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Ecosystem Service Valuation through Wildfire Risk Mitigation: Design, Governance, and Outcomes of the Flagstaff Watershed Protection Project (FWPP)

Roy Miller [1,*], Erik Nielsen [1] and Ching-Hsun Huang [2]

[1] School of Earth Sciences and Environmental Sustainability, Northern Arizona University, 525 South Beaver Street, P.O. Box 5694, Flagstaff, AZ 86011, USA; erik.nielsen@nau.edu

[2] School of Forestry, Northern Arizona University, 200 East Pine Knoll Drive, P.O. Box 15018, Flagstaff, AZ 86011, USA; ching.huang@nau.edu

* Correspondence: rm773@nau.edu; Tel.: +1-602-501-5487

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Abstract: The full value of benefits rendered from healthy watersheds is difficult to estimate, and ecosystem service (ES) valuation sometimes necessarily occurs in the form of costs incurred or avoided. Along these lines, social-ecological systems including Payment for Watershed Services (PWS) are increasing in frequency and can help land management entities to bridge budget shortfalls for funding needed watershed restoration forestry treatments. The Flagstaff Watershed Protection Project (FWPP) is a bond-financed wildfire risk mitigation partnership and PWS program in Northern Arizona, the only forest management project that utilizes a municipal bond as the financial mechanism in conjunction with a partnership governance structure to invest in federal land management. The purpose of this research was to describe this new governance structure to understand the potential benefits to communities and federal land management agencies for protecting watershed services. Data were derived from document review and key informant interviews (n = 9). FWPP institutional design and governance structures were tailored to maximize community strengths and encompassed several advantages over traditional federal land management models; these advantages include increased collaboration and institutional support, financial security, and public approval. The FWPP represents an innovative PWS system that can help showcase unique community and federal forest management partnerships that benefit watershed health in western US communities.

Keywords: payments for ecosystem services; watershed services protection; wildfire mitigation; community wildfire protection; partnership governance; fuels reduction; fuels treatment; PWS institutional design; collaborative forest management; cost-avoidance

1. Introduction

1.1. Forest Health, Public Safety, and Budget Shortfalls

The United States Forest Service (USFS) manages approximately 78,104,329 hectares of national forests and grasslands in 44 states across the US [1]. A large amount of this acreage has been fire-excluded, overgrazed, and heavily logged, resulting in unhealthy, fire-prone landscapes [2]. After a deadly sequence of wildfires in the western US in the early 1900s, the USFS enacted a wildfire suppression policy without a program to counter the inevitable accumulation of highly combustible dead and downed forest debris [3,4]. Federal funding and agency implementation have since been unable to properly address the consequences of these policies, resulting in poor forest health conditions, high risk of catastrophic wildfire, increasingly intense and severe wildfires, and negative environmental and economic impacts on local communities [5]. Accumulation of forest debris, unnaturally dense

stands of small-diameter trees, increased homebuilding in the Wildland/Urban Interface (WUI), and compounding effects of climate change all contribute to this significant wildfire risk [6,7]. Failure to address the scale of the problem affects water security, forest health, community well being, and human lives.

Forest treatments implemented to date in fire-adapted Ponderosa pine forests have proven very effective at reducing the threat and impact of catastrophic wildfire in WUI areas [8]. Additionally, research has shown that treatment type, timing and intensity can affect ecosystem services in northern Arizona Ponderosa pine forests [9]. When properly conducted, treatments can allow for greater use of prescribed burns and wildland fire. Treatments also reduce the spread of spot fires ahead of the main fire [10] and facilitate a drop from fire in the crown of trees to the forest floor. In the cases when firefighting is required, treatments allow for better penetration of fire retardant chemicals and allow improved firefighter access [11,12]. The watershed service benefits of forest treatments include increases in soil water and winter precipitation yields available for stream flow [13]. Furthermore, forest treatment projects in municipal watersheds can potentially reduce capital, operational, and water provision maintenance costs for communities, as well as improve water quantity and quality [14,15].

Unfortunately, federal land management agencies have been unable to finance these needed treatments due to federal budgetary constraints and the scale of the problem. This has resulted in a costly negative feedback loop: as wildfire suppression costs virtually set a new record each year, the practice of fire borrowing (a process of borrowing from non-fire functions of the USFS in order to fund fire suppression) undercuts preventive restoration projects and perpetuates failed fisca policy [16].

1.2. Payments for Watershed/Ecosystem Services

Payments for Watershed Services (PWS) projects are a type of social-environmental system that seek alternative (public and/or private) funding for watershed enhancement projects in order to increase or secure the provision of watershed services. PWS is a form of Payment for Ecosystem Services (PES), which has been defined as voluntary transactions between service users and service providers that are conditional on agreed rules of natural resource management for generating offsite services [17]. PWS systems have numerous social and ecological benefits, but a significant function of PWS systems is that they assign economic values to ecological functions, rendering abstract natural services to terms that can be better understood by those outside the scientific community [14,18]. This attribution of monetary values can be effective in communicating the worth of these services to local policy makers and the public [19,20].

PWS programs have been shown to achieve goals of enhancing or protecting watershed services by providing payments to private landowners to improve land use practices and reduce poverty [18,21]. In most national and international PWS programs, federal agencies or private entities are interested in directing payments or investments to upstream landowners for conducting watershed enhancement activities [22,23]. However, new governance systems are emerging where federal land management agencies are the recipients of payments for the provision of these services. These systems are potentially an important new policy tool for resolving government and market failure to account for ecosystem service losses due to failed agency land management policy, such as overgrazing and fire suppression [24] and short-term budgeting decisions. Very few case studies [14,22,23,25,26] of institutional design for PWS systems in the United States are available in the literature, and so there is a need to document and understand these systems, specifically in regards to institutional evolution, design characteristics, and their potential effects on local and national forest management.

