

2016

Linking forests to faucets: Investigating alternative approaches for securing long-term funding for watershed restoration in New Mexico.

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**Linking Forests to Faucets: Investigating Alternative
Approaches for Securing Long-Term Funding for
Watershed Restoration in New Mexico**

by

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A Professional Project Report Submitted in Partial Fulfillment of the Requirements
for the Degree of

Master of Water Resources and Public Administration

Water Resources Program

The University of New Mexico

Albuquerque, New Mexico

April 2016

Committee Approval

The Master of Water Resources Project Report of **Edward McCorkindale**, entitled **Linking Forests to Faucets: Investigating Alternative Approaches for Securing Long-Term Funding for Watershed Restoration in New Mexico**, is approved by the committee:

Chair

Date

Acknowledge

Thanks to Professor Robert Berrens, my committee chair, for providing direction, insight, and critique since before the beginning of this project. Professor Shane Day, another committee member, also provided feedback on very early versions of some sections that I worked into class assignments. All committee members reviewed later versions of this document, and from their critique came some of the most important changes and additions; for that feedback, and I am thankful. Bob and Shane have also been integral in developing my academic identity in the Water Resources Program and School of Public Administration, and so I am very thankful for their mentorship and guidance.

Much of this research (October 1, 2014 – June 30, 2015) was supported by a grant (#Q01714) from the New Mexico State University Water Resources Research Institute.

Abstract

Due to a mix of inter-related human and natural factors, such as climate change, drought, beetle damage, 20th century fire suppression policy and associated hazardous fuels build-up, and the expansive growth of the Wildland-Urban Interface, many montane forests in New Mexico and elsewhere in the western United States have become increasingly susceptible to high-severity wildfires. Critical sources for public drinking water systems often originate in montane forests, where wildland fires can alter hydrologic systems and degrade watersheds, while creating significant runoff, debris, and water quality impacts downstream. As the impact of high severity wildfires expands significantly beyond the proximal burn area, the scale of institutional arrangements does not match, and old rules for forest management and wildfire risk mitigation often fail. Recent efforts in New Mexico have sought to bring together stakeholders to address forest management and watershed restoration at new regional scales. A critical issue is the creation of sustainable, long-term funding mechanisms to support expanded restoration efforts to mitigate wildfire risk. Borrowing from the work of institutional scholar and Nobel laureate Elinor Ostrom, I apply a theoretical framework for looking at interconnected social-ecological systems, the development of these policy problems, and the efforts to address them, in order to highlight institutional variables that are important for connecting forest health and downstream water uses. I observe that using payment for ecosystem services models as a guide, rather than a panacea, has developed arrangements that are tailored to their purpose and deviate from the traditional payment for ecosystem services arrangements.

Keywords: payments for ecosystem services, social-ecological systems, watershed restoration, wildfire mitigation

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Abbreviations

Board	Forest and Watershed Restoration Board
CFLRP	Collaborative Forest Landscape Restoration Program
CFRP	Collaborative Forest Restoration Program
DOI	United States Department of Interior
EMNRD	New Mexico Energy, Minerals and Natural Resources Department
FIR	Fiscal Impact Report
FLAME	Federal Land Assistance, Management and Enhancement Act
FWRA	Forest & Watershed Restoration Act
FWRP	Forest and Watershed Restoration Fund
GAO	Government Accountability Office
HB	House Bill
HM	House Memorial
IADF	Institutional Analysis and Development Framework
LFC	New Mexico Legislative Finance Committee
NIFC	National Interagency Fire Center
NM	New Mexico
NMED	New Mexico Environment Department
NMGF	New Mexico Game and Fish
NMISC	New Mexico Interstate Stream Commission
OSI	New Mexico Office of Superintendent of Insurance
PES	payment for ecosystem services
PP-MC	ponderosa pine and dry mixed-conifer

PPS	public payment schemes
Reserve	New Mexico Strategic Water Reserve
RGWF	Rio Grande Water Fund
SB	Senate Bill
SES	Social-Ecological System
SFMW	Santa Fe Municipal Watershed
SFSC	Southwest Fire Science Consortium
SFWD	City of Santa Fe Water Division
SM	Senate Memorial
TNC	The Nature Conservancy
UNECE	United Nations Economic Commission for Europe
US	United States
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey
VCA	voluntary contractual arrangements
WFM	Wildland Fire Management
WUI	Wildland-Urban Interface

Introduction

Due to a mix of inter-related human and natural factors, such as climate change, drought, beetle damage, 20th century fire suppression policy and associated hazardous fuels build-up, and the expansive growth of the Wildland-Urban Interface (WUI), many montane forests in New Mexico (NM) and elsewhere in the western United States (US) have become increasingly susceptible to high-severity wildfires. Critical sources for public drinking water systems often originate in montane forests, where wildland fires can alter hydrologic systems, and degrade watersheds, while creating significant runoff, debris, and water quality impacts downstream. As the impact of high severity wildfires expands significantly beyond the proximal burn area, the scale of institutional arrangements does not match, and old rules for forest management and wildfire risk mitigation often fail. Recent efforts in NM have sought to bring together land owners and managers, water users, and other stakeholders to address forest management and watershed restoration at these new regional scales. Current forest and watershed efforts are not sufficient to significantly reduce high regional wildfire risk. A critical issue is the creation of sustainable, long-term funding mechanisms for financing greatly expanded watershed restoration efforts to mitigate wildfire risk.

There have been a number of recent efforts in the Middle Rio Grande of NM, and surrounding forests and watersheds of northern NM targeted at securing funding and increasing the rate of forest and watershed restoration to mitigate the risk of high severity wildfires. These efforts have happened at several different scales, including introduction of a payments for forest ecosystem services program in the Santa Fe, NM municipal watershed, and the work to create collaborative funding mechanisms for forest thinning by the Rio Grande Water Fund (RGWF). In the 2015 NM State Legislature, several bills regarding watershed restoration were advanced,

but eventually failed. From my review of documents from the Legislature and reports of other efforts (e.g., RGWF), I provide a narrative review of watershed restoration efforts in NM.

The objective of this research is to conduct a policy analysis of the feasibility, appropriate scale, and advantages and disadvantages of the primary alternative institutional arrangements for securing long-term funding for NM watershed restoration. Borrowing heavily from the work of institutional scholar and Nobel laureate Elinor Ostrom (Bish, 2014), I apply a theoretical framework (McGinnis & Ostrom, 2014) for looking at interconnected social-ecological systems, the development of these policy problems, and the efforts to address them, in order to highlight issues institutional variables that may be important for connecting forest health and forest land owners with downstream water users. Upstream forests are already understood to be connected downstream in natural systems, though policy and financing of land management is not. Of note, I observe that using payment for ecosystem services models as a guide, rather than a panacea, has developed arrangements that are tailored to their purpose and deviate from the traditional payment for ecosystem services arrangements. The polycentric nature of governance in the US ensures that new arrangements work alongside myriad jurisdictions, and should be focused on meeting needs for long-term watershed restoration planning. By recognizing “Social-Institutional” aspects of watershed restoration planning, as well as “Biophysical” elements of water and forests (Bennett & Gosnell, 2015), this paper uses a socio-ecological system perspective of PES to describe policy developments in NM. Finally, I argue that recent failures to create new state-level policies for watershed restoration may be viewed as a positive or temporary setback, if it sets the stage for more successful efforts in the future. NM’s Strategic Water Reserve, established in 2005, provides an example of creating a policy mechanism without a financing mechanism, which may have resulted if the 2015 Forest & Watershed

Restoration Act (FWRA) had passed. As part of this research, key connections with policy networks are already been established (e.g., collaboration with The Nature Conservancy). The expected result of this analysis is to elucidate and inform public debate in NM.

Overview of Ecosystem Services

Noting that every ecosystem is part of a watershed, Greiber (2009) described how water, as it moves through a landscape to downstream water users and other ecosystems, is enhanced, supported, and regulated by that landscape. The quality, quantity, and temporal characteristics of the water flowing into and within rivers is determined by the geography, geology, soils, vegetation, and land use and other anthropogenic activities within the watershed (Smith, de Groot, & Bergkamp, 2006). Therefore, water-related ecosystem services are closely tied to the places that they originate—a fact that places emphasis on the scale of Payment for Ecosystem Services (PES) projects. Local governance is a likely component of project success (Greiber, 2009). Scaling up of watershed restoration in northern NM from only National Forest lands (in the case of the Santa Fe Municipal Watershed) to include at least seven different federal and state agencies, multiple local governments, several conservation areas and tribes, and many private ownerships, means that new mechanisms may be necessary to coordinate contributions and diverse interests, and administer implementation with a multitude of stakeholders. Further, the identification of stakeholders is an important part of developing a PES program. In the case of the Santa Fe Municipal Watershed (SFMW), there are a limited number of stakeholders: the U.S. Forest Service (USFS), the City of Santa Fe, NM, and a water utility and its users. RGWF is planned to involve many more actors, including Albuquerque, NM (as far as 200 miles downstream). The misidentification of stakeholders may lead to “free-riding” by beneficiaries. The possibility of leaving out beneficiaries and potential donors can increase with the breadth of

the PES scheme. The United Nations Economic Commission for Europe (UNECE, 2007) noted that the involvement of all stakeholders ensures ownership, integration of knowledge, and greater financial contributions. UNECE also noted that the valuation of ecosystem services is affected by scale: small studies often underestimate values that exist at larger scales, and large projects have difficulty in using indirect methods of valuation across larger land units for services that are not traded in actual markets.

Contextual Background

New Mexico background. To begin with a prominent, high-profile example: in 2011, the Las Conchas Fire burned over 156,000 acres of forest in northern NM. Half of the burn area covered the Santa Fe National Forest, 14% was within Pueblo lands, and 3% was private property (Southwest Fire Science Consortium [SFSC], 2011). The fire also burned one third of the Valles Caldera National Preserve (Parmenter, 2011) and most of the Bandelier National Monument (National Park Service, 2012). Rains following the Las Conchas fire created large ash and debris flows into the Rio Grande River, such that downstream water utilities in Albuquerque and Santa Fe, NM were forced to shut down water withdrawals, used for drinking water, to avoid damage to river-water facilities (The Nature Conservancy [TNC], 2014a). Sediment and ash that enter reservoirs must be dredged to avoid damming and adverse impacts to water withdrawals that can continue for extended periods (City of Santa Fe Water Division [SFWD], 2013). Walter and Chermak (2014, as cited in TNC, 2014a) estimated that the total costs of the Las Conchas fire are between \$156,000,000 and \$336,000,000 (between \$998/acre and \$2,150/acre).

Although frequent, low-severity fires are normal in ponderosa pine and dry mixed-conifer (PP-MC) forests in NM (Swetnam & Baisan, 1996), suppression of natural fires over the past 110 years has changed forest structure and fuel loads so that there is increased risk from

fires. However, it is difficult to accurately determine the number of acres that burn each year in the state. From 1980 to 2013, based on reporting from USFS and U.S. Department of Interior (DOI), both the number of acres burned by wildfire in NM and the number of wildfires greater than 1,000 acres increased (Figure 1). The share of burned acres due to larger fires (more than 1,000 acres) was 50% or greater in 31 of the last 35 years (1980–2014). The National Interagency Fire Center (NIFC, 2015a) developed similar statistics for total wildfire acres, including state lands, for years 2002–2014. These data show that some acres defined as NM State lands may have been classified under federal agencies by USFS and DOI reporting, or vice-versa. An assessment of federal fire occurrence data by Brown, Hall, Mohrle, and Reinbold (2002) observed that 10% of USFS data 1970–2000, in some databases, may be unusable due to erroneous spatial coordinates, duplication, and incomplete records. Unusable records for DOI agencies were estimated to be 30% overall for the period, with most agencies having a trend of decreasing percentage of usable records 1980–2000. Figure 1 (USGS), and Figure 2 (NIFC) show large differences in total burned acres between the two datasets, with NIFC ranging from 200% of USGS (in 2007) and 16% less than USGS (in 2013). The datasets classify fire types differently, and removing State acres, wildland fire use (allowing natural fires to burn as part of land management), and prescribed burns from NIFC totals does not account for differences with USGS. However, NIFC is more often cited, particularly by federal agencies (see next section). Although I have noted in this report where data have come from NIFC, USGS, or elsewhere, wildfire data should be compared across multiple sources and checked against field experience and new information as management decisions are made. The RGWF Comprehensive Plan (TNC, 2014a) used multiple data sources (although they are unsourced), and showed a similar trend of increasing acres burned from 1985 to 2013 in the state, noting that the largest fire

recorded in NM (Las Conchas in 2011) was more than five times the previous record. The RGWF also noted that wildfire severity, including the percentage of trees that die and seeds that do not survive, has increased.

Increasing wildfire risk can be connected to areas where there is high debris flow risk in order to predict where the greatest downstream impacts may happen (Cannon et al., 2009). In determining focal areas for forest and watershed management, RGWF used multiple data models, giving greater weight to potential fire risk and water quality and supply, including debris flow risk. Finney, McHugh, Grenfell, Riley, and Short (2011) simulated the occurrence and growth of fires in 134 Fire Planning Units in the US using the large-fire simulation system (FSim), including modules for weather, historical large fire occurrence, fire growth, and probability of containment. This simulation was focused on NM to output the likelihood of wildfire and annual burn probability in the East Mountains (including the Sandia and Manzanos Mountains) (TNC, 2014b). The FlamMap model (Finney, 2006) has also used topography, fuels and fuels moisture, and weather to estimate the probability of forest crown fire. By linking these outputs to debris flow modeling from the U.S. Geological Survey (USGS) Landslide Hazards Program (Cannon et al., 2009), the RGWF was able to estimate debris flow risk to watersheds. Using the same predictors of debris flows, including slope, soil type, and burn severity, the RGWF developed a rapid assessment of the northern Rio Grande watershed (Figure 3) to identify priority areas for forest and watershed management. A more general analysis, adding factors of economic opportunity (timber and biomass availability), forest health (risk of tree mortality), and the presence of crucial wildlife habitat has also been applied to the entire state (Figure 3) to identify other subwatersheds in need of restoration.

With increased risk from fire partially resulting from the structure of forests and fuel loads, forest thinning and allowing natural and prescribed fires to burn have been noted as potential forest restoration strategies (Allen et al., 2002). SFSC observed that the Las Conchas Fire was moderated in areas where there had been recent fires. Hazardous fuel reduction practices in some areas assisted firefighters in preventing or reducing the northern spread of the fire (SFSC, 2011). Data from NIFC (2015a) show that forest management activities by the State of NM utilized prescribed burns on 6,400 acres in 2002, 3 acres in 2003, and then did not use prescribed burns for many years (2004–2013). In 2014, the State used prescribed burns on 245 acres, and then no acres in 2015. Combined prescribed burn acres by USFS and DOI are shown in Figure 2. Before peaking at more than 245,000 acres in 2011 (the year of the Las Conchas fire), the average number of annual prescribed burn acres 2002–2010 was 68,000, primarily from USFS (see Collaborative Forest Landscape Restoration Program discussion below), and this often increased during higher wildfire years as a wildfire management strategy. In addition, the RGWF Comprehensive Plan (TNC, 2014a) estimated that 3,000–5,000 acres of forest have been mechanically thinned each year in the Rio Grande and Rio Chama headwaters (the RGWF area in Figure 3). Brown et al.’s (2002) observations about wildfire and prescribed burn data unreliability present problems for estimating the number of acres that are currently being treated and setting management goals. The numbers estimated by TNC are likely based on the databases that were evaluated by Brown et al., as well as other sources.

The Rio Grande Water Fund.

In April 2013, an advisory board initially met to begin the formation of the Rio Grande Water Fund (RGWF), with the objectives to (TNC, 2014a):

- Restore watershed functions by improving the health of streams and riparian areas,

- Mitigate the downstream effects of flooding and debris flows after wildfires,
- Reduce forest fuels in areas identified as high risk for wildfire and debris flow,
- Support forest products industries' use of wood by-products from forest fuel reduction,
- Maintain the reduced wildfire hazard in treated areas, and
- Secure sustainable financing from water users, government, investors and donors, and facilitate payments to upstream land managers. (p 6).

Through mapping, modeling, and planning activities, RGWF has identified focal areas, project goals and criteria, and restoration priorities in the State. Central to these efforts has been the participation and leadership of TNC, which has taken part in developing 12 other water funds in Latin America (TNC, 2014a). Working with an executive committee of stakeholders and investors (Table 1), RGWF developed a Comprehensive Plan in 2014 to set restoration priorities in northern New Mexico forests and watersheds.

