47 percent) and agreed (53 percent) response categories, albeit in different arrangements from that of Washington.

Among eastern states, the highest ranked score across all five response categories occurred in Florida (29), followed by South Carolina (25) and Texas (24). In the east were five states where 100 percent of the total score was in the strongly agreed and agreed response categories. Included were Florida (86 percent strongly agreed, 14 percent agreed), South Carolina (100 percent strongly agreed), Texas (83 percent strongly agreed, 17 percent agreed), New York (100 percent strongly agreed) and North Carolina (56 percent strongly agreed, 44 percent agreed).

Western		Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
Rank	State	N	Score	N	Score	N	Score	N	Score	N	Score	TOTAL
1	OR	13	65	4	16	1	3	0	0	0	0	**84**
2	ID	13	65	0	0	1	3	0	0	0	0	**68**
3	CO	7	35	3	12	3	9	1	2	0	0	**58**
3	WA	10	50	2	8	0	0	0	0	0	0	**58**
4	MT	5	25	7	28	0	0	0	0	0	0	**53**

Eastern		Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
Rank	State	N	Score	N	Score	N	Score	N	Score	N	Score	TOTAL
1	FL	5	25	1	4	0	0	0	0	0	0	**29**
2	SC	5	25	0	0	0	0	0	0	0	0	**25**
3	TX	4	20	1	4	0	0	0	0	0	0	**24**
4	NY	4	20	0	0	0	0	0	0	0	0	**20**
5	NC	2	10	2	8	0	0	0	0	0	0	**18**

Table 3: Ranked western and eastern states on wildfire hazards

Forest Health

As costs to suppress wildfire have increased, funding to improve forest health has declined, often requiring that forest restoration treatments be paid for by the market value of woody biomass removed. However, since treatment costs in the northwestern U.S. can range as high as eight hundred dollars per hectare depending on site conditions and forest

type (Jain et al., 2012), supplemental funding is needed. Only it is unavailable due to the increasing cost of fire suppression. Interrupting this cycle requires a new strategy which may attainable under GNA.

When asked whether the public would support GNA on national forest lands if it could improve forest health, 88 percent of respondents strongly agreed (43 percent) or agreed (45 percent). In the west, weighted scores were highest in Oregon (79), Idaho (62), and Washington (56). Unlike Oregon and Idaho, however, 100 percent of the total score in Washington was in the strongly agreed (71 percent) and agreed (29 percent) categories, a result duplicated in the strongly agreed (69 percent) and agreed (31 percent) categories in California where prolonged drought has had extreme effects on forest health. Ironically, in Colorado, where wildfire burned more than 112 thousand hectare of national forest land between 2010 and 2015 (National Interagency Fire Center, 2015), one of every five respondents was neutral on the forest health item.