As Bennett et al. found, 205 PWS systems were active worldwide, with 76 programs in development [26]. The value of these transactions between 1973 and 2011 totals over $66 billion, with over 195 million hectares managed within the same time frame. Ninety-seven percent of PWS systems worldwide are public good payer systems, whereby a government or large NGO will pay for watershed enhancement. This is seen increasingly in China, where political interest in "eco-compensation" is growing. When China is excluded, less than 70% of PWS systems worldwide are

public good payer systems, and instead are the result of a downstream beneficiary paying an upstream land user to improve practices. There are 68 examples of active watershed investment programs in the United States, with highest concentrations located in the Pacific Northwest. These systems include bilateral and trustee mechanisms for drinking water protection, trading and offsets, and instream buybacks [26].

Most PWS literature in the US is based around the water quality enhancement program in New York City's upper watershed that leverages municipal water fees [14]. This type of ratepayer-funded PWS scheme has recently shown up in risk mitigation partnerships initiated in Denver, Colorado and Santa Fe, New Mexico; both projects engaged the USFS and a local water utility provider in a collaborative watershed-enhancement and fire risk mitigation effort on National Forest System lands. Outcomes from these PWS systems target watershed service benefits from water quality and/or quantity enhancement through risk reduction and avoided costs from high-severity wildfires. PWS systems that are designed to reduce wildfire risk, like those found in Denver, Santa Fe, and Flagstaff, fall under the category of "fire risk mitigation partnerships", which create a formal partnership between a drinking water utility and the USFS to address risks to water supplies and utility infrastructure associated with high-severity wildfire [23]. The early successes of these programs suggest the potential for appropriately designed PWS projects to address agency and market failure by accounting for positive benefits derived from watershed restoration and fuels reduction treatments [27].

1.3. Governance and Institutional Design

Institutions, in this case, are defined as the formal rules, compliance procedures, and standard operations that structure relationships between individuals in various components of the polity and economy [28]. Institutional design is the establishment and organization of rules and procedures within institutions that are meant to enable and constrain behavior and action in accordance with agreed-upon values and objectives [29]. Institutional analysis involves the examination of how structures, rules, laws, norms, etc. are created and formed [19]. Proper institutional design can help foster trust relations that are hypothesized to be a facilitator of cooperation in shared resource management, reducing transaction costs for those involved by fostering cooperative agreements [30]. Understanding how institutions form and perform can thus potentially be highly beneficial to evaluating future nascent PWS design. More inclusive approaches to governing forest treatment projects have recently become more prominent in forest management paradigms, as the representation of various stakeholder perspectives allows for more complete governance. Collaborative governance is defined as a type of governance where actors from diverse sectors, such as local and federal, or public and private, work together to establish rules for the provision of public goods [31]. This approach promotes a more collaborative model of governance than traditional top-down management schemes, but remains exclusive to interest groups and other stakeholders outside the governing partnership. Ultimately, government rules shape the environment in which voluntary associations and social networks exist by determining the influence those organizations, interests, and individuals will have on democratic function [32]. As resource management paradigms shift towards a more inclusive model of governance, information about how local and federal actors work together in partnerships may prove highly useful to land managers.

1.4. Case Description: Flagstaff Watershed Protection Project

Over the past two decades, the forests around Flagstaff, Arizona have experienced increasingly severe wildfires that have threatened community safety and environmental health. Fuel treatments around the community have proven successful at mitigating the risk and effects of these wildfires, and local agencies have made fuels treatment in WUI areas a priority. In June 2010, the Schultz fire burned a total of 6061 hectares of dense stands of Ponderosa pine and mixed conifer in the Coconino National Forest, near the City of Flagstaff [33]. The burn occurred in an area proposed by the USFS for the Jack Smith/Schultz timber sale, which was legally delayed by environmental groups because of

controversial large-diameter tree removal, and as a result was later found uneconomical for a potential timber sale. The fire was followed by the fourth wettest monsoon season on record in Flagstaff, resulting in debris flows, severe erosion, and substantial flooding in residential areas. Fire suppression and flood mitigation alone cost $58.6 million [34], and impacts on the community will be felt for years to come.

The Dry Lake Hills portion of the Rio de Flag watershed and the Mormon Mountain portion of the Lake Mary watershed are located on the Coconino National Forest and are both at risk of high-intensity, high-severity wildfire. Stand surveys within these areas indicate that 71% of the total area surveyed has a fire hazard rating of "extreme" [35]. Severe wildfire in the Lake Mary watershed poses a significant threat to increasing sedimentation and debris flow into Lake Mary, the City of Flagstaff's primary surface water source. Severe wildfire in the Dry Lake Hills area would have numerous significant consequences: this area is highly visible from downtown Flagstaff, recreationists use it heavily, and if it burned as severely as predicted, would likely result in extensive flooding and debris flow throughout much of Flagstaff, including the downtown area [35]. While the threats to these municipal watersheds are well known, no funding has been available for USFS treatment planning and implementation.