The anti-donation clause of the New Mexico Constitution (art. IX, § 14) prevents the State from using its funds to treat private lands. Therefore, by pooling funds from non-State sources, RGWF provides a way for non-State land, particularly private forests, to receive funding for restoration. At the end of 2015, there were eight candidate projects in the Carson, Cibola, and Santa Fe National Forests, Taos Valley, and Taos Valley that await secured funding for restoration, monitoring, and planning activities (RGWF, 2016a). One of these projects, in the San Juan-Chama focal area, already has \$400,000 in committed funding from RGWF (RGWF, 2016b).

Finney et al. (2007) noted that thinning and prescribed burn treatments, optimally 1% to 2% of a land area each year, could provide reduced fire spread rate, wildfire size, and burn

probability for 20 years, beyond which continued treatment would be needed to maintain benefits. Therefore, of the 1,600,000 acres of PP–MC forest that have been identified in the Rio Grande and Rio Chama headwaters, 16,000–32,000 acres would need to be treated each year. This is between a three- and ten-fold increase in thinning treatments. RGWF has set a goal of treating 30,000 acres each year, resulting in 600,000 acres after 20 years. The cost of thinning and prescribed burns on a single acre is as much as \$2,000 depending on the method used, but at the scale proposed by RGWF is estimated to average at least \$700/acre, and as much as \$1,200/acre (RGWF, 2014). At the treatment goal, the cost would be approximately \$21,000,000 each year to treat PP–MC forests in the Rio Grande, Rio Chama, and tributary watersheds. RGWF’s Comprehensive Plan noted that these estimates were only applicable to PP–MC forests, so other forest types, such as pine and pinion-juniper, comprise additional forest acreage in NM that are being treated, need to be treated, and that will need additional funds to address.

The State of New Mexico. Several State programs are targeted towards watershed restoration, including 15 “high-priority” public land areas planned by the Energy, Minerals and Natural Resources Department (EMNRD). Governor Martinez announced \$6,200,000 in funding for these projects as part of the Watershed Restoration Initiative in June 2014 (Martinez, 2014), to treat approximately 7,700 acres with invasive species control, erosion control, habitat restoration, and forest thinning.

Between July 2008 and January 2016, the State’s Forestry Division, through the Forest and Watershed Health Office (Healthy Forests Program), treated 117,808 acres of NM watersheds (EMNRD, 2016), averaging 13,775 acres/year. This amount is larger than RGWF’s estimate of the number of forest acres currently being thinned each year (5,333), indicating one or a combination of the following: treatment activities beyond forest thinning, activities that do

not contribute wildfire mitigation (e.g., erosion control); treatment projects outside the RGWF area in Figure 3 (most Forestry Division projects are in the Rio Grande Rio Chama headwaters, though some are in western and southern NM); or, incomplete data.

In summary, many of the elements of the problem of wildfire management and mitigating wildfire impacts in New Mexico and the western US are understood, even if some of the data are uncertain. Barriers to mitigating fire affects to hydrologic systems and to downstream water users continues to be in financing and interjurisdictional issues, which become even more complicated as the federal cost of wildfire suppression continues to grow.

Federal wildfire suppression and prevention efforts. Even within the state-level context, federal planning, regulations, and practices are relevant to costs and expenses for watershed restoration and wildfire management. Snider, Daugherty, and Wood (2006) noted that federal land management agencies allocate vastly more funds for suppression than they do to hazard reduction before fires. This practice is deep-seated in organizational culture and public demand for strongly controlling natural fire cycles. All relevant federal and state agencies have their own fuel hazard reduction programs that apply to their own jurisdictions. It is the scope and scale of these efforts that is at issue. Wildfires do not recognize political or jurisdictional boundaries. However, through efforts such as the USFS's Collaborative Forest Restoration Program (CFRP), some collaborative, multi-jurisdictional, local mitigation measures have been taking place since 2001.

The CFRP was piloted only in NM “to provide cost-share grants to stakeholders for forest restoration projects on public land designed through a collaborative process” (American Forests, Fort Lewis College, & The Pinchot Institute for Conservation [American Forests et al.], 2005, p 1). Forest restoration projects under CFRP result in: “wildfire threat reduction; reestablishment

of historic fire regimes; reforestation; preservation of old and large trees; and, increased utilization of small diameter trees” (American Forests et al, 2005, p 1). From 2001 to 2013, CFRP awarded more than \$50,000,000 in grants, including more than \$4,000,000 for small diameter wood utilization, \$1,000,000 for habitat restoration, and \$2,000,000 explicitly for planning of projects (USFS, n.d.-a). Individual forest and watershed restoration projects also involve planning and economic development objectives, making up the remaining \$42,000,000 of grants. In 2007, \$63,774 was awarded to the Santa Fe Watershed Association (USFS, n.d.-a) for planning of SFMW (SFWD, 2013). The program has also set some stage for a larger federal program that is being implemented nationally.

The Collaborative Forest Landscape Restoration Program (CFLRP) is also at work in NM, established nationally in 2009 “to encourage the collaborative, science-based ecosystem restoration of priority landscapes” (Omnibus Public Land Management Act of 2009, 16 U.S.C § 7301). Egan (2014) noted that the scale of CFRP is larger than CFLRP (within the State, but CFLRP has multiple grants nationwide) and that CFRP is more focused on localized participation in its projects. However, in implementation, they have similar objectives. One of the grants under CFLRP was awarded in the Southwest Jemez Mountains area in 2010. The project area is 210,000 acres, of which 52% is in the USFS Santa Fe National Forest and 41% is in the Valles Caldera National Preserve. The remaining extent is shared by private landowners and the Pueblo of Jemez (Santa Fe National Forest & Valles Caldera National Preserve, 2010).

On the national level, wildfire management is more suppression-centric. The Federal Land Assistance, Management and Enhancement (FLAME) Act was passed in 2009 to provide additional reserve funding beyond that appropriated under the Wildland Fire Management (WFM) account and other emergency sources for wildfire suppression activities conducted by

USFS and DOI across the United States (Federal Land Assistance, Management and Enhancement Act [FLAME], 43 U.S.C. § 1748a). The USFS noted that the costs of fire suppression have increased such that they jeopardize the ability of the agency to fully fund its mission (USFS, n.d.-b, p 24). WFM funds have received a great deal of scrutiny because of the magnitude of funding that goes towards wildland fire suppression: \$4,395,500,000 to WFM suppression, \$407,500,000 to WFM emergency funds, and \$1,642,300,000 for FLAME during FY2010–FY2013 (Congressional Research Service, 2013, Table 5, p 14).

From 1999 through at least 2008, USFS and DOI transferred billions in funds from nonfire programs in order to fund fire suppression. The SFWD (2013) noted that USFS funding for fuels treatment, through 2008, were consistent in the Southwest Region, even as other programs saw decreases. In its testimony to the U.S. Congress regarding rising fire costs, the Government Accountability Office (GAO) pointed towards its recommendation for federal agencies to create a cohesive wildfire management strategy in 1999 and again in 2005 (GAO, 2009). A cohesive wildfire management strategy had not been developed by the time the GAO made the recommendation a third time in 2009, and so the agency's testimony to Congress primarily focused on improved decision-making tools to estimate suppression fund requirements, and reserve accounting for emergency suppression. Following the passage of the FLAME Act in 2009, the total cost of suppression of wildfires on USFS, DOI, and state and private lands nationwide continued to increase from \$1,200,000,000 and \$1,100,000,000 in 2009 and 2010, to \$1,700,000,000 and \$1,500,000,000 in 2013 and 2014, and more than \$2,000,000,000 in 2016 (NIFC, 2015b). The increasing cost of wildland fire suppression can also be viewed as the increasing costs of not engaging in restoration-based wildfire hazard reduction. Snider, Daugherty, and Wood (2006) argued that suppression may cost more than hazard reduction.

Therefore, they contended that forested land management policies are “irrational” if they do not invest funding in hazard reduction.

Carpe Diem West (2011) called attention to the view that USFS has primary responsibility for watershed management under the original 1897 Organic Act, through which forest health and restoration, in the context of wildfires, may be deemed necessary to “secure favorable conditions of water flows” for uses that are downstream of National Forest System lands. However, under the regime of the current federal budgeting process (characterized by sequestration and continuing resolutions), fundamental reform of priority budgeting for suppression is unlikely. Indeed, states, municipalities, water utilities, and private and commercial interests should critically evaluate their dependence on federal land management agencies to protect the natural sources of their water, and they should consider alternative, collaborative arrangements for protecting forest health and other resources from catastrophic wildland fires.

Theoretical Background

Ecosystem services. Ecosystem services are benefits to human well-being, standard of living, or development that arise from the natural functioning of ecosystems (Barbier & Markandya, 2013). Environmental/provisioning-type goods (e.g., fresh water), regulating services (e.g., climate, flood, and disease regulation, and water purification), supporting services (e.g., nutrient cycling and soil formation) and cultural services (e.g., aesthetic, spiritual, educational, and recreational) provided by forests (Millennium Ecosystem Assessment, 2005) are threatened by catastrophic fire events. Smith et al. (2006) used a landscape view of ecosystem services, similar to Greiber (2009), to apply the term “watershed services” to all benefits that people obtain from the ecosystems within a watershed, including forests.

Aside from provisioning-type ecosystem services, such as physical water supply, watershed services from forests in NM are considered nonrivalrous because one party's benefit from water quality, nutrient cycling, or other regulating, supporting, and cultural services does not generally diminish the benefits to another party. Costanza (2008) considered the classification of ecosystem services according to their excludability and rivalness, noting that most regulatory services can be considered public goods, rather than common pool or open-access resources (Table 1). Ostrom, Gardner, and Walker (1994; as cited in Ostrom, 2000) made the same observation that resource units that are appropriated in open-access or common-pool systems are not available to other users, making them rivalrous. Since flood, water quality, and water purification regulation are services that forests provide, and downstream water users cannot practicably be prevented from benefitting from them, these services can also be considered non-excludable. Lant, Ruhl, and Kraft (2008) noted that overconsumption of services due to open access is not necessarily a problem for all ecosystem services. Instead, nonrivalrous use of nonexcludable public goods (i.e. consisting of natural capital and the flow of benefits it yields) can lead to "underprovisioning" of those goods. As the gap between what society demands (water supply and quality) and what is being provided grows (particularly when benefits are impacted by wildfire), there is a greater need to protect these resources. Barbier and Markandya (2013) noted that a "zero price" for ecosystem services, according to the theory of supply and demand in resource economics, results in increasing demand because the "good" (ecosystem service) is not bought or sold in a market, and therefore does not have a revealed economic value. If it had a price greater than zero, then there would be less demand for it. However, the fact that many of these ecosystem services are not even recognized or incorporated in economic functions results in underprovisioning rather than underpricing because human

needs exceed what is available. One barrier to fully recognizing these values results from ecosystem structures and functions being distinct from the ecosystem goods and services that they provide (i.e. the natural part and the human valuation part). Ecosystem change affects ecosystem structures and functions directly, driven by human values and uses for goods and services (Figure 4).

Greiber (2009, p 6) defined Payment for Ecosystem Services as “virtually all financial and legal incentive mechanisms for promoting conservation and good environmental citizenship, or only specific ones, such as the provisioning and enhancement of water supply and quality that forests provide.” More specifically, those that pay for PES, known as “Donors” (Table 2), must be aware that they are paying for an ecosystem service that is valuable to them or their constituents as “Beneficiaries.” Parties that receive the payments must perform meaningful and measurable activities as “Suppliers” and “Intermediaries.”

Additionally, Barbier and Markandya (2013) divided PES into three categories: voluntary contractual arrangements (VCA), public payment schemes (PPS), and trading schemes. These categories differ in both the mechanism of payment and their level of reliance on legal frameworks. In private schemes, or VCAs, the primary parties are private ones though government can serve a role in defining property rights and contractual requirements (Barbier & Markandya, 2013), and may also be a land owner and manager (i.e. supplier). VCAs are expected to have a low need for legal instruments, because a nested approach of upscaling from local to regional levels likely requires little regulation (Greiber, 2009). However, it can be expected that a PPS relies heavily on law in order to promote development of the PES, create certainty, and ensure good governance and trust between stakeholders. In this case, government has a primary responsibility for determining payments, collecting and disbursing funds, and

setting priorities (Barbier & Markandya, 2013). The third type, trading schemes, are characterized by the establishment of government standards that inform individual allocations (e.g., tradable permits, pollution caps) that can be traded.

Bennett and Gosnell (2015) used a different taxonomy of PES types that focused on competing disciplinary perspectives. The “traditional” perspective is described in Figure 4 by five characteristics which focus on transactions within the scheme. Bennett and Gosnell noted that there is a lack of examples in practice that meet all five criteria of the traditional perspective. In response to the ideal characteristics of the traditional perspective, the social-institutional PES perspective focuses on social actors themselves, incentives, the alignment of individual and collective land use decisions, social performance measures, transaction costs, and inequities between actors. At another extreme is the biophysical perspective, which focuses on the distinct characteristics of ecosystem services and how they drive PES design. This perspective considers the rivalness and excludability of ecosystem services (Table 3) as well as spatial scales of the services and their benefits. Bennett and Gosnell also identified several critical perspective on PES that come from political economy and political ecology disciplines, primarily critiquing commodification, economic values over social values of nature, and unresolved uncertainties resulting from the other perspectives.

To integrate these diverse perspectives on PES, Bennett and Gosnell proposed a social-ecological system perspective on PES. This perspective recognizes a wide diversity of variables and interactions between social, economic, political, and ecological systems. Since not all of the variables are relevant in every PES design, application of the perspective can be tailored to the unique resources, actors, and context of a PES project. However, different applications of social-

ecological PES designs can still be compared using standardized variables from a given framework.

In the NM context, there are specific resource and governance systems working at several scales. Smith et al. (2006) noted that watersheds determine the flow of water, so they are also the appropriate scale for organizing the management of water resources and watershed services. However, this points towards the incongruence of government and jurisdictional scales with natural scales of forests, wildfire disturbance, and the flow of water that is connected to watershed services. Therefore, the ultimate goal of institutional arrangements and policy decisions in NM must be to link the condition of watersheds to downstream benefits, whether through PES (Smith et al., 2006) or otherwise.

Making policy decisions. There is a need to address all aspects of forested land management in fire-prone and fire-adapted ecosystems. Indeed, while FLAME is a minor part of potential responses to issues in the WUI and the overall priorities of federal land management agencies (i.e. other priorities include cost efficiency under limited resources), it is an important tool in the myriad policy and social instruments that are available. Flexible policy instruments are able to deal with uncertainties (Hahn, 1989) about stakeholder and market behavior, and potential changes in scientific and political understanding. Hahn noted that the use of multiple instruments is the rule rather than the norm. However, more instruments may mean greater costs. Therefore, an appropriate mix of policy instruments must be chosen, particularly in dealing with multiple levels of government and types of stakeholders. Similarly, efforts to reduce carbon emissions from deforestation and forest degradation using accounting and incentive mechanisms have been proposed under three approaches: direct support to projects (small scale), direct

support to states/countries (large scale), or a hybrid of the two (“nested”) (Angelsen, Streck, Peskett, Brown, & Luttrell, 2008).

A nested approach can be a more flexible mechanism that either starts at the project level and gradually moves to larger scales, or exhibits a coexistence of multiple scales at the onset of the project. In nearly all cases, by the nature of federated government powers in the US, there are multiple authorities at work, with overlapping jurisdictions. The term for this is “polycentricity,” first coined by Polanyi (1951, p 170) and applied to municipal government and natural resource issues by Vincent Ostrom and co-authors in the early 1960s (Ostrom, Tiebout, and Warren, 1961). Ostrom, Tiebout, and Warren noted that polycentricity is characterized by the presence of multiple areas of decision-making that “are formally independent of each other” (p 831). Therefore, there can be challenges in harmonizing between scales (i.e. a cohesive plan between projects and scales). Policies implemented and proposed from multiple agencies and stakeholders have the potential to create a de facto nested response to wildfire dynamics, risk within the WUI, and limited budgets. However, even though multiple levels and primacies (i.e. opposite of polycentricisms) of government are focused on wildfire mitigation, governance is not sufficiently connective between efforts. Therefore, lapses, redundancies, and inefficiencies exist in wildfire management response.

Although the science regarding wildland fires is fairly clear, the planning of actions to address them can be considered a “wicked problem”: actions have unclear missions, it is difficult to determine when they have been solved, and solving them involves “elusive political judgment” (Rittel and Webber, 1973, p 160). Elinor Ostrom (2000) pointed towards the “danger of self-evident truths”: common-sense wisdom is not always correct, and wherever the planner begins to address a problem will dictate their understanding of it. Instead, the planner’s inquiry

must not be biased towards one solution over another, or at the very least it must have multiple points of entry. Many solutions have been tried to address wildfire problems in the WUI; while some have worked, none have addressed all aspects of the system. Managing fire-prone and fire-adapted lands means that the balance between social values (e.g., protecting property, limiting budgets) and scientific understanding (e.g., using prescribed fires, letting natural fires burn) may continually tip back-and-forth towards either priority. The current condition of many forests indicates that a monocentric policy of suppression may be doing more harm than good. Further, if the planner accepts the idea that fire suppression is not the only option, then there will always be future forest fires and they may each need to be addressed in different ways.