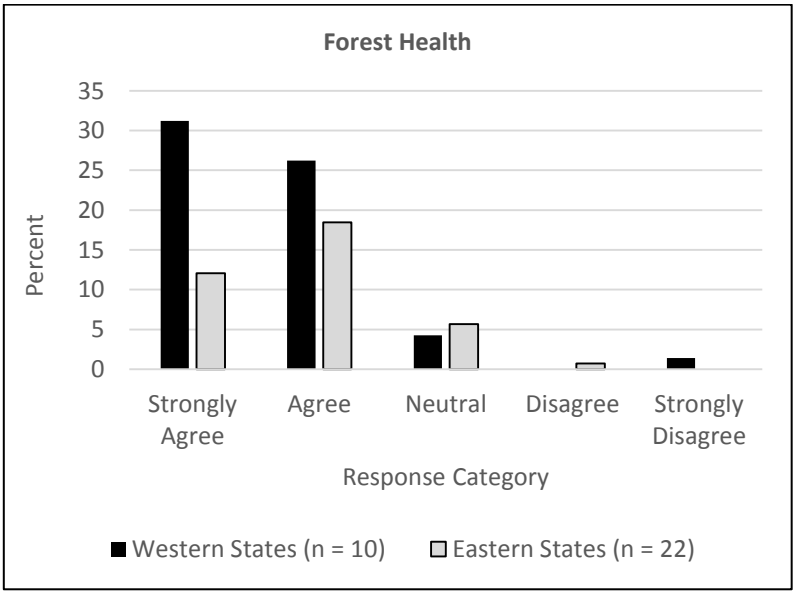

Figure 8: Forest health by response category

Among eastern states, the highest weighted scores on the forest health item occurred in Florida (25) and Texas (21), with New York (19) and South Carolina (19) being equal. Two response categories accounted for 100 percent of the score in Texas (24 percent strongly agree, 76 percent agree), New York (79 percent strongly agree, 21 percent agree), and Pennsylvania (29 percent strongly agree, 71 percent agree).

Western		Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
Rank	State	N	Score	N	Score	N	Score	N	Score	N	Score	TOTAL
1	OR	9	45	7	28	2	6	0	0	0	0	**79**
2	ID	9	45	4	16	0	0	0	0	1	1	**62**
3	WA	8	40	4	16	0	0	0	0	0	0	**56**
4	CO	3	15	7	28	3	9	0	0	1	1	**53**
5	MT	4	20	7	28	1	3	0	0	0	0	**51**

Eastern		Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
Rank	State	N	Score	N	Score	N	Score	N	Score	N	Score	TOTAL
1	FL	2	10	3	12	1	3	0	0	0	0	**25**
2	TX	1	5	4	16	0	0	0	0	0	0	**21**
3	NY	3	15	1	4	0	0	0	0	0	0	**19**
3	SC	0	0	4	16	1	3	0	0	0	0	**19**
4	PA	1	5	3	12	0	0	0	0	0	0	**17**
5	NC	2	10	0	0	1	3	1	2	0	0	**15**

Table 4: Ranked western and eastern states on forest health

Forest Restoration

Eighty-two percent of respondents strongly agreed (44 percent) or agreed (38 percent) that if GNA reduces forest restoration costs, it will receive public support. Result totals from the western group in the strongly agreed (48 percent) and agreed (34 percent) response categories were similar to those of the sample at-large, whereas totals from the eastern group were lower (33 percent strongly agree, 46 percent agree) and in very different arrangements by category. In the west, the highest weighted score occurred in Oregon (79), followed by Idaho (66) and Washington (55). Unlike Oregon, 100 percent of the weighted score in Idaho was in the strongly agree (76 percent) and agree (24 percent)

categories, a finding also seen in the strongly agree (64 percent) and agree (36 percent) categories of Washington.

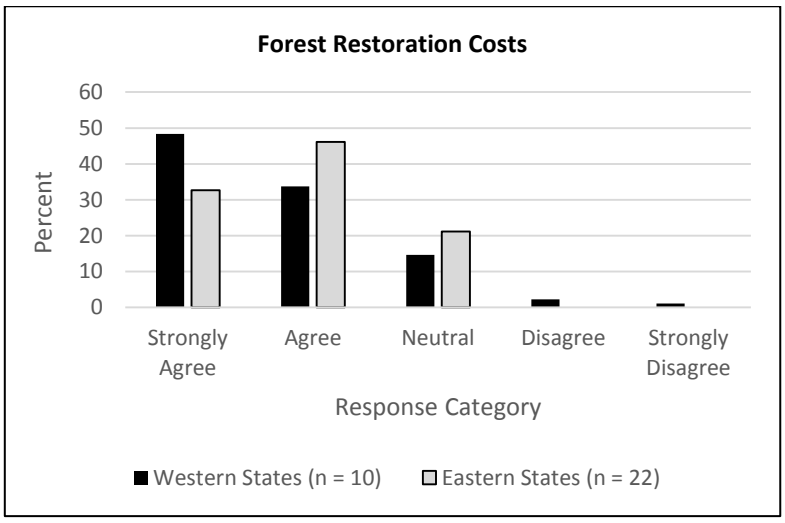

Figure 9: Forest restoration costs by response category

The highest weighted score among eastern states was in Florida (26), with Texas (20) and New York (19) in the second and third positions, respectively. One hundred percent of the weighted score from Florida was in the strongly agree (38 percent) and agree (62 percent) response categories. The total weighted score in North Carolina and Pennsylvania was 18. In both states, 100 percent of the response was in the strongly agree (56 percent) and agree (44 percent) categories.