Growing community awareness of forest health issues and the magnitude of the impacts from the Schultz Fire both contributed to the eventual creation of a PWS program in Flagstaff. In October 2010, researchers from Northern Arizona University organized a workshop that included multiple USFS agencies from the local, regional, and national level in a discussion about PWS feasibility in the Flagstaff area. In May 2011, representatives from the City of Flagstaff and the Greater Flagstaff Forest Partnership attended a workshop that discussed the implementation of a PWS project in Santa Fe, and in March 2012, another workshop was hosted by the City of Flagstaff. At this workshop, the idea for a PWS program in Flagstaff was discussed, and the City Manager and other City officials made the decision to propose a bond-financed PWS project to the Flagstaff City Council. The project was placed on the ballot in the November 2012 elections. On 6 November 2012, a $10 million bond (Item 405) went on the ballot as the Forest Health and Water Supply Protection Project, with the intent of providing financial resource for conducting fuels treatment on approximately 4267 hectares of Coconino National Forest. Actual bond language follows [36]:

> *"To prevent flood damage to the City of Flagstaff ('City'), and to protect the City water supply from damages which occur from large-scale and/or severe wildfire(s) in two watersheds serving the City, shall the City be authorized to sell and issue general obligation bonds in a principal amount up to $10,000,000:*
>
> - *To expedite and conduct forest treatments in the Dry Lake Hills watershed north of town to reduce wildfire threat, thereby mitigating subsequent flooding to Sunnyside, downtown, the NAU campus, and neighborhoods bordering the Rio de Flag;*
> - *To plan and conduct forest treatments in the Lake Mary watershed south of the City to reduce wildfire threat, thereby protecting the storage capacity and water quality of Lake Mary".*

Approximately 1214 hectares of land owned by the State of Arizona and 57 hectares of privately owned land may also receive treatment, but were not included in analysis for the FWPP Final Environmental Impact Statement (FEIS). In addition, 3063 hectares of the FWPP analysis area are within the Dry Lake Hills portion of the Rio de Flag watershed area north of Flagstaff, while 1204 hectares are in the Mormon Mountain area of the Walnut Creek-Upper Lake Mary watersheds. Bond 405 passed with an overwhelming 73.6% majority [37], becoming the first forest treatment PWS project to be voted on by the public and financed by a municipal bond.

The Flagstaff Watershed Protection Project is a unique PWS project in northern Arizona that finances fuels reduction treatments in key watersheds. The purpose of this case study is to describe the institutional design of the FWPP, determine what effects it may have on federal forest management, and facilitate a better understanding of key dynamics and processes in the FWPP partnership that may help inform land management policymakers. This research utilizes data generated from internal documents review as well as key informant interviews in order to answer two questions regarding

institutional design of the FWPP: (1) How was the FWPP designed, and how does it function? (2) What are the impacts, if any, that the FWPP has had on local forest management?

2. Materials and Methods

We took a case-study approach to evaluate key distinctive design characteristics in the FWPP project structure. Case studies are an empirical inquiry investigating phenomena within real-life context, especially when the boundaries between phenomena and context are not clearly evident [38]. In the case of FWPP, the phenomenon is a voter-approved forest treatment bond governed by an agency partnership, and the context is USFS forest treatment projects. Content analysis was the primary methodology utilized for retrieving data from documents as well as interviews. This method can be defined as a research technique that makes replicable inferences from text [39]. This methodology provides insight into the decisions leading up to the FWPP, emphasizing why these decisions were made, how these decisions were implemented, and the results of those decisions [40].

For document content analysis, we drew from official documents released by the partner agencies (City and USFS), as well as from FWPP's website [41] to evaluate the formal institutional rules of the partnership. A total of six documents were selected for analysis: FWPP Executive Summary and Implementation Plan, Memorandum of Understanding (MOU) between the City of Flagstaff and Coconino National Forest, MOU-Cooperating Agency Agreement between City and Coconino National Forest, FWPP Proposed Action, Communication Plan, and Environmental Impact Statement, as well as information released to the public through other means (updates, media releases, and information available from FWPP's website). Document analysis is stable, unobtrusive, exact, and can cover a broad spectrum of topics, but lacks an in-depth approach. In order to provide a more robust approach, interviews with key participants to gain insight into FWPP processes and governance dynamics were conducted alongside document analysis [38]. Semi-structured, open-ended interviews (n = 9) took place in spring 2014 with key participants who had an instrumental role in the FWPP design and/or planning process, in order to understand the informal rules of institutions as well as outcomes.

Interviews are inherently flexible as a data collection method, and allow the researcher to probe, clarify, and create new questions immediately based on responses [42]. The interview instrument (Appendix A) consisted of a demographics section and 30 questions relating to (1) institutional design and governance; (2) planning efficiency and partnership costs; (3) partnership accountability; and (4) public accountability. These questions were designed to gather perspectives from highly engaged members of the FWPP partnership, reflecting themes such as public outreach and involvement, accountability, collaborative efforts, challenges and obstacles, efficiency, and costs [19]. All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Northern Arizona University Institutional Review Board (Project Number 574286-2).

Chain referral and nominated sampling were used to select interview respondents, who were chosen as a result of their high levels of participation throughout the project. Respondents included members of the project steering committee, project management and overall administrative staff from each partner agency. Respondents (n = 9) selected for elite interviews were chosen as a result of their status as project officials heavily involved in the planning and design of FWPP. This list primarily includes representatives from organizations within the FWPP partnership (City of Flagstaff, US Forest Service, and contracted NGOs such as the Greater Flagstaff Forests Partnership and the NAU Ecological Restoration Institute), but also included a federal wildlife agency representative from outside the partnership (Table 1). Participants held titles such as Project Manager, District Ranger, Member of Board of Directors, Director of Policy and Partnerships, Assistant to the City Manager, City Manager, Firewise Specialist, Wildland Fire Management Officer, and Senior Biologist. Five females and four males were interviewed. Experience with forest management projects varied, from four years to 36 years, and the average forest management experience was approximately 15 years.

Table 1. Description of key participant interviewee demographics.

Participant	Job Title	Agency	Years Experience
1	Project Manager	USDA [1] Forest Service	4
2	District Ranger	USDA Forest Service	15
3	Member, Board of Directors	Greater Flagstaff Forest Partnerships	9
4	Director of Policy and Partnerships	NAU [2] Ecological Restoration Institute	15
5	Asst. to City Manager	City of Flagstaff	14
6	City Manager	City of Flagstaff	20
7	Firewise Specialist	City of Flagstaff Fire Department	14
8	Fire Management Officer	City of Flagstaff Fire Department	36
9	Senior Biologist	US Fish and Wildlife Service	25

[1] United States Department of Agriculture; [2] Northern Arizona University.