Similar to traditional scientific experiments, policy changes and management actions can be observed to see what works, what does not work, and how the planner may do better next time. However, the planner does not usually work in a laboratory, and management actions have lasting and potentially irreversible impacts on environmental and human systems. At the core of impacts to human systems, in particular, are social values. Therefore, the planner must attempt to understand as many aspects of a system as possible, including social values, in order to understand the potential impacts of their actions. This information may also be useful in managing the aftermath of policies that go awry. Korten (1980) added that the planner should “embrace error” by being aware of limitations of their knowledge, acknowledging mistakes, and engaging in learning and corrective action in the aftermath of errors.

A solution that works in one community is not likely to work perfectly elsewhere. Ostrom, Janssen, and Anderies (2007) used the term “panacea” to describe the application of a single solution to many problems, resulting in what Ostrom (2007) described as a fixation on specific variables that ignores other variables and causes the planner to overlook better solutions.

Ostrom, Janssen, and Anderies (2007) called for social scientists to diagnose, monitor, and learn from the applied sciences. By applying a diagnostic framework, using interdisciplinary knowledge (i.e. anthropology, biology, ecology, economics, environmental sciences, geography, history, law, political science, psychology, and sociology), monitoring system indicators, and learning from successful actions and failures, planners may improve how they successfully address wicked problems.

Therefore, the planner is bounded on two sides: by the need to avoid panaceas, and the necessity of using a holistic diagnostic method. The first broadens the solutions that are available to planners, but excludes “silver-bullet” answers. The second requires that planners follow a more careful and complicated process that avoids simple solutions (i.e. the former addresses the scope of solutions and the latter addresses the process to identify solutions). Korten’s (1980) blueprint approach is distinct from the concept of “fit,” under which programs, beneficiaries/actors, and institutions are responsive to beneficiary needs, build the institution to be strong, and make the program work. Instead of achieving fit by looking towards a final program or organizational blueprint and applying it elsewhere, a proper fit is found through the process of developing programs and institutions concurrently. Again, the focus is on the process rather than the result.

Research Methods

This policy analysis investigates the feasibility, appropriate scale, and advantages and disadvantages of primary alternative institutional arrangements for securing long-term funding for NM watershed restoration. Research begins with a systematic literature review of efforts in NM to secure long-term funding for watershed restoration, including the SFMW program and RGWF. The outcome of this research synthesis includes the narrative account of restoration activities included in the previous and next sections, and references to graphic representations of patterns of findings. More specifically, the effort of information gathering and synthesis involved the following:

- Attendance at NM Legislature committee hearings during the 2015 session in Santa Fe, NM to observe presentation, debate, and decision-making regarding House Bill (HB) 38 “Forest & Watershed Restoration Act,” (FWRA) and HB 474 “Fire Protection Fund to Watershed Restoration” (Table 4).
- Identification of potential funding sources for RGWF from both observation of NM Legislature committee hearings and publicly available documents, such as proposed bills, amendments, budget analyses, and public notices.
- Review of existing programs, and potential combinations and modifications of them in order to incentivize local participation and receive greater public funding support. This review included annual reports, status reports, and charter documents, and project proposals for both federal, state, and smaller scale forest and watershed restoration efforts.

A policy analysis of potential funding and governance mechanisms for watershed restoration must incorporate a framework that recognizes and addresses the variables involved in

wicked problems. Elinor Ostrom (2011) distinguished between frameworks and theories, noting that frameworks identify the elements or variables of a system and relationships among them, and theories are used to specify which elements and relationships are relevant to a research question; that is, the framework comes first in an inquiry. Therefore, a framework is an important part of the systematic review.

Ostrom's original Institutional Analysis and Development Framework (IADF) was developed to assess institutional reforms by identifying institutional variables (Ostrom, 2011). In the practice of applying IADF to systems with both institutional and biophysical components, it was ultimately incorporated into the Social-Ecological System (SES) Framework (Figure 5). The SES Framework (McGinnis & Ostrom, 2014) is a possible framework for understanding the wicked problem of funding and governance mechanisms that can link NM water users with the watershed services that they rely on.

The initial SES Framework was applicable to common-pool resources and resource systems with users extracting resource units. Recall that forest ecosystems, in the context of the ecosystem services received by downstream users/actors, are considered public goods (providing a suite of ecosystem services), not common-pool resources. Revision of the framework by McGinnis and Ostrom (2014) resulted in a broadened scope of "Actors" to include all donors, beneficiaries, suppliers, and intermediaries, and recognition that resources can be "flows" rather than just units (i.e. many ecosystem services are non-rivalrous and indivisible). McGinnis and Ostrom noted that these changes allow the SES Framework to be applied to systems that "generate public goods and services, most notably the ecological or ecosystem services on which many markets depend for their continued operation" (2014, p 3).

Figure 5 shows the conceptual model of the revised SES Framework. Solid boxes are the first tier variables, with multiple tiers under these to denote logical categories and subdivisions. Interacting with the variables are the social, economic, political, and related ecosystem settings. The variables interact with each other directly, and via action situations in which actors make choices based on the information that they have about other variables. Direct links and feedbacks between settings, variables, and action situations allow this framework to meet the requirements of not being rigid or closed-ended, lacking a formulaic final solution, and being unique based on whatever variables are included depending on what systems are being looked at.

The SES perspective on PES, as described by Bennett and Gosnell (2015) is used in applying the SES Framework as a way to highlight PES-specific issues and variables. Data collected during the systematic review inform the second- and third-tier variables of the framework. Some connections between variables are already demonstrated by recent policy decisions and debate. Other potential or missed connections are also present that may inform future efforts or serve as lessons of current efforts that have failed, and these also inform the narrative and conclusions of this study.

Description of Efforts in New Mexico and Application of the Framework

The use of PES at the local level, collaborative forest restoration planning and funding at the regional level, and efforts to enact state-level funding that can pull even more funding from federal sources, represent multiple methods that can nest within each other, and inform and leverage funding across multiple jurisdictions. Working together, these activities could potentially scale up to greatly expanded watershed restoration efforts to mitigate wildfire risk.

Using Payment for Ecosystem Services Schemes in New Mexico

Payment for Ecosystem Services schemes seek to reverse the underprovisioning of ecosystem services by connecting service users to lands and the people that manage them through payment and governance arrangements, with goals of maintaining the health of the lands that provide the services and mitigating potential threats.

The SFMW Plan (SFWD, 2013) described an effort in the watershed of Santa Fe, NM to address vegetation management and fire use, water management, public awareness and outreach, and financial management based on PES. The costs of forest restoration in the 17,384 acre watershed over 20 years (\$5,100,000) have been estimated to be less than one half the cost of wildfire suppression and rehabilitation (\$11,900,000 minimum) and one-fifteenth the cost of sediment dredging, hauling, and disposal (\$80,000,000 minimum) that would be necessary due to debris flows. From 2003 to 2009, the federal government provided earmarks totaling \$7,000,000 for planning and hazardous fuels reduction in the lower part of the watershed, resulting in the treatment of more than 5,200 acres of forest. Fuel loads in the mixed-conifer and spruce-fir forest in the upper half of the watershed, above one of the city's reservoirs, were not addressed (SFWD, 2013). Although users pay for the capture, treatment, and delivery of water by the City of Santa Fe, and emergency management (firefighting and post-fire forest rehabilitation via

taxes), they do not pay for the watershed services that produce the water and prevent catastrophic fires. The SFMW Plan (SFWD, 2013) noted that these services are not typically paid for by water users, because they are not included in conventional markets.

When SFMW was developed 2007–2009, and adopted by the City Council in 2009, it used the model of PES to develop a financial management plan for 20 years of forest and watershed restoration activities. By estimating restoration costs and the avoided costs of fire, and providing recommendations for financing agreements and mechanisms, the SFMW Plan sought to develop a PES scheme in which “beneficiaries of the watershed (Santa Fe consumers) will knowingly pay for ecosystem services” (SFWD, 2013, p 78). Beginning with this foundation, SFMW was awarded a grant by the NM Water Trust Board to cover 85% of the first three years of program costs (Phase 1). During this period, the cost-per-water user paid by the Water Trust Board and City of Santa Fe was listed as a credit on a separate line on user water bills. Between 2011 and 2013, when the grant (Phase 1) ended, SFMW estimated that more than \$1,400,000 would be spent on vegetation management (43%), water and habitat monitoring and infrastructure (29%), and education and outreach (47%). In Phase 2, the fee would be assessed to the user as a part of water usage. Over the next 17 years, SFMW estimated that the cost of vegetation management would decrease as work became more focused on maintenance of previously treated forest, while annual water management and education/outreach costs would remain the same. By the end of the total project period (20 years), approximately \$6,656,000 would be spent (SFWD, 2013).

The SFMW is driven by a public agency, the SFWD, which collects payments as a form of user fees from parties that purchase the municipal water supply that it provides. The government as supplier, the water users as donors and beneficiaries, and the involuntary nature

of the transaction define this arrangement as a PPS. As a provider of ecosystem services from forests that it manages, the City of Santa Fe applies user fees to the management of the watershed. Through a Memorandum of Understanding and Collection Agreement, Santa Fe is also able to work with USFS as another donor. The SFMW Plan (SFWD, 2013) recognized that much of thinning in the watershed has, historically, been performed by USFS. Even if USFS's funding for hazardous fuels reduction decreases as suppression takes priority, these agreements facilitate the continued involvement of USFS in the PES scheme by leveraging limited federal funds through cost-shares and matching funds (SFWD, 2013).

The SFMW has addressed the institutional and revenue issues related to the arrangement of PES, including the valuation, delivery, and payment mechanism for ecosystem services by combining funding from multiple sources (state and federal) along with line item fees on users' water utility bills. SFMW goes further by including many of the rules for its activities and decision-making in the SFMW Plan, including a review of past restoration and monitoring actions, specific responsibilities of each participant, and recommendations for how funds can be spent based on priorities for the watershed.

At a larger scale, led by the collaborative-building efforts of TNC, RGWF has characterized PP–MC forests in northern NM that can be prioritized for thinning and restoration in order to prevent high-intensity fires. A total of 1,600,000 acres of PP–MC forest have been identified, comprised of multiple land ownerships (Table 5) (TNC, 2014a, p 19). Although the area identified for restoration is more than 90 times that of SFMW, the institutional arrangements described in RGWF's Comprehensive Plan (TNC, 2014a) have some of the same characteristics as SFMW. RGWF has noted the need for Memorandums of Understanding between the fund and its participants, in this case to facilitate public-private cooperation, and lay out commitments of

those who participate. These Memorandums would also lay out donation rules for “Investors,” as the non-profit TNC administers the funds. Initial investors to the RGWF included USFS and other federal agencies, the University of New Mexico, water and electrical utilities, State water agencies, Soil and Water Conservation Districts, other non-profits, county governments, and private businesses and foundations (TNC, 2014a, p 27; Table 1). In addition to monetary donations, investments likely include “in-kind” support such as planning participation time and research resources. In particular, many of those governments and non-profits have previously worked together in the landscape on watershed and forest management, so past and current efforts can facilitate more coordinated action by RGWF. An important example of this is the USFS CFLRP project in the Southwest Jemez Mountains area.

By pairing government expenditures on forest and watershed restoration with private investments, RGWF has defined land managers and downstream users as stakeholders (Table 6) that would benefit and pay for restoration on lands in Table 5 (TNC, 2014a, p 28). As the administrator of donations to RGWF, TNC has been the most important “private” part of the public-private partnership. As a form of contract, the Memorandums of Understanding, and the donations that Investors voluntarily provide, have defined RGWF as a VCA or private PES scheme. RGWF acts as an intermediary, any of the organizations in Table 5 may be a supplier, and essentially any downstream user of water (including donors) are beneficiaries. As a VCA, government agencies would not be expected to serve a role beyond property rights assignments and legal enforcement in RGWF (Barbier & Markandya, 2013). However, Table 5 demonstrates that federal, state, and local governments own more than 75% of PP–MC forests in the RGWF area. Given the public good nature of the watershed services flowing from these lands, and the “checkerboard” (TNC, 2014a, p 4) pattern of property rights in the RGWF area, coordination by

a single intermediary (that is not a primary land owner) best links donors, beneficiaries, and suppliers. RGWF's advisory board, comprised of more than 45 New Mexico entities (TNC, 2014a, p 7), has essentially been made up of beneficiaries and intermediaries that are responsible for outreaching to other stakeholders and supporting the development of RGWF, providing guidance about the research and plans that should be completed, and determining the structure and rules of the VCA.

Assessing the value of ecosystem services is an important part of PES projects because the price that is paid by donors must cover the costs of land management by suppliers that deliver the benefits of ecosystem services to beneficiaries (Table 2). In the case of RGWF, there is no direct mechanism for incentivizing fees or taxes from every downstream water user, as there is in SFMW. Therefore, well-defined system boundaries, information-sharing, and valuation are important for the RGWF as it demonstrates the importance of restoration and mitigating wildfires.

Forest Trends, The Katoomba Group, and United Nations Environment Programme (2008) noted that the price for ecosystem services, as determined by what the buyer (donor) is willing to pay and what the seller (supplier) is willing to accept and deliver, is affected by the economic value of benefits of the services, the costs of replacing damaged services (i.e. fire suppression and rehabilitation), and the relative cost of alternatives (i.e. water filtration, groundwater pumping, sediment removal). The TNC and RGWF have used actual costs after past forest fires in NM, the SFMW Plan (SFWD, 2013), the Walter and Chermak study (2014, as cited in TNC, 2014a), water utility costs from the region, and a watershed avoided cost analysis for the Sierra Nevada in California, to estimate costs from wildfire avoided by treating forests in the RGWF project area. For 145,000 acres of treated forest, low and high estimates were made

for avoided costs related to wildfire suppression, forest rehabilitation, human structure value loss, loss of timber, and reservoir dredging. The analysis compared the low and high avoided cost estimates (present value of total costs), between \$156,477,865 and \$1,263,290,378, to the estimated costs to mechanically treat and reduce fuel loads on those areas, which ranges between \$72,608,783 and \$174,261,078. Other variables not included in the analysis, such as the costs of lost tourism and commercial business, road repair and reconstruction, and other water utility impacts (e.g., water treatment), increase the avoided costs (RGWF, 2014).

The avoided cost analysis that was developed by TNC and RGWF used estimated treatment costs of between \$700 and \$1,200 for each acre (RGWF, 2014). A similar cost range, \$700–\$2,000 is used in the RGWF Comprehensive Plan. Both the SFMW Plan (SFWD, 2013) and RGWF (TNC, 2014a) noted that the cost per acre of treatment decreases at greater scales (i.e. unit cost is less for multiple acres than it is for a single acre). Further, as the project progresses, some acres may only need to be maintained following thinning, which has a lower cost.

Efforts in the New Mexico State Legislature

2013 and 2014 memorials. Moving from the local/watershed (Santa Fe, NM) and regional (northern NM) scales up to the state-level, stakeholders worked together to introduce several memorials and bills in the NM Legislature in 2013, 2014, and 2015 that extended the scope and reach of their efforts with the SFMW and RGWF. House Memorial (HM) 65 in the 51st NM Legislature (2013) (Figure 6) was passed unanimously (Watershed Health Planning & Management [HM 65], 2013b), and addressed the need for collaboration between the USFS and NM agencies in watershed health planning and management, by referencing the Organic Act of 1897. House Memorial 80 and Senate Memorial (SM) 95 both passed unanimously (Long-Term

Forest & Watershed Plan [HM 80], 2014a; Long-Term Forest & Watershed Plan [SM 95], 2014a) in the 51st NM Legislature (2014) (Figure 6) with identical language, and recognized that wildfires extend beyond their own scale, outside of the jurisdictions of State agencies. These memorials also pointed towards the need to leverage federal dollars for long-term funding for forest and watershed restoration. The Congressional Research Service (2007) noted that memorials are requests that “Congress take some action, or refrain from taking certain action.” Indeed, Memorials 65, 80, and 95 were sent to the NM Congressional delegation. Leckrone and Gollob (2010) observed that more than 10% of all memorials sent from states to the U.S. Congress between 1987 and 2006 were related to environmental issues, and another 8% were concerned with public lands and water management. Only defense and health policy issues were more prominent state memorial topics.