Western		Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
Rank	State	N	Score	N	Score	N	Score	N	Score	N	Score	TOTAL
1	OR	10	50	5	20	3	9	0	0	0	0	**79**
2	ID	10	50	4	16	0	0	0	0	0	0	**66**
3	WA	7	35	5	20	0	0	0	0	0	0	**55**
3	CO	3	15	7	28	2	6	1	2	1	1	**52**
4	MT	4	20	5	20	3	9	0	0	0	0	**49**
5	CA	5	25	3	12	2	6	1	2	0	0	**45**

Eastern		Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
Rank	State	N	Score	N	Score	N	Score	N	Score	N	Score	TOTAL
1	FL	2	10	4	16	0	0	0	0	0	0	**26**
2	TX	1	5	3	12	1	3	0	0	0	0	**20**
3	NY	3	15	1	4	0	0	0	0	0	0	**19**
4	NC	2	10	2	8	0	0	0	0	0	0	**18**
4	PA	2	10	2	8	0	0	0	0	0	0	**18**
5	SC	0	0	1	4	4	12	0	0	0	0	**16**

Table 5: Ranked western and eastern states on forest restoration costs

Probing further the topic of forest restoration, respondents were asked whether the public would support GNA projects if state governments shared restoration costs. In the west, 54 percent of the total response was in the strongly agree (26 percent) and agree (28 percent) categories, compared to 56 percent from the east that strongly agreed (21 percent) or agreed (35 percent).

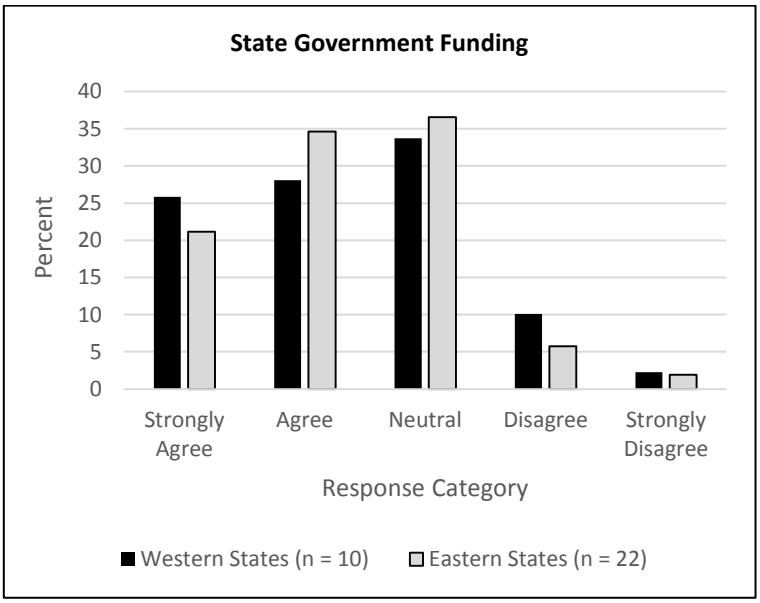

Figure 10: State funding by response category

However, at 71 percent across all states, the neutral response on this item was tellingly large, suggesting that before states assume responsibilities on Federal lands, their first priority is managing lands under their own jurisdictions. If GNA is to succeed on the NFS, this hurdle must be overcome. That eight states have already signed a GNA agreement with the Forest Service indicates this is not unreasonable. While there are other barriers that could also constrain GNA on the NFS – such as a depleted Forest Service workforce and an agency budget handicapped by fire suppression – as more states adopt GNA, ability of the Forest Service to expand restoration efforts should increase.

Forest Bioenergy and Economic Development

Restoration treatments to improve forest health can generate substantial volumes of woody biomass suitable as feedstock for bioenergy. Reported has been that bioenergy from woody biomass can be produced sustainably without risking our current energy system (White, 2010). If the two percent of energy consumed in 2010 supplied by wood and wood-derived fuels were to reach nine percent by 2030 as forecasted by the U.S. Energy Information Administration (2016), job growth and other socioeconomic benefits could ensue. Asked by the study survey was whether GNA projects will be supported by the public if woody biomass projects remove is used to produce bioenergy, creating economic development opportunities.