Participants were asked to provide expected outcomes of the project, and discuss the role of each partner in the project, and how partnership interaction has helped or hindered the planning process. Several interview questions focused on challenges and obstacles that result from the partnership and bond payment, in order to gain an understanding of new problems that may arise from utilizing voter-approved payment solutions with partnership governance structures.

Qualitative data analysis was conducted by thematically coding documents and interview transcripts by hand. Coding is a process of categorizing text into relevant patterns and dimensions by utilizing a structured and inductive process that organizes text into principal themes and sub-themes with graduated level of detail [43]. Converging process-related patterns and structural institutional design dimensions emerged from the FWPP foundational documents and interview transcripts that allowed insight into project design and function. The results describe generalized themes whose richness is illustrated with quotations; the quotations presented are indicative of the theme generated from respondents who represent participating agencies that are heavily involved in the planning process.

3. Results

3.1. Institutional Design Characteristics of the Flagstaff Watershed Protection Project

There are five main participating actors in the project; the landowning agencies are the City of Flagstaff (Fire Department, Water Department, Finance, City Manager), the US Forest Service (Flagstaff Ranger District), and the State of Arizona (Forestry Division). This list also includes two agencies contracted by the City of Flagstaff: NAU Ecological Restoration Institute, who was contracted by the City to provide ecological monitoring and academic advocacy, and the Greater Flagstaff Forests Partnership, who were contracted by the City to provide public outreach and social monitoring. The USFS did not participate in the early stages of the project, becoming active only after the measure passed in November. This was likely to avoid any potential ethical conflicts inherent with asking for additional public funding for forest management [44]. After the bond measure passed, the USFS created a Project Manager position specifically for this project, which was funded entirely by the Forest Service primarily at the forest level. Staff members from the Wildland Fire Division of the Flagstaff Fire Department were also designated to assume project management responsibilities from the City side. An executive team consisting of representatives from higher level political and management backgrounds from the City, USFS, and State of Arizona was established to guide the project and facilitate coordination, updates, and briefings among agencies. A City representative is included on the USFS interdisciplinary planning team (IDT), which is unique to this project at a local level. A coordination team was also established in order to guide the project through its inception phase and bring the right people together during the formulation of the project, and the coordination team met once per month to discuss next steps and goals for the coming month. At the onset, the executive team was meeting twice per month. The first meeting of the month usually discussed

decision-making, while the second meeting was to review coordination of resources and project updates. As the project progressed, those meetings were consolidated into conference calls and in-person meetings were called when needed. The representatives of these institutions were responsible for communicating and seeking resources at various scales of their organizations. For example, FS district officials communicated their needs and accomplishments to the forest administration, which then communicated with the regional office and the Washington office. Along those same lines, City Fire Department officials communicated with the finance department, as well as the City Manager's office, which then communicated with the City Council.

The partnership structure between the City of Flagstaff (City) and the US Forest Service (USFS) is defined by a Memorandum of Understanding and numerous Cooperating Agency Agreements that structure the processes for FWPP planning and implementation. The governance process of the partnership is monitored informally by participants who hold each other accountable by ensuring that everyone is working toward a shared goal of successful collaborative planning, as well as by reports (finance report, leverage report, biannual report) developed by the City and its contractors, ERI and GFFP. Joint planning efforts have so far resulted in the development of the FWPP Environmental Impact Statement, which outlines four treatment alternatives. Including the No Action Alternative, the four alternatives outline the need and proposed use of various common forest treatment techniques, as well as steep-slope logging and combinations of mechanical thinning and prescribed burning that are uncommon in northern Arizona. These alternatives can be "blended"; this means that the responsible official will determine which treatment action is best for a given area, effectively creating a new alternative. This is allowed as long as the impacts of these actions have been evaluated in one of the alternatives.

3.2. Structures and Rules

Review of documents and interviews indicate that the City's primary formal role is to fund the initiative and oversee all bond expenditures. Additionally, they are expected to provide support and special expertise to the USFS throughout the National Environmental Policy Act process, as well as participate in planning, evaluation, implementation and public outreach meetings. Planning will be funded largely by additional USFS resources leveraged by the partnership, saving bond money for implementation. The City assists with planning wherever possible, and contracts out various monitoring and public outreach responsibilities to Greater Flagstaff Forests Partnership (GFFP) and Ecological Restoration Institute (ERI). The main role of GFFP is to facilitate the development of the multi-party monitoring protocol, by asking unique and specific questions about treatment effects such as watershed health and fire risk reduction. ERI acted as the academic advocacy group for the project, and is responsible for conducting outreach and education work, as well as ecological monitoring on behalf of the project and the partnership (Figure 1).

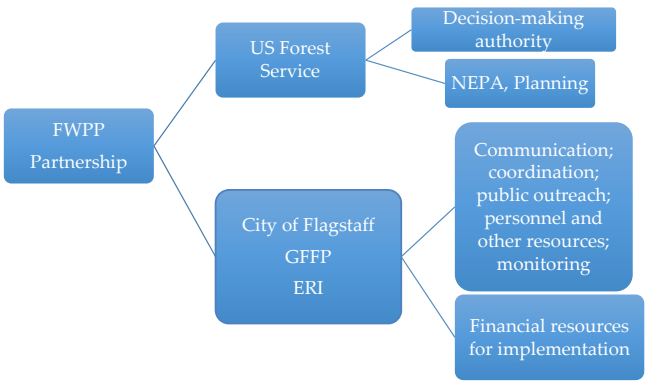

Figure 1. Visual representation of roles for individual partners within the Flagstaff Watershed Protection Project planning structure.