Bills in 2015. Bills in the 2015 New Mexico Legislature Regular Session sought to enact policy and funding mechanisms for forest and watershed restoration by building on agreement on issues identified in the 2013 and 2014 Memorials, and extending the goals of the RGWF. Bill sponsors, Representative Paul Bandy (San Juan), and Senator Peter Wirth (Santa Fe) worked with expert witnesses from the New Mexico Forest Industry Association and TNC to develop language and work the bills through 10 committee and floor hearings (Table 4) over the 60 days that the NM Legislature was in the Regular Session.

Initially, HB 38 (Figure 7) directed funding from the Insurance Department Suspense Fund, which receives fees and taxes from life, health, property, vehicle, casualty, and other types of insurance business premiums, certifications, and licenses (59A NM Stat. § 6-1) (Figure 8). In Fiscal Year 2014, this fund collected \$209,500,000, of which \$74,345,229 went to the Fire Protection Fund. (New Mexico Office of Superintendent of Insurance [OSI], 2014, pp 19-20). As

of the 2015 Regular Session, statutes describe more than six transfers from this fund, as well as additional distributions for fee refunds (e.g., overpayments). Under the Introduced version of the Bill (Forest & Watershed Restoration Act [FWRA], 2015a) there would have been \$1,250,000 transferred monthly from health insurance premium surtaxes; these surtaxes had increased due to the growth in insurance coverage in NM from the federal Patient Protection and Affordable Care Act (*HB 38: Forest and Watershed Restoration Act* [HB 38], 2015a). Fiscal Year 2014 revenue from the premium insurance surtax was \$30,456,607 (OSI, 2014, p 19), of which the annual transfer for watershed restoration would have been nearly 50%. However, left over funds from the health insurance premium surtax transfer to the State's General Fund. Given the tightness of the State's budget in this Legislative session (HB 38, 2015c) and other demands on the General Fund (HB 38, 2015d), the Bill was substituted to remove all appropriated funding sources (FWRA). The substitute Bill also made additions to the Forest and Watershed Restoration Board (Board) in order to incorporate overlapping jurisdictions with the NM Interstate Stream Commission (NMISC) and Department of Game and Fish (NMGF), and to pull in habitat restoration funding from NMGF. As a measure of compromise with the Bill's primary opponent, the State Forester, the Bill was amended before the final Senate Floor vote to make the Board advisory to EMNRD's State Forestry division, rather than a decision-making body. The Legislative Finance Committee (LFC), bill sponsors, and OSI continued to seek opportunities for realizing intersections between the purpose of the Forest and Watershed Restoration Fund (FWRF) proposed by HB 38, and the purposes of other funds shown in Figure 8. The Fiscal Impact Report (FIR) for the Final version of the Bill (LFC, 2015), referenced appropriations that were in the version of HB 2 (General Appropriation Act of 2015) that was sent to the Governor, including \$2,000,000 in one-time funding that would come from the State's Game Protection

Fund, Trail Safety Fund, and EMNRD, and \$250,000 in recurring funds from the Healthy Forests Program. The FIR also estimated that \$1,400,000 of these funds would be needed for start-up activities before the Board would be fully functioning, and that \$650,000 would be needed for recurring operating costs for the program. House Bill 38 passed both the House and Senate unanimously. Considering RGWF's estimated treatment costs per acre (between \$700/acre and \$1,200/acre; RGWF, 2014), only 700–1,200 acres of PP–MC forest could be treated using those funds, after start-up costs; this is less than half of what RGWF estimates is currently being treated. Funding in future years under the final version of FWRA and the appropriations in HB 2 would not cover operating costs, so no treatments would be able to take place unless funding sources were to be found.

In order to address long-term, recurring funding for FWRA, HB 474 “Fire Protection Fund to Watershed Restoration” (Figure 9) was introduced just after the House Energy, Environment & Natural Resources Committee substitute for HB 38. In HB 474, FWRF would receive a portion of the funds being transferred to the Fire Protection Fund for grants to fire districts. In 2015, this amount would be approximately 10% (\$729,600) of the estimated distribution that would go to the Fire Protection Grant Fund, and by 2025 this proportion would increase to approximately 36.6% (\$10,079,700). In 2025, FWRF would receive nearly one half of the annual funds that the RGWF estimates are necessary to effectively manage forests (\$21,000,000) (TNC, 2014a). However, this proposal relied on taking a share of funds that are already purposed in statute. Opponents of HB 474, namely the State Fire Marshall and local fire departments, pointed towards their reliance on these funds for department operations. Nearly 30 fire fighters from departments across the state attended and spoke in opposition at the hearing of the Bill before the House Ways & Means Committee, outnumbering the Bill's proponents (*HB*

474: Fire Protection Fund to Watershed Restoration [HB 474], 2015b). Members of the Ways & Means Committee signaled that they would likely vote in opposition to the bill, and several of them invited the Bill's sponsors to meet with the State Fire Marshall to come to a consensus. The Ways & Means Committee tabled the Bill and that meeting never occurred.

When HB 38 was unanimously passed by the Senate two weeks later and moved to the desk of the Governor, it was only attached to \$2,250,000 of funding. The Governor vetoed HB 38 in April 2015, noting that only executive agencies, rather than the Board, could respond to "critical and pressing needs" (Martinez, 2015a). The Governor specifically named the Department of Homeland Security and Emergency Management, NM Environment Department's (NMED) River Stewardship Program, and State Forestry in EMNRD as executive state agencies with current watershed restoration activities that would be limited by the Bill.

House Bill 2 (General Appropriation Act of 2015; HB 2, 2015) represented all appropriations made by the Legislature in the Regular Session. The version that passed to the Governor authorized \$9,637,300 for the Healthy Forests Program under EMNRD, including \$4,241,500 from the General Fund, and \$4,860,800 from federal sources. Of the General Fund appropriation, \$250,000 was set aside for FWRF, dependent on passage of HB 38 "or similar legislation" in the Regular Session (HB 2, 2015, p 77). This appropriation had a performance measure of 19,000 acres to be treated in the State. A special appropriation from the General Fund was also included in this version of HB 2 to FWRF (\$1,000,000), in addition to a transfer from the Trail Safety Fund (\$500,000) and Game Protection Fund (\$500,000), also dependent on passage of HB 38 (HB 2, 2015, p 184). Another special appropriation was set to take place from the State Lands Maintenance Fund to FWRF (\$200,000), dependent on HB 38 (HB 2, 2015, p 184). The Governor's veto of HB 38 negated these appropriations.

On June 8, 2015, the NM Legislature convened for a Special Session and passed an additional capital outlay bill (SB 1), including \$2,500,000 for watershed restoration and \$1,000,000 for wildfire mitigation. The Governor's announcement of the funding (Martinez, 2015b) noted that these funds would be for 15 watershed projects across the state, of which six had already started, under EMNRD.

Reflection. Despite the failure of these bills, the successful passage of the 2013 and 2014 Memorials, public statements during the hearings on HB 38 and HB 474, the Governor's veto message, and the announcement of funding in the capital outlay, indicate that there is some level of agreement on the connection between forest management, watersheds, and downstream water users. The most significant barriers to more ambitious watershed efforts are a lack of willingness to dedicate long-term funding at the state level, as well as jurisdictional rivalries between state, local, and federal land managers.

During discussion of HB 38 and HB 474 in the NM Legislature (HB 38, 2015a - e; HB 474, 2015a; HB 474, 2015b), RGWF's estimates for the number of treated acres each year (30,000) were used, and it was understood that at least \$21,000,000 would be needed each year for thinning treatments and other costs. The Introduced version of HB 38 (FWRA, 2015a) proposed the most funding of all of the options that were considered, and it was still less than half of what would be needed to meet the treatment goal. One interpretation of why bill sponsors moved forward despite this is that they understood that the remaining funds for thinning would come from other sources, such as RGWF and through leveraging federal dollars. In fact, one of the arguments for the Bill, provided by bill sponsors, was that even a modest commitment of funds from the State would demonstrate its ability and willingness to compete for federal grants. Further, they argued that the Board would be able to coordinate multiple funding sources from

local, regional, state, and federal sources, making sure that projects under FWRA are working best with non-FWRA projects (Figure 7). In the case that this arrangement had successfully passed through the Legislature and was signed by the Governor—either with funding distributions directly from the Insurance Department Suspense Fund, or from the Fire Protection Fund—the Board would still have needed to coordinate and leverage RGWF and federal funds in order to meet the 30,000 acres/year restoration goal.

The version of House Bill 2 signed by the Governor included an output performance measure for appropriations to the Healthy Forests Program: “Number of acres treated in New Mexico’s forest and watersheds,” with a target of 19,000 acres. Based on RGWF’s low-value estimate of \$700/acre for treatment, this would potentially call for at least \$13,300,000 to meet that target. With the veto of HB 38, this appropriation totaled \$9,361,700 for salaries, benefits, contractual services, and other costs under the Healthy Forests Program. This program under the State Forestry Division is consistent with one of the roles of the Division as a collaborator with other local, state, tribal, federal and private entities in landscape-scale efforts in forest and watershed restoration. It’s unclear from the appropriation, and from reporting by the Forestry Division (e.g., the last annual reports and work plans for the Forest and Watershed Health Office are from Fiscal Year 2009), how much was budgeted for basic operations of the Office and the other performance measure listed in HB 2: “Number of nonfederal wildland firefighters provided professional and technical incident command system training,” and how much of the appropriation will go directly towards acres being treated. Ultimately, the 19,000 acre target is still short of the 30,000 acres of PP-MC that RGWF concluded must be treated each year.

Taken as a whole, 2015 efforts in New Mexico regarding wildfire and forest and watershed management appear unclear, disconnected, and largely reactive. Although the State

appeared to show a concerted effort to increase funding for forest and watershed restoration and to signal their response to the need for greater restoration efforts, the impact of those dollars is unclear. Based on comments during Legislative hearings by bill sponsors, State efforts have been insufficient or even counterproductive. However, from the perspective of an outside observer (myself), there have been more commitments to increase funding than eagerness to collaborate across scales to increase the impact of funding that was successfully appropriated during the Regular and Special Sessions. This is despite common goals of the parties to negotiations of HB 38 and HB 474.

A common theme of local, regional, and state-level efforts has been the nexuses between land management and wildfire risk, wildfire risk and property insurance premiums, and all of these with the ecological and cultural services (e.g., recreation, aesthetic) from forests that are threatened by catastrophic wildfires. At the center of these issues is the connection between forests as headwaters and water quality and quantity in the minds of downstream users that depend on the watershed services that forests provide to them. Although HB 38 and 474 would have increased funding for watershed restoration in the state, they used different mechanisms from the SFMW and RGWF. Denied the opportunity to observe the implementation of the FWRA and Board, it cannot be determined whether state-level efforts would have been able to connect forest health to water quality and quantity in the same way, or even as successfully, as SFMW has done by educating water users and having them directly pay for watershed restoration. The sharing of information and outreach is also an important part of RGWF.

Status of funding at the end of 2015. In its 2015 Annual Report (TNC, 2015), RGWF noted that \$10,000,000 had been invested in watershed restoration efforts in New Mexico from 2014 to 2015 from all sources. The majority of these funds were leveraged from non-RGWF

sources for treatments (~\$7,700,000) or were funded directly by RGWF (~\$1,000,000). The remaining funds were used for planning (~\$1,300,000). In Fiscal Year 2015, planning and treatment funds came primarily from State and federal sources (46% each), with the rest from RGWF (8%). Averaged over the two years, there was about \$4,350,000 each year in funding for treatments. Using RGWF's estimate of an average treatment cost of \$700/acre, there were about 6,200 acres treated each year, which is 21% of the number of PP-MC acres that RGWF says need to be treated each year.

2016 updates. Legislative action regarding forest fires and watershed restoration continued in the 2016 session. Ongoing awareness, and even increased importance of these issues is represented by the introduction of three House Memorials (Figure 10) regarding collaboration with the U.S. Department of Agriculture (USDA) (HM 47, unanimously passed), the use of prescribed fire (HM 49, unanimously passed), and recognition of the CFRP (HM 74, died in committee). Like the HMs, a Senate Bill (SB 128; Figure 12) was passed without any connected appropriations, entering NM to the Interstate Compact for the Prevention and Control of Forest Fires. Notably, this Compact allows states to coordinate directly, rather than through federal agencies, to coordinate firefighting aid between member states.

General appropriations to the Healthy Forests Program increased 15% (to \$10,766,700) from 2015 (HB2, Figure 11), with a target to treat 15,500 acres. House Bill 167 (Figure 11) authorized loans or grants for individual watershed restoration and management projects, and HB 219 (Figure 11) appropriated another \$2,500,000 for watershed restoration improvements in Fiscal Years 2016 through 2020. As I've mentioned before, these watershed restoration projects are intended to be implemented statewide, so it's unlikely that they will have much impact on the 30,000 acres of PP-MC that RGWF states must be treated each year.

The most significant legislation in 2016 was SB 110, titled “Revenue for Forest & Watershed Projects” (Figure 12). This Bill, passed unanimously without connected appropriations, broadened the potential revenue sources and potential uses of the Forest Land Protection Revolving Fund. This Fund was established by the Forest Conservation Act to collect sales of confiscated and wood and other seized property by the Forestry Division, to be used for enforcement of the Act. With passage of the Bill, the Fund can now receive revenue from federal agencies, such as USFS and the National Park Service, to conduct restoration projects on lands that those agencies manage. In the past, federal agencies have had restoration funds that they couldn’t use due to a lack of other resources (e.g., staffing) and opportunity to do the projects themselves, and the State lacked a mechanism to receive that revenue. Senate Bill 110 also allowed revenue to be received from state agencies, such as NMGF and the State Land Office.

In several ways, SB 110 avoids some of the obstacles that faced HB 38 and HB 474 in 2015 while incorporating some of the important mechanisms from those bills. First, without attached appropriations, SB 110 dodged concerns from any State entities about redirecting the funds that they consider their own. Further, the Bill pooled revenues that were not previously available and allowed them to be put towards the same purpose. By noting the willingness of federal and State agencies to provide revenue for the Fund (LFC, 2016b), the Legislature recalled a missed opportunity from 2015: an eagerness to increase forest and watershed restoration despite the lack of a policy mechanism to do so.

Second, SB 110 used a Fund that already existed, thereby avoiding concerns that its revenues would take from or compete with existing restoration activities. By noting that the Fund’s revenue and appropriation rules had been very limited in the past, the Bill’s FIR hinted that the Fund had been underutilized. Further, since the Fund is under EMNRD, the Bill

expanded restoration activities under the agency that has been traditionally responsible for implementing restoration activities and coordinating with similar federal agencies. The Forestry Division under EMNRD was among the largest opponents of HB 38 and HB 474, and SB 110 did not attempt to support restoration activities that are independent of that entity.

Third, by requiring that the State Forester sign vouchers for projects, SB 110 incorporated an 11th-hour change that was made to HB 38 in 2015 that strengthened EMNRD's oversight and approval of restoration projects in that Bill. In 2015, this was understood to be a necessary condition for the HB 38 to move forward and gain minimal acceptance from the State Forester (HB 38, 2015e).

Finally, SB 110 recognized and addressed two uncertainties that would have been faced by HB 38, had it passed. First, in the context of an ongoing paucity of revenue for the State, the State's General Fund is always in need of funding from any source within the State budget, including any fund with excess revenue. This was an issue that was raised in response to the Introduced version of HB 38, which would have drawn from excess funds slated for the General Fund (Figure 8) (HB 38, 2015c; HB 38, 2015d). Funds in the Forest Land Protection Revolving Fund cannot revert to the General Fund, so there's no possibility that funds will be lost before they can be appropriated. Second, although one of the main purposes of the Forest and Watershed Restoration Board created by HB 38 was to coordinate and leverage funding from federal sources, how that would have been done in practice was uncertain (HB 38, 2015b). By expressly incorporating the ability to receive funds from federal sources, without much specificity about which agency sources the revenue can come from, SB 110's changes to the Forest Land Protection Revolving Fund will signal an opportunity for federal agencies to give their own excess funds to the State. At the same time, these changes may be a sufficient signal

that the State has the ability and willingness to compete for federal grants that can also go into the Fund, which was one of the benefits of HB 38 presented by its sponsors (Figure 7) though that possibility was not incorporated in HB 38 itself as it was in SB 110.

Application of the Social-Ecological System (SES) Framework

These nexuses that connect “forests to faucets” are part of the decision-making that takes place in “action situations” at the center of the SES Framework, involving the interplay of actors, their assigned responsibilities and actions, the information and control that they possess, and the net costs and benefits they assign to potential outcomes (Ostrom, 2011). Action situations can be chosen from the many spaces where actors have exchanged information, goods, and services, made decisions, or exercised authority over each other in the development of the SFMW and RGWF, passage of the 2013 and 2014 Memorials, and debate of HB 38 and HB 474.