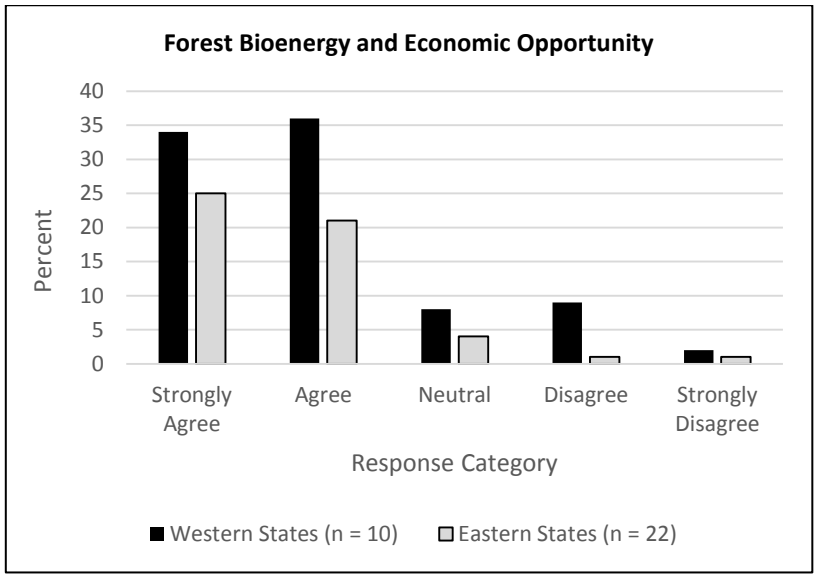

Figure 11: Bioenergy and economic opportunity by response category

The mode for central tendency among all states combined was in the strongly agree category (59), which comprised 42 percent of the total response. In the west, however, the mode occurred in the agree category (36) where 40 percent of the response was seen as opposed to 38 percent in the strongly agree category. Among western states in the

strongly agree and agree categories combined was 96 percent of the response from Washington, 94 percent from Oregon, and 77 percent from Idaho. In the east, the mode for central tendency occurred in the strongly agree category (25) which constituted 48 percent of the total response, compared to 40 percent in the agree category. Among eastern states in the strongly agree and agree categories combined was 100 percent of the response from New York, 95 percent from South Carolina, and 89 percent from Texas.

Western		Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
Rank	State	N	Score	N	Score	N	Score	N	Score	N	Score	TOTAL
1	OR	8	40	8	32	1	3	1	2	0	0	**77**
2	ID	7	35	2	8	3	9	2	4	0	0	**56**
3	WA	7	35	4	16	0	0	1	2	0	0	**53**
4	MT	4	20	5	20	2	6	1	2	0	0	**48**
5	CO	1	5	8	32	1	3	2	4	2	2	**46**

Eastern		Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
Rank	State	N	Score	N	Score	N	Score	N	Score	N	Score	TOTAL
1	FL	3	15	1	4	2	6	0	0	0	0	**25**
2	SC	4	20	0	0	0	0	0	0	1	1	**21**
3	NY	3	15	1	4	0	0	0	0	0	0	**19**
4	TX	0	0	4	16	0	0	1	2	0	0	**18**
5	NC	1	5	3	12	0	0	0	0	0	0	**17**

Table 6: Ranked western and eastern states on forest bioenergy opportunities

Conclusions

Developed was a self-administered, web-based survey offering five response alternatives to 10, Likert-type items. Survey objective was to gauge public support for GNA as a forest restoration tool on national forest lands. From October 1st, 2015 through December 31st, 2015, received were 141 survey responses from 32 different states. Sixty-three percent of submissions were from western states (n = 10) and 37 percent from eastern states (n = 22). Survey findings were condensed into four main themes and analyzed descriptively as recommended by Boone and Boone (2012).