The FWPP management team sets goals and landmarks internally with consensus from team members (primarily USFS and City), and has moved forward in planning with the goal of reducing the risk of wildfire and flooding, mitigating a potential emergency scenario for the community and securing public safety.

> *"We want to plan the project in a way where we meet our objective, which is to reduce the risk of catastrophic fire and post-fire flooding, and we also want to do it in a way that meets broader community and agency goals, in terms of minimal impacts to the environment and wildlife, and soils, and the watershed, but also to accomplish the long term goal of reducing wildfire and post-fire flooding risk."*
>
> —USFS employee

Costs and additional resources leveraged from other agencies are being closely monitored by the partnership. Each agency is responsible for maintaining a record of project costs; the City Fire Department works with the budget and finance department to monitor bond spending and resource leveraging, and the USFS has been tracking their own administrative costs with a new budget account code devoted specifically to this project.

> *"Our finance and purchasing people in the city are heavily involved in this. So they are maintaining all the books and tracking the bond through the city budget. We do a leverage report every six months, and disclose how much has been spent internally. We're not counting City dollars in that leverage report. We know we started with $10 million, so it's about what else is coming from the table from all other entities. For example, Continental Country Club donated a half page out of their newsletter for FWPP. We consider that a leveraged resource."*
>
> —City employee

Both partners share duties of timely communication and coordination within the partnership, as well as public outreach and education responsibilities (Table 2).

Table 2. Descriptions of roles assumed by each actor within the Flagstaff Watershed Protection Project partnership.

Actors	Roles
City of Flagstaff	Finance administration, communication, coordination, and public outreach.
US Forest Service	NEPA [1], planning, land management, communication, and personnel.
Greater Flagstaff Forests Partnership	Public outreach, facilitate development of monitoring plan.
NAU Ecological Restoration Institute	Ecological monitoring and academic advocacy.

[1] NEPA: National Environmental Policy Act.

City and USFS representatives on the FWPP Communications Working group drafted an informal communication plan that outlines appropriate media and public relations protocols and responsibilities. Participants continually reported that no specific measures have been established that hold the partnership accountable to the public or each other, instead relying on a shared responsibility to effectively utilize public money. The below quotation describes the informal mechanisms utilized for resolving conflict or maintaining accountability within the partnership.

> *"We really don't have a formal process, there's no real dispute resolution process, or committee. We don't have any strict rules, its just been more of an agreement that we're going to work together and this understanding that we have to work together, or else the project falls apart and we're both held accountable by the public if that happens. So there are invisible enforcement mechanisms."*
>
> —USFS employee

Partners also share monitoring duties, as well as responsibilities associated with overseeing implementation. The USFS provides the NEPA analysis and has final decision authority for treatment

implementation, which cannot be delegated. However, the City of Flagstaff still has a formal role in NEPA planning via their membership on the Interdisciplinary Team (IDT). Since this project uses the bond as the financial mechanism for this project and the USFS cannot accept direct public payments, the City of Flagstaff acts as the intermediary and distributor of bond funds for planning and implementation.

> *"We rely heavily on the Forest Service for the planning. We're the third party financiers. For this scale and on federal land, we need to rely on the federal government."*
>
> —City employee

3.3. Additional Costs of Partnership

Interviewees suggested that the partnership structure may entail some additional costs. Both partners mentioned extra personnel costs due to increased public outreach efforts, and additional time needed to draft the MOU's and other agreement documents. Another complexity mentioned additional but slight transaction costs resulting from the transfer of bond resources between the City and the USFS. The below quotation describes potential costs associated with transferring bond resources.

> *"In terms of challenges with the partnership as we go along, I think that the main thing that might just be complicating is the transfer of money. After we sign a decision, and the City decides to fund those actions with the bond money, there is a series of processes that we go through, called Supplemental Participating Agreements, or SPA. For every dollar that is transferred we have to do one of those and say exactly how much money, what its going to go for, what expectations on both sides are . . . because depending on the amount of money it might have to go to City Council for approval."*
>
> —USFS employee

However, these transaction costs were reportedly offset by the partnership structure, as significant financial and personnel resources have been leveraged as a result of the bond payment, accounting for an additional $3.4 million as of December 2016 [45]. This additional resource has gone towards completing necessary road improvement projects, project boundary surveying, and personnel costs attributed to the planning process of the FWPP. As illustrated by the quotation below, whatever additional or transaction costs have been incurred as a result of the partnership structure have been negated or offset by the amount of additional funding the project has been able to leverage as a result of the bond mechanism.

> *"We have been able to go to our regional and Washington levels of our agency and encourage them to fund us for the planning process and for surveys and a little bit of road work and those types of things, knowing that once we get through the planning process, and surveys, and so on, that the City is going to be able to pay for a large part of the implementation. So that ($10 million bond payment) has allowed us to leverage those funds internally. Otherwise, they might not have ever given us those funds because they would say 'how will you ever be able to pay for implementation?'"*
>
> —USFS employee

In terms of challenges, obstacles, and potential disadvantages, the FWPP partnership has reportedly not been overly hindered or compromised throughout the planning process. Every participant agreed that the benefits of the FS/City partnership far outweighed any additional costs incurred as a result of this partnership, and participants did not report any instances of conflict. These benefits include enhanced public engagement, fast planning timelines, leveraged additional resources, enhanced monitoring protocols, and increased accountability.