Application of the SES Framework focuses on analyzing the variables at work in these action situations, with a goal of illuminating how restoring watersheds will improve water security for communities. This application recognizes that institutional adaptations for restoration and financial management must be established before consistent restoration practices can be ensured for the 20-year lifetime that is proposed for RGWF and then again by HB 38 and HB 474. The expected result of this analysis is to elucidate and inform public debate in NM, which involves many issues beyond water security, and therefore involves many diverse actors. Utilizing the McGinnis and Ostrom (2014) rendition of the SES Framework, Figure 13, Figure 14, Figure 15, Figure 16, Figure 17, Figure 18, and Figure 19 index the multiple settings and variables that are linked within the framework. Earlier work by Elinor Ostrom (2009) provides additional context for how elements of the framework should be indexed under the first tier.

Figure 14, Figure 15, Figure 16, and Figure 17 represent the first-tier and second-tier variables of Resource Systems (RS), Governance Systems (GS), Resources Units (RU), and Actors (A). Figure 13 and Figure 19 are the tiered variables of the social, economic, political (S), and related ecosystems (ECO) settings. Figure 18 addresses action situations. Bennet and Gosnell (2015, Figure 3, pg. 178) identified SES variables that are particularly relevant to PES. I have indicated these variables in these figures with an asterisk (*). Some of these variables, such as RUW3 and RUF3 (Interaction between resource units, Figure 15) are important for understanding watershed services. Further, the separation of variables for forests and water (*Figure 14, Figure 15*) reflects distinct conceptual and physical characteristics, despite them being managed collectively in important ways as watershed services. The amount of information needed in Figure 17 reflects the diversity that exists across the multiple actors that are involved in land ownership and benefits from watershed services.

Conclusions

Linking Watershed Condition to Downstream Benefits

Barbier and Markandya (2013) note that taxes and fees on resource use, in practice, have had an emphasis on revenue-raising rather than incentives for particular resource use choices. Revenue-raising from other sources (not directly from taxes and fees on resource use) were proposed in the NM Legislature in order to fund forest and watershed restoration. At first glance, the proposed arrangement could be considered a PPS because the payments and funds are managed by government. However, the arrangements differ from the traditional forms of PES schemes described by Greiber (2009) and Barbier and Markandya (2013) because “payments,” as they are understood in PES transactions, are not flowing directly from downstream water users to upstream land owners and managers. Still, bill sponsors and other parties looked towards examples of PES schemes, such as SFMW, to build an alternative arrangement at the larger scale. Instead of proposing direct payments from beneficiaries to suppliers, bill sponsors and the LFC looked for the State funds and revenue sources that best intersected with the purposes of forest and watershed restoration, resulting in the public as a whole, and certain tax and fee payers (e.g., anyone that pays for insurance), being the donor(s) in the arrangement. These intersections were found with habitat restoration, health insurance premiums, property insurance, and other forest and watershed restoration activities in EMNRD. Some of these intersections have justification from other studies, including hedonic pricing impacts by wildfire to homes in the WUI (Donovan, Champ, & Butry, 2007; Hansen, Mueller, & Naughton, 2014), and health effects from wildfire smoke (Jones, Thacher, Chermak, & Berrens, 2015). However, the rationale for these intersections were not discussed in detail by bill sponsors during Legislative hearings. New beneficiaries were also identified through this negotiation process, including NMISC (potential

of increased flows from headwaters) and NMGF (habitat improvement for game species). Further, the value of ecosystem services and the costs of restoration are progressively becoming better-defined through economic estimates, forest product markets, and ecological studies. Therefore, the outcomes of negotiation in the NM Legislature and the Final version of HB 38 resulted in many if not all characteristics of PES transactions (Figure 4).

This observation is also made by looking at SFMW and RGWF, which were designed according to PES models, but do not exactly meet the traditional PES types described in Greiber (2009), that are more applicable to arrangements with less concrete property rights, lack strong legal and institutional frameworks, and involve other types of ecosystem goods and services (Table 1). In a physical sense, each of these programs fit within each other at progressively larger landscape scales (local, regional, state). It is also clear that they build on each other by borrowing many of the same stakeholders, referencing each other, and setting similar restoration goals. However, the most important element that these arrangements have in common is the use of some form of education and outreach that is focused on creating economic incentives that recognize value of resources and services or mental models to connect downstream water users to headwaters (i.e. “forests to faucets”). In arrangements where payments do not come directly from beneficiaries and go directly to suppliers (e.g., FWRA), any activities that better define and value ecosystem services for beneficiaries become much more key. In this way, even less traditional arrangements may fulfill the voluntary and informed donor requirements that are so important for private and public (VCA and PPS) PES schemes.

Legislation as Panacea, and Lessons from the Strategic Water Reserve

If HB 38 had been signed by the Governor, it would have contributed no funding to FWRF beyond what would be necessary for start-up costs. Recurring funding, set at \$250,000

each year from the Healthy Forest Program, would have fallen short of the estimated annual operating costs (\$650,000). Therefore, an institutional arrangement would have been created without the ability to sustain itself.

To help put this in context, NM's Strategic Water Reserve (Reserve) was created in 2005 to allow NMISC to purchase or lease water rights in order to comply with water compacts and to manage water to benefit threatened or endangered species or to avoid listing (i.e. environmental flows) (72 NM Stat. § 14-3.3). The Legislature appropriated \$2,800,000 in 2005, \$2,000,000 in 2006, and \$500,000 in 2007. In 2009, \$1,500,000 was de-authorized from the Reserve (a "budget crisis year"; Utton Transboundary Resources Center [UTRC], 2015) and the remaining funds were frozen. Remaining funds were de-authorized the following year (NMISC, 2015).

After seven years without new appropriations, the Legislature provided \$2,000,000 in 2014 for the purpose of purchasing water rights for habitat restoration projects (NMISC, 2015). In the interim, NMISC had explored water rights acquisitions in the Middle Rio Grande, and alternative implementations given limited funding to the Reserve. One of these acquisitions, that was not completed, would have involved the transfer of water rights and \$10,000,000 for use by the Reserve from a private business (UTRC, 2015).

Despite its role as an important tool for water management, and having spent more than \$3,200,000 to purchase and lease water rights between 2005 and 2014 (NMISC, 2015), the Reserve lacks a long-term funding mechanism. The program is dependent on individual appropriations from the Legislature, much like the state level watershed restoration projects announced by the Governor. As a state level water agency, NMISC is able to do water acquisition planning even when the funds are not available to make purchases. The Forest and Watershed Restoration Board would not have this luxury, meaning that it would likely need to go

to the Legislature each year to request funding for restoration above what it would also need to request for its operations.

Having a long-term funding mechanism in place at the on-set of FWRA, based on the estimated costs for restoration activities, would ensure that the Board and its activities could operate for 20 years. However, as the failure of HB 474 and revisions to HB 38 demonstrate, it is not viable to rely on a single funding source that has already been purposed by the Legislature. The unanimous passage of HB 38 by both the Senate and House indicates that, more likely, arranging multiple, smaller funding sources is more acceptable. An alternative conclusion is that establishing the institutional mechanism, even without financing, would have signaled the State's commitment to start planning long-term watershed restoration and begin coordinating between multiple jurisdictions. More simply, I can ask if it is better to have some mechanism, rather than no mechanism, for coordinating long-term watershed restoration. Preferring an unsustainable mechanism over continued work on a better state-level financing mechanism ignores the current work being done by SFMW and RGWF, which are already coordinating multiple jurisdictions at those scales. Therefore, the FWRA did not only fail in developing a sustainable funding mechanism, its veto by the Governor also means that it failed to resolve jurisdictional issues at the state-scale.

In many of the areas where HB 38 and HB 474 failed, SB 110 succeeded. However, as a reformed policy mechanism for watershed restoration, the Forest Land Protection Revolving Fund lacks secure, long-term funding, much like the proposed FWRF and current Strategic Water Reserve. One interpretation of the 2016 changes to the Forest Conservation Act is that they strike a balance between taking revenue from other State funds (as HB 474 attempted to do) and avoiding start-up and ongoing operating costs of a wholly new mechanism (as HB 38 would

have done, without sufficient funds to cover those costs). Another interpretation is that the primary benefit of SB 110 was to resolve some of the jurisdictional issues within the State, particularly with restoration of federal lands that make up most forested areas (Table 5). In any case, changes to the Forest Land Protection Revolving Fund fail to directly secure new funding for restoration work in the State.

Missed Opportunities, and Opportunities for Future Success

Without a new state-level mechanism that provides secure, long-term funding for watershed restoration, attention likely returns, at least temporarily, to the RGWF and the possibilities for self-organization and pooling of funds by stakeholders in the State. However, these and future legislative efforts can be informed by this observations about the failure of HB 38 and HB 474, and passage of SB 110.

The Governor's veto message for HB 38 focused on emergency management and other executive functions that are involved in forest restoration and wildfire response. One interpretation of this is that the administrative/executive branch, in control of its agencies, is not thinking long-term and is more focused on emergency response in reaction to wildfire, and not forested watersheds that contribute to wildfires. There is no reason to believe that RGWF would have replaced current forest and watershed restoration activities with its own. Rather, the push for a state-level coordinating body in HB 38 recognizes the need for long-term funding and coordination between state executive functions and other efforts that are already in the State. To demonstrate: the objectives of the NM River Stewardship Program, under NMED, include the restoration of stream and river hydrology, the enhancement of river and riparian habitats, and the leveraging of federal funds from the Clean Water Act. The Governor's inclusion of the River Stewardship Program in her veto message points towards overlap in objectives with FWRA.

However, rather than there being conflict or competition between the work of these two programs, I believe that there would be the possibility for synergy. NMED's project priority criteria (NMED, n.d.) demonstrate that the Program is focused on water quality and stream habitat restoration for impaired streams, including those affected by past wildfires. FWRA's activities would have been focused on mitigation of wildfire effects on streams and rivers before they become impaired. In fact, the avoided cost analysis being conducted by TNC and RGWF (RGWF, 2014) noted that impacts to local economies and increased water quality treatment due to wildfire could be included as costs that are avoided by using restoration and mitigation before fire happens. Ultimately, the continuing disconnect between short-term incremental funding for watershed restoration and wildfire response, and long-term, well-financed restoration and wildfire mitigation is a jurisdictional issue that will need to be resolved.

One of the questions that was raised by Legislative committee members, on several occasions but was not discussed in detail, was whether bill sponsors had insight into potential decision-making rules, project priorities, and expected spending for the Board. One of the likely reasons these questions could not be answered is that most of these things could not be decided until the Board had an opportunity to meet for the first time. Looking from local up to the state scale, I see a set of strong rules and more direct, reliable funding mechanisms in SFMW, and a lack of initial decision-making rules and financing proposed in FWRA. The model of SFMW has informed how RGWF is structured, and there was a similar opportunity to use the model of RGWF to educate and respond to committee members about potential decision-making rules and restoration priorities—RGWF and PES were not described during committee hearings. The SES Framework includes a second-tier element, "A7 – Knowledge of Social-Ecological System/Mental Models" under "Actors" (Figure 17), indicating that any models that Actors have

to work with can inform the decisions that they make. Legislative committee meetings offered an opportunity to describe the underlying PES model extending from SFMW and RGWF (and described in this paper) as way to show the direction that FWRA is headed and what some of the decision-making rules for the Board may look like.

Ultimately, there have been two successful outcomes from these policy efforts that address two important parts of jurisdictional issues in the state: RGWF (public-private partnerships) and the reformed Forest Land Protection Revolving Fund (pooling of State and federal funds). Both of these mechanisms focus on pooling funding from multiple sources, demonstrating that arranging multiple, smaller funding sources is likely more acceptable in the current budget climate.

Further Study and Critique

The largest opportunity for further study is with formal application of the SES Framework to the PES designs that I have described. Given the diversity of ways that PES can be designed within the SES PES perspective, it is important to determine, with specificity, how RGWF operates as PES, how reforms to the Forest Land Protection Revolving Fund may operate as PES, and how variables in the NM case can be incorporated in future PES designs at scales greater than RGWF.

Further study may also apply interest-based negotiation and conflict resolution theory. As applied to both organizational conflict management (i.e. human resources) and multi-party bargaining and decision-making, interest-based negotiation is defined as a process through which parties seek to identify and respond to needs and interests of all of the parties through collaborative problem solving (Roche & Teague, 2012; Western Rural Development Center, 1992). Interest-based methods borrow from A. H. Maslow's model for human motivation

(Maslow, 1943), known as “Maslow’s Hierarchy of Needs.” Further study should focus on conflicts in the SES Framework (I4, Figure 18) regarding the 2015 bills, as well as decision-making (the action-situations in the SES Framework, Figure 18) leading up to the failure of the 2015 bills as well as the ongoing negotiations through which the needs and interests of Actors (Figure 17) have been communicated. Maslow’s model may be used as a lens for categorizing met and unmet stakeholder needs (i.e. safety, love/acceptance, esteem, and self-actualization/idealism), describing the reasons why Actors either supported or oppose policy options because of those needs, and how policy sponsors may successfully respond to or may better incorporate the needs of other Actors. A simple example of this is the opposition to HB 474 by local firefighters and the State Fire Marshall. The Bill would have left less money available for grants to their departments, signaling a potential threat to the safety of their operations. Despite a shared purpose with the bill sponsors to mitigate fires, the fulfillment of that purpose did not address the safety need that is more basic in Maslow’s hierarchy. In addition, Egan (2014) lamented that “it is too often assumed that interest in the socio-economic dimensions of forest restoration necessarily equates to expertise” in the context of how CFRP presumes that its participants will “come to the table” because they have an interest and have something to contribute. From the point-of-view of interest-based negotiation, every party’s perspective is valid and deserves equal consideration. Therefore, even in more structured negotiations, focusing on meeting the interests and needs of various parties, rather than simply having everyone present “at the table,” is how effective collaborative decision-making occurs.

Local and downstream water and land users do not typically pay for the value of ecosystems that benefit them because the services are not included in conventional markets. Multiple methods exist to estimate the value for watershed services. Such approaches can help us

better understand the value of these services and justify PPS versions of implementing PES models. For example, they can be calculated indirectly (at least partially) in increased home and property insurance rates due to wildfire risk (TNC, 2014a) as a form of hedonic pricing (Barbier & Markandya, 2013). Donovan et al. (2007) indicated that the use of hedonic pricing related to wildfire risk and housing prices was not common ten years ago. However, as shown in a recent review, the application of these techniques is growing (Hansen et al., 2014). Replacement costs, in the form of paying for alternatives to lost ecosystem services and treatment of damages (Barbier & Markandya, 2013), such as the thinning and prescribed burning of forests and treatment of water quality due to ash and sediment, can also be used. This type of pricing, in the form of avoided cost analysis, is being conducted by TNC and RGWF; it will inform the decisions of voluntary donors as they compare the cost of watershed restoration to the cost of potentially catastrophic fires (the no-action scenario).

Finally, although the SES PES perspective was proposed by Bennett and Gosnell (2015) to incorporate multiple perspectives on PES, critical perspectives on PES bring up important issues with PES designs, natural resources, actors, and decision-making that aren't fully captured by the SES Framework. In particular, historical land disputes, race and power conflicts, and traditional land uses are subsumed by larger policy negotiations between actors that are relatively distant from the resources. From a critical perspective, such as political ecology, one might look at issues of marginalization related to histories of colonization of New Mexico and subsistent reliance on forest and water resources. Since most of the Actors involved in negotiations at the Legislature have already been included in many of the current institutions (e.g., executive agencies) and partnerships (e.g., CFRP, CFLRP, RGWF), there continues to be few ways for other stakeholder voices to be heard.