No other item in the study survey was endorsed more favorably than that regarding wildfire. Ninety-three percent of respondents strongly agreed (72 percent) or agreed (21 percent) the public will support GNA if it can it can reduce wildfire hazards. Followed closely were 88 percent of respondents who strongly agreed (43 percent) or agreed (45 percent) GNA will be well-received by the public if it improves forest health. Eighty-two percent (44 percent strongly agree, 38 percent agree) said that if GNA can reduce forest restoration costs, it will receive public support. Lastly, were economic development opportunities to result from GNA projects that produce woody biomass to make bioenergy, 81 percent of respondents strongly agreed (43 percent) or agreed (38 percent) GNA will receive public support. As much as 42 percent of the NFS requires forest restoration (USDA Forest Service, 2016). If this backlog is to be reduced significantly, needed are cost-effective strategies that change the status quo. Designed to restore forest, rangeland, and watershed health utilizing active forest management, GNA under the 2014 Agricultural Act is a feasible alternative.

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Chapter 4

Conclusions

Once an organization adopts a particular track having deterministic properties, high reversal costs can limit future choices (Levi, 1997). The longer the track persists, the less likely it is to be replaced (Lindblom, 1959). If maintaining the track generates increasing returns it can become locked-in, making change very difficult (North, 1990). In the early 20th century, what had been an ill-defined collection of publically-owned lands known as forest reserves were consolidated as the NFS, and the Forest Service was delegated by Congress as its principal custodian. In a personal letter written in 1905 to Gifford Pinchot, first Chief of the Forest Service, Secretary of Agriculture, James Wilson, laid out the precept under which these lands were to be managed:

> "All lands are to be devoted to their most productive use for the permanent good of the whole people. Where conflicting interests must be reconciled, the question will always be decided based on the greatest good of the greatest number in the long run (Roth, 1984)."

Embodied within the 'greatest good' was protection from wildfire though, in the Forest Service's early years, the means needed to do so systematically were practically nonexistent (Pyne, 1982). Thus, in keeping with the agencies' mission "to sustain healthy, diverse, and productive forests and grasslands for present and future generations," decision-makers acted in accordance with the knowledge at hand.

Lack of farsightedness was not the issue. Rather, agency officials were unaware they did not know the extent to which their decisions in the present would affect terrestrial and aquatic ecosystems over time and space. Buoyed by the aftereffects of manifest destiny,

natural resources on the national forests were to be exploited if the demands of an ever expanding population were to be met. Particularly in the western U.S. where the majority of the NFS is located, this meant converting lands that for millennia had been relatively unmanaged to new purposes. As lands' overseer, the Forest Service was obligated to actualize this process in ways a plurality of society would accept, which it succeeded in doing for well over 50 years (Fukuyama, 2014).

However, as time progressed, Federal and academic researchers became increasingly aware of and concerned about the effects excluding fire from forest landscapes were having on forest health. Studies in the U.S. southeast (Chapman, 1926) and west (Weaver, 1943) correlated declining forest conditions and fire exclusion. In forests accustomed historically to frequent, low- to moderate-intensity surface fire such as those of the Inland Northwest, significant changes in structure, composition, and fuel loads were documented (Hessburg and Agee, 2003). Still, many advances in fire ecology and science that would later appear had not yet transpired, helping explain why, at this juncture, Forest Service fire policy was not reconfigured.

Emanating from the path dependence concept is another explanation. Across the upper Midwest and northern Rocky Mountain regions, wildfires in the late-19th and early-20th centuries took hundreds of lives and charred millions of hectare of forestland. Wishing to avoid similar, future events, the Forest Service embraced a fire policy based on exclusion. Choosing this track increased returns: socially in the form of public approval, politically from Congress who funded the agencies' budget, an economically through reimbursement of firefighting costs under the Forest Fires Emergency Act (Public Law 60-136). As Pierson

(2000) would put it, the Forest Service calculated in the shadow of the future and, therefore, was unlikely to indulge in myopic, short-term maximizing behavior at its own long-term expense. As commitment to exclusion escalated, fire policy became locked-in, decreasing the likelihood the Forest Service would replace its preferred path with one incorporating fire as a management tool as this could have resulted in high replacement costs and loss of returns. In the words of Pyne (1996), "fire protection paid the freight." As long as resources were available, fire managers continued to spend on suppression if damage was decreased by even a small increment (Holmes et al., 2008).