> *"Benefits of partnership outweigh these costs, not only with the bond money but with the support and involvement of the community and with the environmental groups, I think those benefits are extremely high and not to be underrated."*
>
> —USFS employee

3.4. Outcomes of Partnership Institutional Design

Respondents reported multiple outcomes of the USFS/City partnership throughout the planning process. Common themes included process-oriented outcomes such as increased efficiency, accountability, and public outreach, as well as general outcomes such as fire risk mitigation and national recognition. Respondents emphasized the fact that this project would not have ever been considered without the bond and the ensuing partnership.

> *"Funding from the bond is a unique opportunity. We probably would not be working on this area if it weren't for the bond. We have a lot of area that needs to be restored, a lot of areas where tree densities are much too high, and we can do a lot more in other areas for the same amount of money, and there are other areas that are more of a risk to communities in terms of fire entering a community...So this is more of a secondary impact concern, really, a fire in this (FWPP) area is probably not going to burn into town but it's that post-fire effect that would really affect town."*
>
> —USFS employee

The USFS and City of Flagstaff Fire Department have been involved with planning and implementation of forest treatment projects in the Flagstaff area for decades. Actors have productive working relationships, especially within the partnership between the City and USFS; mutual respect, understanding, and trust were mentioned during interviews as contributing to the project's success, and conflict within the project was not reported by any of the interview respondents. Traditionally, large agency landowners such as the USDA Forest Service would be chiefly responsible for planning, financing, and implementing forest treatment actions, as well as conducting post-implementation monitoring. This type of in-house forest management allows for public comment during NEPA analysis, and increasingly more collaborative approaches, but this structure does not ensure adequate funding for implementation.

> *"Normally we almost do our analysis in a box and then involve the public and our partners during key points, so this is a little different in that we have a representative of the City on the Interdisciplinary Team who is at meetings fairly regularly, but then also if there's any small decision we usually check in with the City."*
>
> —USFS employee

Challenges with traditional forest planning and management can arise from environmental and conservation organizations exercising legal rights that delay or halt the implementation of land management plans through lawsuits or appeals [46], as well as inadequate funding for implementation. The legal challenges and delays are a major consideration of the project management process, as losing bond money due to litigation would certainly result in negative public opinion of local forest management and affect future forest management partnerships. To date, there has been no legal action against the project, and social monitoring by GFFP will help determine whether public acceptance has increased or decreased. The City of Flagstaff conducts numerous public outreach and education initiatives, including an interactive treatment map, direct mailings to landowners adjacent to project sites, field tours with members of the public, City Council, and environmental groups, and has maintained a presence at local events such as the Flagstaff Festival of Science.

The FWPP has reportedly been open to recruiting all stakeholders who wish to contribute to monitoring and public outreach, but the institutional design of the project and the very nature of the partnership prevent full collaboration of all stakeholders in the planning process. The USFS is not

able to compromise when it comes to delegating final decision authority, but they reportedly made efforts to incorporate feedback from NGO stakeholders and the public alike before the formal comment period on the Draft Environmental Impact Statement (DEIS) and final decision, in order to address potential issues. Participants continually reported enhanced monitoring protocols as a key innovation of the project's design. A multi-party monitoring plan was developed in order to address four key focus areas: fire behavior, hydrologic response, socioeconomic effects, and other ongoing/potential monitoring projects. The USFS/City planning partnership contributed to this outcome, as well as the inclusion of various local groups that assist with monitoring efforts.

> *"We have been working with the City very closely on developing checkpoints, but we also have some built into the NEPA too, in terms of prescribed fire monitoring protocols that we have started on the district before this project. That's the big one: we would do monitoring on our side but there is also a desire to do monitoring post-implementation from other entities like USGS or City, GFFP, in order to answer the questions of 'did we really reduce the risk of high-severity wildfire?'"*
>
> —USFS employee

Interviewees reported that the FWPP partnership has made a substantial effort to increase public outreach and education in order to maintain transparent relationships, employing all potential resources and outlets to keep them abreast of concerns or issues and helping facilitate trust and understanding with the public. There have been several measures taken to ensure public participation and accountability within the project. Maintaining a presence at local events and holding public meetings where input is actively solicited and incorporated into the planning process have increased public participation. The quotations below discuss public outreach and accountability efforts by the partnership.

> *"FWPP has definitely put more money into the outreach and education component, and into monitoring. A lot more than traditionally, and benefits definitely outweigh the costs."*
>
> —GFFP Board Member

> *"If you talk to the [city] council, it [public involvement] is extremely important, because we are staff and they are the ones with their jobs on the line. They all went on record in favor of the project publicly, so they're going to be the first ones to ask questions about accountability."*
>
> —City employee

The planning timeline of this project was aggressive for forest treatment planning efforts. From start to finish, the FWPP planning process has moved from initiation to a Record of Decision (ROD) in 32 months (November 2012–September 2015). Respondents reported having never been a part of a project of this size and scope that moved as quickly. Timely accomplishment of planning forest treatment actions is reportedly enhanced since the FWPP is considered as a priority project by regional and national offices of the USFS. This means that the USFS is committed to seeing this project succeed and is willing to provide additional resources to support this effort. The following quotations demonstrate the time efficiencies of the project.

> *"Normally, a project of this size with this level of analysis would take multiple years, up to 5–10 years, depending on how it is on the priority scale, and here (FWPP), we estimate to have a decision (in just under 3 years)."*
>
> —USFS employee

> *"One of the other advantages to having the City as a partner is that it has enabled us to make FWPP a forest priority, and dedicate a team specifically to this project to be able to meet really aggressive timelines."*
>
> —USFS employee

The FWPP has attained recognition from the highest levels of the agencies involved, and has also peaked the interests of communities and land managers facing similar forest health conditions and financial insufficiency issues. As communities begin to recognize the potential community watershed service impacts of unhealthy forests and watersheds, collective action systems similar to the FWPP were mentioned as a possible solution. The following quotations help illustrate how land managers from other communities are interested in similar arrangements as the FWPP because it presents a new method of implementing wildfire risk reduction and watershed health forest treatment projects in at-risk communities.