Table 1	
<i>Rio Grande Water Fund Investors (as of 2015)</i>	
Investor Level	Organization
Founding	Bernalillo County Ciudad Soil and Water Conservation District U.S. Fire Learning Network LOR Foundation Lowe’s Charitable and Educational Foundation Lowe’s Companies U.S. Bureau of Reclamation via the Southern Rockies Landscape Conservation Cooperative US Forest Service
Lead	Buckman Direct Diversion McCune Charitable Foundation Middle Rio Grande Conservancy District New Mexico Department of Game and Fish New Mexico Watershed and Dam Owners Coalition NM EPSCoR PNM Resources, Inc.
Secure	Albuquerque Bernalillo County Water Utility Authority City of Albuquerque Jonathan and Kathleen Altman Foundation Edgewood Soil & Water Conservation District New Mexico Interstate Stream Commission Santa Fe Community Foundation U.S. Geological Survey
Contributor	Avalon Trust General Mills Foundation Los Alamos County Los Alamos National Laboratory and Los Alamos National Security, LLC Tides Foundation U.S. Army Corps of Engineers Wells Fargo Bank/Wells Fargo Foundation
Other	Bank of Albuquerque Los Alamos National Bank Kelly’s Brewery
<p><i>Note.</i> At the end of 2015, there were 35 investors to the RGWF. All but individuals are listed above, by investor level with highest investor category at top and lowest at the bottom. Adapted from “Rio Grande Water Fund Annual Report 2015,” by The Nature Conservancy (TNC), 2015, p. 7.</p>	

Table 2	
<i>PES Stakeholder Types.</i>	
<u>Stakeholder Type</u>	<u>Notes</u>
Donors	Donors provide contributions/funds for acquiring ecosystem services.
Beneficiaries	Private or public organizations that benefit from ecosystem services (downstream). May also be a donor.
Suppliers	Owners of land or management rights of resources (property) that provide ecosystem services.
Intermediaries	Intermediaries link donor, beneficiaries, and suppliers through development and administration of the PES project.
<i>Note.</i> Adapted from <i>Payments for Ecosystem Services: Legal and Institutional Frameworks</i> , edited by T. Greiber, 2009, p 8.	

Table 3		
<i>Ecosystem Services Classified According to their Excludability and Rivalness</i>		
	<u>Excludable</u>	<u>Non-excludable</u>
<u>Rival</u>	Most provisioning ecosystem services (market goods)	Some provisioning ecosystem services (open-access resources)
<u>Non-rival</u>	Some recreational/cultural ecosystem services (club goods)	Most regulatory and cultural ecosystem services (public goods)

Note. Adapted from “Ecosystem services: Multiple classification systems are needed,” by R. Costanza, 2008, *Biological Conservation*, 142(2).

Table 4			
<i>Milestones of Watershed and Forest Restoration Bills in the 2015 New Mexico Legislature</i>			
<u>Bill Number</u>	<u>Hearing/Meeting</u>	<u>Date</u>	<u>Vote/Action</u>
HB 38		12/15/2014	Introduced
HB 38	House Agriculture, Water & Wildlife*	1/30/2015	Pass (Unanimous)
HB 38	House Energy, Environment & Natural Resources (HEENC)*	2/11/2015	
HB 38 HEENC Substitute	House Energy, Environment & Natural Resources (HEENC)*	2/16/2015	Pass (Unanimous)
HB 38 HEENC Substitute	House Appropriations & Finance*	2/24/2015	Pass (Unanimous)
HB 38 HEENC Substitute	House Floor	2/27/2015	Pass (Unanimous)
HB 38 HEENC Substitute, Amended	Senate Conservation*	3/12/2015	Pass (6/1)
HB 38 HEENC Substitute, Amended	Senate Finance	3/18/2015	Pass (Unanimous)
HB 38 HEENC Substitute, Amended #2	Senate Floor*	3/20/2015	Pass (Unanimous)
HB 474		2/18/2015	Introduced
HB 474	House Energy, Environment & Natural Resources (HEENC)*	2/25/2015	Pass (7/4)
HB 474	House Ways & Means*	3/9/2015	Tabled
<i>Note.</i> Asterisk (*) indicates hearing/meetings observed by the author.			

Table 5		
<i>Land ownership of ponderosa pine and mixed conifer forests identified by RGWF</i>		
<u>Ownership</u>	<u>Acres</u>	<u>Percent of Total</u>
U.S. Forest Service	1,103,926	68.22
Private Lands	243,470	15.05
Tribal Lands	157,312	9.72
Valles Caldera National Preserve	37,655	2.33
National Park Service	31,894	1.97
Bureau of Land Management	15,611	0.96
State Parks and Wildlife Conservation Areas	13,537	0.84
Other Federal (Reclamation, Defense, Energy)	10,316	0.64
State Trust Lands	3,835	0.24
Local Government Lands	619	0.04

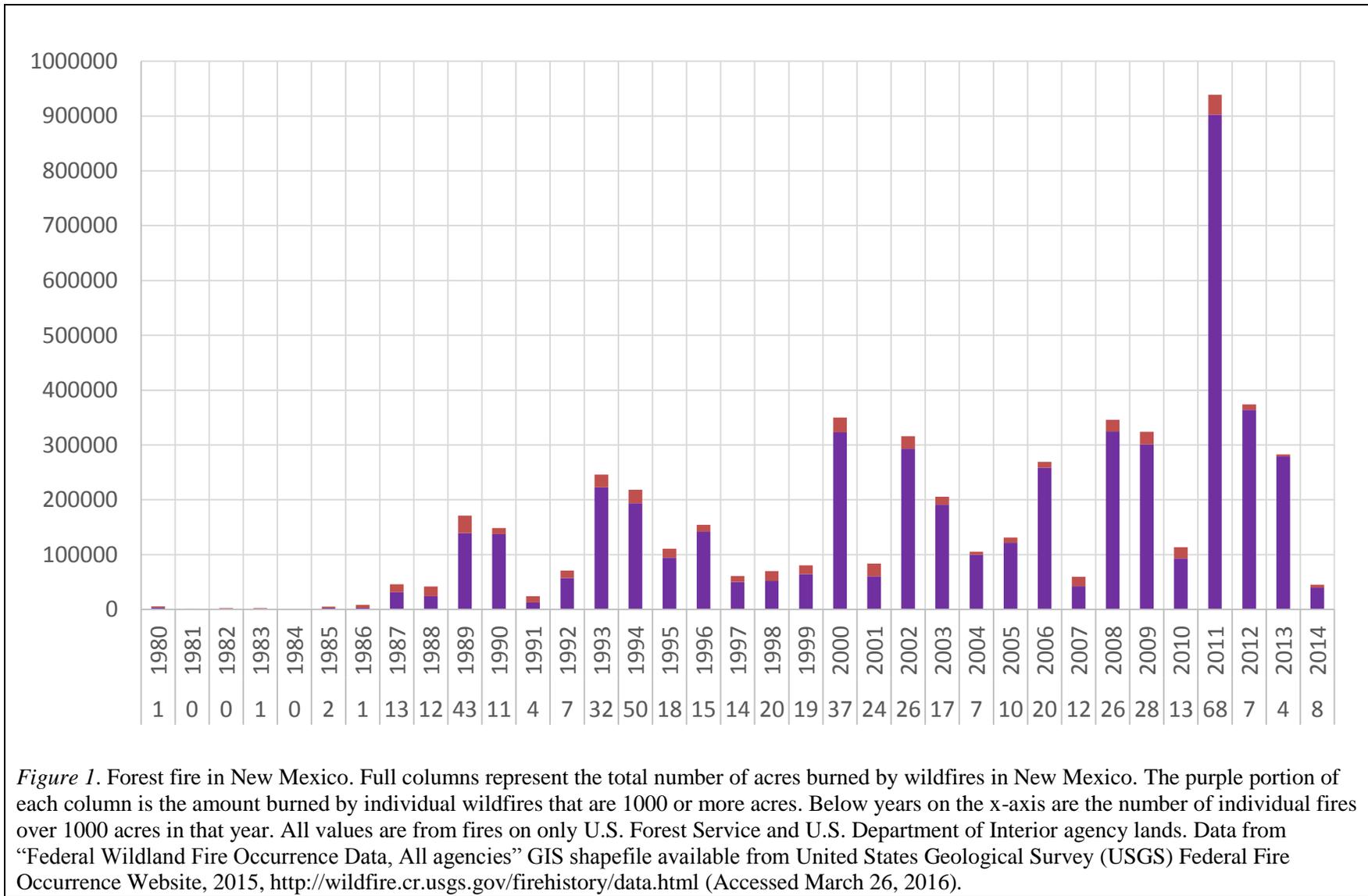
Note. Adapted from “Rio Grande Water Fund Comprehensive Plan,” by The Nature Conservancy (TNC), 2014a, p. 19.

Table 6

Key RGWF Investor Types

Federal Land & Water Management Agencies
Tribes & Land Grants
Local Governments
Utilities
Corporations, Water Users, and Other Donors
State Land & Water Management Agencies

Note. Adapted from “Rio Grande Water Fund Comprehensive Plan,” by The Nature Conservancy (TNC), 2014a, p. 28.



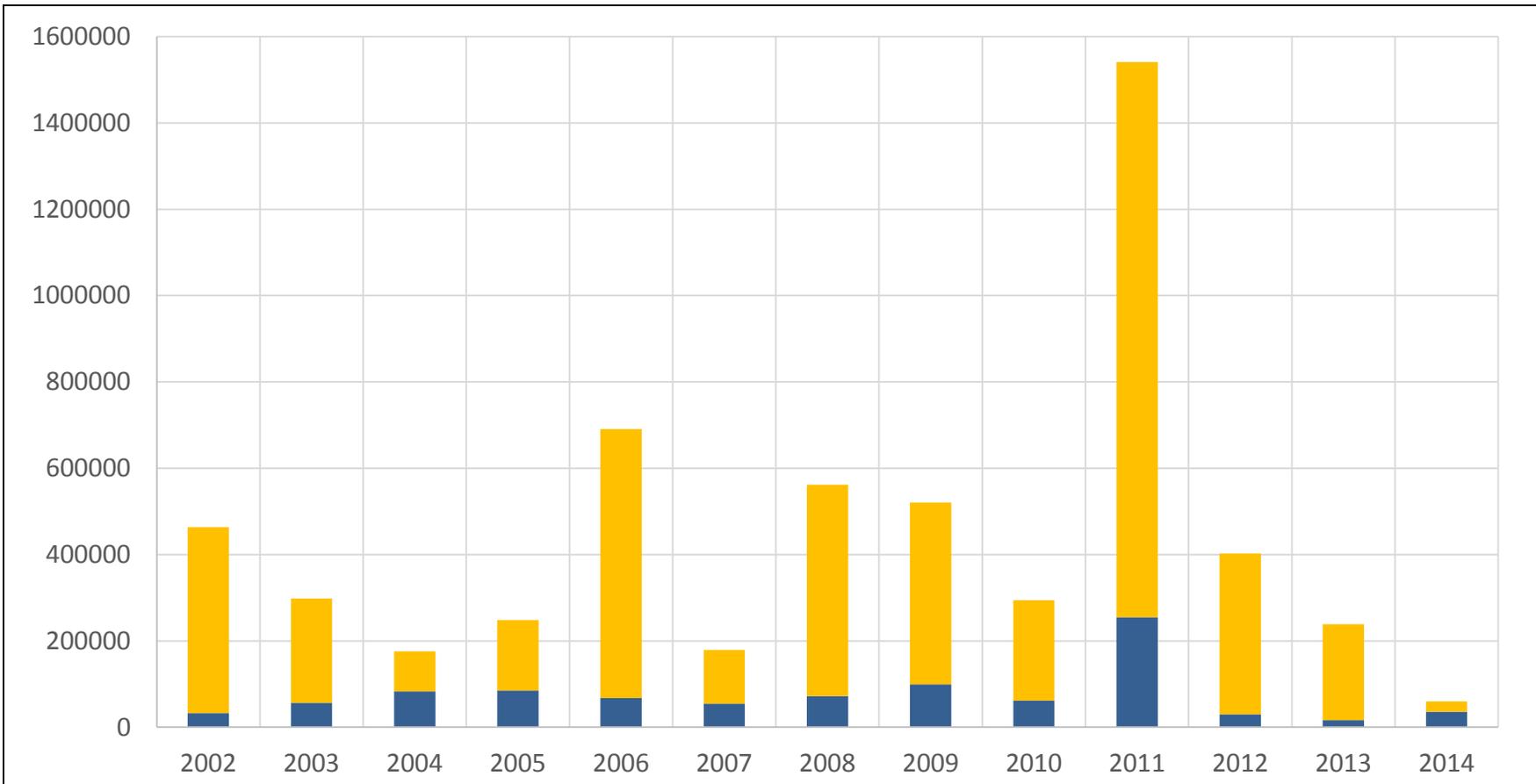


Figure 2. Prescribed fire in New Mexico. Full columns represent the total number of acres burned by wildland fire, prescribed burn, and wildland fire use in New Mexico. The blue portion is the number of prescribed burn acres. All values are from fires on U.S. Forest Service, U.S. Department of Interior, and New Mexico State lands. Data from “National Report of Wildland Fires and Acres Burned by State (Reps. 2002-2014) from National Interagency Fire Center (NIFC) website, 2015a, <https://www.nifc.gov/fireInfoNational> Report of Wildland Fires and Acres Burned by State (Reps. 2002–2014). Retrieved from https://www.nifc.gov/fireInfo/fireInfo_statistics.html (Accessed March 26, 2016).

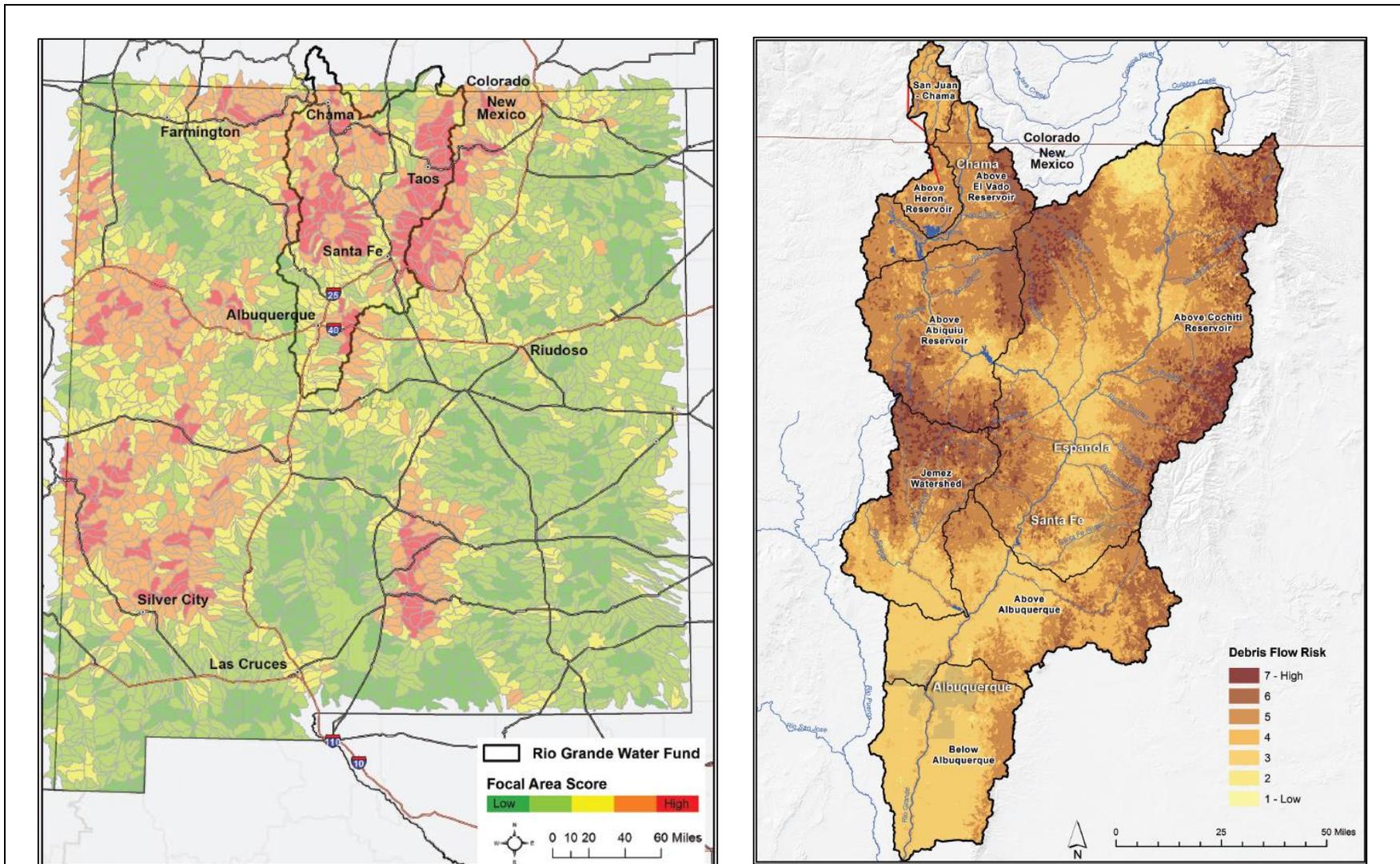
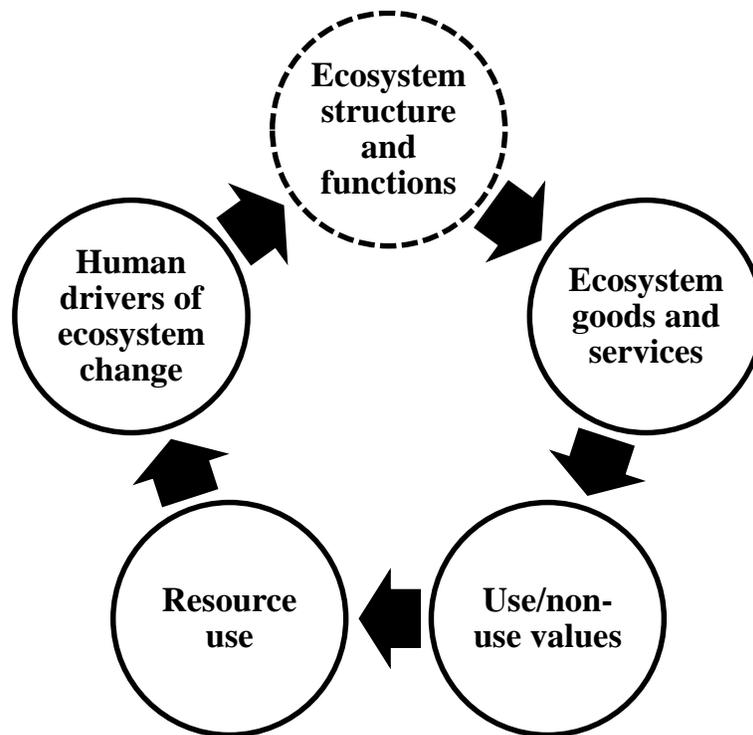


Figure 3. New Mexico subwatershed focal areas (left) and debris flow risk in the Rio Grande Water Fund area (right). Left map shows subwatershed restoration priorities (Low to High) based on five criteria (described on p 12). Right map shows detail of black outline on left map of the Rio Grande Water Fund area, with output of debris flow risk in the East Mountains area of northern New Mexico. Left map from “Rio Grande Water Fund Comprehensive Plan,” by The Nature Conservancy (TNC), 2014a, p 31. Right map from same, p 16.