Prior to this sequence becoming successful, other options were available (Lyon, 1966; Shearer et al., 1970; Arno, 1976). However, to have chosen one could have meant forgoing social, political, and economic rewards offered by the policy in place which, presumably, was regarded by the Forest Service as having greater value. With the benefit of hindsight, had more attention been given to the effects excluding fire was having on forest ecosystems and fire policy adjusted accordingly, perhaps a larger percentage of the funds now needed to support a multi-billion dollar firefighting infrastructure would be available for forest restoration.

If progress improving forest health is to be made, a feasible strategy that changes the existing mode of operation must be developed. Change of this degree will be difficult but not impossible if the Forest Service can implement effectively GNA under the 2014 Agricultural Act. Crucial will be the agencies' ability to apply the principle of the 'invisible hand' (Smith, 1776), a term to describe the unintended social benefits of individual actions. States containing vast amounts of national forest land requiring restoration must

understand it is in their self-interest to redress forest health-related concerns, and if, in the process, the public good is promoted, so much the better. On many of those lands, concerns stem from early fire policy which abetted the replacement of fire-dependent tree species by others less tolerant of fire, enabling wildfire, when it does occur, to burn with greater intensity and duration (North et al., 2012). Recruiting states motivated by advancing their self-interests can create a multiplier effect, assisting the Forest Service improve forest health at scales it does not have the human or financial resources to achieve. Mishandled, however, social discord could erupt; rekindling unrest that, in the past, has impeded natural resource management on public lands.

Suggested has been that forest restoration on the NFS can increase beyond its current level if woody biomass restoration treatments remove is used to produce biofuel and other bioenergy products. Interest in this option has grown due to what some believe is its potential to mitigate climate change and dependence on fossil fuels. On national forest lands across the U.S. are tens of millions of forested hectare, containing untold volumes of dead woody biomass, requiring restoration (Krist et al, 2014). Depending on a host of site-related variables, research has shown some of this material can be removed cost-effectively (Bobzien and Van Alstyne, 2014). However, where slope is steep, volume per hectare low and markets scarce, treatment costs render woody biomass removals economically infeasible. Moreover, small and large-scale studies have shown the importance of dead wood in forest ecosystems is much greater than was ever believed (Perry et al., 2008), explaining why many in the scientific community question the use of woody biomass for bioenergy (Stokland et al., 2012).

Midway through calendar year 2016, the U.S. produced more petroleum and natural gas hydrocarbons than any other country in the world, and the average, domestic retail price of gasoline was lower than it has been since 2009 (U.S. Energy Information Administration, 2016). Historically, whenever a new energy production system has arisen, it has not been competitive unless it could develop the sophisticated production, processing, and distribution networks of its rivals (Smil, 2014). If liquid biofuel from woody biomass is to become an energy staple in the U.S., it will likely not be an exception. Though fossil fuels are finite, having recoverable reserves of at least 36 billion barrels of petroleum, 338 trillion cubic feet of natural gas, and enough coal to last for hundreds of years (U.S. Energy Information Administration, 2015) suggests they will remain the primary energy source in the U.S. for many years to come.

This does not mean change is futile. In the run-up to the most recent recession, price per barrel of crude oil in the U.S. rose from $11 in 1998 to $140 in 2008 (U.S. Energy Information Administration, 2016). Though the current price of crude oil is below $50 per barrel (Ibid, 2016), if prices in the U.S. were to regain their pre-recession level, and fuels from wood were to account for nine percent of total energy consumed by 2030 (Ibid, 2016), demand for bioenergy from woody biomass could increase. Beyond the scope of this study but an interesting question for future research is whether this transformation could be hastened by coupling forest bioenergy and GNA.