> *"The USFS is being asked all over the West, 'What are the agreements being used? How are they being managed?' People want to do these partnerships but I think its fair to say that across the FS, there is an uneven understanding of how you can use contracts and other money transfer mechanisms efficiently. Everyone is looking at FWPP as working really well, but they are really interested in knowing the gritty details of how these agreements are put in place. Breaking institutional boundaries and transferring that knowledge in the West is an opportunity."*
>
> —ERI employee

> *"It was pretty significant that we took the framework for forest treatments and turned it upside down, in the sense that you rely on the federal government to manage federally managed land and the City of Flagstaff manages City of Flagstaff owned land, and I think it's a good illustration of how things are changing in the country. It's about cities and towns and counties taking their own destinies into their own hands. Not that we are turning our back on the FS and the federal government, we need them, we need them greatly, but it's a different type of network than we've seen in the past. The reason we wanted to convene and address this problem is because we realize that local action was essential to make the kind of impact we really needed, and put aside the traditional way of thinking about policy and governance, and who's responsible and why is it not fair. We really put that aside and focus on what are the impacts and how can we adapt and respond to those impacts? Because regardless of whose land it is, those impacts are ours."*
>
> —City employee

The results demonstrate specific rules and compliance procedures that are shaping the relationships in the FWPP. For example, the partnership's responsibilities and structure of communication facilitate the trust and cooperation demonstrated by the interviewees. In addition, it has helped make this type of forest governance more efficient and effective than traditional forest governance. It has enabled increased trust and communication in relationships, and any transaction costs associated with increased public outreach or the transfer of money within the partnership were reportedly far outweighed by the benefits associated with the unique governance structure and financial mechanism of the project.

4. Discussion

FWPP incorporates multiple agencies and areas of expertise with clearly defined roles and rules for partnership, which has allowed for different methods of procurement, enhanced monitoring, increased accountability, and streamlined communication methods. Informants felt these structures had produced time efficiencies, as the planning process has progressed at a considerable rate compared to traditional fuels treatment projects. While the planning process for most projects of this scope and size reportedly often take more than five years to complete, the FWPP was able to reach a Record of Decision in only 32 months (November 2012–June 2015). Creating a USFS Project Manager position was also beneficial, as projects of this scope and scale often need to appoint an organized person who can accomplish goals independently as well as delegate work to others [25].

The interview participants who contributed the data to this study clearly had an effect on the partnership and the way the FWPP was governed. The participants interviewed were the most

involved and influential actors in the project, and through this partnership were able to build on a strong history of institutional cooperation in Flagstaff. Trust had already been established between the actors, and a common vision for the project was easily reached, and the planning process may not have gone as smoothly if these conditions for success had not already existed. The FWPP was also uniquely equipped to be sustainable throughout the duration of the project. The FWPP meets several conditions for sustainability, including organizational, social, and financial capacities. Organizationally, the FWPP contained formal agreements such as the MOU, Communication Plan, and an informal commitment to working together that contributed to project success. Socially, the FWPP focused on a strong commitment to public outreach and education, enhanced communication protocols, and community involvement. Financially, the FWPP demonstrated the ability for ongoing resource leveraging as well as committed long-term funding because of the upfront bond payment.

Local and federal government actors determine the influence that third-party organizations, interests, and individuals have on democratic function [32]. The FWPP brought together a large diverse group for multi-party monitoring efforts, as well as during the concept and planning phases. This enhanced monitoring process helps ensure accountability for bond money well spent and the resulting protection of ecosystem services by collaboratively addressing key environmental concerns. The traditional definition of collaboration involves the pooling of tangible resources, money, information, etc., by two or more stakeholders in an effort to solve a problem that neither party can solve alone [47]. The FWPP fits this definition because it was governed by a partnership of mainly two stakeholders that came together to address a problem that neither could address, but it is not truly collaborative. Although nuanced, collaboration implies a joint decision-making approach to resolving problems, where there is shared power between multiple parties and each party takes collective responsibility for their actions and their outcomes [46]. In the FWPP, decision-making authority regarding treatment implementation on federal lands is not formally shared however the strong communication and inclusion of a city representative on the IDT appears to have rendered a strongly supported final decision.

Although the USFS officially planned and analyzed prescriptions and alternatives, they were open to considering input from the public, stakeholder group, and City throughout the process. Shared goals among diverse and well-organized stakeholders led to formalized roles and collective action in the FWPP, with the potential to result in long-term strong institutions and high social capital [48]. The results of this study suggest that the structure, communication, and relational norms have strengthened social capital in the planning phase of this project. Since agency boundaries can be restrictive to accomplishing collaborative objectives, compromise was struck by working to incorporate legitimate opinions, comments, and concerns of stakeholders from non-governmental organizations (NGOs) and the general public outside of formal comment periods. In this instance, a non-traditional project management partnership model was able to incorporate public and stakeholder input into planning objectives on an accelerated timeline, utilizing a multi-party monitoring group to evaluate outcomes. A long track record of organizational collaboration and public outreach in Flagstaff among members of the partnership has also provided a foundation for local agency ability for organization and authority, as well as the capacity for institutional design, monitoring, and accountability.

Flagstaff has proven to be an excellent launching pad for PWS systems that require local involvement, financing, and support. However, there are several potential theoretical limitations to the quality of this model that could threaten effective application in other communities. For instance, the bond-financed model is entirely dependent on the attitudes of individual voting constituencies and the implementation and administration capacities of local and federal actors. Considering the strengths of the political culture of the community may prove essential to project success. The viability of enacting similar PWS models may be dependent on a community's proximity to the forested watershed and the watershed services at risk. As such, it is important to customize the individual project to the social and ecological context in order to ensure a well-functioning system, forming the correct institutional boundaries for the biophysical conditions, community attributes, and rules-in-use [49].