Characteristics common to all PES transactions:

- The ecosystem service or land use to deliver that service is well-defined/valued.
- The transaction is voluntary and legally-binding.
- There is a minimum of one donor and one beneficiary.
- There is a minimum of one supplier.
- Payments are conditional on continued provision of the ecosystem service by the supplier.

Figure 4. Valuation of ecosystem goods and services and characteristics of Payment for Ecosystem Services (PES) transactions. The structure and functions of ecosystems in the flowchart provide goods and services that are valuable to humans. Valuation determines how resources are used, resulting in human drivers of change to the natural system, which directly affect ecosystem structures and functions. Dashed circles are part of the natural system. Flowchart adapted from *A New Blue Print for A Green Economy*, by E. B. Barbier and A. Markandya, 2013, Box 4.5, p 63. PES characteristics adapted from *Payments for Ecosystem Services: Legal and Institutional Frameworks*, edited by T. Greiber, 2009 p 7.

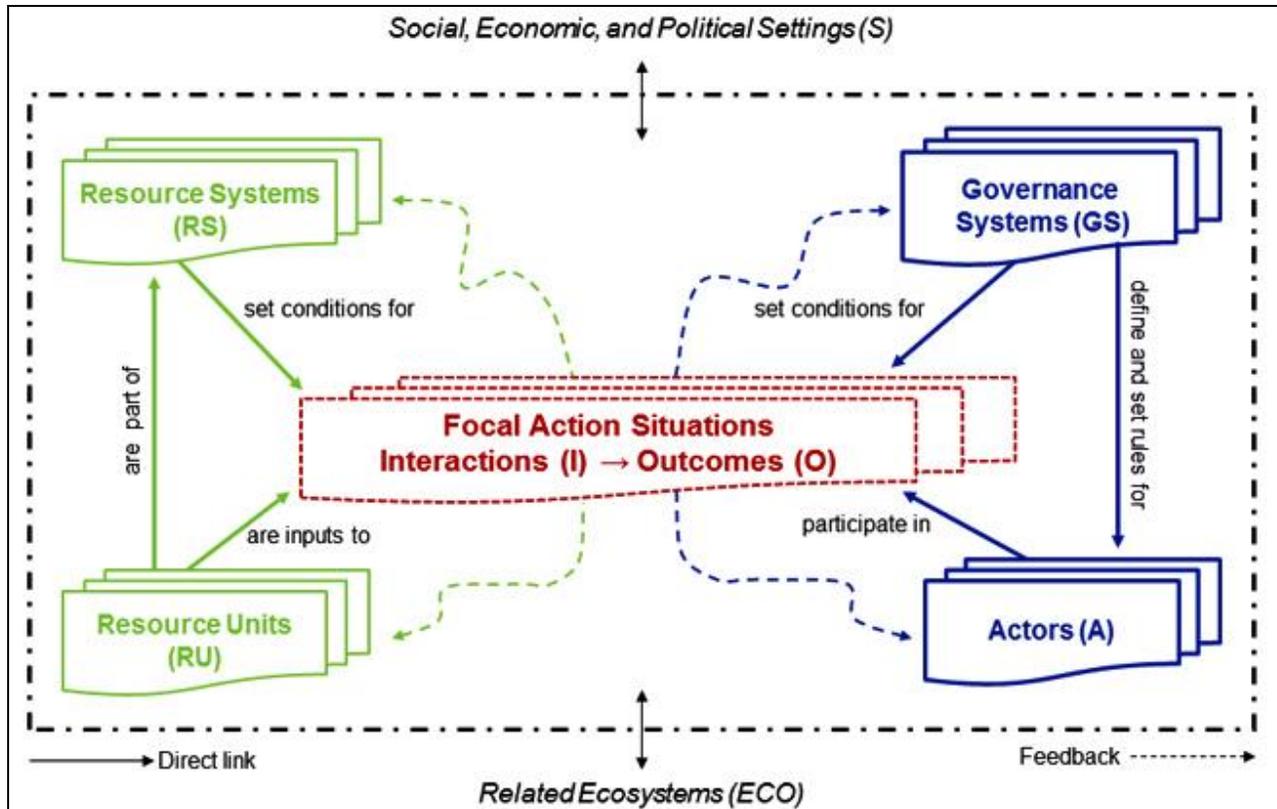


Figure 5. Conceptual model of the Social-Ecological Systems (SES) Framework. Solid boxes denote first-tier categories. Resource Systems, Resource Units, Governance Systems, and Actors are the highest-tier variables that contain multiple variables at the second tier as well as lower tiers (See Figure 13, Figure 14, Figure 15, Figure 16, Figure 17, Figure 18, and Figure 19). Dashed arrows denote feedback from action situations to each of the top-tier categories. The dotted-and-dashed line that surrounds the interior elements of the figure indicates that the focal SES can be considered as a logical whole, but that exogenous influences from related ecological systems or social-economic-political settings can affect any component of the SES. From “Social-ecological system framework: initial changes and continuing challenges,” by M. D. McGinnis and E. Ostrom, 2014, *Ecology and Society*, 19(2), article 30.

2013 House Memorial 65

A Memorial requesting the United States Forest Service to engage with New Mexico State agencies and local governments in meaningful watershed health planning and management.

- Recognizes diverse land ownerships in New Mexico, primarily by the federal government and private parties.
- Points towards “the purpose of securing favorable conditions for water flows” and “protection against destruction by fire and depredations upon the public forests and national forests” as part of the Organic Act of 1897.
- Resolves to request that state and federal agencies integrate watershed health and local, state, and tribal watershed plans and management with range and forest planning in New Mexico.

2014 House Memorial 80 and 2014 Senate Memorial 95

A Memorial requesting the New Mexico Legislative Council to direct the appropriate interim committee to develop a long-term funding plan for forest and watershed restoration work in New Mexico.

- Recognizes that current “active management of forests is insufficient to address the scope, scale and pace needed to restore” them, and that the scale of wildfires and insect damage is beyond that of current efforts to improve forest health.
- Points towards a need to “leverage” federal dollars with pools of funds from state, local, tribal, and private sources, via a multi-party coordinated approach, to be used for forest and watershed restoration.
- Resolves to request for an interim committee to be formed to develop a long-term funding plan for all stakeholders to cooperate on forest and watershed restoration in New Mexico.

Figure 6. Overview of House Memorial 65, House Memorial 80, and Senate Memorial 95. House Memorial 65 from Watershed Health Planning & Management, HM 65: Final Version, 51st NM Legis. (2013a). House Memorial 80 from Long-Term Forest & Watershed Plan, HM 80: Final Version, 51st NM Legis. (2014b). Senate Memorial 95 from Long-Term Forest & Watershed Plan, SM 95: Final Version, 51st NM Legis. (2014b).

2015 House Bill 38

An Act relating to natural resources; enacting the Forest and Watershed Restoration Act; providing for forest and watershed restoration and wildlife habitat conservation; creating a fund; establishing a board; providing criteria for the evaluation and funding of projects.

Talking Points of Bill Sponsors

- Forest and watershed restoration will increase runoff, reduce fire risk, create economic opportunity for the use of smaller diameter trees, and lower property insurance premiums.
- Current forest and watershed efforts are not sufficient to affect high wildfire risk. While current efforts use temporary or one-time funding, a long-term approach is necessary.
- The Forest and Watershed Restoration Board, with sustained funding, will allow the State to leverage funding from federal sources. The Board will be in the best position to coordinate current and future funding and projects that take place at local, state, and federal scales.
- The bill is the culmination of collaboration by many stakeholders, including conservation, ranchers, hunters, fishers, the forest products industry, and land managers.

Major Concerns with the Bill

- Executive agencies, committees, and funding are already in place to carry out forest and watershed restoration, with current projects. The Board will slow down current efforts.
- The anti-donation clause of the New Mexico Constitution (art. IX, § 14) prevents funds from being used on private land. Since most high wildfire risk lands are private or federal, it is unclear how these funds will be spent.
- The bill is not tied to permanent funding.
- The prioritization of restoration projects is unclear or incomplete.

Bill Changes in Response to Major Concerns

- Inclusion of “wildlife conservation and habitat improvement” project criteria and the Director of Department of Game and Fish on the Board in order to expand funding sources.
- Inclusion of the Director of the Interstate Stream Commission, a member of the Acequia Commission, and non-voting, advisory members from the U.S. Forest Service and Bureau of Land Management on the Board.
- Removed funding coming directly from the Insurance Department Suspense Fund.
- Allowed projects to be prioritized if they have matching contributions, have potential commercial or traditional forest product uses, or create incentives for investment by other entities, including downstream water users.
- Clarified that the Board would be advisory to the State Forestry in carrying out the Act.

Figure 7. Overview of House Bill 38, “Forest & Watershed Restoration Act.” Summarized by the author from testimony, committee records, legislation drafts, and public comment: Forest and Watershed Restoration Act, HB 38, 52d NM Legis. (FWRA, 2015a - d); and, HB 38: Forest and Watershed Restoration Act (HB 38, 2015a - e).

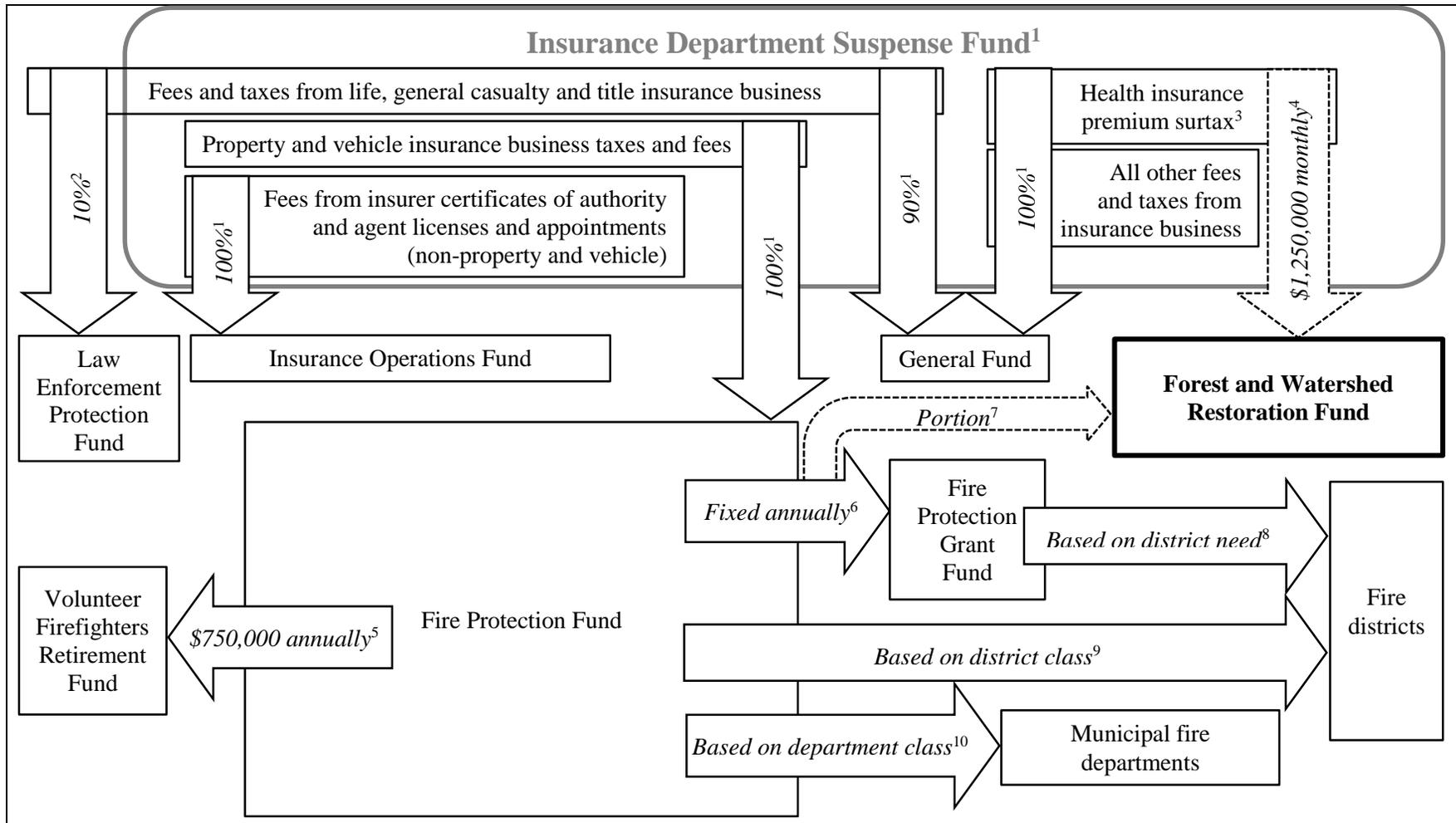


Figure 8. Insurance Department Suspense Fund distributions and Fire Protection Fund distributions (solid arrows), including those proposed for the Forest & Watershed Restoration Fund (dashed arrows).
¹ 59A NM Stat. § 6-5. ² 29 NM Stat. § 13-3. ³ 59A NM Stat. § 6-2. ⁴ Fire Protection Fund to Watershed Restoration, HB 474, 52d NM Legis. (2015). ⁵ 10 NM Stat. § 11A-3. ⁶ 59A NM Stat. § 53-5.2. ⁷ Forest and Watershed Restoration Act, HB 38, 52d NM Legis., (2015a). ⁸ 59A NM Stat. § 53-19. ⁹ 59A NM Stat. § 53-4. ¹⁰ 59A NM Stat. § 53-5.

2015 House Bill 474

An Act relating to public finance; providing for an annual transfer from the Fire Protection Fund to the Forest and Watershed Restoration Fund; changing the current transfer schedule; making an appropriation.

Talking Points of Bill Sponsors

- The transfer of funds is equal to a portion of the increase going to the Fire Protection Fund each year. Therefore, the amount in the Fund will continue to increase.
- Property insurance collectors support the bill. There is an obvious nexus between wildfire prevention and the protection of property from wildfire.

Major Concerns with the Bill

- The purpose of the Forest and Watershed Restoration Fund does not align with the purpose of the Fire Protection Fund.
- Impacts to rural and small fire departments that request funding from the Fire Protection Fund for maintenance, improvement, or construction of fire stations or equipment, and fire fighter training.

Bill Changes in Response to Major Concerns

- House Committee members suggested that bill sponsors meet with bill opponents to come to an agreement. This meeting did not happen.