Much has been written on the effects excluding fire from forest ecosystems have had on forest composition, functions, and processes (Swetnam and Dieterich, 1985; Hessburg and Agee, 2003; Stephens and Ruth, 2005; Carroll et al., 2007; Schoennagel et al., 2016).

Apart from the direct effects of exclusion has been that results often occurred as they did due to fire policy having been applied in a 'one-size-fits-all' fashion. *Proffered by GNA is an antidote, an opportunity to rehabilitate stand structure, reduce live and dead fuels, and improve forests' resistance to drought and fire – assuming errors from the past are not repeated in the future.*

Take, for example, the influence political orientation could have on the viability of GNA in states affiliated with the BANR project such as Colorado, Idaho, and Oregon. A recent Gallup poll (Jones, 2016) found Colorado to be competitive (i.e. average), Idaho solidly Republican, and Oregon leaning Democratic. Collectively, these states contain millions of hectare of national forest land requiring restoration and have suffered tremendous losses due to wildfire in recent years. On that portion of these lands at the wildland-urban interface – the transitional zone between unoccupied land and human development that accounts for more than nine percent of the contiguous U.S. landmass (Cooke, 2016) – all three states would likely agree land managers, policymakers, and citizens benefit when wildfire risks are reduced.

However, what if obtaining the funds to achieve this objective required a state-imposed tax increase? Would a relatively liberal state such as Oregon be less averse to this option than a solidly conservative state such as Idaho? Likewise, if acquiring the necessary funds to reduce wildfire risks meant increasing commercial timber sales on the national forests, would a solidly conservative state such as Idaho be more amenable than a relatively liberal state such as Oregon? And what of Colorado; though 'average', realistically where on the political spectrum would it reside? Excluding fire from forest landscapes without regard to

a context of place was singled out by Agee and Skinner (2005) as having caused significant environmental problems for public land managers. *If the potential of GNA is to be realized, key differences among states must be accommodated, or else generic implementation could result in policy consequences similar to those of fire exclusion*. Were this to occur, states desiring and able to participate in GNA could become disillusioned, undermining the Forest Service's ability to improve forest health at broad scales.

Recommendations

Buttressed by the path dependence literature, argued has been that early, Forest Service fire policy exacerbated contemporary forest health on national forest lands, particularly in the dry forests of the Inland Northwest region of Idaho and Montana. As a corrective measure, proposed has been GNA under the 2014 Agricultural Act. Drawing from research findings generated by this mixed methods study, four recommendations are put forward in this regard.

One – states must grasp they have a vested interest in collaborating with the Forest Service to mitigate forest management issues of mutual concern. Planning strategies must be tailored to states' individual dissimilarities. Employing context of place will lessen social and environmental crises and help prioritize the use of limited resources. Two – restoration treatments must emphasize active forest management, especially understory thinning and, wherever possible, prescribed fire. Knowledge of historic conditions can help clarify restoration goals. But a reasonable balance must be struck between reducing stand density and opening forest canopies as this could lower the moisture content of dead woody fuels and increase wildfire severity. Three – mechanisms must be developed to ensure reliable

restoration funding. ‘Goods for services’ contracts and local policies are useful but transitory. Federal appropriations dedicated specifically to forest restoration, such as those authorized in 2014 by the Agricultural Act, will have the greatest long-term impact. Four – society to whom the NFS belongs must trust its assets are being managed with foresight and care; in which case, the Forest Service will be more likely to achieve its objectives. Absent trust, the agency will operate with a weakened mandate and could lapse into a self-reinforcing process exhibiting increasing returns, making reestablishing trust all the more difficult.

Institutions tend to be risk-averse, preferring to retain their existing model, even if it is suboptimal, than change (Greener, 2005). However, as of July 2016, eight states – from solidly Democratic California to solidly Republican Idaho – had chosen differently by entering into a GNA agreement with the Forest Service, confirming there are those that believe the tool has legitimate value. By enlisting these states, the Forest Service has demonstrated a willingness to pursue a new path for revitalizing the health and resilience of forest ecosystems. If GNA can further this shift, a predictability in politics will have been achieved, proving, as de Tocqueville noted in 1831, old rules can be reformed to new purposes better aligned with conventional wisdom.

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