5. Conclusions

The FWPP was designed effectively to maximize the strengths of the community, but caveats to the FWPP model are inherent and should be asserted. For example, the FWPP has been able to leverage over $3.4 million in additional resources, thus maximizing the public's investment by ensuring its use for implementation costs. While this may seem like a win-win scenario, this additional money had to be redirected from other functions. Much of it was earmarked at a national or regional level and directed to the project, potentially undercutting other objectives critical to the mission of the Forest Service. The FWPP may have shifted attention away from other priority fuels reduction treatments; at the local level, agency managers from the City of Flagstaff fire department and from the USFS Flagstaff Ranger District were redirected to the FWPP. This potentially limits their resource capacity for providing other needed forest treatments to the community.

The project appears to represent several requisite factors critical to successful PWS systems. These include ownership, tenure security, multiple levels of public and agency cooperation, effective enforcement of rules and regulations, monitoring, strong leadership with capacity for local organization, expectation of benefits, common interests, and local authority [50,51]. The findings of this research support the idea that institutional support provided by prior partnerships serves to reinforce collaboration and engagement between actors, as well as enhancing potential for ongoing and future projects [52]. Heightened public outreach and education efforts and new working relationships with stakeholders and NGOs provide experience and credibility for both agencies within the local forest management community, and can help facilitate public acceptability for ongoing maintenance costs and other forest treatment projects.

Institutional design of the FWPP is unique because of the bond payment coupled with the USFS/City planning partnership bounded by clear rules and relationships. Exploring creative institutional design opportunities may assist land management agencies in western US communities to overcome government failure, institutional gridlock, and budgetary shortfalls that prevent successful mitigation of significant public health and safety threats that result from wildfire in forested watersheds. Furthermore, the progression of PWS projects approved by downstream communities advances the notion that ecosystems provide services to communities and thus should be preserved using local and federal resources to deliver benefits to watershed residents. While the partnership structure may inhibit broad stakeholder participation in collaborative planning, addressing and incorporating stakeholders' comments and concerns throughout the entire planning process (not just formal NEPA comment periods) can have potentially significant timeline returns. Since local taxpayers primarily finance the project, it is important for the partnership to address public concerns throughout the planning process in order to avoid legal delays that could potentially consume the bond and interfere with project success.

The FWPP has been recognized as a top priority for the US Forest Service, and it has been called a model for community action in forest management. However, the applicability of any PWS model is contingent upon a host of variables. While the FWPP has the potential to serve as one successful example of community-based PWS, the generalizability of this case to other western communities should be underscored by the importance of customizing institutional design and governance structures to the individual needs, capacities, and watershed conditions in distinct communities.

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Appendix A. Interview Instrument

A.1. Demographics

1. What agency or organization do you represent?
2. What is your role or position in this organization?
3. How many years have you been involved in forest treatment projects in the Southwest?

A.2. Institutional Design and Governance

1. What is your organization's role in the project, and how does this differ from traditional projects like Jack Smith/Schultz? (USFS, GFFP, City)
2. What are your organization's goals for the FWPP planning process?
3. What are some unique key challenges or obstacles, to date, presented by the FWPP partnership? What are some expected unique key challenges or obstacles presented?
4. What are some unique opportunities or advantages presented by the way FWPP was designed and structured (bond, partnership, sharing of responsibilities)?
5. Has there been any conflict between parties involved in the planning process?
6. How has the financial mechanism (bond) affected how resources are used?

A.3. Planning Efficiency and Partnership Costs

1. How has the USFS/City partnership affected the speed of the FWPP planning process comparative to traditional projects?
2. What about the partnership has slowed down or sped up planning speed the most? Have you ever been involved in a similar project that has moved as quickly?
3. How has the USFS/City partnership led to greater efficiency in planning as opposed to traditional projects like Jack Smith?
4. In your opinion, what are the main reasons that FWPP has or has not been efficient throughout the planning process?
5. Are there any disadvantages to the USFS/City partnership in planning?
6. Have overall planning costs been higher or lower as a result of the partnership? Why?
7. On a scale from 1–5, (1—lowest, 5—highest) how would you rank the efficiency of the planning process?
8. What resources (financial, personnel) has your organization leveraged or reallocated for planning FWPP? How and why were these resources reallocated? (USFS, City only)
9. Have additional costs been incurred as a result of the FWPP partnership, as opposed to traditional planning? Like what? Do benefits of the partnership outweigh these costs?

A.4. Partnership Accountability

1. How are the partners accountable to each other?
2. How have performance goals been set in the project? Who contributed to setting goals?
3. What measurements are used for monitoring effectiveness in planning?
4. Which organization is responsible for the majority of the planning duties within the partnership? How are planning responsibilities delegated?
5. How have roles and structures evolved in this project, from ballot measure to DEIS?
6. How has financial and resource integrity been established within the partnership? How has accountability with public resources been enforced?
7. How has the USFS been accountable to the City for work accomplished with the bond monies? How is this enforced?

8. How are partners held accountable to the rules and procedures agreed upon in the MOU and other FWPP documents?
9. How have documents like the Communication Plan helped facilitate accountability?

A.5. Public Accountability

1. How has the partnership been accountable to the public for actions taken in the planning process? How should the project be accountable to the public?
2. How has public outreach been emphasized to a greater degree in FWPP than in traditional USFS projects?
3. How has public input been solicited and incorporated into planning?
4. How important is public involvement to accountability in this project?
5. What are some of the most frequent comments, questions, and concerns about FWPP that you have received from the public?
6. Do you believe that the partnership and the planning process have been effective so far in the eyes of the general public? Why?

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