*Figure 9. Overview of House Bill 474, “Fire Protection Fund to Watershed Restoration.” Summarized by the author from testimony, committee records, legislation drafts, and public comment: Fire Protection Fund to Watershed Restoration, HB 474, 52d NM Legis. (2015); and, *HB 474: Fire Protection Fund to Watershed Restoration* (HB 474, 2015a; HB 474, 2015b).*

2016 House Memorial 47
Unanimously Passed¹, Signed by Governor

A Memorial encouraging state agencies to seek a stronger role in working with the United States Department of Agriculture.

- Focused on agriculture, but references water projects.²
- Encourages state agencies to develop closer contact with the United States Department of Agriculture (of which USFS is a part) to better understand how USDA funding can be used to leverage state projects.²
- Resolves that “appropriate” cabinet agencies develop plans with USDA for potential funding. The Memorial’s FIR references current work between the State’s Forestry Division, NMGF, and the federal USDA.³

2016 House Memorial 49
Unanimously Passed⁴, Signed by Governor

A Memorial promoting the continued use of prescribed fire in a safe and controlled manner to enhance natural landscapes and to support New Mexico agriculture.

- Notes that prescribed fires are used by ranchers and the agricultural industry to manage forage and remove debris.⁵
- Recognizes the role of periodic fire in forest health, and danger of wildfire due to excessive amounts of debris in forests and drought conditions.⁵
- Resolves that prescribed fires continue to enhance natural landscapes and agriculture.⁵

2016 House Memorial 74
Died in Committee

A Memorial requesting recognition of the Collaborative Forest Restoration Program benefits to Otero, Lincoln and Chaves Counties.

- Recognizes future work through the CFRP to treat 6,000 acres of Lincoln National Forest and forest within the city of Alamogordo.⁶
- Notes efforts to revitalize the logging industry through forest and watershed restoration, and that restoration will provide increased surface runoff and groundwater recharge, and reduce threat of devastating wildfires.⁷
- The Memorial’s FIR references relationships between HM 74 and HM 47 regarding collaboration with USDA and state project funding.⁷

Figure 10. House Memorials proposed in the 2016 New Mexico Legislative Session that are relevant to forest and watershed restoration. Major points are drawn by the author from introduced or final/enacted versions of memorials: ¹ HM 47, 52d NM Legis. (2016b). ² HM 47, 52d NM Legis. (2016a). ³ LFC (2016d). ⁴ HM 49, 52d NM Legis. (2016b). ⁵ HM 49, 52d NM Legis. (2016a). ⁶ HM 74, 52d NM Legis. (2016). ⁷ LFC (2016a)

2016 House Bill 2**Passed House (38/31)¹, Passed Senate (39/1)², Signed by Governor (partial veto)***An Act making general appropriations and authorizing expenditures by state agencies required by law.*

- Healthy Forests Program: personal services and employee benefits (\$5,145,700), contractual services (\$527,200), and other (\$5,093,800). Performance measures: firefighter trained (1,650) and acres treated (15,500).³

2016 House Bill 167**Unanimously Passed^{4 5}, Signed by Governor***An Act related to finance; authorizing the New Mexico Finance Authority to make loans or grants from the Water Project Fund for certain water projects; declaring an emergency.*

- Authorized loans and grants include four watershed restoration and management projects for Soil and Water Conservation Districts in three counties (Quay, Torrance, and Harding) in central-east New Mexico.⁶

2016 House Bill 219**Unanimously Passed^{7 8}, Signed by Governor (partial veto)***An Act related to capital expenditures; authorizing the issuance of severance tax bonds; authorizing expenditures from certain funds and balances; clarifying conditions for the issuance of bonds; establishing conditions for the expenditure of severance tax bond proceeds; establishing conditions for the reversion of unexpended balances; making appropriations; declaring an emergency.*

- Appropriated \$2,500,000 from the New Mexico Finance Authority Water Project Fund to EMNRD for watershed restoration improvements in Fiscal years 2016 through 2020.⁹

Figure 11. House Bills proposed in the 2016 New Mexico Legislative Session that are relevant to forest and watershed restoration. Major points are drawn by the author from introduced or final/enacted versions of the bills: ¹ HB 2, 52d NM Legis. (2016c). ² HB 2, 52d NM Legis. (2016b). ³ HB 2, 52d NM Legis. (2016a). ⁴ SB 167, 52d NM Legis. (2016b). ⁵ SB 167, 52d NM Legis. (2016c). ⁶ SB 167, 52d NM Legis. (2016a). ⁷ HB 219, 52d NM Legis. (2016c). ⁸ HB 219, 52d NM Legis. (2016b). ⁹ HB 219, 52d NM Legis. (2016a).

2016 Senate Bill 110**Unanimously Passed^{1 2}, Signed by Governor**

An Act relating to forest conservation; amending a section of Chapter 28, Article 2 NMSA 1978 to provide for federal revenue and expenditures from the Forest Land Protection Revolving Fund for forest and watershed management projects.

- Expands revenue sources for the Forest Land Protection Revolving Fund, which was originally established to receive funds from sale of confiscated wood and seized property under the Forest Conservation Act, to include revenue from federal and state agencies. Specifically, these funds can now be used to conduct forest and watershed management projects on land that is not owned or managed by the State Forestry Division.³
- State Forestry estimates that about \$300,000 could be received each year from federal agencies that have funding but lack resources to conduct projects on federal lands. The FIR for the Bill also notes that revenue from NMGF and State Land Office can be received by the Fund. These revenues cannot revert to the General Fund.³
- The FIR for the Bill notes that the Fund can be used to treat areas that are adjacent to State lands in order to reduce the risk of wildland fire spread. These funds may not only be used for direct treatments, but also to repair forest thinning equipment, and for planning.³
- Expenditures subject to legislative appropriation, signing of vouchers by State Forester.⁴

2016 Senate Bill 128:**Passed House (62/1)⁵ Passed Senate (39/0)⁶, Signed by Governor**

An Act relating to timber; enacting the Interstate Compact for the Prevention and Control of Forest Fires; declaring an emergency.

- Enters the State into the Interstate Compact for the Prevention and Control of Forest Fires, with current members (South Dakota, North Dakota, Wyoming, Colorado).⁷
- The compact promotes effective forest fire prevention and control through the maintenance of forest firefighting services and reciprocal aid in fighting fires among member states.⁷
- The FIR for the Bill notes that a federal process exists for states to share resources, but this Compact would overcome delays in that process by allowing states to interact directly, thereby allowing wildfires to be responded to with more resources more quickly.⁸

Figure 12. Senate Bills proposed in the 2016 New Mexico Legislative Session that are relevant to forest and watershed restoration. Major points are drawn by the author from introduced or final/enacted versions of the bills: ¹ SB 110, 52d NM Legis. (2016c). ² SB 110, 52d NM Legis. (2016b). ³ LFC (2016b). ⁴ SB 110, 52d NM Legis. (2016a). ⁵ SB 128, 52d NM Legis. (2016c). ⁶ SB 128, 52d NM Legis. (2016b). ⁷ SB 128, 52d NM Legis. (2016a). ⁸ LFC (2016c).

Social, Economic, and Political Settings (S)

S1 – Improved economic viability for small diameter forest products

S2 – Relatively high unemployment in NM; Population growth in WUI

S3 – Gubernatorial elections take place every four years; decreasing State revenues

SW5 – Water markets: municipal water (public) and water rights

SF5 – Forest markets: USFS silviculture and private forest product sales (traditional, small diameter, building materials)

S7 – Research of technology for use of small diameter forest products

Figure 13. Second-tier Social, Economic, and Political Setting attributes of proposed PES for forest and watershed services in New Mexico.

Water System (RS)

- * RSW1 – Sector: water and watersheds
- * RSW2 – Clarity of system boundaries is relatively high, but is not readily apparent
- * RSW3 – Size of individual watersheds: 2,000,000+ acres
- RSW4 – Human-constructed facilities: reservoirs and dams
- * RSW6 – Periods of drought are normal, but drought is exacerbated by other factors
- * RSW7 – Lower predictability due to climate change and drought, but we can model debris flow risk and impacts of drought/climate
- * RSW9 – Co-located within forest systems, but also in all other ecosystem types

Forest System (RS)

- * RSF1 – Sector: forests
- * RSF2 – Ecosystem/forest boundaries are fairly clear based on vegetation type, though land ownership boundaries are less clear
- * RSF3 – Size varies based on jurisdiction and project: between 17,000 and 1,600,000 acres
- RSF4 – Human-constructed facilities: homes
- * RSF6 – Natural fire regimes are considered equilibrium
- * RSF7 – Lower predictability due to climate change and drought, but we can model wildfire risk and severity
- * RSF9 – Often upstream within water systems

Figure 14. Second- and third-tier Resource System attributes of proposed PES for forest and watershed services in New Mexico. Variables with an asterisk (*) were identified by Bennett and Gosnell (2015, Figure 3, pg. 178) as particularly relevant to PES.

Water (RU)

- * **RUW1 – High mobility**
- RUW2 – Renewability dependent on precipitation and snowpack**
- * **RUW3 – Interaction between water and forests**
- * ***RUW3a* – As water flows through forests, it picks up sediment and nutrients, or deposits them, dependent on the ecosystem type and its condition**
- * **RUW4 – Economic value of water: determined by water markets; economic value of watersheds: determined by economic analysis of watershed services**
- * **RUW7 – Water is affected by watershed services throughout the watershed, but most importantly in forests areas (generally in upper parts of watersheds); water users are generally in lower areas of watersheds**
- * ***RUW7a* – The condition of the water is assessed at the point of intake for use, which is at a distance from watershed services**

Forests (RU)

- * **RUF1 – Not mobile**
- RUF2 – Renewability low in burned areas but improved with restoration**
- * **RUF3 – Interaction between forests and water**
- * ***RUF3a* – Reduced density yields greater recharge and runoff; Decreased forest cover increases evapotranspiration to the atmosphere, decreases snowfall, and results in earlier melt of the snowpack; dense forest cover also results in earlier melt of the snowpack.**
- * **RUF4 – Economic value of forest products: determined by markets; economic value of forests as watersheds: determined by economic analysis of watershed services**
- * ***RUF4a* – Forest products: larger diameter (older trees) generally have more value; watersheds: water flow is generally faster in fire-damaged watersheds than through forested watersheds**
- * ***RUF4b* – Forest products: benefit reduces with distance from market; watersheds: generally far upstream from the water user**
- * **RUF5 – One tree does not make a forest, and dense forests are not healthy and are less valuable**
- * **RUF7 – Forested watershed services are important in-situ, generally in upper parts of watersheds, but also anywhere there are forests (and therefore wildfires)**
- * ***RUF7a* – Condition of forested watershed services is verified in-situ, and at the forest scale**

Figure 15. Second- and third-tier Resource Unit attributes of proposed PES for forest and watershed services in New Mexico. Variables with an asterisk (*) were identified by Bennett and Gosnell (2015, Figure 3, pg. 178) as particularly relevant to PES.

Governance System (GS)

- * **GS1 – Government organizations**
 - GS1a – Suppliers: U.S. Forest Service, National Park Service, Bureau of Land Management, Department of Defense, Department of Energy, New Mexico Energy, Minerals and Natural Resources Department, New Mexico Department of Game and Fish (agencies responsible for managing land); beneficiaries: water utilities, local governments**
 - GS1b – Anti-donation rules (N.M. Const. art. IX, § 14)**
- * **GS2 – Non-government organizations**
 - GS2a – Intermediaries: The Nature Conservancy, forest products industry; beneficiaries: forest products industry, acequia organizations**
 - GS2b – Fiscal agency rules**
- * **GS4 – Property-rights systems: water rights and land rights (public/trust and private)**
- * **GS5 – Operational-choice rules: RGWF project criteria; New Mexico Forest & Watershed Health Plan**
- * **GS6 – Collective-choice rules: Forest and Watershed Restoration Board (proposed)**
- * **GS7 – Constitutional-choice rules: Forest & Watershed Restoration Act (proposed)**
- * **GS8 – Monitoring & sanctioning rules for PES program**
 - GS8a – Firewise Communities USA Program**

Figure 16. Second- and third-tier Governance System attributes of proposed PES for forest and watershed services in New Mexico. Variables with an asterisk (*) were identified by Bennett and Gosnell (2015, Figure 3, pg. 178) as particularly relevant to PES.

Actors (A)**1A – Donors**

- * 1A1 – ~23 RGWF Investors; anyone who pays a SFWD water bill
- * 1A2 – Socioeconomic attributes
 - * A2a – Levels of access to resource: mixed, and dependent on land ownership (i.e. land management agencies have higher access)
 - * A2b – Relative power: mixed, and dependent on land ownership and policy authority
 - * A2c – Relative wealth: various, but overall high
- * 1A6 – Norms (trust-reciprocity)/social capital: donors lack shared identity, other than as donors
- * 1A7 – Knowledge of SES/mental models: interaction with (e.g., SFMW) and knowledge of PES models
- * 1A8 – Importance of resource (dependence): as organizations, not individuals, resource dependence is low

2A – Beneficiaries

- * 2A1 – New Mexico Interstate Stream Commission; water utilities; plus, anyone who uses surface water from the watershed (e.g., drinking, recreation, agriculture)
- * 2A2 – Socioeconomic attributes
 - * A2a – Levels of access to resource: low, except for at point of intake of water (other than recreation)
 - * A2b – Relative power: low
 - * A2c – Relative wealth: low
- * 2A3 – History or past experiences: Las Conchas fire and resulting debris flow
- * 2A4 – Location
 - * A4a – In the case of northern NM, beneficiaries are distant from land owners/suppliers
- * 2A8 – Importance of resource (dependence): high

Figure 17 continued)

Actors (A)

3A – Suppliers (forested land owners)

- * **3A1 – More than a dozen federal, state, and tribal land owners/agencies; all private land owners with forested lands**
- * **3A2 – Socioeconomic attributes**
 - * **A2a – Levels of access to resource: high**
 - * **A2b – Relative power: high**
 - * **A2c – Relative wealth: various**
- * **3A3 – History or past experiences: Las Conchas, and collaboration in CFRP and CFLRP**
- * **3A4 – Location**
 - * **A4a – In the case of northern NM, land owners/suppliers are distant from beneficiaries**
- * **3A6 – Norms (trust-reciprocity)/social capital: previous collaboration with other actors in CFRP and CFLRP**
- * **3A8 – Importance of resource (dependence): high**

4A – Intermediaries

- * **4A1 – The Nature Conservancy; RGWF Advisory Board (~43 members); members of the Forest and Watershed Restoration Advisory Board; forest products industry**
- * **4A2 – Socioeconomic attributes**
 - * **A2a – Levels of access to resource: low**
 - * **A2b – Relative power: various**
- * **4A7 – Knowledge of SES/mental models: interaction with (e.g., SFMW) and knowledge of PES models**
- * **4A8 – Importance of resource (dependence): various (forest products industry is high)**
- * **4A9 – Availability of small diameter/biomass energy technology that increases economic value of non-lumber forest products**

Figure 17. Second- and third-tier Actor attributes of proposed PES for forest and watershed services in New Mexico. Variables with an asterisk (*) were identified by Bennett and Gosnell (2015, Figure 3, pg. 178) as particularly relevant to PES.

Interactions (I) → Outcomes (O)

- * **I2 – Education and outreach by SFMW and RGWF; coordination by the Forest and Watershed Restoration Advisory Board**
- * **I4 – Conflicts: budget/legislative decisions; overlapping jurisdictions**
- I6 – Lobbying: several stakeholders have been going to the Legislature since 2013 about watershed restoration; fire departments and the State Fire Marshall lobbied against HB 474**
- * **I9 – Monitoring activities**
 - * **I9a – Contract compliance: uncertain if these activities would occur**
 - * **I9b – Ecological: vegetation surveys and maintenance of treated areas**
 - * **I9c – Social well-being: economic surveys (e.g., job creation)**
- * **O1 – Social performance measures**
 - O1a – Awareness: House Memorials and two years of legislative negotiations**
 - O1b – Economic development: number of jobs created**
- * **O2 – Ecological performance measures**
 - O2a – Number of acres treated**
 - O2b – Reduction in high-severity wildfires**

Figure 18. Second- and third-tier Interaction and Outcome attributes of proposed PES for forest and watershed services in New Mexico. Variables with an asterisk (*) were identified by Bennett and Gosnell (2015, Figure 3, pg. 178) as particularly relevant to PES.

Related Ecosystems (ECO)

ECO1 – Increasing evapotranspiration due to warmer temperatures, also resulting in less precipitation in the form of snow and earlier melt of snowpack; growth patterns and transpiration of trees disrupted by warmer temperatures

ECO2 – Smoke from wildfires is an air pollutant with human health effects

Figure 19. Second-tier Related Ecosystem attributes of proposed PES for forest and watershed services in New Mexico.

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